Colorado Climate Summary Water-Year Series

(October 1992-September 1993)

Nolan J. Doesken
Thomas B. McKee

Climatology Report No. 94-2

DEPARTMENT OF ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY
FORT COLLINS, COLORADO

Colorado Climate Summary
Water-Year Series

(October 1992-September 1993)

by

Nolan J. Doesken

Thomas B. McKee

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

March 1994

Climatology Report No. 94-2

ACKNOWLEDGMENTS

As always we would like to take this opportunity to thank the many cooperative weather observers in Colorado and their National Weather Service supervisors, Jerry Sherlin and Michael Elias, for making it possible to monitor the climate in all parts of Colorado at a very low cost. Again, our sincere thanks are in order.

The authors also wish to express their appreciation to Odilia Bliss for doing a fine job of preparing and processing each month's climate data and assembling this finished product. The work of John Kleist in automating much of the data analysis has been very helpful.

These summaries have been made possible by funding for the Colorado Climate Center from the CSU Agricultural Experiment Station through the College of Engineering.

TABLE OF CONTENTS

I. INTRODUCTION

The 1993 Water Year marked the 19th year of existence of the Colorado Climate Center (CCC) and the 16th year of closely monitoring the climate of this diverse and interesting state. The first monthly climate summary prepared by the CCC was written in early 1977 in the midst of an unprecedented severe winter drought. Since that time Colorado has experienced a myriad of extremes – record winter cold, incredible snowstorms, disastrous hail storms and tornadoes, some dry periods, but also some of the snowiest years in the past 60 years and one of the wettest consecutive periods in the state as a whole, (1982-1986). Our monthly descriptions of Colorado climate have expanded to document and describe as much of this information as possible.

The monthly climate descriptions are intended to accomplish several purposes. They are a written historical record of what our climate has been which can hopefully always be used as a reference in the future. By tracking monthly departures of temperature and precipitation from long-term averages, these summaries also become tools for operations, planning and policy-making related to agriculture, water resources, recreation, land use and energy. Finally these summaries are used to educate the people of Colorado about our unique climate and its impact on our lives and livelihoods.

In Colorado, the Water Year (October 1 through September 30) is the most appropriate period for monitoring climate. This 12-month period is directly correlated

with the state's water storage–water usage cycle. In October snow usually begins to accumulate in the high mountains. As winter progresses, the snowpack normally continues to build. This snow is the frozen reservoir which supports the huge ski and winter recreation industry. As it melts in the subsequent spring and summer, it supplies much of the water for human consumption, for extensive irrigation, for industry, for replenishing reservoirs, and to satisfy long-standing streamflow compacts with neighboring states. Irrigated agriculture still accounts for the majority of water used in Colorado. Therefore, demand for water peaks during the summer and tapers off as temperatures drop, crops are harvested, and autumn arrives. September marks an appropriate end to the water year.

Because of the crucial importance of water to Colorado, this publication emphasizes precipitation and water-year accumulated precipitation. Comparisons with long-term averages are made to help determine which parts of the state are wetter or drier than average. This makes it possible to document the availability of water resources and to assess potential drought situations.

In November 1991, we began a two-column layout for each monthly report. This format was continued throughout the 1993 Water Year. The first page of each monthly report begins with a brief synopsis of the month. A short paragraph and small map describe precipitation patterns for the month. A similar paragraph and map, showing temperature departures from normal, completes the front page. Normal climate, for both temperature and precipitation is defined as the 30-year average for the period 1961-1990.

The second page of each monthly summary gives a day-by-day narrative account of specific weather patterns, air masses and storm systems affecting Colorado. It includes selected examples of temperature values and precipitation totals. This page ends with a tabulation of temperature, precipitation and snowfall extremes for the state as reported by official National Weather Service Cooperative weather stations. This page is designed to give readers a good feel for the timing and location of significant weather events and general weather patterns without having to dig into detailed data tabulations or other references.

The third page is a graphical display of daily maximum and minimum temperatures for the month for nine selected locations in Colorado. The same nine cities are shown each month along with smoothed 30-year daily averages: Grand Lake, Denver, Akron, Grand Junction, Gunnison, Pueblo, Durango, Alamosa and Lamar. It is important to note that many stations do not use a midnight to midnight reporting period. The time of observation clearly has an impact on reported temperatures. For example, Durango, Gunnison and Lamar all take their observations at about 8 a.m. The maximum temperatures they report each day usually occurred the previous afternoon. It is important to take time of observation differences into consideration when comparing temperatures from different locations.

The fourth page of each monthly summary contains a map of monthly precipitation totals for the state, a brief narrative description of significant precipitation events and a bar graph showing daily precipitation amounts averaged spatially over the entire state of Colorado. This graph also shows the approximate percent area of the state receiving measurable (greater than or equal to 0.01 inches) precipitation each day.

Again, it is important to realize that differences in observation time influence these results. A station with an 8 a.m. observation time will report yesterday afternoon's precipitation on today's date.

The fifth page of each monthly report shows a map with monthly precipitation plotted as a percent of the 1961-90 average. Beneath the map is a graph showing the number of stations in each of eleven precipitation categories varying from less than 25% of average to more than 100% of average. This graphic, accompanied by a brief narrative, allows a quick evaluation of the frequency distribution of monthly precipitation. The lower right hand portion of the page contains monthly precipitation rankings and extremes for six Colorado weather stations with long data records. These rankings are intended to give readers a long-term perspective on how typical or unusual precipitation was during the month in different parts of the state.

Page six consists of a map, graph and narrative description of water-year accumulated precipitation with respect to average. This page is very helpful for evaluating the cumulative precipitation inputs into state water supplies. This page is omitted from the October summary since total water year precipitation after just one month is the same as the monthly data (fifth page).

Heating degree day data for 36 Colorado cities are published each month on the seventh page of each monthly report in a data table similar to previous years. A description of heating degree days and their use is given in Section II of this report.

The next two pages are tabular climate information for the month for selected Colorado stations. Stations are divided into 4 regions: the Eastern Plains, the Foothills/Adjacent Plains (includes the Front Range urban corridor), the Mountains and

High Interior Valleys, and the Western Valleys (includes stations in western Colorado below 7,000 feet). Data presented for each station include the average high (Max), average low (Min) and mean temperature (Mean) for the month and the departure (Dep) from the 1961-1990 average all in degrees Fahrenheit. The extreme highest (High) and lowest (Low) temperature recorded during the month comes next followed by the monthly total of heating (Heat), cooling (Cool) and growing (Grow) degree days (see Section II for definitions), the monthly total precipitation (Total) in inches, the departure from the 1961-1990 average (Dep), the percent of the 1961-1990 average (% Norm) and the total number of days with measurable (≥ 0.01") precipitation (# days).

Beneath the data tables is a comparative table of number of clear, partly cloudy and cloudy days and the percent of possible sunshine for several National Weather Service stations. This is followed by a graph of daily total solar radiation data measured at Fort Collins and a graph of daily soil temperatures at four selected depths (4", 12", 36", and 72"). Beneath the soil temperatures is a brief section, "Hats Off To: _____ _____ ", which acknowledges an individual or an institution for their contribution to data collection and climate monitoring in Colorado.

The components of the monthly report described above are provided each and every month. However, there is some flexibility in the final few pages. Almost every month there is an in-depth analysis and discussion of some important aspect of Colorado's climate. These features vary in length from one to three pages. Under special circumstances there may be two feature stories per month. The September issue always contains a wrap-up of the water year. Here is the index of the feature stories published during the 1993 Water Year.

1) Just Say Snow, October 1992, Page 20.

2) Colorado Snowfall Trends, November 1992, Page 32.

3) We're Under Less Pressure in Colorado, December 1992, Page 43.

4) Thar' She Blows - Winds in Colorado, January 1993, Page 54.

5) Winds in Colorado - Part II, February 1993, Page 65.

6) Mountain Snowstorm, 2/15-26/93, February 1993, Page 66.

7) A Final Look at the 1992-93 Winter, March 1993, Page 78.

8) Coldest Temperature Each Winter, March 1993, Page 80.

9) Precipitation, Bar Graphs, and Floods, April 1993, Page 91.

10) Climate Variability - Some Musings, May 1993, Page 104.

11) How Hot Can It Get???, June 1993, Page 115.

12) How Hot Can It Get, Part 2, July 1993, Page 126.

13) Planning for Snow, August 1993, Page 137.

14) A Review of the 1993 Water Year, September 1993, Page 150.

The final components of each monthly report is a statewide data summary provided to the Colorado Climate Center by the Joint Center for Energy Management (JCEM) at the University of Colorado at Boulder. Back in 1988 they developed a small network of automated weather stations to help gather data useful for heating and cooling design and for energy conservation. A one-page table and graph provides a very compressed summary of statewide temperature, humidity, solar energy and wind based on hourly data. The actual raw data can be obtained on request from JCEM by calling (303) 449-4547. There were some problems with their network during 1993 so some months were not included in our reports.

Except for the JCEM data, temperature and precipitation data used in the monthly summaries were obtained from the National Weather Service cooperative observer network. Data from the major National Weather Service stations, such as Denver and Grand Junction, are also used extensively. A few volunteers who are not affiliated with the National Weather Service's networks are also included based on the Colorado Climate Center's judgement that the data are of good quality.

Please note that specific *daily* temperature and precipitation data are not listed here. Daily data can be obtained in digital and/or hard copy form from the Colorado Climate Center, the Western Regional Climate Center (Reno, NV) and the National Climatic Data Center (Asheville, NC). Much of the daily data are published in the government document, ***Climatological Data.***

The averages which are used in this report for both temperature, heating degree days and precipitation were calculated using 1961-1990 data. Some adjustments have been applied to a few stations where station moves have resulted in significant differences between current observations and their historic data.

The written descriptions here give a good general accounting of each month's weather, but the majority of information is contained on the maps and tables which accompany each report. The accuracy of all of these maps and tables is quite good. However, these reports were initially prepared soon after the end of each month, and preliminary information was sometimes used. Therefore, some of the precipitation, temperature, and heating, cooling and growing degree day values may differ slightly from what is later published by the National Climatic Data Center.

II. EXPLANATION OF DEGREE DAYS

Many climatic factors affect fuel consumption for heating and cooling. Wind, solar radiation and humidity all play a part, but temperature is by far the most important element. Very simply, the colder it gets; the more energy is needed to stay warm.

A simple index, given the name, *heating degree days*, was devised many years ago to relate air temperatures to energy consumption (for heating). The number of *heating degrees* for a given *day* is calculated by subtracting the mean daily temperature (the average of the daily high and low temperature) from 65°F. Sixty-five degrees is used as the base temperature because at that temperature a typical building will not require any heating to maintain comfortable indoor temperatures. That difference (65°F minus the mean daily temperature) is the number of heating degrees for that day. For example, on a day with a maximum temperature of 40°F and a minimum of 10°F the mean daily temperature is 25° and the heating degree total is 40. When the mean daily temperature is 65° or greater, the heating degree day total is defined as 0. The daily values are accumulated throughout the heating season to give heating degree day totals. Different base temperatures can be used to calculate heating degree days, but 65° is the long-standing traditional base.

The heating degree day total for a month or for an entire heating season is approximately proportional to the quantity of fuel consumed for heating. Therefore, the *colder* it gets and the *longer* it stays cold, the *more* heating degree days are accumulated and the more energy is required to heat buildings to a comfortable temperature.

So why is this important? Very simply, if you know how much energy you have used for heating your home or business during a certain period of time, and if you also know the heating degree day total for the same period, you can then establish an energy consumption ratio. With that information you can then make reasonable estimates of your future energy consumption and costs. Also, you can easily check the success and calculate the savings resulting from energy conservation measures such as new insulation, new windows or lowering the thermostat.

Cooling degree days are calculated in a similar fashion. *Cooling degrees* occur each day the daily mean temperature is *above* 65°F. They are accumulated each day throughout the cooling season and are roughly proportional to the amount of energy required to cool a building to a comfortable inside temperature. Cooling degree days are less useful than heating degree days here in Colorado where air conditioning requirements are minimal in many parts of the state. However, they still offer a means of making general comparisons from site to site, year to year or month to month.

Growing degree days, which are sometimes referred to as "heat units" or "crop growth units" are a measure of temperature which has been found to correlate with the rate of development and maturation of crops. Several methods exist for computing growing degree days. In this report the "corn" growing degree day definition was used.

The optimum growth occurs at 86°F and essentially no growth occurs at temperatures below 50°F. Therefore, when computing the daily mean temperature any minimum temperature below 50° is set equal to 50° and any maximum above 86° is counted as 86°F. Growing degree day totals are obtained by subtracting the 50° base temperature from each adjusted mean daily temperature and the accumulating daily totals throughout the growing season.

III. 1993 WATER-YEAR IN REVIEW

In previous years up through the 1984 water year summary, several pages were written recapping the highlights of the year's climate and the impact it had on Colorado. This section now appears as the special feature story that accompanies the September 1993 summary found on pages 150-152.

COLORADO CLIMATE

OCTOBER 1992

Volume 16 Number 1

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

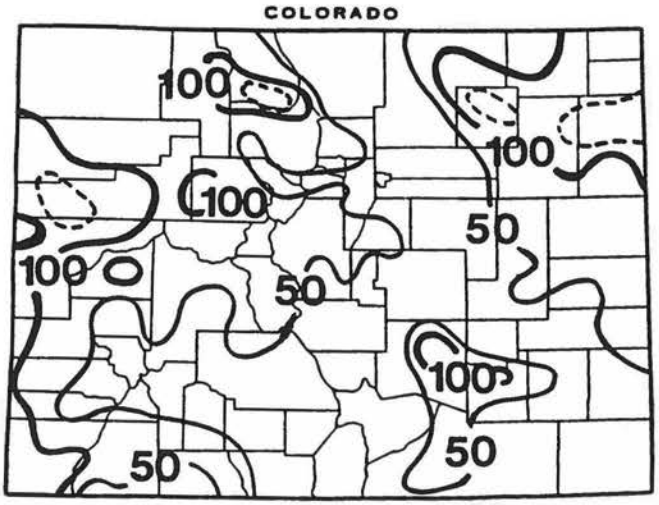
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

October in Perspective – Warm and Mild

The warm, dry weather pattern from September continued into October. Several cold fronts and storm systems flirted with Colorado throughout the month, but most were ineffective. Finally, late in the month mountain snows set in bringing cheer but challenges to the thousands of hunters across the region. Overall, the month ended up drier than average and one to four degrees Fahrenheit warmer than average over the majority of Colorado.

Precipitation

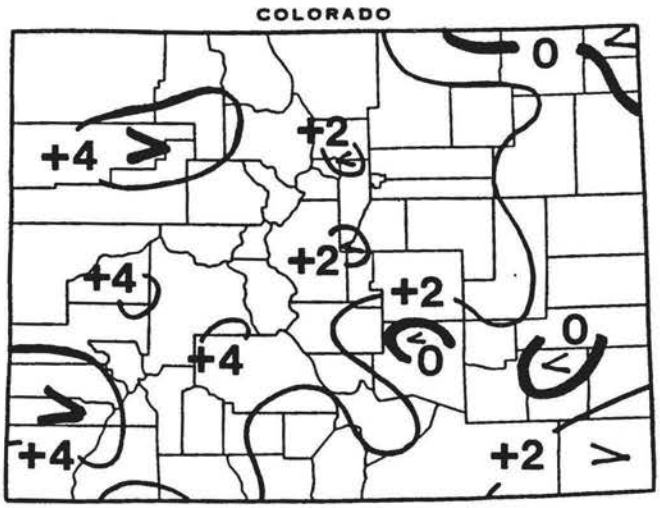
October's precipitation fell predominantly as rain this year, except at high elevations. A storm in early October was responsible for most of the month's moisture east of the mountains, while the last week of the month was damp for the mountains and Western Slope. Most of Colorado ended up drier than normal for the month. The driest areas included most of the Front Range urban corrider, the San Luis Valley and parts of the Southwestern Mountains. Numerous sites recorded less than 25% of average. Wetter than average conditions were limited to extreme western areas, the northeast corner of the State and a small portion of north-central Colorado.



October 1992 precipitation as a percent of the 1961-1990 average.

Temperatures

A hard freeze convincingly brought an end to the growing season at lower elevations early in October, and temperatures showed their normal decline statewide as autumn progressed. No severe cold similar to what Colorado experienced in October 1991 was evident this year. Overall, temperatures for October ended up two to four degrees above average over most of the mountains and Western Slope. Areas east of the mountains experienced more intrusions of cool air but still ended up from near average to locally as much as three degrees above average.



Departure of October 1992 temperatures from the 1961-90 averages.

Inside This Issue

OCTOBER 1992 DAILY WEATHER

1-4 October began with dry, cloudless and very warm weather. Daytime temperatures in the 70s and 80s were widespread. Even some 90s were felt in southeast Colorado. Nights were chilly in the mountains though, and 50-degree day-night temperature changes were common. An upper-air disturbance nicked northern Colorado on the 4th bringing clouds, slightly cooler temperatures, a little lightning and thunder, but only scant rainfall.

5-8 The 5th was cooler and cloudier but still pleasant. Then a strong storm system developed over Colorado on the 6th. Scattered light rains and mountain snows fell in western Colorado as temperatures tumbled. Most precipitation was light, but Steamboat Springs measured 0.50" and Rand reported 0.65" including 5" of wet snow. The storm strengthened as it moved east and brought thunderstorm activity to northeast Colorado late on the 6th. Rains turned to snow early on the 7th over portions of the Eastern Plains – the first of the season. An inch or more of moisture fell from the storm at Julesburg, Wray and Yuma. A few locations awoke to more than 1" of wet snow. Precipitation ended, but strong winds blew on the 7th with gusts to 40 mph on the plains. Skies then cleared and temperatures plummetted. Much of Colorado had the coldest temperatures of the month early on the 8th. Pueblo dipped to 16°F. The 4° reading at Rand was the coldest in the State for October.

9-13 Temperatures warmed quickly, but a fast-moving Pacific cold front moved in already on the 9th accompanied by a few mountain snow flurries and local strong, gusty winds. Then the warm-up accelerated 10-13th with temperatures back in the 70s and 80s. Clouds increased on the 13th, but downslope winds east of the mountains enhanced the warming. Denver reached 84°F. Las Animas and Holly each hit 94°F, the highest in the State.

14-18 Warm weather continued across southern and western Colorado, but much cooler air alternately slipped in and out of eastern Colorado with occasional gusty winds as a cold high pressure area pushed southward out of Canada across the Great Plains. Despite several cold fronts, no precipitation was observed except for some very light snows in the mountains 15-16th.

19-24 Dry weather with warmer than average temperatures covered the State with daytime temperatures mostly in the 70s each day (60s in the mountains). There was scarcely a cloud to be seen anywhere in Colorado on the 20th. Then winds aloft shifted to the southwest, and clouds moved over the Western Slope 21-22nd. A few light showers damped southwest Colorado. Meanwhile, east of the mountains temperatures soared to near-record values. Denver's 81° on the 21st set a new record for the date. The 23rd and 24th were partly cloudy and dry across Colorado, but with light winds and warm temperatures, both days seemed just delightful. Attempts to make artificial snow at ski areas were slowed by daytime temperatures into the 60s almost up to 11,000 feet and nighttime temperatures only slightly below freezing.

25 A combination of moist Pacific air from the west and cooler air from the north triggered a period of rain on the 25th across much of western Colorado spilling over east of the mountains from Boulder south to Colorado Springs. Precipitation was mostly light, and only above 10,000 feet did rains eventually turn to snow. But some areas got a good soaking. Evergreen received 0.44". Norwood, Salida, Buena Vista and Grand Lake all totalled at least 0.50". Clouds also spread out onto the Eastern Plains, but no precipitation fell there.

26-31 Precipitation ended on the 26th except for some lingering mountain showers. It was mild 26-27th statewide, but a change was coming. More Pacific moisture arrived in western Colorado late on the 27th. Showers were widespread but mostly light on the 28th. Meanwhile, much colder air moved into eastern Colorado on the 28th accompanied by fog and areas of light rain and a few snowflakes. Fort Morgan reported 0.34" of rain. Temperatures stayed in the 30s or low 40s east of the mountains on the 29th with fog and a little drizzle. Weather remained cool, damp and unsettled on the 30th as valley rains and mountain snows began spreading into western Colorado late. Halloween (31st) was stormy over much of the State. Heavy precipitation (rains and mountains snows) drenched many areas of Western Colorado during the day. More than 1.00" of rain was reported at Cedaredge, Yellow Jacket and areas near Grand Junction. Snow was heavy (and welcome) in the mountains – Wolf Creek Pass reported nearly a foot. Later, chilly rains spread eastward across parts of the Front Range. Pueblo recorded 0.62". Halloween evening was soggy for Colorado trick-or-treaters in southeast Colorado.

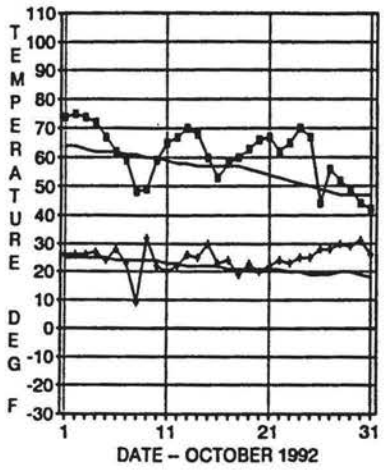
Weather Extremes

Highest Temperature	94°F	October 13	Holly and Las Animas
Lowest Temperature	4°F	October 8	Rand
Greatest Total Precipitation	3.35"		Wolf Creek Pass 1E
Least Total Precipitation	0.00"		Rush 4N
Greatest Total Snowfall	16"		Wolf Creek Pass 1E
Greatest Snow Depth	15"	October 31	Wolf Creek Pass 1E

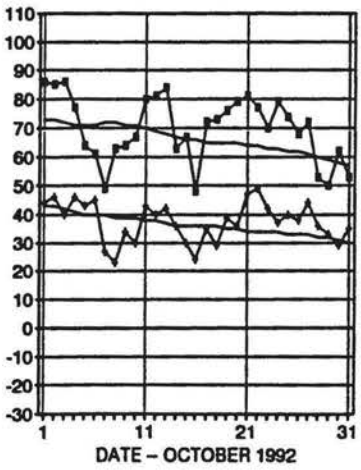
OCTOBER 1992 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown below along with smoothed daily average highs and lows for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 4 p.m. The remaining stations shown below report at midnight.)

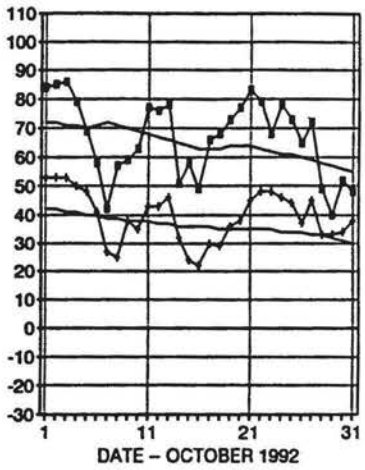
GRAND LAKE 1NW



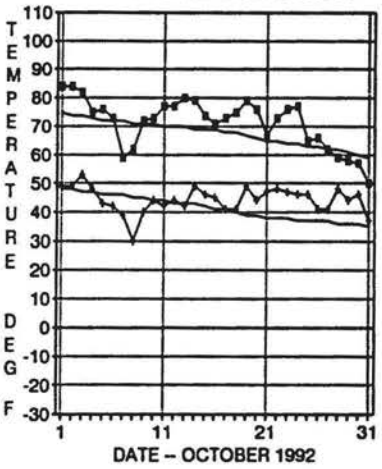
DENVER



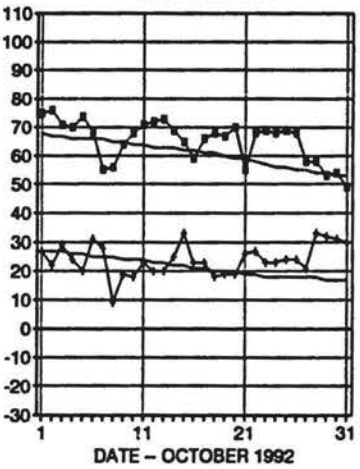
AKRON 1N



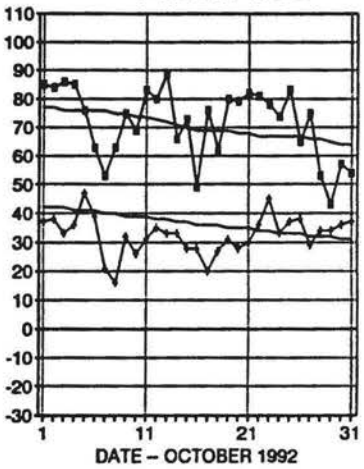
GRAND JUNCTION



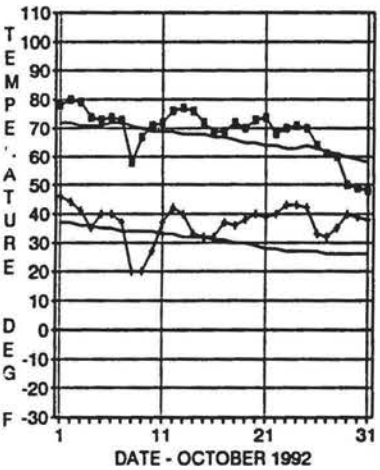
GUNNISON



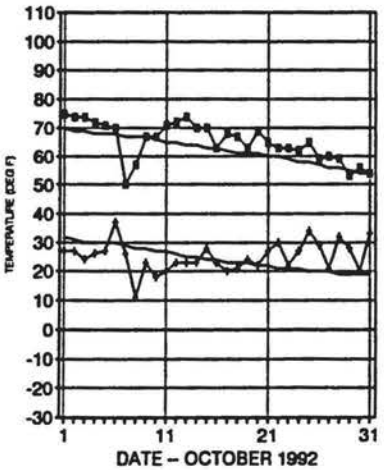
PUEBLO WSO



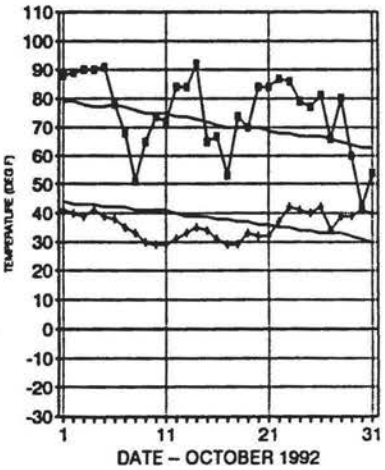
DURANGO



ALAMOSA



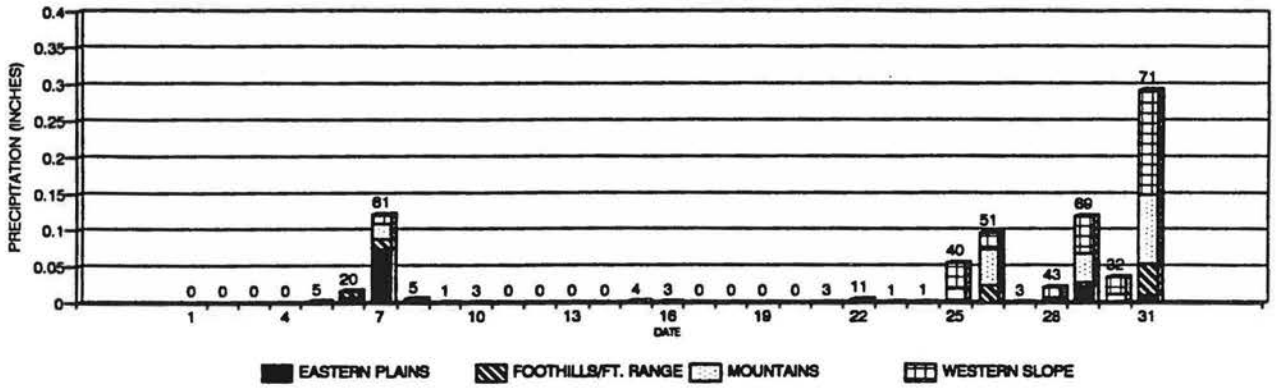
LAMAR



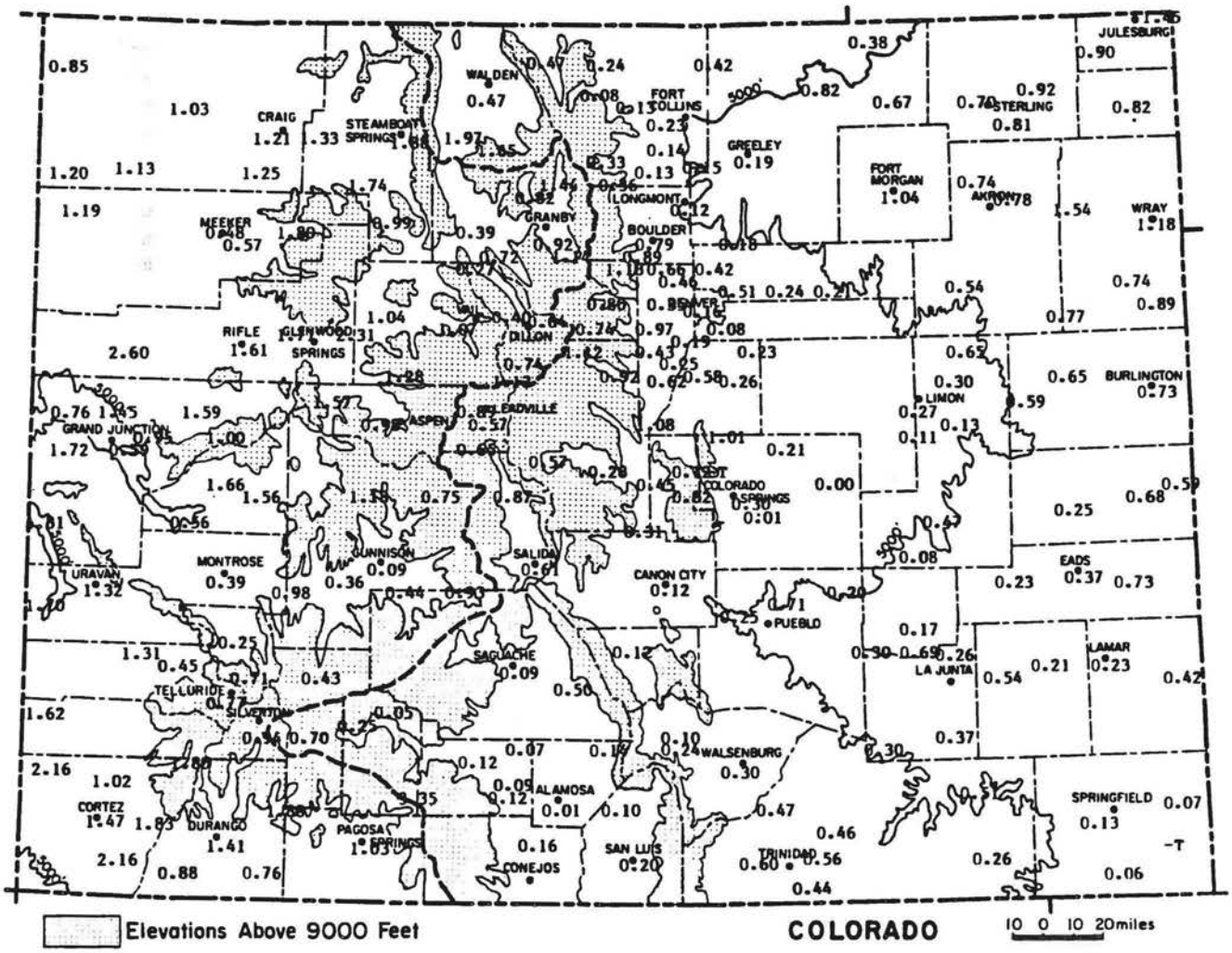
OCTOBER 1992 PRECIPITATION

October precipitation was limited to three significant events. The storm of October 6-7th was the only event to produce much moisture on the eastern plains. It was dry from the 8th through the 24th except for a few scant showers or flurries, mostly in the mountains. Prolonged periods of dry weather in October are not unusual. Two storms at the end of October marked the beginning of the snow accumulation season in the mountains – right about on schedule. The wettest day of the month was October 31.

COLORADO DAILY PRECIPITATION - OCT 1992

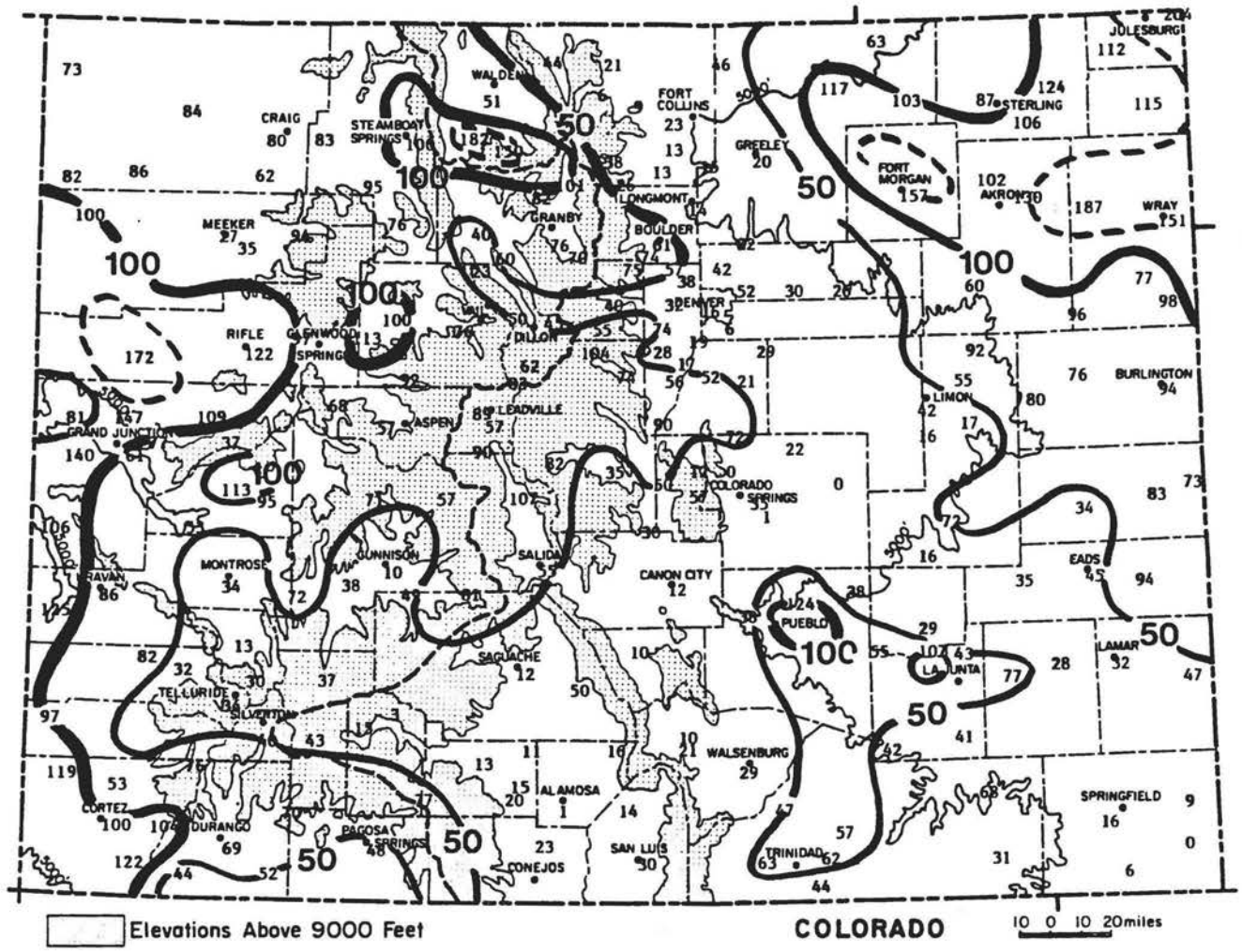


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

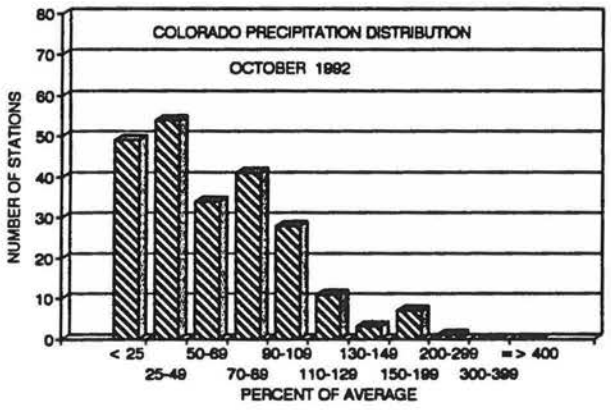


Precipitation Amounts (in inches) for October 1992.

OCTOBER 1992 PRECIPITATION COMPARISON



October 1992 Precipitation as a Percent of the 1961–90 average.



The majority of Colorado's weather stations received below average precipitation in October, but this is very common for autumn months in Colorado. For example, Denver received just 52% of their average, but this only ranked as their 43rd driest October on record.

OCTOBER 1992 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.51"	43rd driest in 121 years of record (driest = <0.01" 1934)
Durango	1.41"	48th wettest in 99 years of record (wettest = 11.72" in 1972)
Grand Junction	1.45"	20th wettest in 101 years of record (wettest = 3.45" in 1972)
Las Animas	0.54"	55th wettest in 126 years of record (wettest = 3.75" in 1870)
Pueblo	0.71"	40th wettest in 125 years of record (wettest = 4.91" in 1957)
Steamboat Springs	1.88"	39th wettest in 88 years of record (wettest = 5.97" in 1908)

COMPARATIVE HEATING DEGREE DAY DATA FOR OCTOBER 1992

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	40	100	303	657	1074	1457	1519	1182	1035	732	453	165	8717
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607									1130
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583									1421
BOULDER	AVE	0	6	130	357	714	908	1004	804	775	483	220	59	5460
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337									483
BUENA VISTA	AVE	47	116	285	577	936	1184	1218	1025	983	720	459	184	7734
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536									1096
BURLINGTON	AVE	6	5	108	364	762	1017	1110	871	803	459	200	38	5743
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372									490
CANON CITY	AVE *	0	10	100	330	670	870	950	770	740	430	190	40	5100
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305									409
COLORADO SPRINGS	AVE	8	25	162	440	819	1042	1122	910	880	564	296	78	6346
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383									548
CORTEZ	AVE *	5	20	160	470	830	1150	1220	950	850	580	330	100	6665
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373									555
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498									863
DELTA	AVE	0	0	94	394	813	1135	1197	890	753	429	167	31	5903
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301									M
DENVER	AVE	0	0	135	414	789	1004	1101	879	837	528	253	74	6014
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346									449
DILLON	AVE	273	332	513	806	1167	1435	1516	1305	1296	972	704	435	10754
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744									2014
DURANGO	AVE	9	34	193	493	837	1153	1218	958	862	600	366	125	6848
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371									593
EAGLE	AVE	33	80	288	626	1026	1407	1448	1148	1014	705	431	171	8377
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503									832
EVERGREEN	AVE	59	113	327	621	916	1135	1199	1011	1009	730	489	218	7827
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540									1048
FORT COLLINS	AVE	5	11	171	468	846	1073	1181	930	877	558	281	82	6483
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377									541
FORT MORGAN	AVE	0	6	140	438	867	1156	1283	969	874	516	224	47	6520
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352									442
GRAND JUNCTION	AVE	0	0	65	325	762	1138	1225	882	716	403	148	19	5683
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222									253

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	264	468	775	1128	1473	1593	1369	1318	951	654	384	10591
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685									1715
GREELEY	AVE	0	0	149	450	861	1128	1240	946	856	522	238	52	6442
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374									490
GUNNISON	AVE	111	188	393	719	1119	1590	1714	1422	1231	816	543	276	10122
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617									M
LAS ANIMAS	AVE	0	0	45	296	729	998	1101	820	698	348	102	9	5146
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304									348
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785									2139
LIMON	AVE	8	6	144	448	834	1070	1156	960	936	570	299	100	6531
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442									645
LONGMONT	AVE	0	6	162	453	843	1082	1194	938	874	546	256	78	6432
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388									546
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426									645
MONTROSE	AVE	0	10	135	437	837	1159	1218	941	818	522	254	69	6400
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332									477
PAGOSA SPRINGS	AVE	82	113	297	608	981	1305	1380	1123	1026	732	487	233	8367
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538									1101
PUEBLO	AVE	0	0	89	346	744	998	1091	834	756	421	163	23	5465
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390									463
RIFLE	AVE	6	24	177	499	876	1249	1321	1002	856	555	298	82	6945
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375									531
STEAMBOAT SPRINGS	AVE *	90	140	370	670	1060	1430	1500	1240	1150	780	510	270	9210
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570									1165
STERLING	AVE	0	6	157	462	876	1163	1274	966	896	528	235	51	6614
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400									520
TELLURIDE	AVE	163	223	396	676	1026	1293	1339	1151	1141	849	589	318	9164
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529									1211
TRINIDAD	AVE	0	0	86	359	738	973	1051	846	781	468	207	35	5544
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321									400
WALDEN	AVE	198	285	501	822	1170	1457	1535	1313	1277	915	642	351	10466
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709									1695
WALSENBURG	AVE	0	8	102	370	720	924	989	820	781	501	240	49	5504
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271									359

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

OCTOBER 1992 CLIMATIC DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	64.8	30.8	47.8	-0.2	85	12	529	0	255	0.38	-0.22	63.3	2
STERLING	69.7	34.6	52.1	2.1	89	21	391	0	320	0.70	-0.10	87.5	2
FORT MORGAN	70.2	36.8	53.5	2.7	88	24	352	2	329	1.04	0.38	157.6	2
AKRON FAA AP	66.5	39.2	52.9	2.2	86	22	380	13	279	0.74	0.02	102.8	4
AKRON 4E	67.7	35.1	51.4	1.2	88	19	419	5	299	0.78	0.18	130.0	3
HOLYOKE	65.6	36.2	50.9	-0.6	85	21	430	0	270	0.82	0.11	115.5	2
JOES	69.5	36.1	52.8	0.8	87	22	369	1	321	0.77	-0.03	96.2	2
BURLINGTON	68.3	38.1	53.2	1.2	87	24	372	13	306	0.73	-0.04	94.8	3
LIMON WSMO	66.1	34.9	50.5	2.2	83	20	442	0	265	0.27	-0.37	42.2	6
CHEYENNE WELLS	72.2	34.5	53.4	0.2	91	13	367	13	350	0.68	-0.13	84.0	3
EADS	71.0	36.5	53.8	-0.0	89	25	341	1	342	0.37	-0.44	45.7	2
ORDWAY 21N	72.9	34.5	53.7	2.2	89	22	341	1	357	0.08	-0.40	16.7	1
ROCKY FORD 2SE	75.1	34.7	54.9	0.7	90	21	305	2	391	0.69	0.05	107.8	3
LAMAR	74.0	28.7	51.4	-3.3	92	22	416	0	368	0.23	-0.48	32.4	3
LAS ANIMAS	73.5	36.9	55.2	-0.3	94	26	304	7	366	0.54	-0.16	77.1	4
HOLLY	75.3	36.6	56.0	1.9	94	26	287	14	388	0.42	-0.46	47.7	2
SPRINGFIELD 7WSW	75.0	40.4	57.7	2.6	90	29	241	21	387	0.13	-0.66	16.5	1
TIMPAS 13SW	72.9	37.6	55.2	1.8	87	27	280	4	342	0.30	-0.40	42.9	1

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	67.9	37.2	52.6	2.8	84	23	377	0	289	0.23	-0.75	23.5	2
GREELEY UNC	68.4	37.0	52.7	2.2	87	25	374	0	298	0.19	-0.76	20.0	3
ESTES PARK	62.8	33.3	48.0	3.1	75	18	520	0	207	0.33	-0.53	38.4	6
LONGMONT 2ESE	71.3	34.2	52.8	2.9	87	20	350	0	322	0.12	-0.73	14.1	5
BOULDER	68.4	39.7	54.0	0.5	84	23	337	5	302	0.79	-0.50	61.2	7
DENVER WSFO AP	69.8	37.5	53.6	2.2	86	23	346	1	316	0.51	-0.47	52.0	5
EVERGREEN	64.6	29.8	47.2	2.6	80	20	540	0	241	0.97	-0.34	74.0	6
CHEESMAN	68.7	23.6	46.2	-0.5	80	11	575	0	298	1.08	-0.12	90.0	5
LAKE GEORGE 8SW	61.2	27.2	44.2	2.4	72	16	636	0	189	0.29	-0.50	36.7	4
ANTERO RESERVOIR	60.0	21.4	40.7	2.8	71	13	746	0	171	0.57	-0.12	82.6	3
RUXTON PARK	57.9	24.0	41.0	2.6	70	10	737	0	148	0.82	-0.61	57.3	5
COLORADO SPRINGS	67.2	37.5	52.3	2.2	83	23	383	0	285	0.30	-0.54	35.7	2
CANON CITY 2SE	71.5	38.5	55.0	0.8	84	21	305	3	343	0.12	-0.83	12.6	2
PUEBLO WSO AP	71.6	32.5	52.1	-1.5	89	16	390	0	346	0.71	0.14	124.6	3
WESTCLIFFE	65.0	27.2	46.1	2.1	74	9	561	0	232	0.12	-1.01	10.6	1
WALSENBURG	73.3	38.9	56.1	3.0	83	26	271	4	373	0.30	-0.73	29.1	4
TRINIDAD FAA AP	72.5	36.3	54.4	0.9	83	22	321	0	359	0.46	-0.34	57.5	2

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	59.5	24.2	41.8	3.1	78	6	709	0	168	0.47	-0.45	51.1	5
LEADVILLE 2SW	54.8	24.2	39.5	2.7	67	12	785	0	100	0.57	-0.43	57.0	6
SALIDA	68.1	30.7	49.4	2.9	80	13	477	0	285	0.61	-0.49	55.5	3
BUENA VISTA	64.9	30.0	47.5	2.1	76	22	536	0	241	0.87	0.06	107.4	3
SAGUACHE	65.1	30.5	47.8	3.2	75	18	526	0	245	0.09	-0.61	12.9	3
HERMIT 7ESE	61.8	21.9	41.9	3.4	75	15	710	0	193	0.25	-1.34	15.7	3
ALAMOSA WSO AP	65.3	25.0	45.1	1.6	75	11	607	0	245	0.01	-0.69	1.4	1
STEAMBOAT SPRINGS	65.7	27.1	46.4	4.2	83	13	570	0	255	1.88	0.01	100.5	5
YAMPA	62.9	33.2	48.0	6.2	76	20	516	0	211	0.99	-0.31	76.2	6
GRAND LAKE 1NW	60.9	24.7	42.8	3.9	75	9	682	0	186	1.44	0.02	101.4	8
GRAND LAKE 6SSW	59.8	25.5	42.7	2.8	74	9	685	0	164	0.82	-0.17	82.8	5
DILLON 1E	57.3	24.3	40.8	2.3	70	11	744	0	140	0.40	-0.40	50.0	5
CLIMAX	50.4	24.5	37.5	4.1	64	7	846	0	60	1.13	-0.23	83.1	7
ASPEN 1SW	61.5	30.4	45.9	2.4	75	12	583	0	192	0.98	-0.73	57.3	6
CRESTED BUTTE	58.8	23.4	41.1	1.9	72	9	732	0	157	1.18	-0.46	72.0	5
TAYLOR PARK	55.0	24.9	40.0	2.2	67	12	766	0	102	0.75	-0.55	57.7	5
TELLURIDE	66.2	29.3	47.8	4.7	79	15	529	0	264	0.77	-1.45	34.7	8
PAGOSA SPRINGS	67.5	27.3	47.4	2.2	79	12	538	0	278	1.03	-1.08	48.8	6
SILVERTON	57.5	24.5	41.0	2.1	69	15	737	0	142	0.94	-1.40	40.2	6
WOLF CREEK PASS 1	49.1	27.6	38.3	2.1	61	16	713	0	39	3.35	-1.00	77.0	7

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	65.7	31.7	48.7	3.6	82	17	498	0	251	1.21	-0.29	80.7	5
HAYDEN	65.6	31.7	48.7	3.5	83	16	498	0	257	1.33	-0.27	83.1	6
MEEKER NO. 2	70.0	32.7	51.3	5.2	83	19	389	0	297	0.48	-1.29	27.1	4
RANGELY 1E	69.7	35.5	52.6	3.7	83	23	376	0	313	1.19	0.01	100.8	5
EAGLE FAA AP	66.7	30.3	48.5	3.6	83	12	503	0	270	1.04	-0.00	100.0	7
GLENWOOD SPRINGS	69.8	34.0	51.9	3.4	86	22	400	0	315	1.71	-0.04	97.7	8
RIFLE	72.4	32.9	52.6	3.6	88	19	375	0	355	1.61	0.30	122.9	6
GRAND JUNCTION WS	71.3	44.2	57.8	3.2	84	30	222	7	341	1.45	0.47	148.0	5
CEDAREDGE	72.1	35.5	53.8	3.1	85	19	342	0	352	1.66	0.20	113.7	6
PAONIA 1SW	72.0	41.4	56.7	5.2	85	26	251	2	349	1.56	-0.08	95.1	7
DELTA	74.1	36.0	55.0	3.1	86	24	301	0	378	0.56	-0.49	53.3	6
GUNNISON	65.2	23.8	44.6	3.4	76	9	565	0	219	0.09	-0.75	10.7	1
COCHETOPA CREEK	65.4	25.6	45.5	4.7	79	9	596	0	249	0.44	-0.45	49.4	4
MONTROSE NO. 2	69.6	38.4	54.0	3.6	79	25	332	0	315	0.39	-0.75	34.2	4
URAVAN	76.2	39.8	58.0	3.8	89	28	211	1	409	1.32	-0.21	86.3	4
NORWOOD	65.4	35.5	50.4	4.2	78	23	446	0	249	1.31	-0.28	82.4	3
YELLOW JACKET 2W	68.1	40.1	54.1	4.4	79	26	332	0	296	2.16	0.35	119.3	6
CORTEZ	69.9	35.5	52.7	2.7	80	22	373	0	316	1.47	0.01	100.7	6
DURANGO	69.0	36.7	52.8	4.0	80	20	371	0	301	1.41	-0.61	69.8	7
IGNACIO 1N	66.4	32.3	49.4	1.6	77	18	480	0	262	0.76	-0.70	52.1	6

Data are received by the Colorado Climate Center for more locations than appear in these tables. Please contact the Colorado Climate Center if additional information is needed.

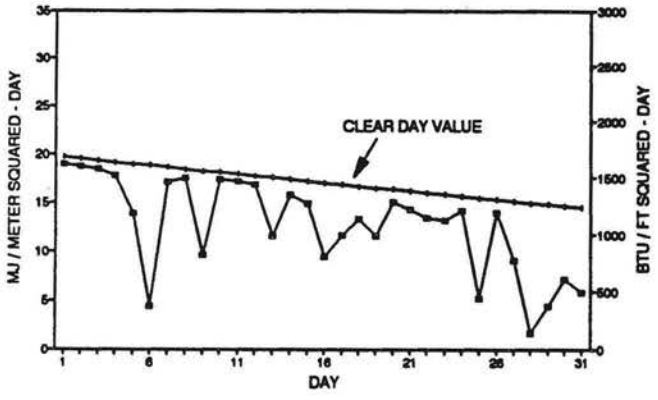
OCTOBER 1992 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	11	13	7	--	--
Denver	11	9	11	65%	72%
Fort Collins	13	8	10	--	--
Grand Junction	16	8	7	74%	74%
Limon	11	10	10	--	--
Pueblo	N/A	N/A	N/A	75%	78%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

There were a number of cloudless days in October, which is normal. Dense cloud cover late in October compensated for plentiful sunshine early in the month. Solar energy ended up close to average for the month.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
OCTOBER 1992

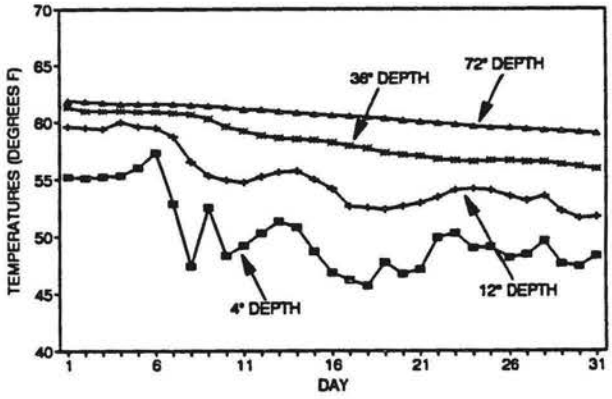


OCTOBER 1992 SOIL TEMPERATURES

Near-surface soil temperatures cooled in October but remained warmer than average for this time of year. Deep soil temperatures were near average.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
OCTOBER 1992



HATS OFF TO: *Terry Gaines* of Flagler 2NW, Colorado

Terry Gaines has been taking daily weather observations on the family farm since April 8, 1970. He took over from his father who had been the official observer there for another 22 years. Their driest year was 1964 when less than 10" of moisture fell. In 1965, they received almost that much just in June.

JUST SAY SNOW

A few months ago we gave you readers the opportunity to let us know some of the things about Colorado's climate that you wanted to learn more about. From Julesburg to Cortez and from valley bottom to mountain top a resounding cry arose from across the State, "Tell us more about snow!" (forgive my slight exaggerations). That request is fair and reasonable. I like snow. I don't mind writing about it, and it is fairly important to Colorado. After all, our economy in so many ways relies on snow either in its original white flaky form or its subsequent liquid form when it splashes down from the mountains.

There are two reasons why I haven't said much about snow in recent issues of "**Colorado Climate**". First of all, from 1985 to 1987 I wrote numerous features on Colorado snow, most of which are not out of date. Here is a list of the articles I found. Please dust off your old issues and read up on snow.

"Snowfall in Colorado –
How does it stack up" ..... October 1985
"What's so hard about measuring snow?" ... December 1985
"The last snow of winter" ..... February 1986
"White Christmas – What are the Odds?" .. November 1986
"10 to 1 – The story of
snow densities in Colorado" ..... January 1987
"The elusive first snow" ..... August 1987
"Colorado snow removal problems –
A climatological perspective" ..... December 1987

Secondly, of the climatological observations that are taken in our country, snow data are among the lousiest. When I report to you, I like to tell you the truth as best I can with the data we have available. When it comes to snow, I don't think I can tell you the truth snow measurements are often inaccurate and inconsistent. If I randomly chose 10 people, gave them all polished rulers and a pad of paper and told them to go out and measure how much snow fell from a given storm and for an entire winter season, there is at least a 90% chance that I would get 10 different answers. The answer could even be affected by who the observer happens to work for. Furthermore, I wouldn't be too surprised if I couldn't do just as well and maybe even better sitting in my living room and looking out the window without ever going outside to measure anything. Such is the nature of the lovely beast we call snow.

Probably I'm too critical. A lot can be done with the data we have from dozens of locations across Colorado. But as chief observer at the 104 year old Fort Collins weather station, I know the problems of measuring snow all too well. I've trained dozens of observers. Most of them do just great until a windy, spring snowstorm comes along when the temperature is 33° and more snow sticks to the side of the tree than to the ground. Perhaps it is time for me to sit down and write a little book called, "How to measure snow and satisfy climatologists". It won't be a best seller.

Let's review briefly the elements of a complete snow observations. Then I'll re-examine the characteristics of snow that make it so blasted difficult to measure. When we are done, perhaps you'll be as skeptical as I am about 75% of the snow reports you hear, or may be you will be a better snow measurer.

The ideal weather observation consists of the following measurements taken and recorded each day:

1) **Precipitation.** This is the amount of moisture which falls, either as rain or the melted equivalent of snow or other frozen precipitation, ideally measured on a daily basis. The standard measurement uses a raingage with a diameter of 8". Smaller diameter gages may do fine for measuring rain but often are ineffective for measuring snow. During winter, the precipitation that falls each day must be melted, poured into a smaller diameter cylinder and then measured and recorded in increments of 0.01".

2) **Snowfall.** This is the amount of new snow, measured in inches and tenths, which has fallen in the past 24-hours or other designated time period.

3) **Snow depth.** This is just as it sounds -- the total depth of snow, both new snow and any remaining old snow on the ground, measured to the nearest inch.

4) **Water equivalent of snow on ground.** This requires taking a representative core of snow on the ground and measuring its water content, either by weighing it or by melting it and measuring it like precipitation. This is a common measurement for evaluating mountain snowpack but is often not included in observations at cooperative stations.

With these four pieces of information, measured and recorded properly each day of the winter season, you have the necessary information to deduce almost anything you may need – skiing conditions, snow removal requirements, potential runoff and water supplies, structural snow loads, etc. The example on the next page shows this information for Fort Collins, including temperatures, for a period in March 1990 when a remarkable snowstorm struck the area.

There are several basic facts about snow that help explain the difficulties in taking good measurements.

1) Snow flakes do not like to land inside a raingage. The dynamics of airflow around a raingage are not unlike the movement of air around a car travelling down the road. The air tends to deflect up, down or to the sides. The stronger the wind blows, the more likely that snowflakes will deflect rather than enter the gage. This means that precipitation measurements using standard raingages may be very inaccurate during snow.

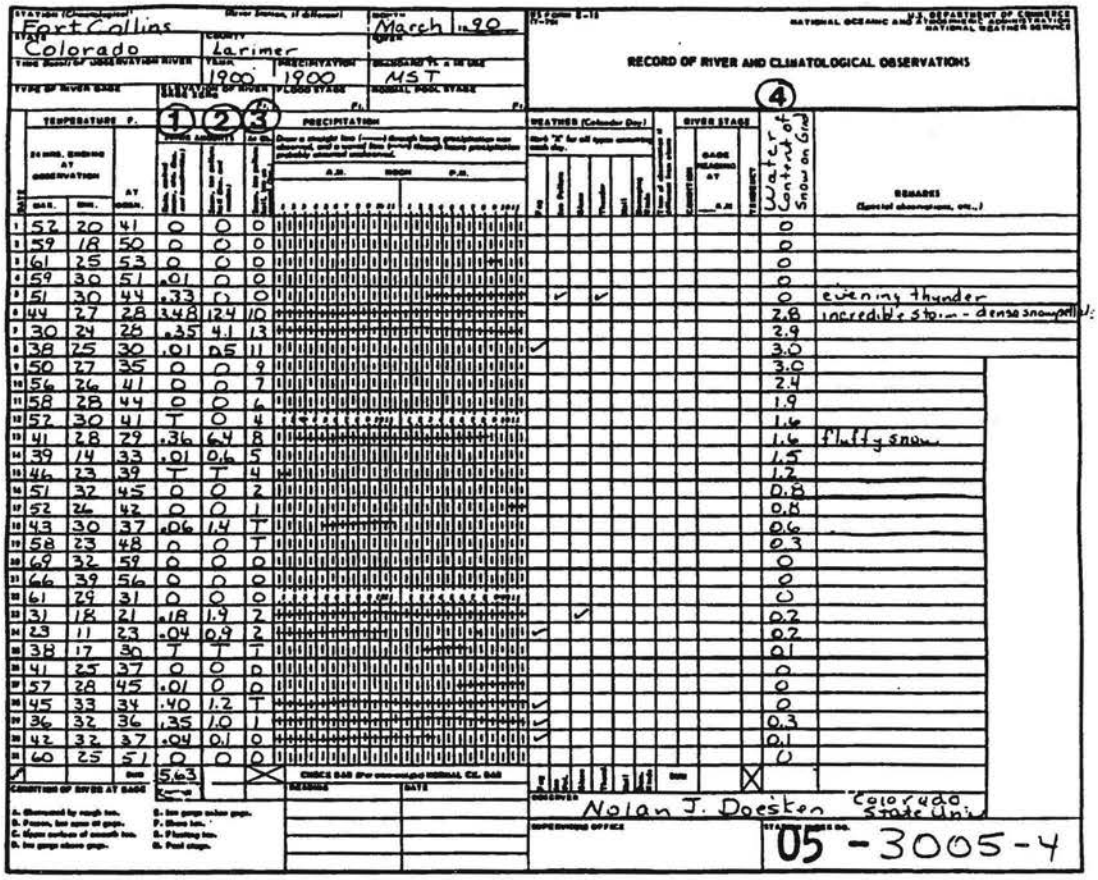
2) The density (water content) of snow varies greatly from one storm to another and even from one portion of a storm to another depending on the structure of the snow crystals. I have seen the water content from an inch of fresh snow vary from as little as 0.01" to nearly 0.20". The classic

1 = Precipitation

2 = Snowfall

3 = Snow depth

4 = Water content of snow on ground



RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

Fort Collins, Colorado — Larimer — March 1990 — 1900 — 1900 — MST

Date	Temperature °F: 24 hrs. ending at observation: Max.	Min.	At obsn.	Precipitation: 1 Water equivalent (in.)	2 Snowfall (in.)	3 Snow depth (in.)	Water Content of Snow on Grid (4)	Remarks
1	52	20	41	0	0	0	0	
2	59	18	50	0	0	0	0	
3	61	25	53	0	0	0	0	
4	59	30	51	.01	0	0	0	
5	51	30	44	.33	0	0	0	evening thunder
6	44	27	28	3.48	12.4	10	2.8	incredible storm - dense snowpack
7	30	24	26	.35	4.1	13	2.9	
8	38	25	30	.01	0.5	11	3.0	
9	50	27	35	0	0	9	3.0	
10	56	26	41	0	0	7	2.4	
11	58	28	44	0	0	6	1.9	
12	52	30	41	T	0	4	1.6	
13	41	28	29	.36	6.4	8	1.6	fluffy snow
14	39	14	33	.01	0.6	5	1.5	
15	46	23	39	T	T	4	1.2	
16	51	32	45	0	0	2	0.8	
17	52	26	42	0	0	1	0.8	
18	43	30	37	.06	1.4	T	0.6	
19	58	23	48	0	0	T	0.3	
20	69	32	59	0	0	0	0	
21	66	39	56	0	0	0	0	
22	61	29	31	0	0	0	0	
23	31	18	21	.18	1.9	2	0.2	
24	23	11	23	.04	0.9	2	0.2	
25	38	17	30	T	T	T	0.1	
26	41	25	37	0	0	0	0	
27	57	28	45	.01	0	0	0	
28	45	33	34	.40	1.2	T	0	
29	36	32	36	.35	1.0	1	0.3	
30	42	32	37	.04	0.1	0	0.1	
31	60	25	51	0	0	0	0	
				5.63				

Observer: Nolan J. Doesken, Colorado State Univ.

05-3005-4

ratio that many of you have probably heard before, 10 to 1 (10 inches snow contains 1 inch of water) rarely applies here in Colorado. One inch of water for every 14 or 15" of snow is more reasonable here in Colorado.

3) Snow sometimes melts as it falls. Even when the air is very cold, snow may melt from beneath since it acts as a marvelous insulator and traps the warmth from the soil.

4) Snow doesn't land and accumulate uniformly, and it is easily blown by the wind. As a result, it is important that measurements take this into account and attempt to average over the full range of conditions. It is not unusual out on the Eastern Plains of Colorado to find open fields nearly bare after a blizzard while 12-foot drifts surround every structure. We often see very small precipitation totals reported from stations that are out in the open while stations behind windbreaks or in the small towns out on the plains report large totals.

5) Snow settles. Without the help of melting or blowing, fresh snow will compact greatly during the period immediately following fresh snowfall. Within a few hours to a few days, 8" of fresh powder snow can compact to 4" or less. Compaction depends on density, temperature, sunshine and other factors. Therefore, depending on the time of day when an observer takes his or her observations, a totally different result can be obtained. Staffed National Weather Service offices report snowfall at 6-hour intervals. Daily totals are the sum of 6-hour periods. These totals tend to be greater than cooperative stations where readings are taken just once a day allowing more time for snow to settle.

Ideally, all of these conditions would be recognized and accounted for in our climate records. In truth, they are not. Most available winter precipitation measurements underestimate actual precipitation. Systematic and uniform procedures have not been adopted by all agencies taking snow measurements. As a result, snowfall measurements are incomplete and inconsistent. There are hardly any long-term measurements suitable for studying climate variations and change. The quality of snowdepth measurements is better, but this variable was not a part of required observations at many stations until recent decades and many stations still do not record it. Water equivalent of snow on the ground is the most important variable from a hydrological or structural perspective, but it is not a standard measurement at many stations outside of the USDA Soil Conservation Services snow survey programs. Finally, National Weather Service automation may phase out any snow measurements from airport sites beginning very soon. At present, no satisfactory automated device exists for the measurement of all these key elements.

There is much room for improvement. As a State particularly fond and proud of our snow, we should be taking the lead nationally to assure accurate and consistent measurements. This will be on my priority list in the months ahead. If you would like to help in some way, please contact me early in 1993.

– Happy Holidays to all of you. May the climate of the New Year be as interesting and varied as 1992. –

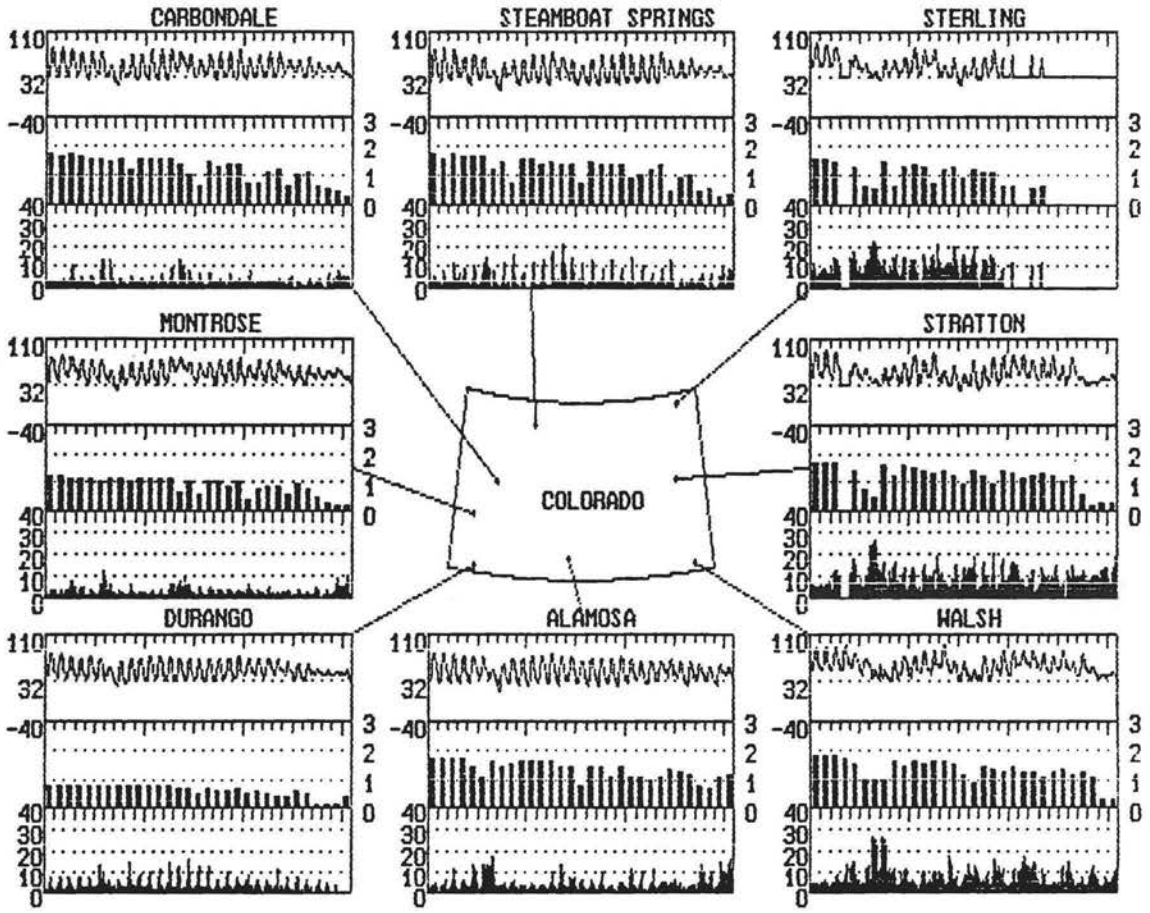
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

WTHRNET WEATHER DATA OCTOBER 1992

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	45.8	47.5	47.1	50.8	41.3	42.9	49.5	54.7
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	76.1 13/15	75.0 1/15	84.2 2/15	79.5 2/15	80.4 2/14	90.3 1/16	88.0 2/14	90.3 13/15
minimum:	12.2 8/ 6	19.9 8/ 7	16.9 8/ 6	20.1 8/ 6	10.2 8/ 6	18.0 16/ 6	21.2 16/ 4	28.8 18/ 6
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	73 / 20	66 / 24	77 / 26	63 / 26	69 / 18	40 / -0	69 / 27	62 / 29
11 AM	27 / 22	37 / 27	35 / 23	33 / 27	29 / 18	31 / 13	40 / 29	37 / 30
2 PM	19 / 20	28 / 25	23 / 22	27 / 26	22 / 18	20 / 2	32 / 28	28 / 29
5 PM	21 / 19	31 / 24	26 / 22	29 / 25	24 / 17	22 / 1	35 / 26	28 / 27
11 PM	42 / 17	54 / 24	52 / 23	46 / 24	52 / 16	37 / -0	58 / 25	47 / 27
monthly average wind direction (degrees clockwise from north)								
day	194	215	240	277	223	110	132	173
night	162	85	169	168	107	131	185	227
monthly average wind speed (miles per hour)	4.23	3.49	2.28	2.68	3.04	5.44	8.77	7.29
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	360	435	603	508	500	330	50	78
3 to 12	350	274	134	235	194	301	521	576
12 to 24	34	15	2	1	18	113	165	80
> 24	0	0	0	0	0	0	8	10
monthly average daily total insolation (Btu/ft²·day)	1303	590	1179	877	1176	816	1150	1284
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	200	1	161	54	167	100	184	187
40-60%	83	3	77	60	53	50	62	96
20-40%	40	233	48	73	47	31	45	33
0-20%	7	100	29	101	32	37	36	25

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

NOVEMBER 1992

Volume 16 Number 2

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

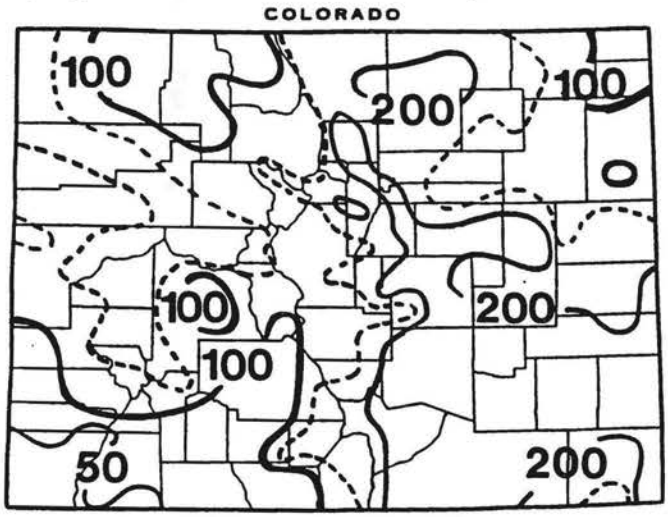
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

November Climate in Perspective – Cloudy, Snowy and Cold

Several significant storms hit Colorado in November continuing the tendency toward wet and snowy Novembers that has characterized the past two decades. Between storm systems there were more general cloudiness and fog than normal. Warm days were also in short supply. November ended up several degrees colder than average statewide ranking anywhere from the 3rd to the 10th coldest November since 1889.

Precipitation

Four significant storms during November left most of Colorado wetter and whiter than average. The heaviest precipitation struck the central mountains (52" of snow with

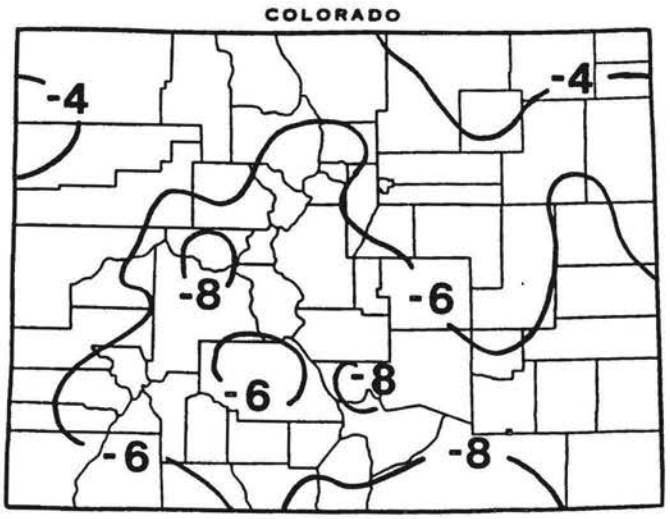


November 1992 precipitation as a percent of the 1961-1990 average.

4.01" water content at Aspen), the Front Range (Boulder totalled 2.56" of moisture from 44.7" snow) and the Eastern Plains (Lamar reported 18" of snow with 1.99" of moisture, 383% of average). Precipitation in excess of 200% of average, much in the form of snow, fell on most Front Range cities and over nearly all of southeastern Colorado. The storms nearly missed southwest Colorado. The Four Corners area had less than 50% of their average. The Yampa River Valley from Yampa to Maybell and extreme northeastern Colorado were also a little drier than average.

Temperatures

A few days of mild weather in mid-November was Colorado's last taste of autumn for 1992. The rest of November was cold statewide with mid-winter temperatures the last 10 days of the month. All areas of Colorado ended up well below average for the month with most stations 4 to 5 degrees F below average across northern Colorado increasing to 6 to 10 degrees below average across southern Colorado. This was the coldest November since 1979 over much of the mountains and western valleys while east of the mountains it was the coldest November since 1972.



Departure of November 1992 temps. from the 1961-90 averages.

Inside This Issue

NOVEMBER 1992 DAILY WEATHER

1-3 Deep low pressure moved east of Colorado on the 1st. Snow showers fell over the Northern and Central Mountains while the Eastern Plains had sunshine but strong winds. Then a strong disturbance banged into western Colorado early on the 2nd with wind, heavy snow and cold temperatures. Aspen reported a foot of new snow while Glenwood Springs had a combination of rain and snow totalling 1.10" of moisture. The hard-hitting storm closed some mountain roads for a time. Snow diminished as the storm crossed the mountains, but some areas east of the mountains received significant amounts. The first snow of the year for Fort Collins totalled 6" in just 6 hours. Only some mountain snowshowers remained on the 3rd, but cold, gusty winds made for an uncomfortable day over much of the State.

4-8 Partly cloudy to cloudy and unseasonably cold weather 4-6th was followed by a return to more seasonal temperatures 7-8th. The first subzero readings of the season were observed across the high valleys of southwest Colorado 4-6th. The Hermit 7ESE weather station slipped to -14° on the 4th. Strong but intermittent downslope winds 7-8th helped warm temperatures east of the mountains. Las Animas shot up to 74° on the 8th, the warmest in Colorado for November. Most of the State was dry these few days, but daily snowshowers occurred in the Northern and Central Mountains. Nearly 5" of snow fell at Steamboat Springs early on the 8th.

9-12 Eastern Colorado enjoyed a nice day on the 9th, but a strong storm was forming to the west. Snow spread over most of the mountains and Western Slope on the 10th. For most areas precipitation was not heavy, but some areas in central Colorado were hit hard. Paonia received about 0.50" of rain followed by 6" of snow. Aspen was buried by nearly 20" of new snow in town with more in the mountains. The storm then moved eastward across southern Colorado on the 11th. Lamar picked up 6" of wet snow with 0.68" water content. Precipitation ended on the 12th, but unseasonably cold temperatures continued. Alamosa reported -3° that morning while Fraser was -6°F. With a strong jetstream overhead, some areas in the mountains and eastern foothills caught gusty winds approaching speeds of 50 mph.

13-17 This was the only period all month with several consecutive days of sunny, dry weather. Denver hit 70° on the 15th. Clouds then increased and temperatures cooled gradually 16-17th.

17-19 Late on the 17th, chilly, moist air slipped into eastern Colorado producing dense fog and low clouds. An upper air disturbance from the west triggered some convective showers late on the 18th. A burst of snow about 5 p.m. made mountain driving treacherous on I-70. Then cooler air and more clouds invaded western Colorado on the 19th as a new storm approached.

20-24 Two strong winter storms hit Colorado in rapid succession. The first storm dropped its heaviest snows from the Front Range across the Eastern Plains 20-21st with lesser amounts in the mountains. 8-12" totals were common along the Front Range. Monument reported 17". Thanks to relatively warm pavement temperatures, most main roads remained clear. Snow ended on the 21st but was followed by patches of dense fog as temperatures dropped. Pueblo was a nippy +2° on the 22nd. The second storm swept in already on the 23rd and again was heaviest east of the mountains. Strong winds and colder temperatures made this storm a bigger problem for transportation. 6-10" totals were common over most of eastern Colorado, but Boulder was amazed to receive 21" of fluffy snow.

25-27 Colorado enjoyed 3 beautiful days of sunshine and gradually moderating temperatures. Deep blue skies and deep snow combined for a picture-perfect Thanksgiving. But cold nights were the rule with single digits at lower elevations and subzero readings in the mountains.

28-30 A weak storm crossed the State late on the 28th bringing light snows to the mountains. Some snow also fell along the Front Range. Boulder again got the heaviest part of the storm with 5" on the 29th. Frigid temperatures gripped the mountains on the 30th. Antero Reservoir's -28° was the coldest in Colorado for November. Sunshine was welcome on the 30th, but strong downslope winds gusting well over 50 mph in some areas along the Front Range whipped old snow into drifts and closed some roads. Temperatures in windy areas at the base of the foothills soared into the mid 50s.

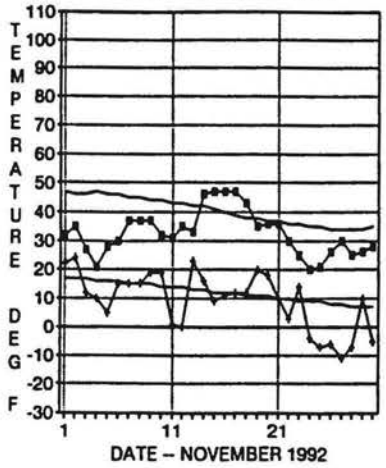
Weather Extremes

Highest Temperature	74°F	November 8	Las Animas
Lowest Temperature	-28°F	November 30	Antero Reservoir
Greatest Total Precipitation	6.10"		Bonham Reservoir
Least Total Precipitation	0.26"		Manassa
Greatest Total Snowfall	66"		Marvine Ranch
Greatest Snow Depth	29"	November 24	Wolf Creek Pass 1E

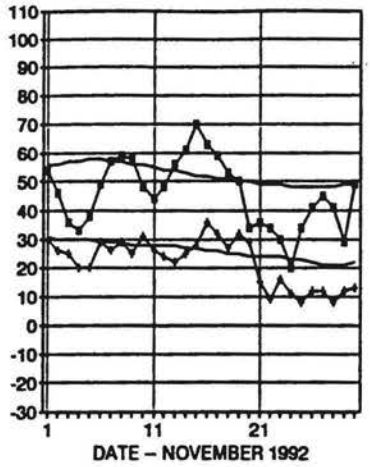
NOVEMBER 1992 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

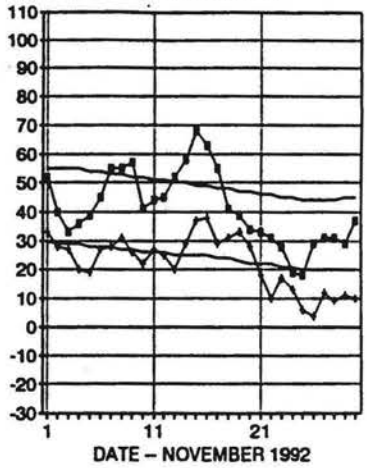
GRAND LAKE 1NW



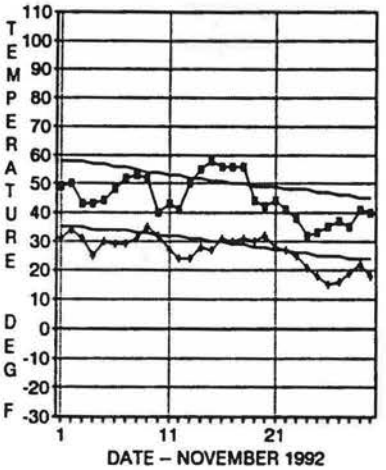
DENVER



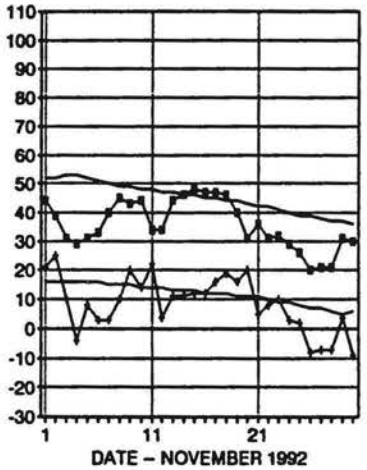
AKRON 1N



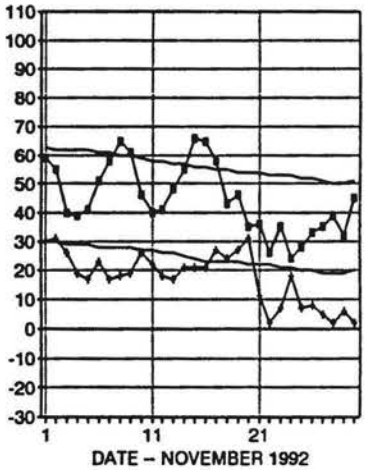
GRAND JUNCTION



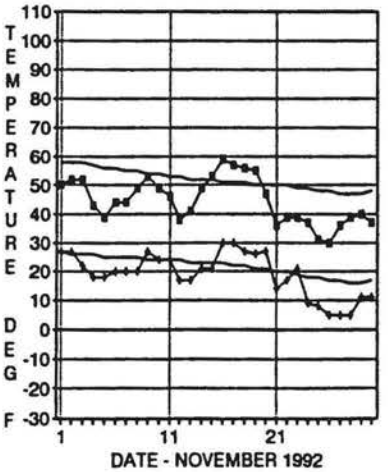
GUNNISON



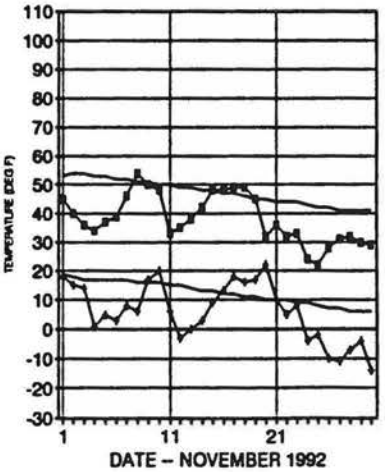
PUEBLO WSO



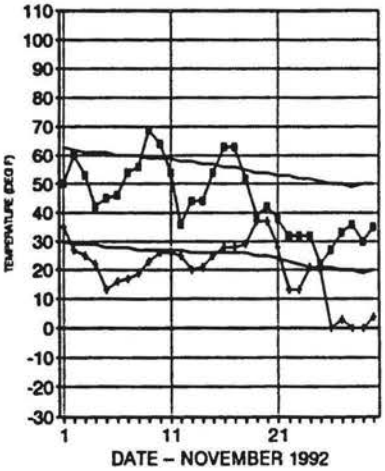
DURANGO



ALAMOSA



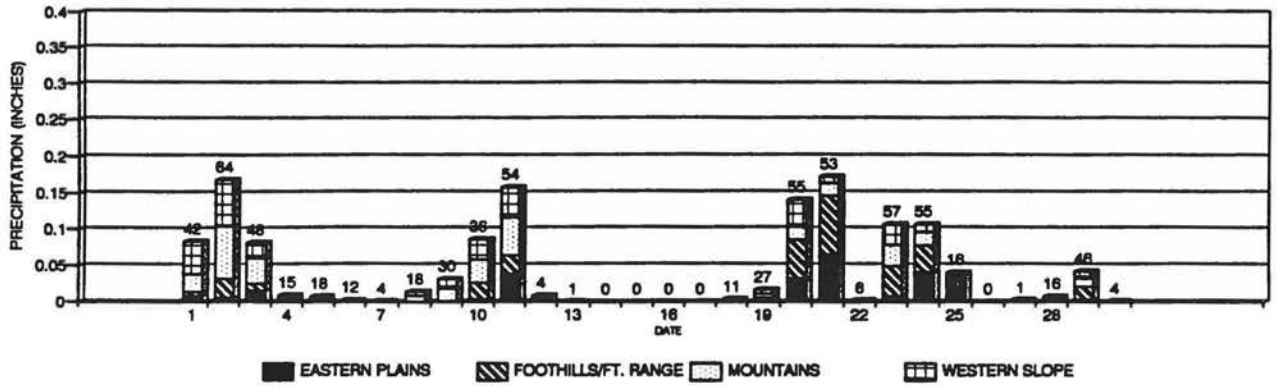
LAMAR



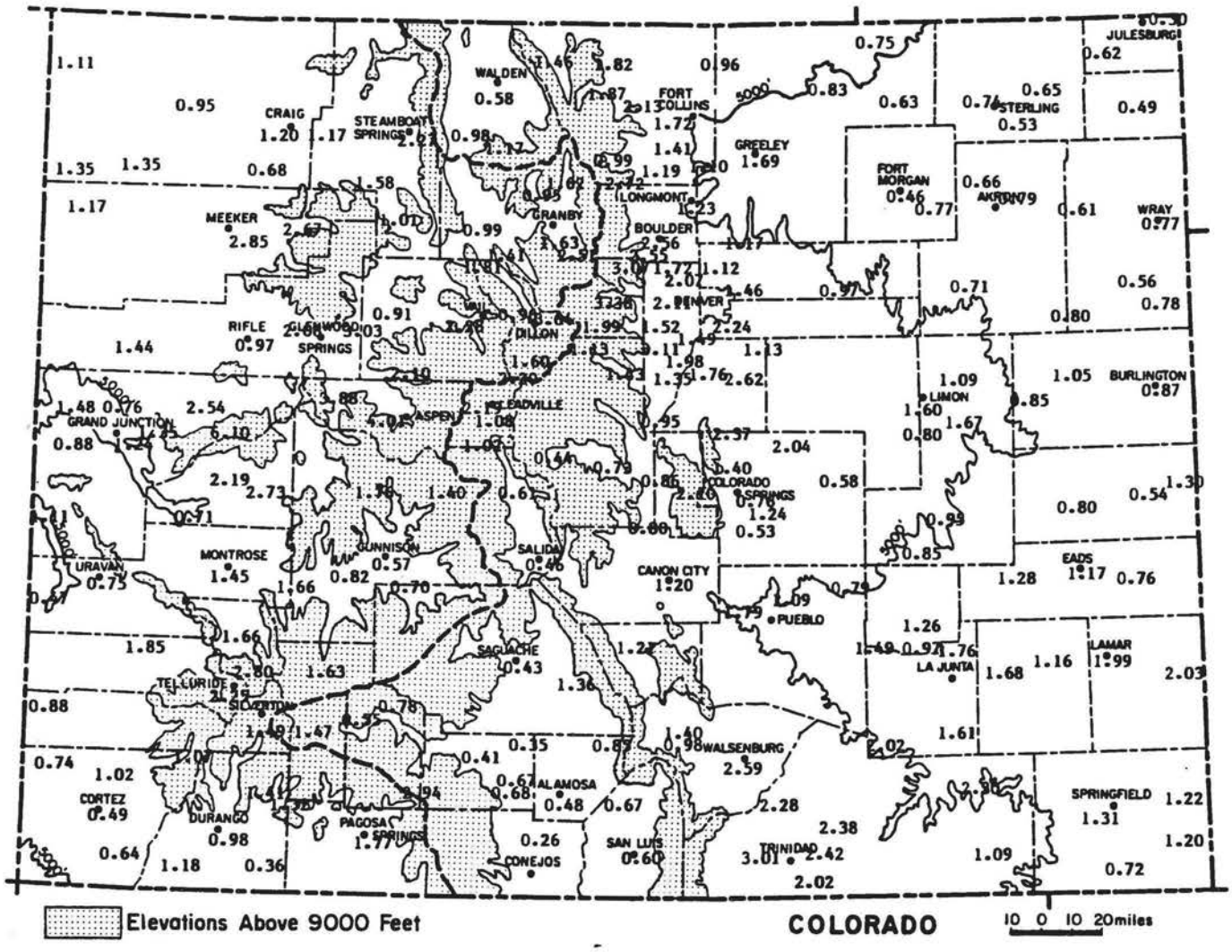
NOVEMBER 1992 PRECIPITATION

Most of November's precipitation fell from storms on the 2nd, 10-11th, 20-21st and the 23rd. But statewide precipitation for each of those days was not excessive and averaged less than 0.20". That indicates the storms' water contents were not excessive (typical for winter) and not all of Colorado was affected. Also note the Nov. 1 precipitation. Most actually fell on Oct. 31 but was reported the following day since many stations take their readings early in the morning. The only days with no precipitation reported in Colorado were the 13-17th and the 26th (Thanksgiving).

COLORADO DAILY PRECIPITATION - NOV 1992

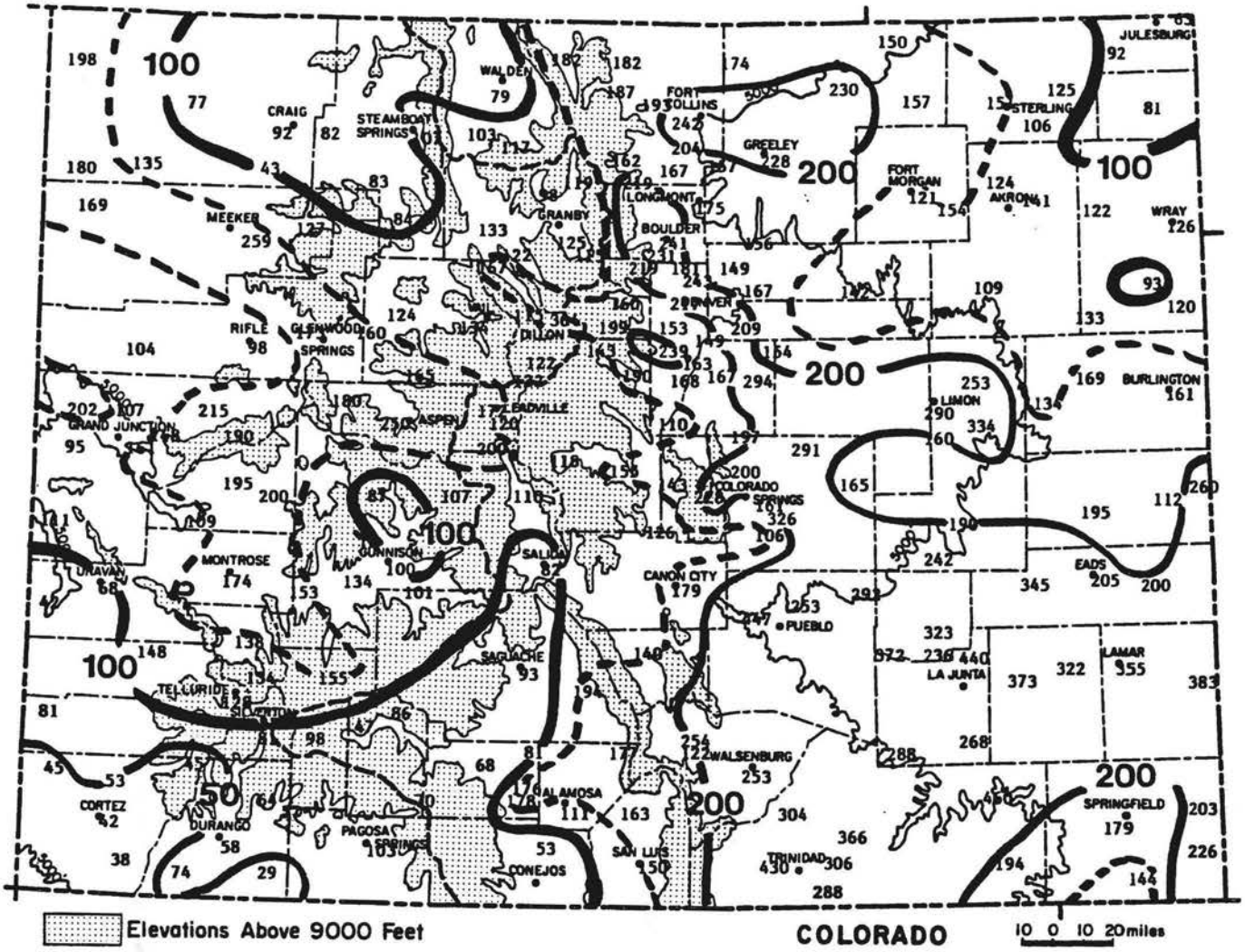


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

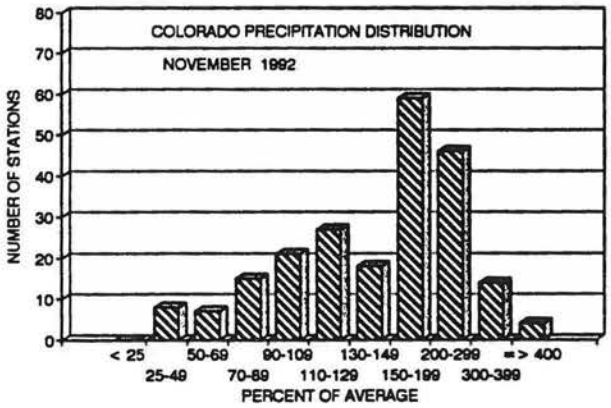


Precipitation Amounts (in inches) for November 1992.

NOVEMBER 1992 PRECIPITATION COMPARISON



November 1992 Precipitation as a Percent of the 1961–90 average.



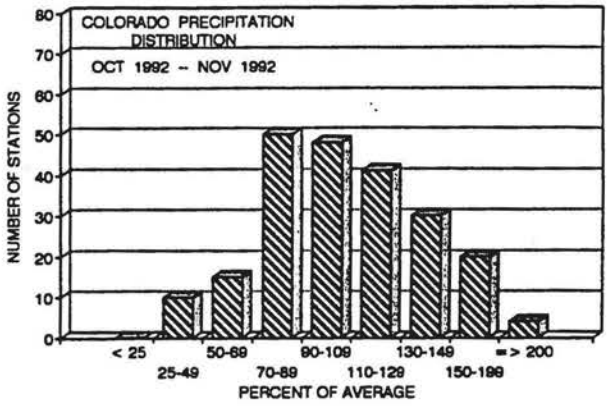
Wet areas greatly outnumbered dry areas in Colorado in November, and a few locations had one of their five wettest Novembers on record. But, as usual, the storms skipped parts of the State leaving a handful of stations with less than 50% of their average moisture.

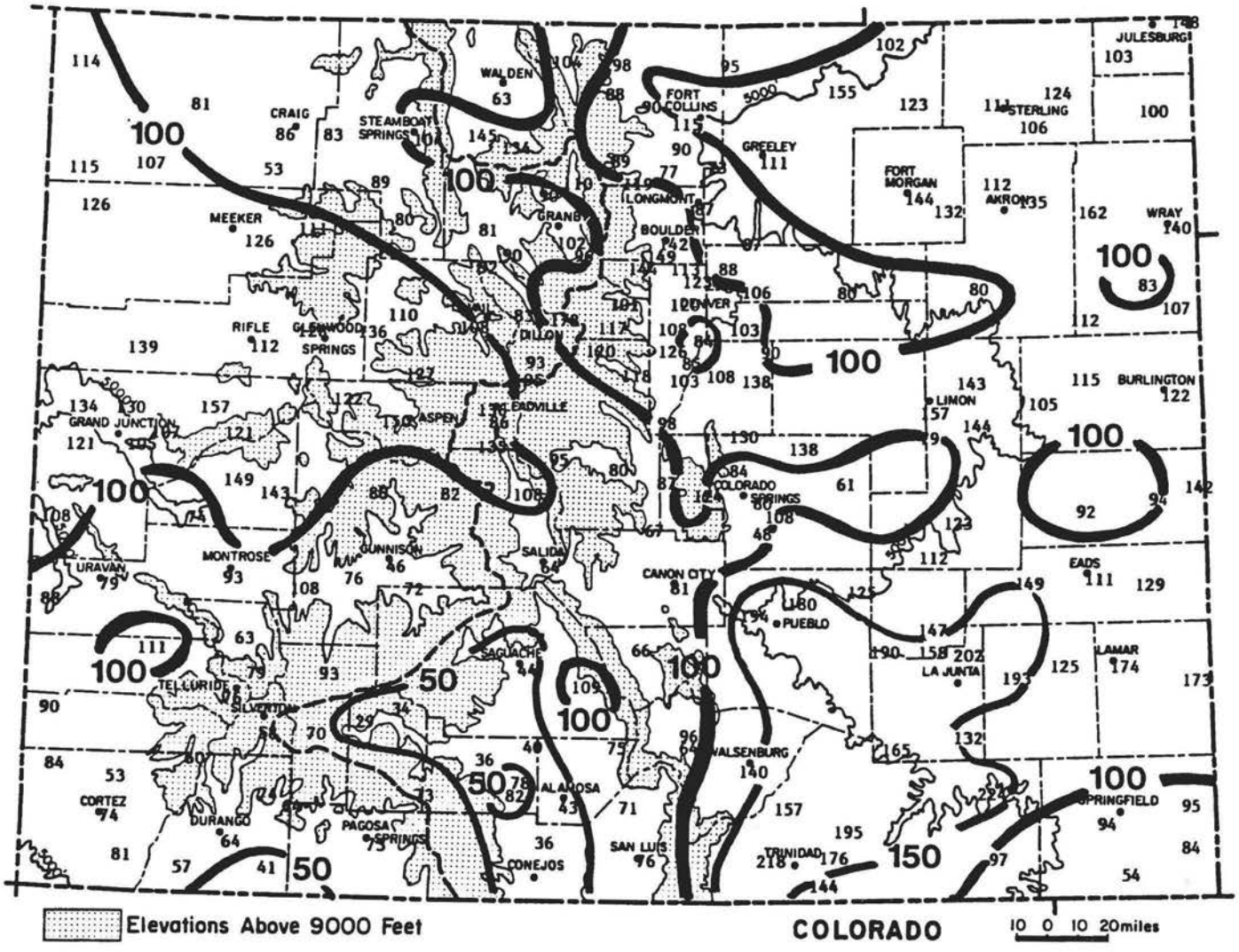
NOVEMBER 1992 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	1.46"	15th wettest in 121 years of record (wettest = 3.21" in 1946)
Durango	0.98"	47th driest in 100 years of record (driest < 0.01 " in 1894, 1901, 1903, 1904, 1914, and 1989)
Grand Junction	0.76"	30th wettest in 101 years of record (wettest = 2.39" in 1895)
Las Animas	1.68"	5th wettest in 126 years of record (wettest = 3.06" in 1946)
Pueblo	1.09"	11th wettest in 124 years of record (wettest = 2.48" in 1991)
Steamboat Springs	2.27"	28th wettest in 88 years of record (wettest = 5.59" in 1985)

1993 WATER YEAR PRECIPITATION

The wet weather of November helped offset the dry October and brought accumulated precipitation totals for more than half of Colorado to near or above average for the first two months of the 1993 water year. The wettest areas west of the Continental Divide include Aspen (156% of average) and Collbran (157%). Parts of the Northern Mountains and most of west central Colorado are above average. However, most of the wettest areas are east of the mountains including Boulder (142% of average), Fort Morgan (144%) and Limon (157%). Well over 150% of average has accumulated in the region of southeast Colorado that includes Pueblo, La Junta and Trinidad. The driest areas remain in southwestern Colorado. In the Rio Grande Valley for example, some locations including Creede, Del Norte and Manassa have received less than 40% of average so far this water year.





October–November 1992 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR NOVEMBER 1992

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	40	100	303	657	1074	1457	1519	1182	1035	732	453	165	8717
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281								2411
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272								2693
BOULDER	AVE	0	6	130	357	714	908	1004	804	775	483	220	59	5460
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921								1404
BUENA VISTA	AVE	47	116	285	577	936	1184	1218	1025	983	720	459	184	7734
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119								2215
BURLINGTON	AVE	6	5	108	364	762	1017	1110	871	803	459	200	38	5743
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928								1418
CANON CITY	AVE *	0	10	100	330	670	870	950	770	740	430	190	40	5100
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882								1291
COLORADO SPRINGS	AVE	8	25	162	440	819	1042	1122	910	880	564	296	78	6346
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990								1538
CORTEZ	AVE *	5	20	160	470	830	1150	1220	950	850	580	330	100	6665
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965								1520
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139								2002
DELTA	AVE	0	0	94	394	813	1135	1197	890	753	429	167	31	5903
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301	919								M
DENVER	AVE	0	0	135	414	789	1004	1101	879	837	528	253	74	6014
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926								1375
DILLON	AVE	273	332	513	806	1167	1435	1516	1305	1296	972	704	435	10754
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346								3360
DURANGO	AVE	9	34	193	493	837	1153	1218	958	862	600	366	125	6848
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988								1581
EAGLE	AVE	33	80	288	626	1026	1407	1448	1148	1014	705	431	171	8377
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140								1972
EVERGREEN	AVE	59	113	327	621	916	1135	1199	1011	1009	730	489	218	7827
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074								2122
FORT COLLINS	AVE	5	11	171	468	846	1073	1181	930	877	558	281	82	6483
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940								1481
FORT MORGAN	AVE	0	6	140	438	867	1156	1283	969	874	516	224	47	6520
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937								1379
GRAND JUNCTION	AVE	0	0	65	325	762	1138	1225	882	716	403	148	19	5683
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868								1121

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	264	468	775	1128	1473	1593	1369	1318	951	654	384	10591
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301								3016
GREELEY	AVE	0	0	149	450	861	1128	1240	946	856	522	238	52	6442
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948								1438
GUNNISON	AVE	111	188	393	719	1119	1590	1714	1422	1231	816	543	276	10122
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278								M
LAS ANIMAS	AVE	0	0	45	296	729	998	1101	820	698	348	102	9	5146
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937								1285
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401								3540
LIMON	AVE	8	6	144	448	834	1070	1156	960	936	570	299	100	6531
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018								1663
LONGMONT	AVE	0	6	162	453	843	1082	1194	938	874	546	256	78	6432
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982								1528
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123								1768
MONTROSE	AVE	0	10	135	437	837	1159	1218	941	818	522	254	69	6400
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000								1477
PAGOSA SPRINGS	AVE	82	113	297	608	981	1305	1380	1123	1026	732	487	233	8367
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123								2224
PUEBLO	AVE	0	0	89	346	744	998	1091	834	756	421	163	23	5465
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009								1472
RIFLE	AVE	6	24	177	499	876	1249	1321	1002	856	555	298	82	6945
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976								1507
STEAMBOAT SPRINGS	AVE *	90	140	370	670	1060	1430	1500	1240	1150	780	510	270	9210
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247								2412
STERLING	AVE	0	6	157	462	876	1163	1274	966	896	528	235	51	6614
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949								1469
TELLURIDE	AVE	163	223	396	676	1026	1293	1339	1151	1141	849	589	318	9164
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194								2405
TRINIDAD	AVE	0	0	86	359	738	973	1051	846	781	468	207	35	5544
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991								1391
WALDEN	AVE	198	285	501	822	1170	1457	1535	1313	1277	915	642	351	10466
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310								3005
WALSENBURG	AVE	0	8	102	370	720	924	989	820	781	501	240	49	5504
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894								1253

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

NOVEMBER 1992 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	41.9	19.9	30.9	-3.9	66	3	1015	0	26	0.75	0.25	150.0	5
STERLING	45.1	21.1	33.1	-3.5	68	-3	949	0	47	0.74	0.25	151.0	4
FORT MORGAN	43.2	23.8	33.5	-3.5	64	0	937	0	40	0.46	0.08	121.1	2
AKRON FAA AP	41.3	22.3	31.8	-5.3	68	4	990	0	35	0.66	0.13	124.5	7
AKRON 4E	41.9	19.7	30.8	-5.8	68	1	1021	0	36	0.79	0.23	141.1	6
HOLYOKE	44.8	23.1	34.0	-4.0	68	6	925	0	45	0.49	-0.11	81.7	4
JOES	43.6	21.2	32.4	-6.6	70	7	970	0	43	0.80	0.20	133.3	4
BURLINGTON	42.2	23.3	32.8	-5.2	68	8	928	0	35	0.87	0.33	161.1	6
LIMON WSMO	41.5	20.1	30.8	-4.4	64	7	1018	0	32	1.60	1.05	290.9	9
CHEYENNE WELLS	44.0	21.8	32.9	-6.7	69	5	955	0	44	0.54	0.06	112.5	7
EADS	44.3	22.0	33.1	-6.7	67	5	947	0	45	1.17	0.60	205.3	5
ORDWAY 21N	45.6	20.2	32.9	-4.6	66	5	954	0	57	0.85	0.50	242.9	8
ROCKY FORD 2SE	46.4	20.5	33.4	-6.9	67	-7	938	0	56	0.97	0.56	236.6	8
LAMAR	44.9	20.0	32.5	-8.2	69	0	968	0	48	1.99	1.43	355.4	6
LAS ANIMAS	46.6	20.3	33.5	-7.9	74	-5	937	0	61	1.68	1.23	373.3	8
HOLLY	45.0	23.6	34.3	-5.6	68	2	915	0	49	2.03	1.50	383.0	9
SPRINGFIELD 7WSW	46.2	23.6	34.9	-7.4	67	8	895	0	65	1.31	0.58	179.5	7
TIMPAS 13SW	44.4	21.6	33.0	-7.8	65	7	952	0	48	2.02	1.32	288.6	6

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	44.4	22.5	33.5	-4.0	65	4	940	0	32	1.72	1.01	242.3	8
GREELEY UNC	43.5	22.8	33.1	-4.3	66	3	948	0	31	1.69	0.95	228.4	7
ESTES PARK	38.6	19.7	29.1	-5.5	55	-5	1066	0	9	0.99	0.38	162.3	12
LONGMONT 2ESE	45.9	18.1	32.0	-5.2	68	1	982	0	46	1.23	0.53	175.7	5
BOULDER	45.5	22.7	34.1	-6.7	67	4	921	0	33	2.56	1.50	241.5	8
DENVER WSFO AP	45.8	21.9	33.9	-5.1	70	8	926	0	48	1.46	0.59	167.8	8
EVERGREEN	42.9	15.1	29.0	-5.4	66	-4	1074	0	25	1.52	0.53	153.5	9
CHEESMAN	43.0	9.5	26.2	-9.9	65	-7	1156	0	29	0.95	0.09	110.5	9
LAKE GEORGE 8SW	34.6	10.6	22.6	-6.1	55	-17	1263	0	3	0.73	0.26	155.3	7
ANTERO RESERVOIR	34.4	3.3	18.8	-5.9	55	-28	1377	0	4	0.44	0.07	118.9	6
RUXTON PARK	36.7	6.5	21.6	-6.2	57	-12	1295	0	10	2.10	1.18	228.3	11
COLORADO SPRINGS	42.3	21.4	31.8	-6.2	61	11	990	0	25	0.76	0.29	161.7	7
CANON CITY 2SE	47.8	22.8	35.3	-7.0	69	9	882	0	62	1.20	0.53	179.1	5
PUEBLO WSO AP	44.8	17.4	31.1	-9.4	66	2	1009	0	50	1.09	0.66	253.5	6
WESTCLIFFE	38.2	6.7	22.4	-10.3	53	-13	1269	0	4	1.21	0.35	140.7	6
WALSENBURG	47.6	22.4	35.0	-6.8	68	7	894	0	57	2.59	1.57	253.9	11
TRINIDAD FAA AP	45.0	18.4	31.7	-9.6	66	0	991	0	48	2.38	1.73	366.2	9

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	33.3	8.9	21.1	-5.4	50	-16	1310	0	0	0.58	-0.15	79.5	10
LEADVILLE 2SW	32.2	3.9	18.0	-6.8	47	-14	1401	0	0	1.08	0.18	120.0	14
SALIDA	43.2	16.4	29.8	-6.2	62	-1	1051	0	19	0.46	-0.10	82.1	5
BUENA VISTA	40.9	14.0	27.5	-6.4	60	-5	1119	0	14	0.61	0.06	110.9	7
SAGUACHE	39.6	12.8	26.2	-5.2	56	0	1158	0	5	0.43	-0.03	93.5	6
HERMIT 7ESE	33.8	1.6	17.7	-7.3	50	-14	1412	0	0	0.55	-0.61	47.4	2
ALAMOSA WSO AP	38.2	6.0	22.1	-7.8	54	-14	1281	0	2	0.48	0.05	111.6	6
STEAMBOAT SPRINGS	34.3	12.0	23.1	-5.9	48	-12	1247	0	0	2.27	0.15	107.1	14
YAMPA	35.4	14.8	25.1	-4.1	49	-6	1188	0	0	1.01	-0.18	84.9	8
GRAND LAKE 1NW	32.8	9.2	21.0	-5.2	47	-11	1314	0	0	1.62	0.26	119.1	17
GRAND LAKE 6SSW	30.9	12.0	21.4	-6.5	43	-6	1301	0	0	0.95	-0.01	99.0	15
DILLON 1E	32.2	7.6	19.9	-6.9	50	-9	1346	0	0	0.96	0.13	115.7	14
ASPEN 1SW	33.5	11.2	22.3	-8.2	48	-5	1272	0	0	4.01	2.41	250.6	14
CRESTED BUTTE	30.2	-0.2	15.0	-10.4	46	-22	1491	0	0	1.76	-0.25	87.6	11
TAYLOR PARK	30.9	5.4	18.2	-6.1	44	-24	1397	0	0	1.40	0.10	107.7	10
TELLURIDE	39.0	10.9	24.9	-6.5	55	-8	1194	0	8	2.25	0.50	128.6	12
PAGOSA SPRINGS	43.2	11.5	27.3	-5.8	60	-2	1123	0	20	1.77	0.06	103.5	9
SILVERTON	36.0	1.9	18.9	-8.0	51	-13	1372	0	1	1.49	-0.33	81.9	9
WOLF CREEK PASS 1	28.4	7.5	18.0	-7.7	46	-9	1404	0	0	2.94	-1.22	70.7	15

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	36.7	16.9	26.8	-4.8	58	-4	1139	0	13	1.20	-0.10	92.3	13
HAYDEN	36.2	17.4	26.8	-5.4	55	-3	1138	0	8	1.17	-0.24	83.0	11
MEEKER NO. 2	38.4	16.2	27.3	-6.4	58	-9	1123	0	10	2.76	1.69	257.9	16
RANGELY 1E	41.1	21.0	31.0	-3.2	57	0	1013	0	9	1.17	0.48	169.6	7
EAGLE FAA AP	37.2	16.2	26.7	-5.3	47	-10	1140	0	0	0.91	0.18	124.7	10
GLENWOOD SPRINGS	38.9	19.3	29.1	-6.8	55	5	1069	0	5	2.08	0.88	173.3	11
RIFLE	44.5	20.0	32.2	-4.5	58	5	976	0	23	0.97	-0.01	99.0	8
GRAND JUNCTION WS	45.0	26.7	35.8	-4.4	58	15	868	0	20	0.76	0.05	107.0	5
CEDAREDGE	44.2	17.7	31.0	-7.0	60	4	1012	0	22	2.19	1.07	195.5	9
PAONIA 1SW	44.3	23.6	33.9	-5.1	61	10	924	0	27	2.73	1.37	200.7	9
DELTA	45.2	22.9	34.0	-5.1	58	10	919	0	24	0.71	0.06	109.2	8
GUNNISON	35.8	8.5	22.1	-6.3	48	-9	1278	0	0	0.57	0.00	100.0	4
COCHETOPA CREEK	37.0	7.8	22.4	-5.6	50	-10	1270	0	0	0.70	0.01	101.4	7
MONTROSE NO. 2	41.2	21.6	31.4	-6.3	53	9	1000	0	5	1.45	0.62	174.7	7
URAVAN	49.1	24.5	36.8	-4.1	62	11	839	0	45	0.75	-0.34	68.8	7
NORWOOD	40.1	15.9	28.0	-6.2	54	-3	1106	0	7	1.85	0.60	148.0	7
YELLOW JACKET 2W	43.2	20.1	31.7	-5.5	59	2	994	0	17	0.74	-0.88	45.7	4
CORTEZ	45.7	19.4	32.5	-5.7	59	6	965	0	23	0.49	-0.67	42.2	5
DURANGO	44.7	18.9	31.8	-5.3	59	5	988	0	21	0.98	-0.70	58.3	8

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

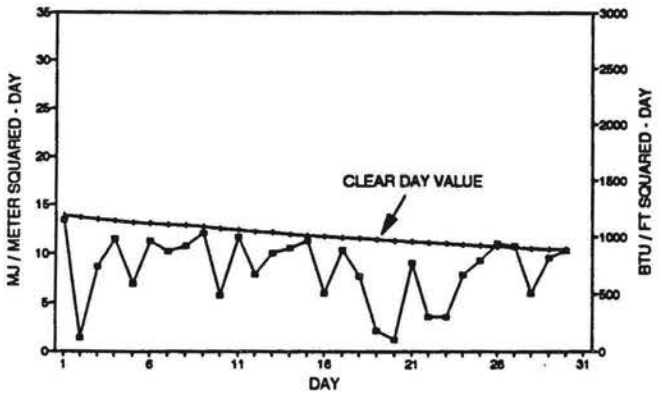
NOVEMBER 1992 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	N/A	N/A	N/A	–	–
Denver	8	9	13	52%	65%
Fort Collins	6	12	12	–	–
Grand Junction	10	9	11	53%	63%
Limon	6	10	14	–	–
Pueblo	N/A	N/A	N/A	48%	73%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

Sunshine and solar radiation were considerably less than average over all of Colorado. With only 50% of possible sunshine in November this means that Colorado's sunshine climate was about like Iowa normally expects for November.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
NOVEMBER 1992

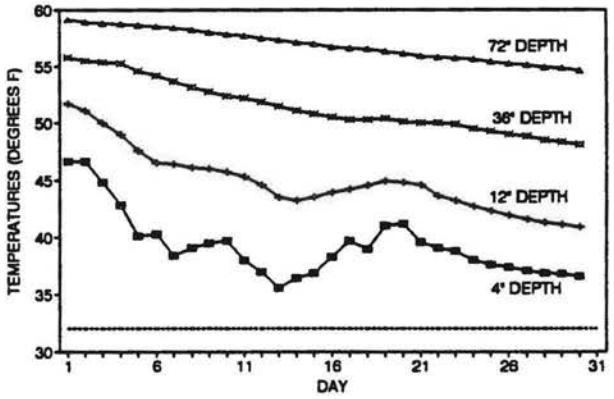


NOVEMBER 1992 SOIL TEMPERATURES

Soil temperatures plummeted in early November following the first major snowfall of the season. But later in the month, the deep snow accumulation actually helped keep the ground warmer by acting like an insulating blanket.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
NOVEMBER 1992



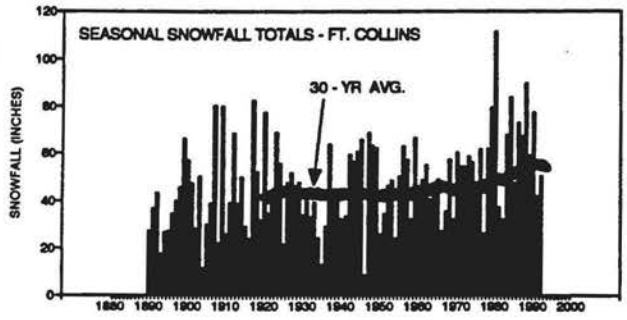
HATS OFF TO: *Mabel Wright* of the Hermit 7ESE Station southwest of Creede.

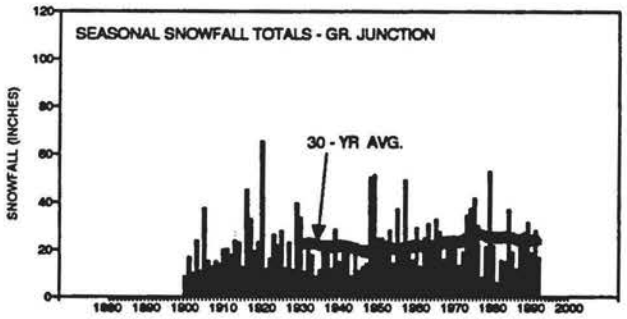
Soon to be 94, Mabel Wright is the oldest and perhaps wisest of Colorado's volunteer weather observers. She has observed lots of amazing weather in her 48 years as the observer near Hermit. Last year she was mentioned on the **Today Show** to honor her accomplishments and her spunk. Mabel, our hats are off to you, and don't ever stop enjoying the fantastic climate of southwest Colorado.

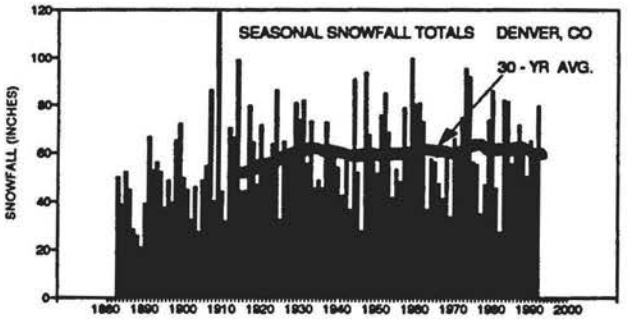
COLORADO SNOWFALL TRENDS

Last month we discussed the many problems that limit and compromise the accuracy of snowfall measurements. I may have convinced you not to take existing snowfall data too seriously. This month I plan to be more optimistic. A few sites in Colorado have gathered fairly consistent snow data over a long period of time. By limiting our analysis to selected stations, I will try to avoid the pitfalls of inconsistent data.

How has total seasonal snowfall varied here in Colorado during the past century? The data show some interesting traits. We have long records from Denver, Grand Junction and Fort Collins. Long records exist at other sites but with gaps and/or discontinuities observed at most other stations. We deeply regret that there is not a single weather station in the Colorado mountains with adequate snowfall data for analyzing long-term trends. The U.S. Dept. of Agriculture Soil Conservation Service snow course data begin in the late 1930s at a few sites. These records are extremely valuable but do not include measurements of snowfall. We'll talk more about those data another time.

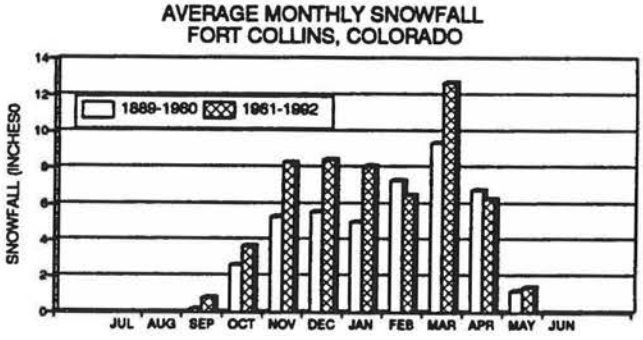






Based on our meager sample of three sites, there have been the normal dramatic year to year variations in snowfall at all sites. Looking at running 30-year averages plotted at the end of each 30-year period, data suggest a recent upward trend in snowfall at Fort Collins. Grand Junction had been increasing but has leveled off for the past 15 years. Denver has shown little change since a marked increase early this century (that may have been data-related). Of these sites, Grand Junction receives less snow than almost any other location in Colorado. Denver averages more snow than Fort Collins, but Fort Collins has been gaining ground (snow, actually).

A significant feature of snowfall trends along the Front Range is that snowfall has shown a substantial increase from late fall into mid winter. Except for an increase in March, little change or even a slight decrease in snow has been noted during the traditionally heavy snow period of late winter into spring. If you do much driving or snow shoveling, the significance of greater snowfall in early and mid winter is probably obvious. Snows that fall before mid-November or after the middle of February don't last long on streets and driveways because of frequent sunshine and temperatures that rebound quickly following most storms at lower elevations. But from Thanksgiving through January, the sun is low in the sky, temperatures may not cooperate, and the snow doesn't melt easily. For many years, low elevation snowfall along the Front Range was light during that critical period. But in recent years numerous large storms have struck then such as the infamous Christmas Eve blizzard of 1982. Much more time, energy and money is required for cleaning up after these storms if society insists on continuing to race about at our normal frantic pace.



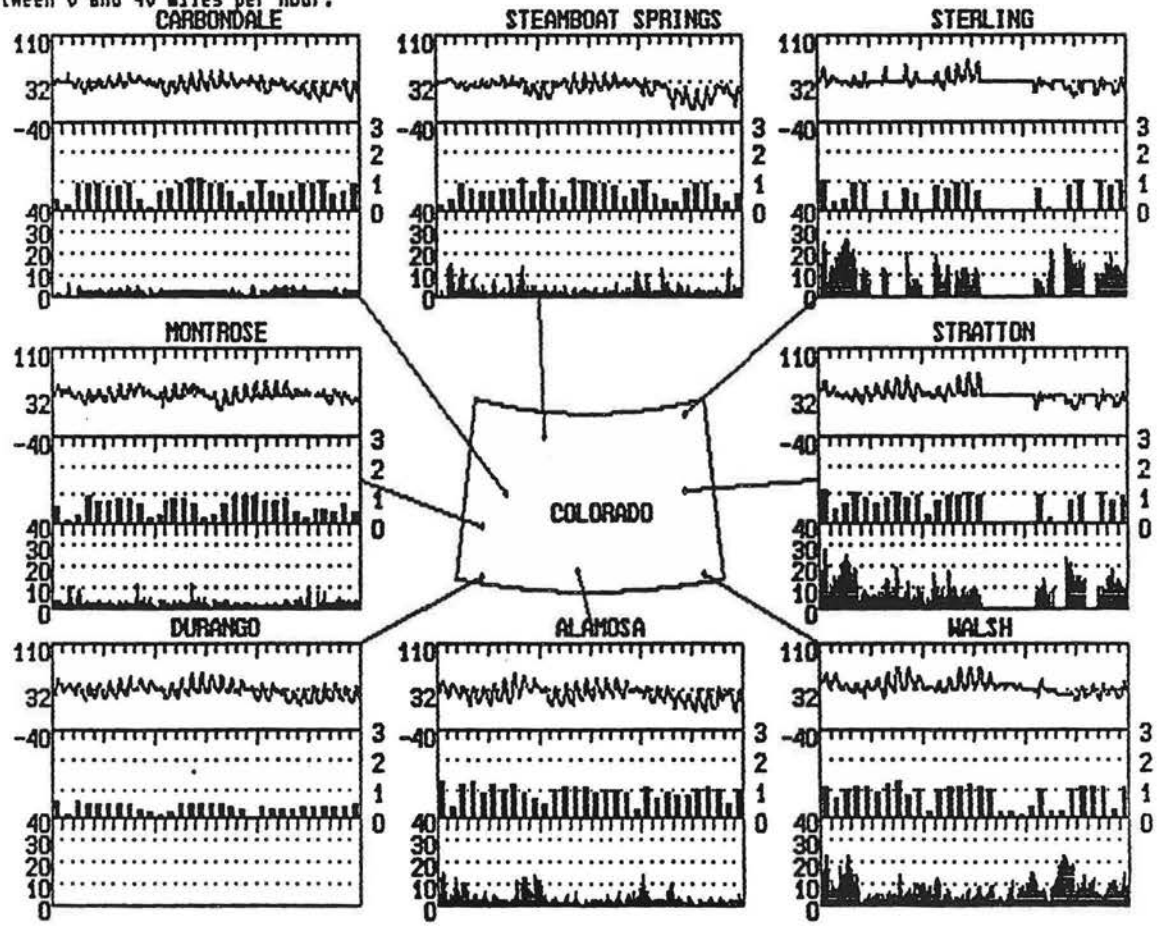
Composite snowfall information from numerous mountain stations with shorter records do not indicate any strong trends either upward or downward, but some modifications in the seasonal distribution of snowfall have been noted. For approximately the past 20 years, early season snowfall has been greater than in the past while mid-winter snow has decreased. Our southern mountains have been wetter than before while our northern mountains have been a bit drier. We are never certain if these patterns will continue or if they will soon revert back to the original or yet another new distribution. As new information becomes available, I'll do my best to pass it along to you.

WTHRNET WEATHER DATA NOVEMBER 1992

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	22.6	27.6	25.6	31.6	20.8	31.3	31.6	34.7
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	56.5 8/16	57.4 15/15	48.6 17/15	54.5 16/15	47.5 17/15	67.6 15/15	68.7 15/14	68.7 8/14
minimum:	-8.5 30/ 7	2.8 25/ 6	0.3 30/ 8	5.9 12/ 4	-16.4 26/ 7	4.5 25/22	4.5 25/22	10.2 26/ 6
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	87 / 8	89 / 16	90 / 16	91 / 24	72 / 7	33 /-15	62 / 5	79 / 22
11 AM	62 / 17	56 / 20	65 / 19	66 / 26	58 / 12	39 / 1	44 / 10	55 / 24
2 PM	43 / 14	46 / 20	50 / 19	53 / 24	41 / 9	35 / 3	36 / 7	48 / 22
5 PM	47 / 13	49 / 18	58 / 19	57 / 23	49 / 10	38 / -0	43 / 5	54 / 21
11 PM	81 / 12	79 / 17	87 / 19	87 / 24	70 / 10	40 / -8	57 / 4	72 / 22
monthly average wind direction (degrees clockwise from north)								
day	189	13	196	202	146	157	104	168
night	190	36	144	167	118	116	154	211
monthly average wind speed (miles per hour)	3.48	0.00	1.62	2.36	2.34	6.32	7.28	7.76
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	421	244	630	522	546	328	194	80
3 to 12	276	0	55	174	153	238	376	529
12 to 24	23	0	0	0	5	146	143	111
> 24	0	0	0	0	0	8	7	0
monthly average daily total insolation (Btu/ft²•day)	892	385	703	609	676	547	700	791
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	153	0	97	34	91	55	106	127
40-60%	71	0	75	56	65	47	56	54
20-40%	55	190	72	54	80	33	32	39
0-20%	17	110	55	117	51	25	14	61

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

DECEMBER 1992

Volume 16 Number 3

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

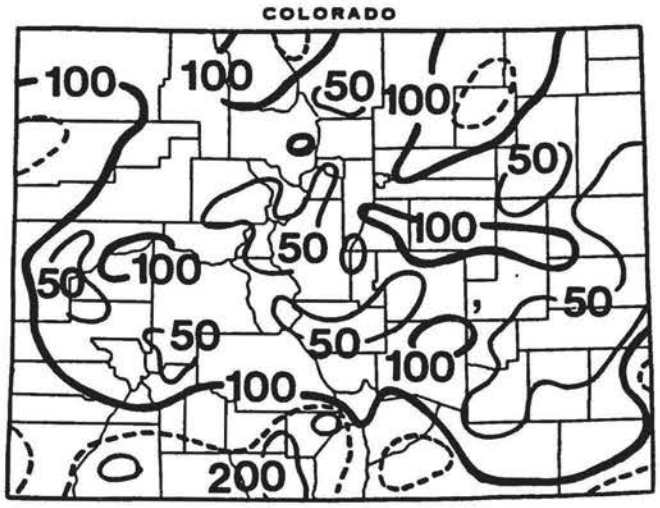
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

December Climate in Perspective—Winter Holds a Firm Grip

December was composed of frequent invasions of cold air, several periods of light snow, persistent snow cover a number of episodes of strong winds in the high mountains and eastern foothills, a dry and sunny Christmas, many temperature inversions, air pollution opportunities and dense fogs, and finally a major Pacific storm to end the month. Overall, the month was considerably colder than average for most of the State but with variable precipitation totals.

Precipitation

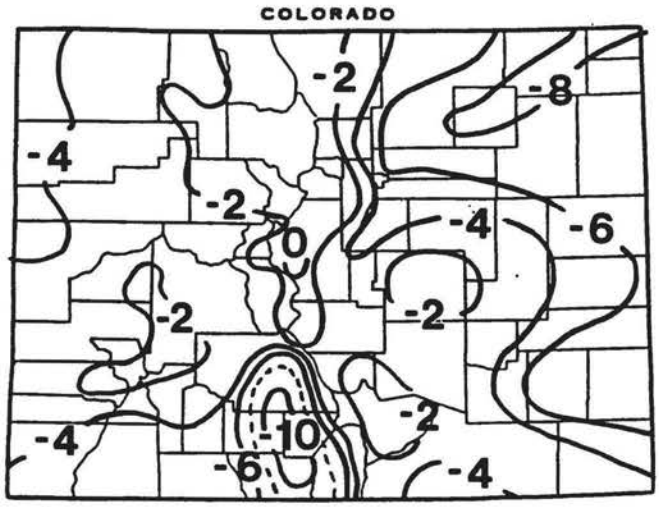
There were several periods of snow during the first 18 days of December, but precipitation totals were mostly light. Then, following a dry week, the month ended with a burst of heavy snow and low elevation rains that pounded southwest Colorado but diminished quickly to the east and north. December moisture totals ended up below average for much of the State. Many stations east of the mountains received less than 0.25". There were some very wet areas, however. Parts of southwest and extreme southern Colorado reported 150% to more than 200% of average. A few locations east of the mountains were also wetter than average.



December 1992 precipitation as a percent of the 1961-1990 average.

Temperatures

Warm chinook winds along the Front Range battled frequent invasions of cold air – and most of the time the cold air won. Cold air was also persistent west of the mountains until the late-month storm blew very mild, moist air into the region. December monthly temperatures ended up well below average over Colorado with much of eastern and southern areas 5 to 10 degrees F colder than the 1961-1990 averages. Extreme cold was the rule in the San Luis Valley for the second consecutive December. The northern and central mountains and Front Range foothills were only a little cooler than average, but these areas had much more wind to contend with.



Departure of December 1992 temps. from the 1961-90 averages.

Inside This Issue

DECEMBER 1992 DAILY WEATHER

1-2 Dry weather for Colorado, but northwest winds aloft delivered mountain snowshowers mostly on the 2nd. Strong winds were noted on the 1st especially near the Front Range. Temperatures were seasonal west but colder than average over eastern Colorado.

3-6 It was a wintry period for Colorado. Cold air pushed southward across the State on the 3rd. Several inches of fluffy, dry snow fell along the Front Range late in the day. Clearing and very cold in northern Colorado on the 4th, but snow continued along the southern Front Range and heavy snow developed in southwest Colorado as a California storm moved inland. 6-12" of snow fell from Mesa Verde to Wolf Creek Pass. The storm weakened as it moved eastward on the 5th, but 1-3" snowfall totals were widespread in the mountains and across the Eastern Plains with locally heavier amounts. Dense fog developed in many areas east of the mountains. Much of the State cleared on the 6th, but snows continued in the northern mountains – Steamboat Springs totalled 6". Very cold temperatures were common with lows near zero in areas east of the mountains 5-6th. Hohnholz Ranch reported -26°F on the 5th. Alamosa dipped to -21° on the 6th.

7-10 A sunny, cold day on the 7th was followed by milder, cloudier weather on the 8th as a Pacific storm tracked south of Colorado. Stable air allowed pollution to build up in some areas. Mountain snow showers along with very strong winds developed on the 9th and cascaded down the Front Range clearing the air. Gusts close to 100 mph were reported near Berthoud Pass and closed ski lifts at Winter Park. 40-80 mph winds were common along the Front Range. Downslope warming raised temperatures dramatically east of the mountains. Pueblo reached 58° on the 9th. Winds diminished on the 10th, and it was a mild day for most of Colorado.

11-16 A new storm crossed California on the 11th headed toward Colorado. Clouds increased and temperatures soared to their high point for the month for much of the State. Leadville enjoyed 47° while Canon City hit 66°F. Temperatures dropped sharply on the 12th, especially east of the mountains. Snow began on the 12th and continued on the 13th. Most snow totals were light except in southern Colorado. Telluride received 8" while Trinidad and Walsenburg had close to 12". It was very cold statewide as a low pressure trough aloft moved directly over Colorado. Skies cleared on the 14th. A new disturbance kept temperatures below average and triggered mountain snows on the 15th ending on the 16th. 4-6" of new snow covered the areas from Boulder and Evergreen down to Monument.

17-19 Strong inversions produced smoggy weather on the 17th. Then snows developed in western Colorado on the 18th with 1-5" accumulations for most of the mountains and Western Slope. Only a few flakes spilled across east of the mountains. Fog shrouded eastern Colorado on the 19th contributing to numerous accidents on I-25. The mountains were above the fog, but temperatures on the 19th were frigid.

20-27 A period of dry weather for all of Colorado was a relief following a month of frequent storms. Clear skies, widespread snowcover, and low solstice sun angles resulted in persisting cold, stable air in most valleys. Alamosa saw temperatures drop to -20° or colder nearly every night. The coldest mornings were the 20th and 24th. Taylor Park was -38° on the 24th, the coldest in the State. Several episodes of downslope winds in the mountains and eastern foothills tried to erode the cold, stable air at low elevations. At times, the temperatures in the foothills were as much as 30 degrees warmer than in valley locations like Greeley or Fort Morgan. In exchange for warmer temperatures, the foothills tolerated occasional wind gusts of 30 to 70 mph, while low-elevation winds were nearly calm.

28-31 1992 ended with a dynamic battle between warm and very moist Pacific air and frigid arctic air over the northern Plains. Colorado escaped the arctic blast, but shallow layers of cold, foggy air did slip into portions of the Eastern Plains. Heavy snows hit southwest Colorado 28-29th and even changed to rain at lower elevations. Snows dissipated rapidly north and east of the San Juan Mountains. Durango received more than 2" of moisture in about 24 hours. In four days Wolf Creek Pass totalled several feet of new snow with 5.02" of water content bringing back memories of the amazing late-December snow blitz of 1951. Campo, in extreme southeast Colorado, reached 68° on the 30th, the warmest in the State.

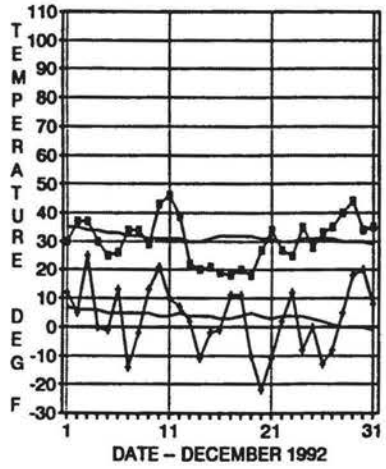
Weather Extremes

Highest Temperature	68°F	December 30	Campo 7S
Lowest Temperature	-38°F	December 24	Taylor Park Reservoir
Greatest Total Precipitation	7.19"		Wolf Creek Pass 1E
Least Total Precipitation	0.00"		Eads
Greatest Total Snowfall	82.5"		Wolf Creek Pass 1E
Greatest Snow Depth	58"	December 31	Wolf Creek Pass 1E

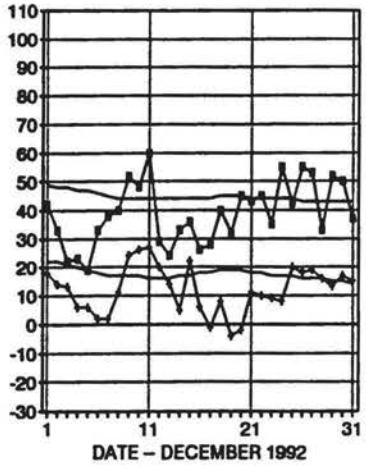
DECEMBER 1992 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

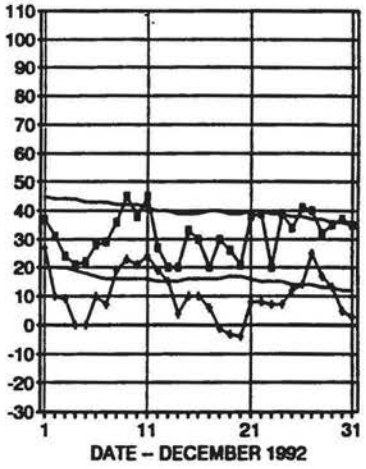
GRAND LAKE 1NW



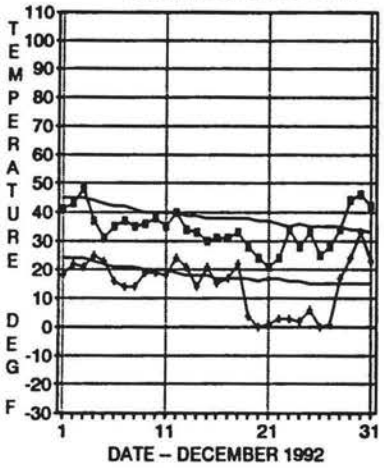
DENVER



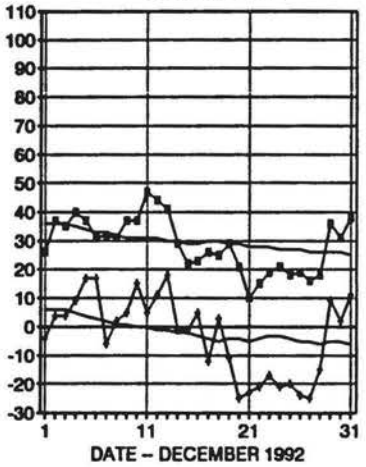
AKRON 1N



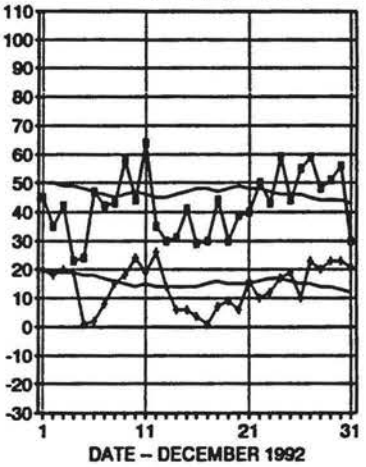
GRAND JUNCTION



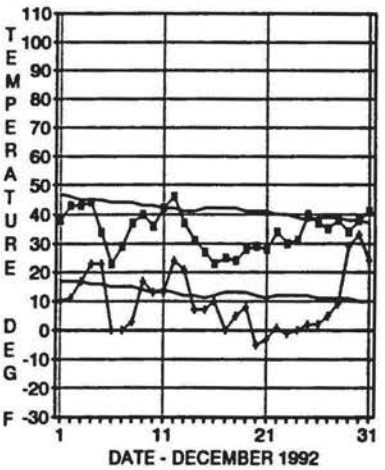
GUNNISON



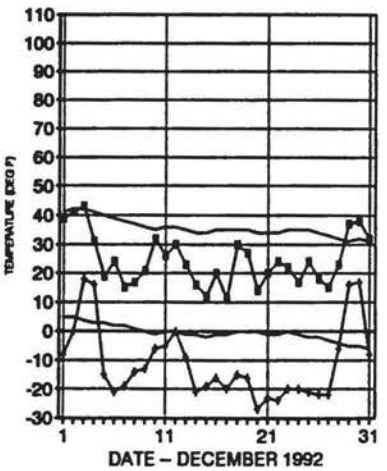
PUEBLO WSO



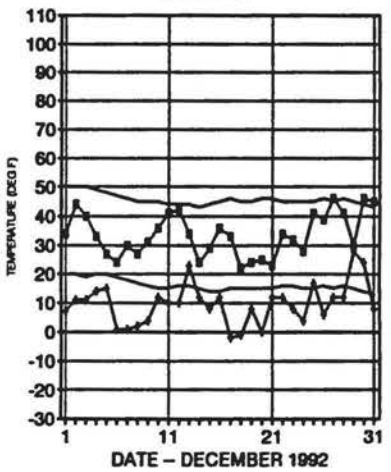
DURANGO



ALAMOSA



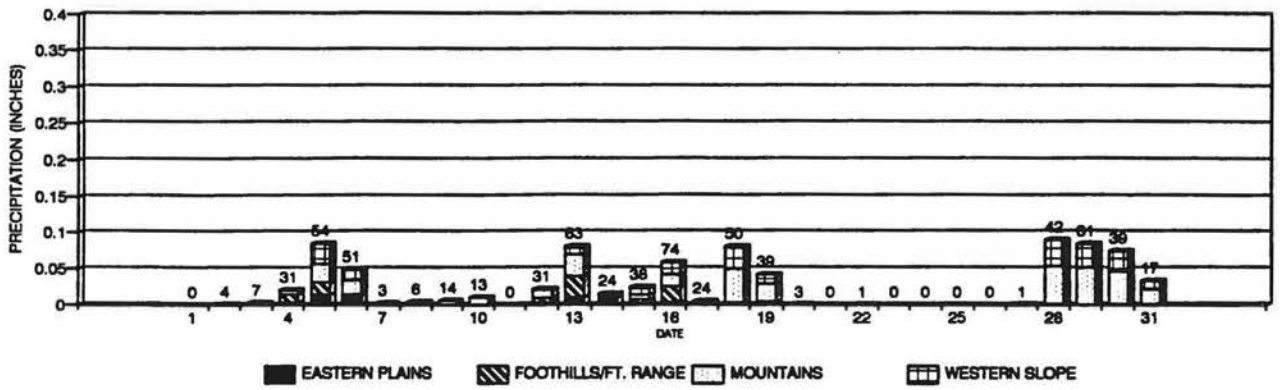
LAMAR



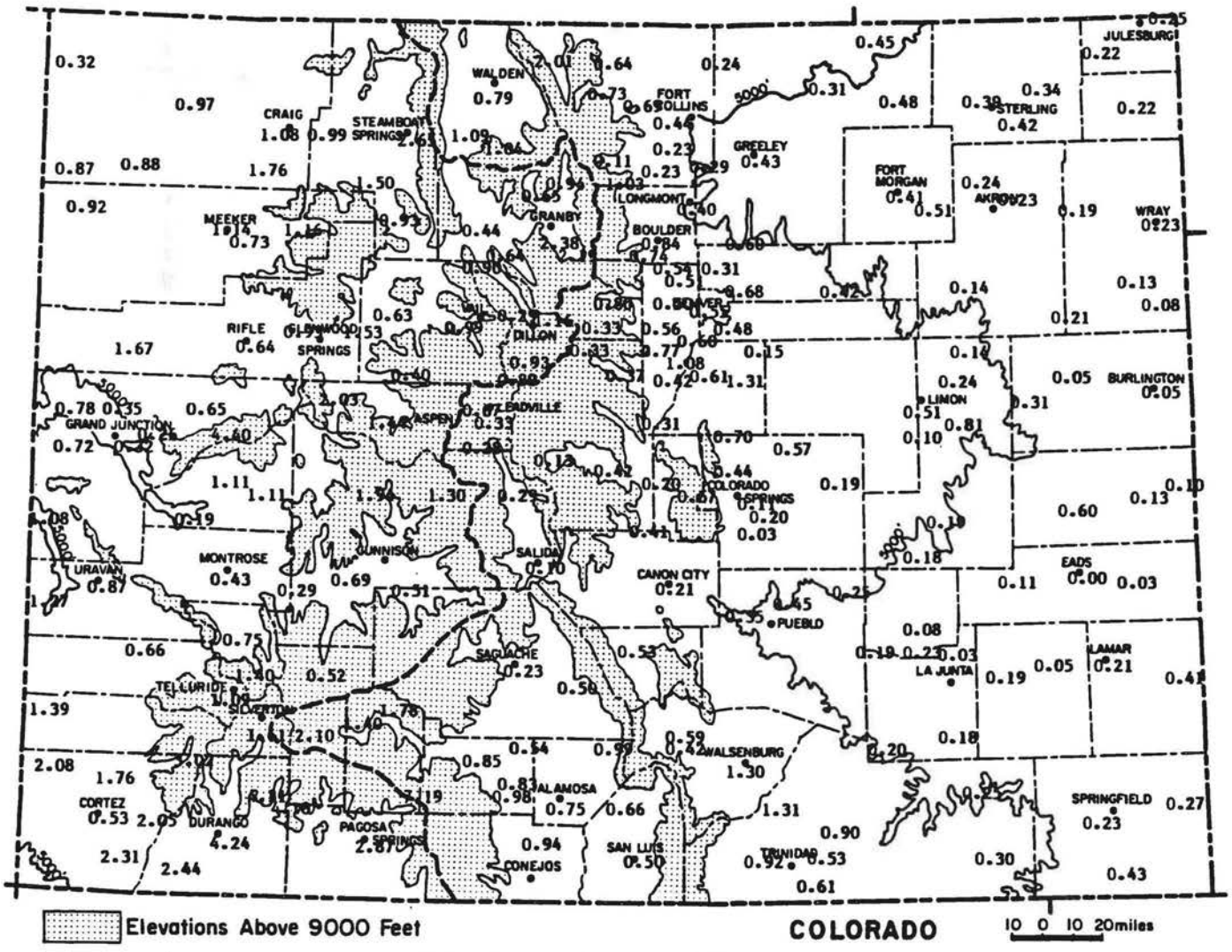
DECEMBER 1992 PRECIPITATION

As is often the case, most of December's precipitation fell in small doses. The only storm systems to affect most areas of Colorado occurred Dec 4-5th and 12-13th. The largest precipitation events were 4-5th in southwest Colorado, 12-13th across southern Colorado, 18th in much of the mountains, and 28-30th over southwest Colorado. The last storm was very heavy in the San Juan Mountains, but only grazed other parts of Colorado. The period from December 19-27 brought almost no precipitation to any portion of the State.

COLORADO DAILY PRECIPITATION - DEC 1992

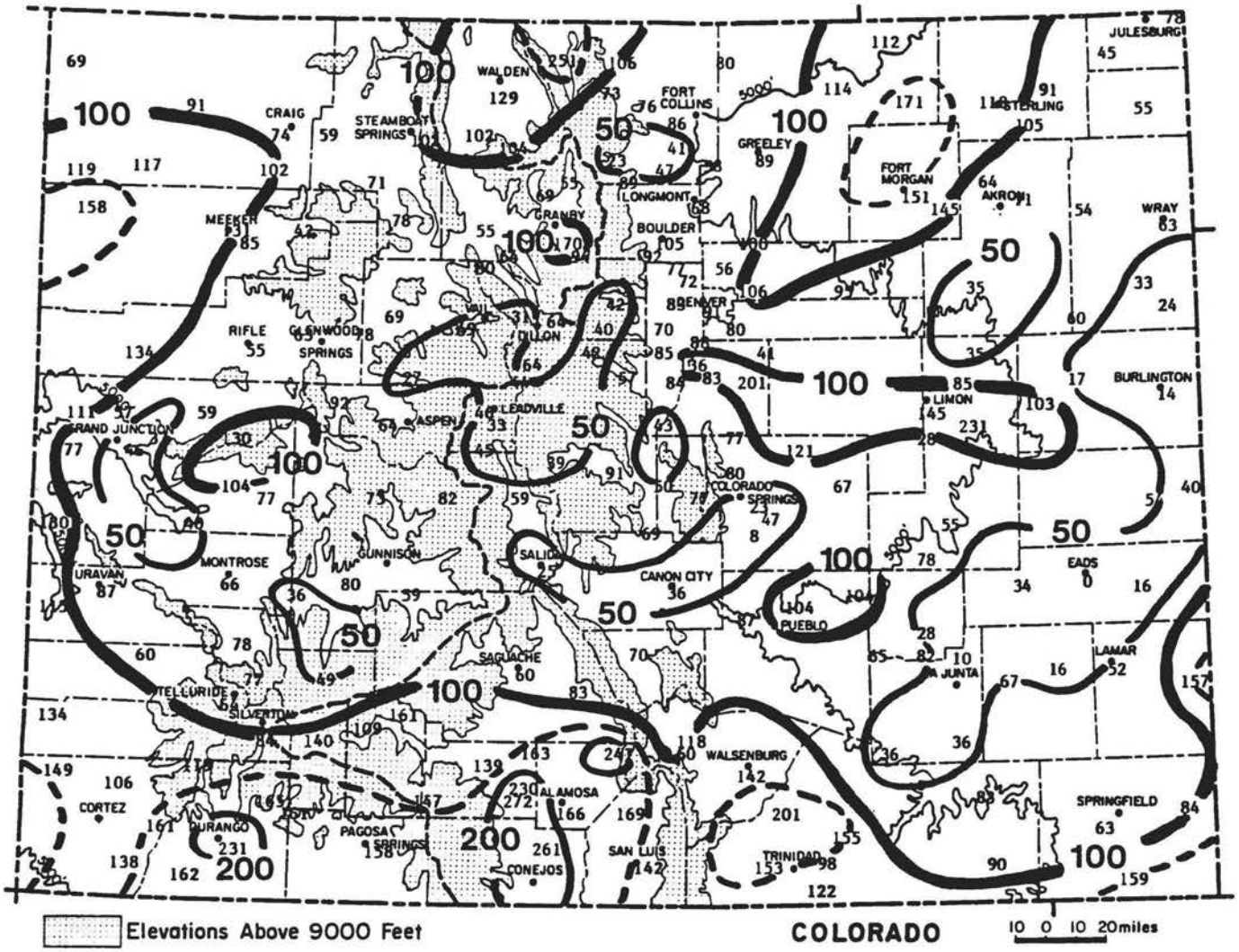


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

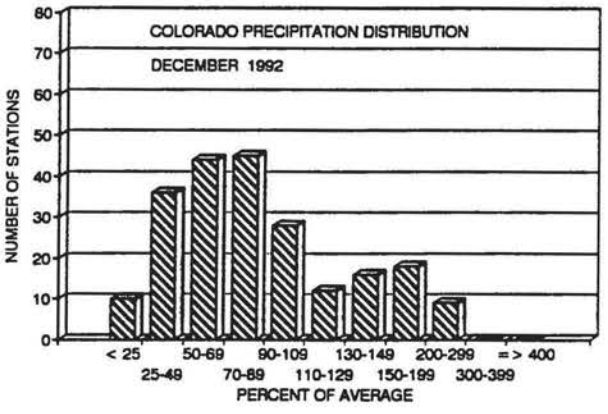


Precipitation Amounts (in inches) for December 1992.

DECEMBER 1992 PRECIPITATION COMPARISON



December 1992 Precipitation as a Percent of the 1961–90 average.



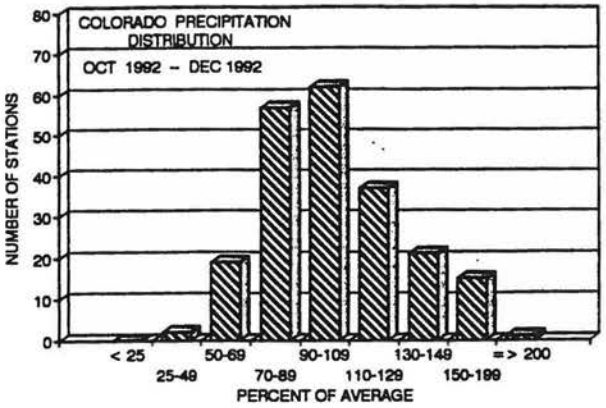
December precipitation ranged from well above average in southwest Colorado to much below average over parts of central and eastern Colorado. Eads reported no precipitation for the month while Durango's 4.24" total was 231% of average. Statewide, dry areas greatly outnumbered wet areas.

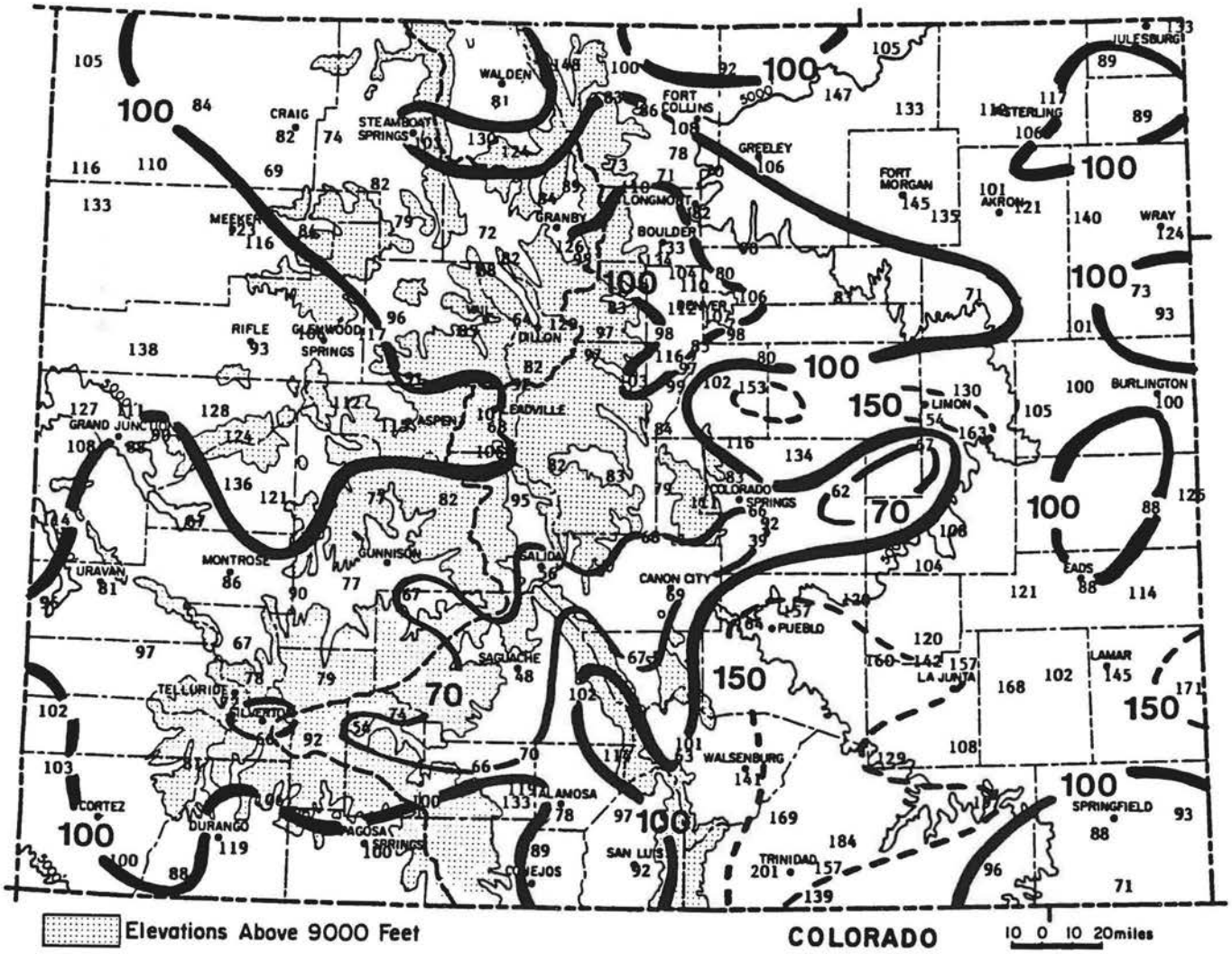
DECEMBER 1992 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.68"	42nd wettest in 121 years of record (wettest = 5.21" in 1913)
Durango	4.24"	5th wettest in 99 years of record (wettest = 7.37" in 1913)
Grand Junction	0.35"	33rd driest in 101 years of record (driest < 0.01" in 1900)
Las Animas	0.19"	57th driest in 126 years of record (driest < 0.01" in 23 separate years)
Pueblo	0.45"	49th wettest in 125 years of record (wettest = 1.35" in 1913)
Steamboat Springs	2.65"	35th wettest in 88 years of record (wettest = 7.26" in 1951)

1993 WATER YEAR PRECIPITATION

The 1993 water year is off to a variable start. Overall, statewide precipitation accumulation is quite close to average. Local variations, however, are quite substantial. Nearly every portion of the State includes both wetter and drier than average areas. For example, Boulder has been very snowy and has received 133% of their average while nearby Longmont is only 82% of average. Similar examples can be found nearly everywhere in the State. With respect to average, the wettest area for the first 3 months of the 1993 water year is near Trinidad where locally twice the normal precipitation has been recorded. The driest areas include northern parts of the San Luis Valley, parts of the Gunnison basin, parts of the upper Colorado basin and portions of the Arkansas basin west and north of Pueblo. Some of these areas have received less than 70% of their average precipitation.





October–December 1992 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR DECEMBER 1992

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	40	100	303	657	1074	1457	1519	1182	1035	732	453	165	8717
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796							4207
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458							4151
BOULDER	AVE	0	6	130	357	714	908	1004	804	775	483	220	59	5460
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921	1093							2497
BUENA VISTA	AVE	47	116	285	577	936	1184	1218	1025	983	720	459	184	7734
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302							3517
BURLINGTON	AVE	6	5	108	364	762	1017	1110	871	803	459	200	38	5743
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301							2719
CANON CITY	AVE *	0	10	100	330	670	870	950	770	740	430	190	40	5100
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976							2267
COLORADO SPRINGS	AVE	8	25	162	440	819	1042	1122	910	880	564	296	78	6346
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101							2639
CORTEZ	AVE *	5	20	160	470	830	1150	1220	950	850	580	330	100	6665
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276							2796
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453							3455
DELTA	AVE	0	0	94	394	813	1135	1197	890	753	429	167	31	5903
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301	919	1192							M
DENVER	AVE	0	0	135	414	789	1004	1101	879	837	528	253	74	6014
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219							2594
DILLON	AVE	273	332	513	806	1167	1435	1516	1305	1296	972	704	435	10754
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480							4840
DURANGO	AVE	9	34	193	493	837	1153	1218	958	862	600	366	125	6848
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6663
	92-93	34	49	139	371	988	1319							2900
EAGLE	AVE	33	80	288	626	1026	1407	1448	1148	1014	705	431	171	8377
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389							3361
EVERGREEN	AVE	59	113	327	621	916	1135	1199	1011	1009	730	489	218	7827
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200							3322
FORT COLLINS	AVE	5	11	171	468	846	1073	1181	930	877	558	281	82	6483
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222							2703
FORT MORGAN	AVE	0	6	140	438	867	1156	1283	969	874	516	224	47	6520
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472							2851
GRAND JUNCTION	AVE	0	0	65	325	762	1138	1225	882	716	403	148	19	5683
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245							2366

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	264	468	775	1128	1473	1593	1369	1318	951	654	384	10591
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563							4579
GREELEY	AVE	0	0	149	450	861	1128	1240	946	856	522	238	52	6442
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334							2772
GUNNISON	AVE	111	188	393	719	1119	1590	1714	1422	1231	816	543	276	10122
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M							M
LAS ANIMAS	AVE	0	0	45	296	729	998	1101	820	698	348	102	9	5146
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267							2552
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502							5042
LIMON	AVE	8	6	144	448	834	1070	1156	960	936	570	299	100	6531
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278							2941
LONGMONT	AVE	0	6	162	453	843	1082	1194	938	874	546	256	78	6432
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299							2827
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306							3074
MONTROSE	AVE	0	10	135	437	837	1159	1218	941	818	522	254	69	6400
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247							2724
PAGOSA SPRINGS	AVE	82	113	297	608	981	1305	1380	1123	1026	732	487	233	8367
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442							3666
PUEBLO	AVE	0	0	89	346	744	998	1091	834	756	421	163	23	5465
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132							2604
RIFLE	AVE	6	24	177	499	876	1249	1321	1002	856	555	298	82	6945
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241							2748
STEAMBOAT SPRINGS	AVE *	90	140	370	670	1060	1430	1500	1240	1150	780	510	270	9210
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583							3995
STERLING	AVE	0	6	157	462	876	1163	1274	966	896	528	235	51	6614
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473							2942
TELLURIDE	AVE	163	223	396	676	1026	1293	1339	1151	1141	849	589	318	9164
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268							3673
TRINIDAD	AVE	0	0	86	359	738	973	1051	846	781	468	207	35	5544
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137							2528
WALDEN	AVE	198	285	501	822	1170	1457	1535	1313	1277	915	642	351	10466
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471							4476
WALSENBURG	AVE	0	8	102	370	720	924	989	820	781	501	240	49	5504
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951							2204

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

DECEMBER 1992 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	32.6	9.0	20.8	-5.7	48	-5	1361	0	0	0.45	0.05	112.5	5
STERLING	30.4	4.2	17.3	-9.0	46	-6	1473	0	0	0.39	0.06	118.2	2
FORT MORGAN	27.4	7.3	17.4	-9.0	42	-8	1472	0	0	0.41	0.14	151.9	3
AKRON FAA AP	31.4	10.0	20.7	-7.1	45	-4	1366	0	0	0.24	-0.13	64.9	3
AKRON 4E	28.9	6.7	17.8	-8.9	43	-7	1454	0	0	0.23	-0.09	71.9	3
HOLYOKE	36.1	11.5	23.8	-4.9	57	0	1271	0	15	0.22	-0.18	55.0	2
JOES	32.8	9.6	21.2	-8.4	49	-2	1348	0	0	0.21	-0.14	60.0	2
BURLINGTON	32.6	13.0	22.8	-6.4	46	3	1301	0	0	0.05	-0.29	14.7	2
LIMON WSMO	35.3	11.7	23.5	-3.7	50	0	1278	0	0	0.51	0.16	145.7	5
CHEYENNE WELLS	36.9	14.5	25.7	-4.5	50	4	1210	0	0	0.13	-0.11	54.2	3
EADS	34.8	11.4	23.1	-7.2	51	3	1290	0	2	0.00	-0.37	0.0	0
ORDWAY 21N	40.9	11.9	26.4	-2.1	58	-3	1189	0	15	0.18	-0.05	78.3	2
ROCKY FORD 2SE	40.3	13.1	26.7	-4.2	55	-2	1180	0	8	0.23	-0.05	82.1	3
LAMAR	33.6	9.4	21.5	-9.3	46	-2	1340	0	0	0.21	-0.19	52.5	4
LAS ANIMAS	38.0	9.7	23.9	-7.5	54	0	1267	0	2	0.19	-0.09	67.9	3
HOLLY	33.8	11.6	22.7	-7.5	46	-2	1304	0	0	0.41	0.15	157.7	5
SPRINGFIELD 7WSW	44.4	20.7	32.5	-1.1	65	7	997	0	35	0.23	-0.13	63.9	3
TIMPAS 13SW	42.2	16.7	29.5	-1.5	56	2	1094	0	10	0.20	-0.35	36.4	3

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	36.5	14.1	25.3	-3.8	56	0	1222	0	6	0.44	-0.07	86.3	7
GREELEY UNC	31.9	11.5	21.7	-6.6	51	-2	1334	0	1	0.43	-0.05	89.6	7
ESTES PARK	35.2	18.0	26.6	-1.3	52	-6	1183	0	1	0.11	-0.36	23.4	4
LONGMONT 2ESE	37.5	8.1	22.8	-5.4	58	-8	1299	0	12	0.40	-0.18	69.0	6
BOULDER	41.4	17.4	29.4	-4.1	61	1	1093	0	16	0.84	0.04	105.0	8
DENVER WSFO AP	38.8	12.0	25.4	-5.6	60	-4	1219	0	15	0.68	0.04	106.2	8
EVERGREEN	42.9	9.2	26.0	-1.7	59	-5	1200	0	23	0.56	-0.23	70.9	6
CHEESMAN	42.6	6.0	24.3	-4.2	56	-7	1254	0	12	0.31	-0.40	43.7	4
LAKE GEORGE 8SW	31.3	-2.4	14.4	-2.9	47	-22	1561	0	0	0.42	-0.04	91.3	3
ANTERO RESERVOIR	33.1	-1.8	15.7	0.5	47	-28	1521	0	0	0.13	-0.20	39.4	3
COLORADO SPRINGS	41.1	17.5	29.3	-0.5	62	8	1101	0	19	0.11	-0.35	23.9	4
CANON CITY 2SE	46.5	20.1	33.3	-2.7	66	3	976	0	41	0.21	-0.37	36.2	4
PUEBLO WSO AP	42.3	14.1	28.2	-2.8	64	1	1132	0	28	0.45	0.02	104.7	5
WESTCLIFFE	36.9	7.5	22.2	-2.0	52	-16	1318	0	1	0.53	-0.22	70.7	4
WALSENBURG	45.4	22.7	34.0	0.0	60	1	951	0	24	1.30	0.39	142.9	6
TRINIDAD FAA AP	42.1	14.1	28.1	-4.4	60	-5	1137	0	16	0.90	0.32	155.2	8

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	28.8	4.6	16.7	-1.4	46	-17	1491	0	0	0.79	0.18	129.5	8
LEADVILLE 2SW	30.2	2.3	16.2	-1.3	47	-16	1502	0	0	0.33	-0.67	33.0	12
SALIDA	39.9	13.1	26.5	-0.6	54	-6	1186	0	3	0.10	-0.30	25.0	2
BUENA VISTA	36.8	8.6	22.7	-2.9	50	-9	1302	0	0	0.29	-0.20	59.2	5
SAGUACHE	27.3	-4.6	11.3	-9.4	47	-17	1657	0	0	0.23	-0.15	60.5	5
HERMIT 7ESE	29.3	-10.3	9.5	-3.1	36	-29	1711	0	0	1.40	0.12	109.4	6
ALAMOSA WSO AP	24.5	-11.1	6.7	-10.7	43	-27	1796	0	0	0.75	0.30	166.7	8
STEAMBOAT SPRINGS	27.6	-0.2	13.7	-3.5	42	-20	1583	0	0	2.65	0.07	102.7	17
YAMPA	33.9	9.0	21.5	1.3	52	-15	1340	0	1	0.93	-0.26	78.2	8
GRAND LAKE 1NW	30.5	2.9	16.7	-0.9	46	-22	1491	0	0	0.94	-0.75	55.6	13
GRAND LAKE 6SSW	27.0	1.8	14.4	-3.0	43	-27	1563	0	0	0.65	-0.28	69.9	11
DILLON 1E	31.1	2.8	17.0	-1.2	51	-15	1480	0	1	0.29	-0.63	31.5	6
CLIMAX	25.6	-1.5	12.1	-2.5	41	-14	1631	0	0	0.89	-1.13	44.1	11
ASPEN 1SW	31.2	4.2	17.7	-4.8	50	-11	1458	0	0	1.44	-0.81	64.0	12
CRESTED BUTTE	24.5	-7.1	8.7	-5.3	42	-32	1739	0	0	1.94	-0.69	73.8	11
TAYLOR PARK	22.8	-8.5	7.1	-3.2	34	-38	1788	0	0	1.30	-0.28	82.3	11
TELLURIDE	37.7	9.8	23.8	0.4	50	-7	1268	0	0	1.09	-0.61	64.1	11
PAGOSA SPRINGS	34.5	1.8	18.2	-4.9	46	-15	1442	0	0	2.87	1.06	158.6	10
SILVERTON	32.4	-5.2	13.6	-3.6	55	-20	1587	0	3	1.61	-0.29	84.7	11
WOLF CREEK PASS 1	24.4	5.8	15.1	-5.6	37	-8	1537	0	0	7.16	2.31	147.6	16

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	30.4	5.5	18.0	-2.8	48	-9	1453	0	0	1.08	-0.37	74.5	10
HAYDEN	30.0	6.9	18.4	-1.7	44	-13	1435	0	0	0.99	-0.67	59.6	11
MEEKER NO. 2	35.8	9.5	22.6	-2.2	53	-14	1306	0	3	1.14	0.27	131.0	8
RANGELY 1E	28.6	1.5	15.0	-5.2	43	-14	1540	0	0	0.92	0.34	158.6	6
EAGLE FAA AP	32.5	7.4	19.9	-0.4	53	-18	1389	0	4	0.63	-0.28	69.2	9
GLENWOOD SPRINGS	33.9	11.2	22.5	-2.8	48	-6	1308	0	0	0.93	-0.54	63.3	7
RIFLE	37.4	12.1	24.8	-0.4	50	-13	1241	0	0	0.64	-0.51	55.7	6
GRAND JUNCTION WS	34.2	14.8	24.5	-4.0	48	0	1245	0	0	0.35	-0.26	57.4	6
CEDAREDGE	39.7	11.5	25.6	-2.9	55	-4	1216	0	3	1.11	0.05	104.7	10
PAONIA 1SW	39.1	15.9	27.5	-1.0	54	-6	1155	0	4	1.11	-0.32	77.6	8
DELTA	37.8	14.8	26.3	-2.6	53	2	1192	0	3	0.19	-0.28	40.4	2
COCHETOPA CREEK	28.7	-2.9	12.9	-2.1	47	-25	1607	0	0	0.51	-0.35	59.3	5
MONTROSE NO. 2	35.5	13.5	24.5	-3.1	51	0	1247	0	2	0.43	-0.22	66.2	4
URAVAN	40.2	14.8	27.5	-2.9	53	1	1154	0	2	0.87	-0.13	87.0	11
NORWOOD	34.9	10.7	22.8	-2.1	47	-6	1299	0	0	0.66	-0.43	60.6	6
YELLOW JACKET 2W	36.1	14.4	25.2	-2.6	47	-2	1224	0	0	2.08	0.69	149.6	10
CORTEZ	37.4	9.8	23.6	-4.4	51	-10	1276	0	1	0.53	-0.65	44.9	7
DURANGO	34.4	9.9	22.1	-5.3	46	-5	1319	0	0	4.24	2.41	231.7	12

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

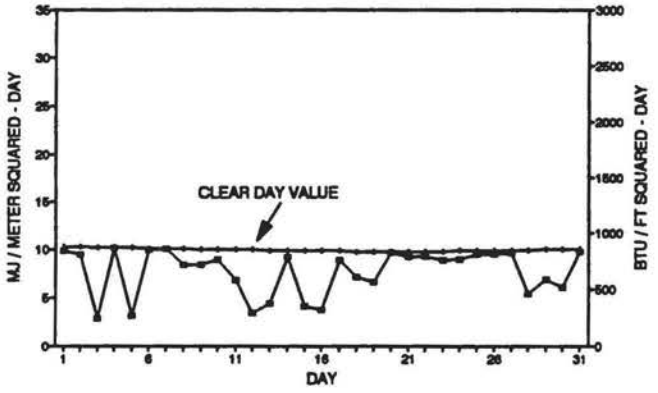
DECEMBER 1992 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	N/A	N/A	N/A	--	--
Denver	16	4	11	68%	67%
Fort Collins	15 ?	3 ?	13 ?	--	--
Grand Junction	7	10	14	71%	61%
Limon	13	9	9	--	--
Pueblo	N/A	N/A	N/A	53%	71%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

December days are short, and the month got off to a fairly cloudy start. A stretch of a full week with sunny weather near Christmas made up for the cloudy periods and left most areas with sunshine and solar radiation that was close to average.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
DECEMBER 1992

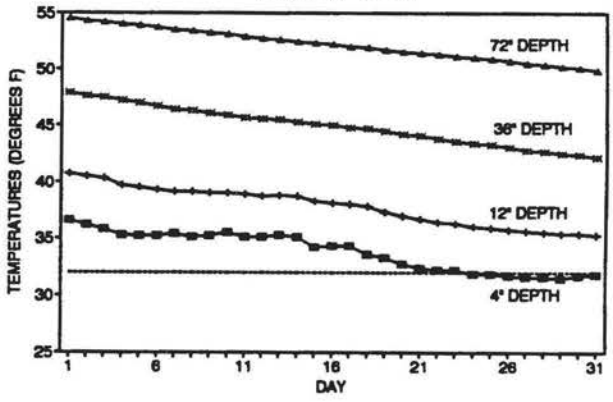


DECEMBER 1992 SOIL TEMPERATURES

Continuous snowcover in December helped to insulate the soil from the colder than normal air temperatures. As a result, soil temperatures dropped only slowly and were actually warmer than usual for this time of year.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
DECEMBER 1992



HATS OFF TO: *John Perrine and the crew* at Loveland Water Treatment Plant (Waterdale Station)

Weather observations have been taken since 1896 near the mouth of the Big Thompson Canyon west of Loveland. The Loveland Water Department has been responsible for those observations (at the site of the old Waterdale Ranch) since 1968. Our hats are off to all of the crew there that helps with the daily weather observations.

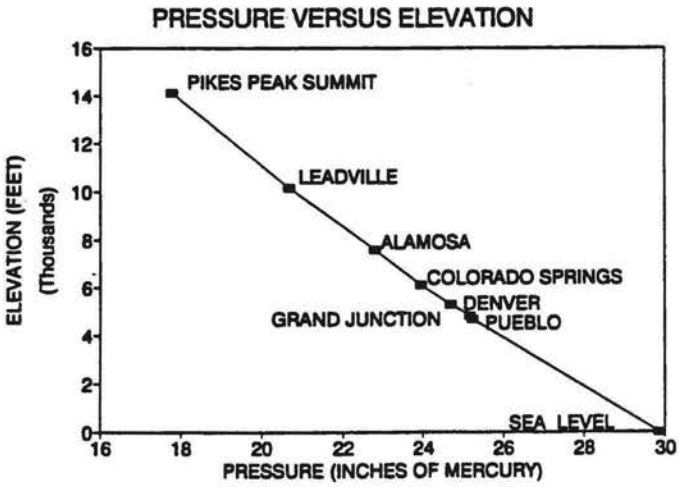
WE'RE UNDER LESS PRESSURE IN COLORADO

It may seem like you're under a lot of pressure in your life, both at home and at work. But if you live in Colorado, you're under less pressure than most of the people in the world – atmospheric pressure that is.

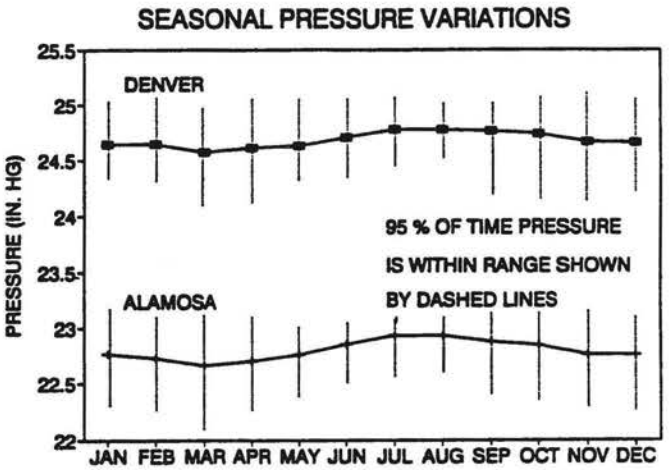
How can this possibly be? The explanation is simple. Higher elevation means lower pressure. The higher the ground, the less atmosphere there is pushing down. There are higher elevation areas on the earth, the most notable being the Tibetan Plateau and the Himalaya Mountains. But, save for places like Mexico City, most high elevation areas have low population densities. Of the total global population, the vast majority resides at elevations within 4000 feet of sea level. Almost all of Colorado lies above 4000 feet.

If you have your own barometer or if you watch the evening news, you're probably used to seeing numbers like 29.71 or 30.23 inches of mercury. That is how high a column of mercury in a vacuum would be pushed by the force exerted by the atmosphere if we were at sea level. Meteorologists must make adjustments to sea level in order to meaningfully analyze weather maps. If actual pressure was all we could use, the weather maps would mostly look like elevation maps – and meteorologists would make lousy weather forecasts.

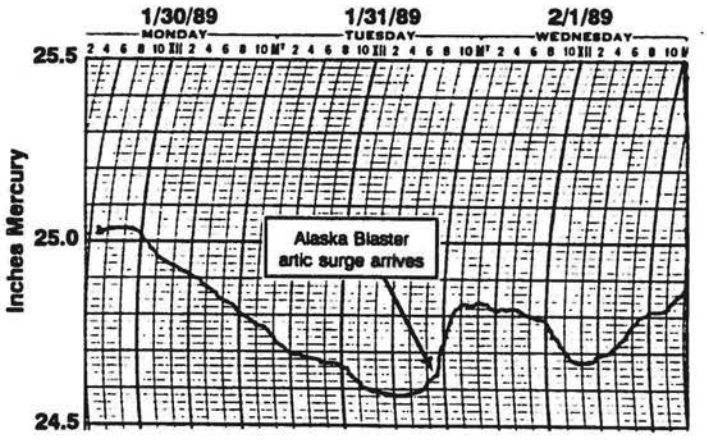
Average pressure at sea level is about 29.90" and can range from less than 28" in the eye of a hurricane to more than 31" under a large polar high pressure area. Near the United States, sea-level pressures range from as low as about 28.80" near the center of the most intense winter and spring low pressure areas up to about 30.80 under cold winter high pressure areas. As we go up in elevation, the actual pressure differs greatly from seal level pressure. The following figure shows average pressures at locations in Colorado as a function of elevation. Out near the Kansas border, the pressure exceeds 26" in some locations but decreases to 24-25" along the Front Range. On Colorado's highest mountain peaks, such as Pikes Peak, the pressure exerted by the atmosphere averages less than 18" of mercury or roughly 60% of sea level pressure. No wonder people get headaches, nosebleeds and get out of breath.



Weather-related and seasonal variations, although significant, are of a much lesser magnitude than elevation variations. Average station pressure is lowest in the early winter and spring at both Alamosa and Denver (and throughout most of Colorado) and highest in the summer. The summer months see relatively little pressure changes at a site compared to spring and fall when local pressure has its greatest range in variations. Up at mountain top levels, the seasonal pressure cycle is a bit more pronounced going from a minimum in mid winter to a maximum in mid summer with a range of nearly 0.5".



Day to day pressure variations are always interesting and informative as the examples below show. I could write a book about pressure changes and their meanings. This is not new information. Scientists and inventors have known how to measure changes in atmospheric pressure for centuries. But the atmosphere is still a living, moving laboratory where each and everyone of us, regardless of our age, formal education, or position can watch, learn and be amazed – without spending a lot of money.



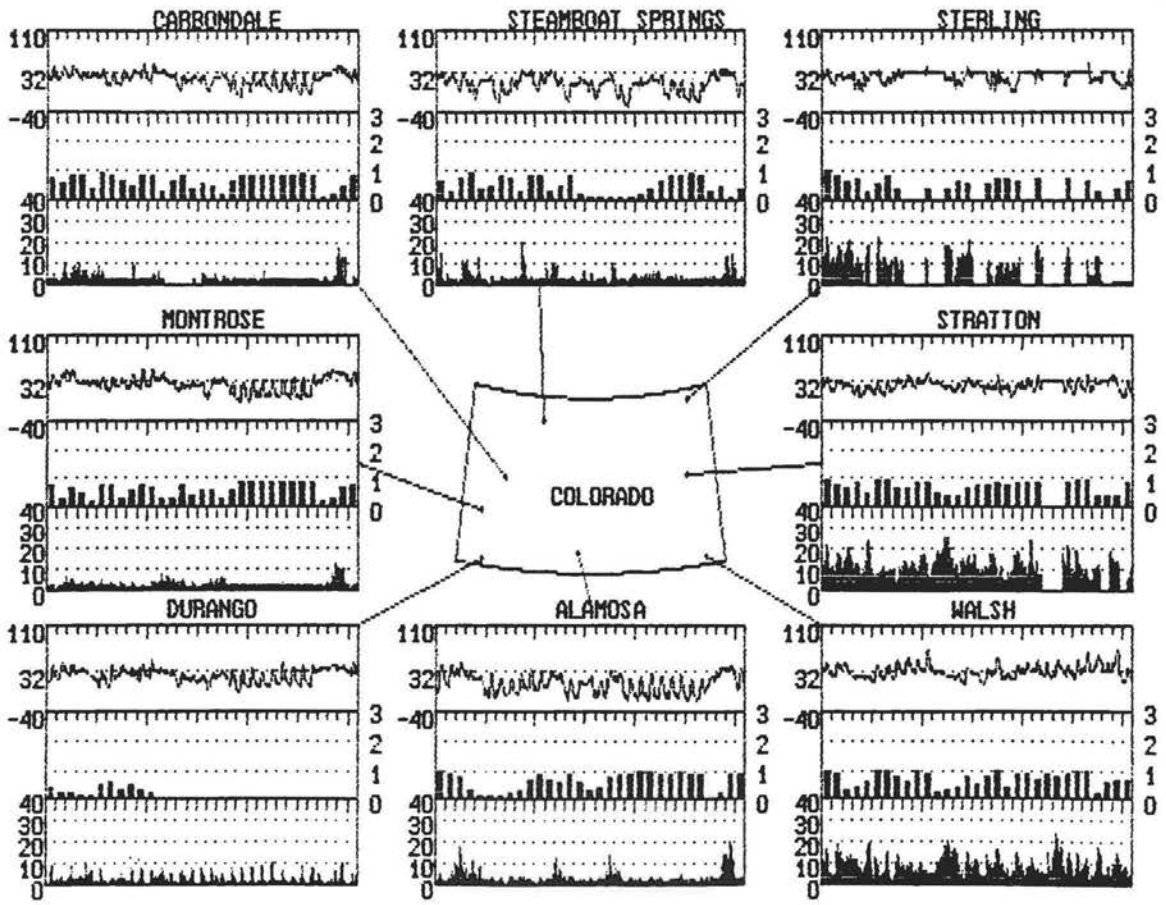
Fort Collins Station Pressure.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	8.0	21.3	20.6	23.4	10.7	24.4	21.9	29.7
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	44.4 3/12	46.8 11/12	48.2 10/16	50.5 3/14	38.1 10/14	50.4 27/15	42.1 11/14	66.2 11/15
minimum:	-23.4 20/ 7	-8.1 20/ 4	-11.0 20/ 7	-7.1 20/ 6	-28.3 20/ 8	-2.2 20/ 4	1.0 31/ 7	6.4 15/ 5
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	81 / -6	90 / 11	82 / 9	85 / 13	67 / -3	27 /-23	71 / 6	77 / 17
11 AM	76 / 7	65 / 17	61 / 12	64 / 18	63 / 2	48 / -6	68 / 13	57 / 20
2 PM	59 / 10	60 / 18	47 / 12	52 / 17	46 / 4	50 / -0	68 / 18	50 / 20
5 PM	60 / 7	69 / 17	50 / 10	59 / 16	52 / 2	53 / -4	73 / 13	61 / 20
11 PM	83 / -3	88 / 16	76 / 11	82 / 15	68 / 0	48 /-11	72 / 8	76 / 18
monthly average wind direction (degrees clockwise from north)								
day	205	146	199	221	130	150	179	194
night	182	142	154	177	120	102	197	226
monthly average wind speed (miles per hour)	3.19	2.12	2.19	2.48	2.41	4.87	9.69	8.30
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	498	544	572	565	583	405	101	47
3 to 12	222	180	102	178	142	233	408	546
12 to 24	24	0	6	1	11	106	231	151
> 24	0	0	0	0	0	0	4	0
monthly average daily total insolation (Btu/ft²•day)	634	117	604	605	444	450	704	688
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	121	3	103	39	75	68	133	113
40-60%	57	13	72	54	41	43	60	69
20-40%	54	30	71	81	64	33	62	64
0-20%	74	66	45	76	95	29	1	36

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

JANUARY 1993

Volume 16 Number 4

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

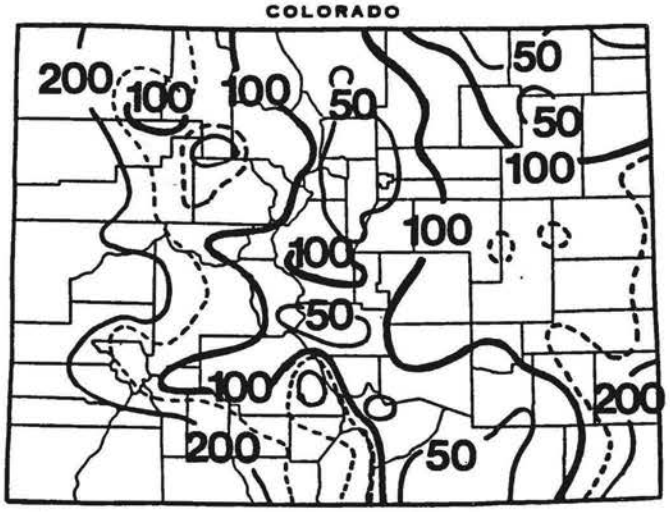
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

January Climate in Perspective–Cold East, Wet West

The Continental Divide served to effectively separate Colorado's January weather conditions. West of the Divide saw frequent intrusions of mild and moist Pacific air with precipitation almost every day the first three weeks of the month. Storms dissipated as they moved east, and a shallow layer of cold air remained in place east of the mountains much of the month interrupted by a few warmer days. Most precipitation east of the mountains was light.

Precipitation

For the first January in several years, precipitation was heavy and widespread over western Colorado providing inland evidence of the barrage of storms that struck California.

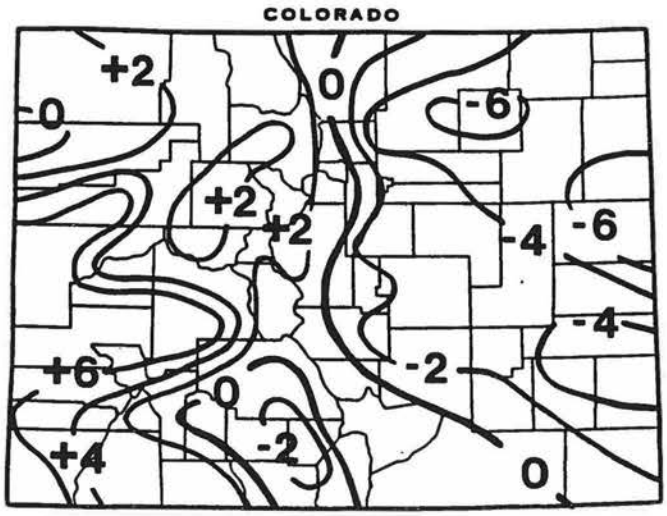


January 1993 precipitation as a percent of the 1961-1990 average.

Near the Utah border almost all weather stations reported more than 200% of average with 300-400% of average in southwest Colorado. High elevation snowfall was also abundant, but precipitation diminished abruptly east of the Continental Divide. Along the Front Range, many locations were much drier than average. Trinidad and Northglenn each measured just 0.07" for the month. On the Eastern Plains, precipitation ranged from above average in the southeast to drier than average in northeastern counties.

Temperatures

A fascinating pattern of temperature anomalies developed in January. Cold air maintained its grip on eastern Colorado as it has for 6 of the last 8 months. Temperatures in the immediate South Platte and Arkansas River valleys were as much as seven degrees Fahrenheit below average. Temperatures warmed into the lower foothills indicating the frequent presence of temperature inversions along the Front Range. Meanwhile, the moist, cloudy Pacific air that dominated western Colorado for most of January reduced nighttime cooling and helped keep temperatures as much as seven degrees above average on the Western Slope. Most of Colorado had about the normal amount of subzero cold.



Departure of January 1993 temperatures from the 1961-90 averages.

Inside This Issue

JANUARY 1993 DAILY WEATHER

1-2 Mild over western Colorado but chilly east of the mountains on the first. Clouds increased on the 2nd and snows began over southwest Colorado. Temperatures remained unseasonably warm across the mountains and Western Slope. Alamosa enjoyed a 40° reading. Temperatures also shot up in eastern Colorado with the help of brisk southwesterly breezes. Denver hit 59° while Springfield was 66°F.

3-5 Snow ended during the day on the 3rd in the mountains after depositing relatively light amounts. Wolf Creek Pass 1E was the exception – reporting 15" of new snow. Then temperatures dropped sharply statewide. Light snows developed over eastern Colorado. Colorado Springs measured 3", but most totals ranged from a trace to 2". Skies cleared overnight and temperatures on the 4th were the coldest of the month over much of the mountains. Crested Butte dropped to -32° while Taylor Park was the State's cold spot with -35°F. Temperatures were also icy east of the mountains with single digits (plus and minus) in most areas. Temperatures remained cold on the 5th, but high clouds raced into the State with the help of a strong westerly jetstream over Colorado.

6-12 Mild temperatures prevailed across western Colorado, but clouds, snows and some low-elevation rains were the rule, especially in southwestern counties. Snow totals of a foot were common. Durango was especially hard hit totalling nearly 30" of wet snow for the period with a remarkable water content of 3.39". Wolf Creek Pass picked up 4 feet of new snow. Meanwhile, wintry weather covered eastern Colorado as Arctic high pressure over southern Canada caused cold easterly upslope winds and clouds from the plains to the Front Range. Many areas picked up snow 8-9th with up to 6" out near Idalia. Temperatures were especially cold 9-10th. Fort Morgan was 30 degrees colder than Dillon on the 9th. Pueblo had a low of -7° on the 9th and a high of just 12° on the 10th. Snows diminished in the mountains on the 11th as an upper disturbance moved eastward. Mountain temperatures dropped sharply. A little snow dusted southeastern Colorado early on the 12th.

13-15 It was still cold east of the mountains on the 13th. Greeley dipped to -9° and Lamar iced out at -16°F. Snow moved into the mountains again during the day, but snows were mostly light. Then temperatures moderated 14-15th with dry weather east of the mountains but with some light, scattered mountain snows and valley fog.

16-19 Pacific moisture continued to drift into western Colorado with mild temperatures and occasional light snow 16-17th. After a mild start on the 16th, chilly, hazy air slipped back into eastern Colorado. Dense fog developed in many areas. Then a new powerful storm from California headed into southwest Colorado on the 18th. The storm weakened as it struck Colorado, but still managed to dump 6-15" in southwestern areas. With 6" of sloppy, wet snow, Durango reached a snowdepth on level ground of 39", possibly the deepest on record this century. Several buildings were damaged under the weight of the snow. Fog and light snow spread over eastern Colorado on the 19th.

20-22 As the storm moved eastward, temperatures rose sharply east of the mountains with occasional strong, gusty downslope winds gusting over 60 mph in windprone areas. Snows that had covered the ground on the plains for many weeks finally began melting. Denver reached 60° on the 22nd and the Trinidad airport was the State's hot spot with 69°F. Mountain temperatures also were a bit warmer than average, and occasional snow fell, especially in the northern and central mountains.

23-24 Two upper disturbances zipped across Colorado in quick succession accompanied by winds, much colder mountain temperatures, and a skiff of snow. Climax only had a high of 14° on the 23rd. Walsenburg was surprised with 6" of snow. Skies cleared on the 24th and typically-cold winter air settled back into Colorado's mountain valleys. Fraser read -19°F.

25-31 A break in the weather with sunny and mild conditions over much of the State, but very cold air stayed in some local valleys creating interesting local contrasts. On the 27th, for example, Leadville lounged in toasty 47° air while down in Kremmling the high was only 9°F. Shallow cold air snuck back into eastern Colorado 28-29th accompanied by some low clouds and a few flakes of snow. Then milder again 30-31st but with some very strong local valley temperature inversions. Clouds increased in western Colorado on the 31st as a new storm approached.

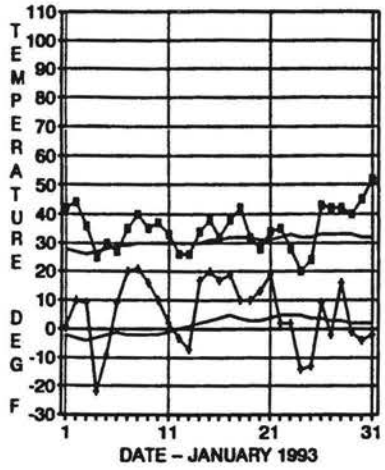
Weather Extremes

Highest Temperature	69°F	January 22	Trinidad Airport
Lowest Temperature	-35°F	January 4	Taylor Park Reservoir
Greatest Total Precipitation	8.67"		Wolf Creek Pass 1E
Least Total Precipitation	0.03"		Trinidad (River)
Greatest Total Snowfall	87.0"		Wolf Creek Pass 1E
Greatest Snow Depth	90"	January 20	Wolf Creek Pass 1E

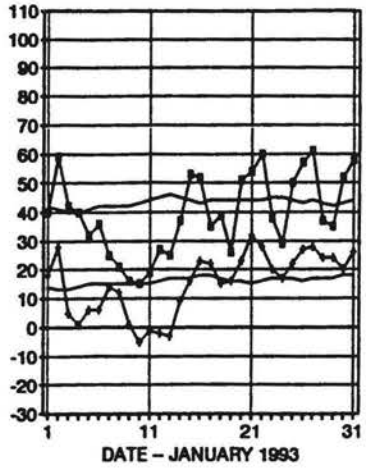
JANUARY 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

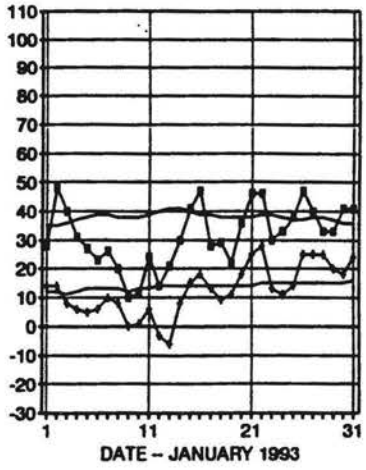
GRAND LAKE 1NW



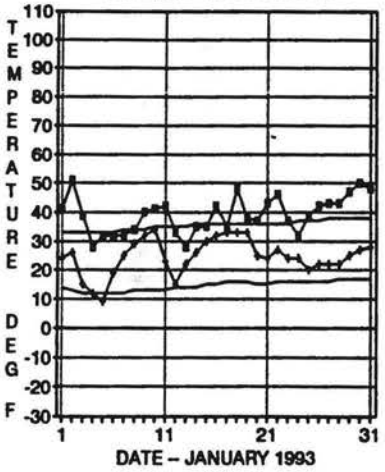
DENVER



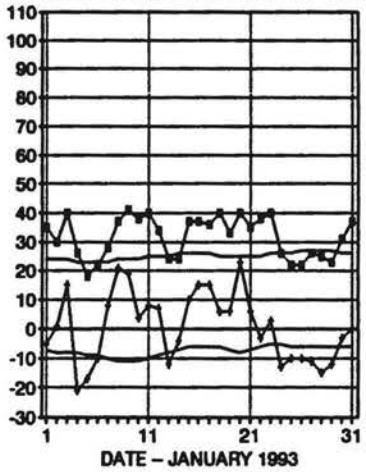
AKRON 1N



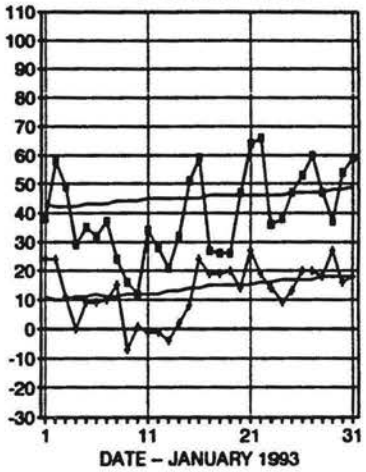
GRAND JUNCTION



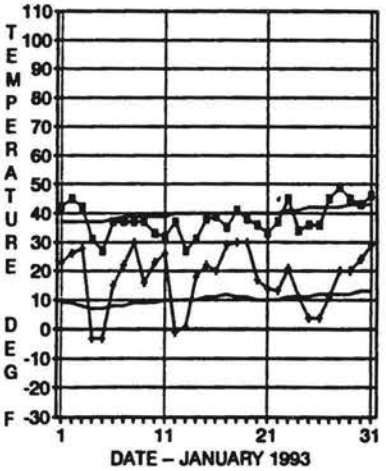
GUNNISON (COCHETOPA CRK.)



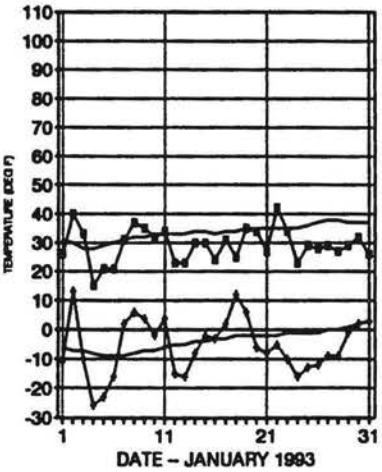
PUEBLO WSO



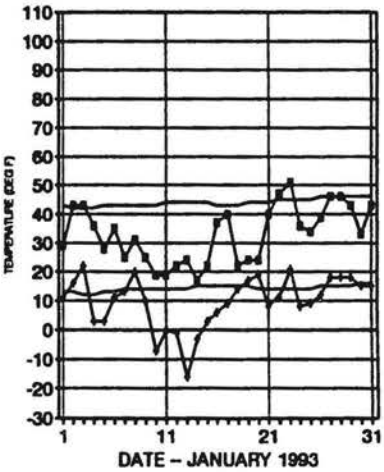
DURANGO



ALAMOSA



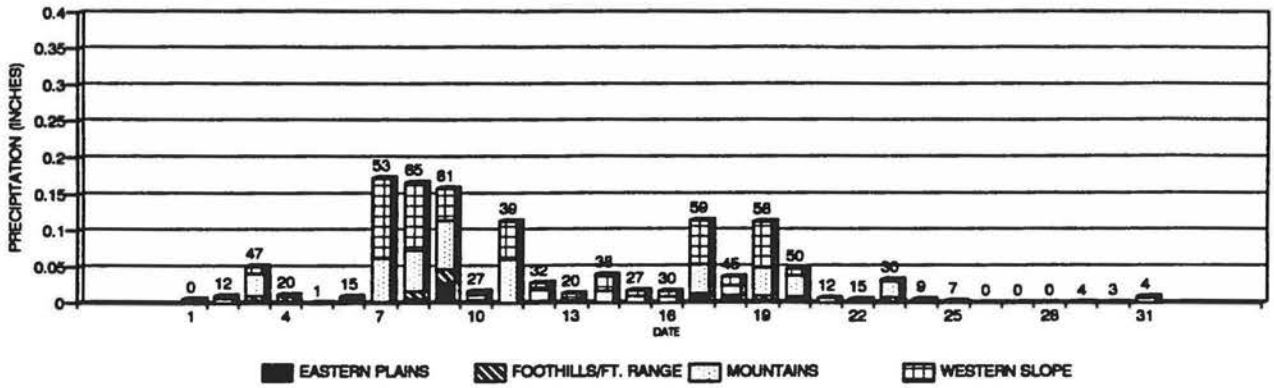
LAMAR



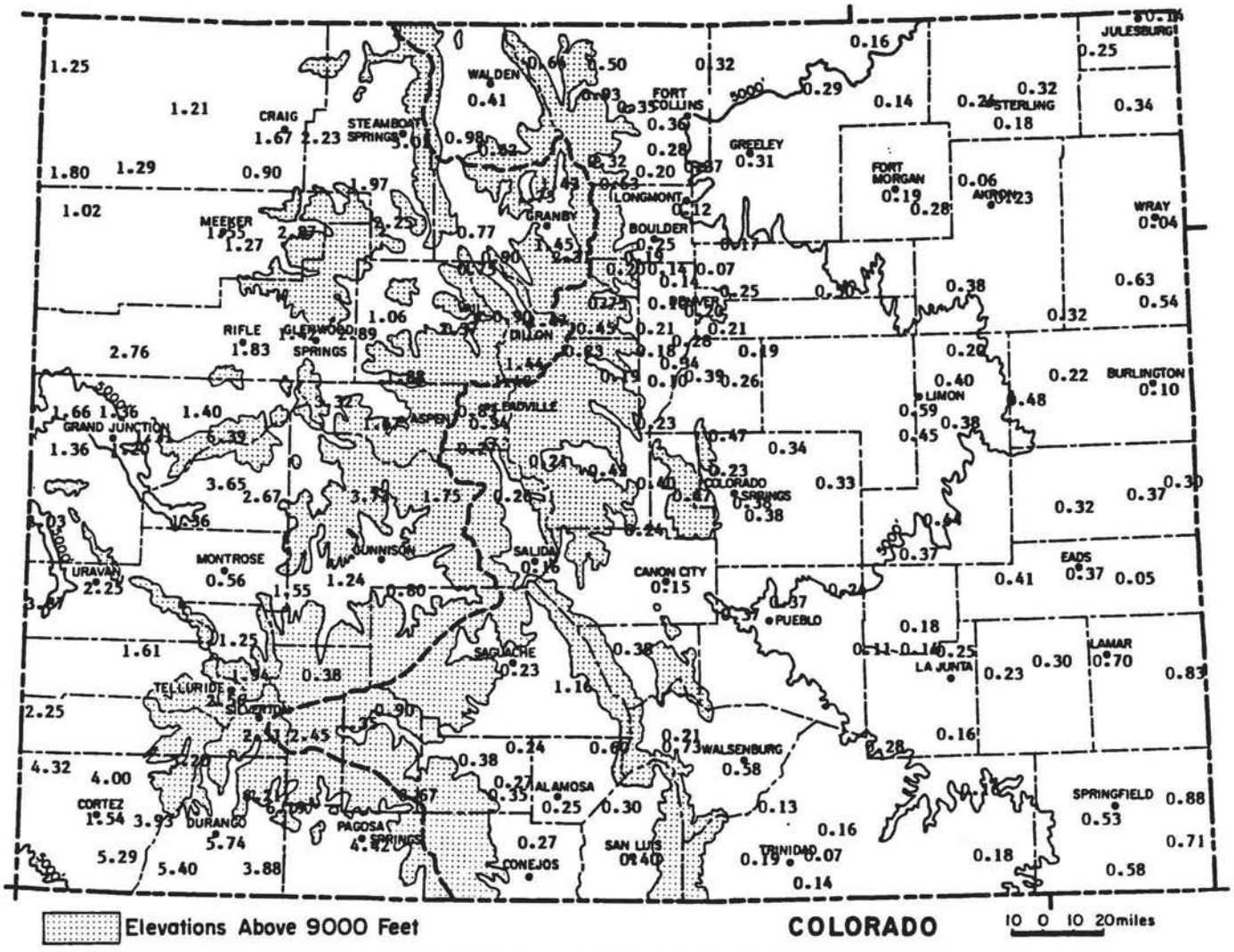
JANUARY 1993 PRECIPITATION

Snow, with some low elevation rain, was nearly a daily phenomenon across the western half of Colorado for the first 3 weeks of January. The heaviest onslaughts occurred from the 6-11th and again 17-19th. Precipitation east of the mountains was trivial by comparison, but significant snows were reported on the plains 8-9th with scattered snows 17-19th. A week of dry and predominantly clear weather at the end of January was a welcome change of pace for most Coloradans.

COLORADO DAILY PRECIPITATION - JAN 1993

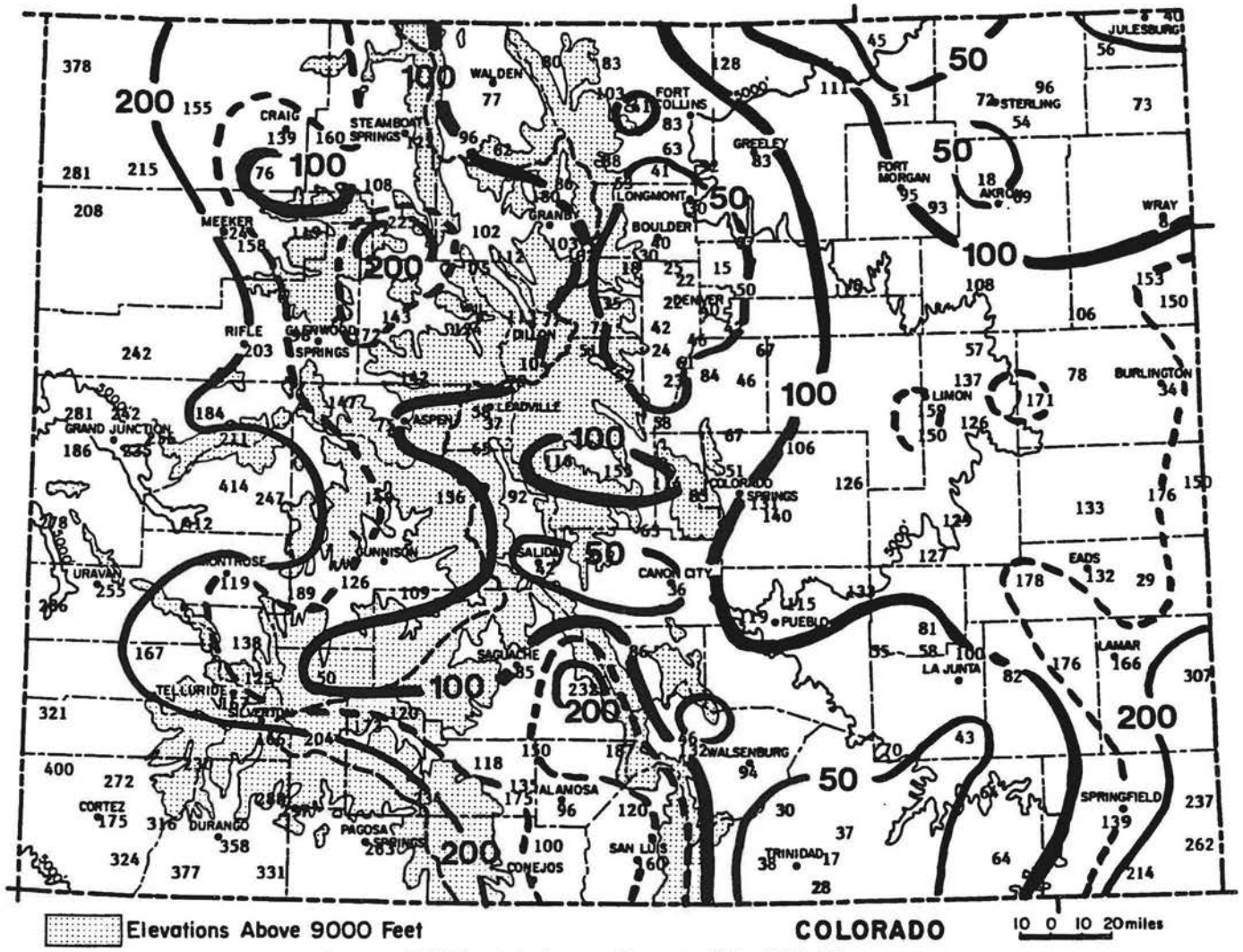


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

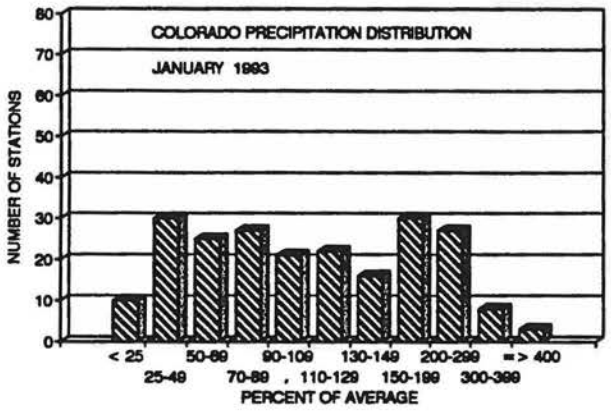


Precipitation Amounts (in inches) for January 1993.

JANUARY 1993 PRECIPITATION COMPARISON



January 1993 Precipitation as a Percent of the 1961–90 average.



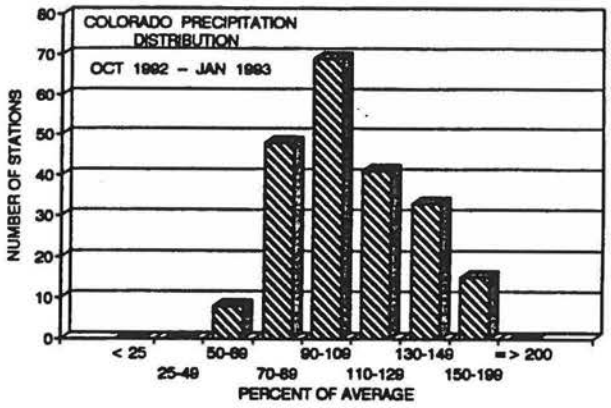
Remarkably variable precipitation totals were observed in Colorado in January with the very dry areas just east of the mountains almost equalling the extremely wet areas in western Colorado. Individual sites ranged from just 8% of average at Wray to 414% of average at Cedaredge.

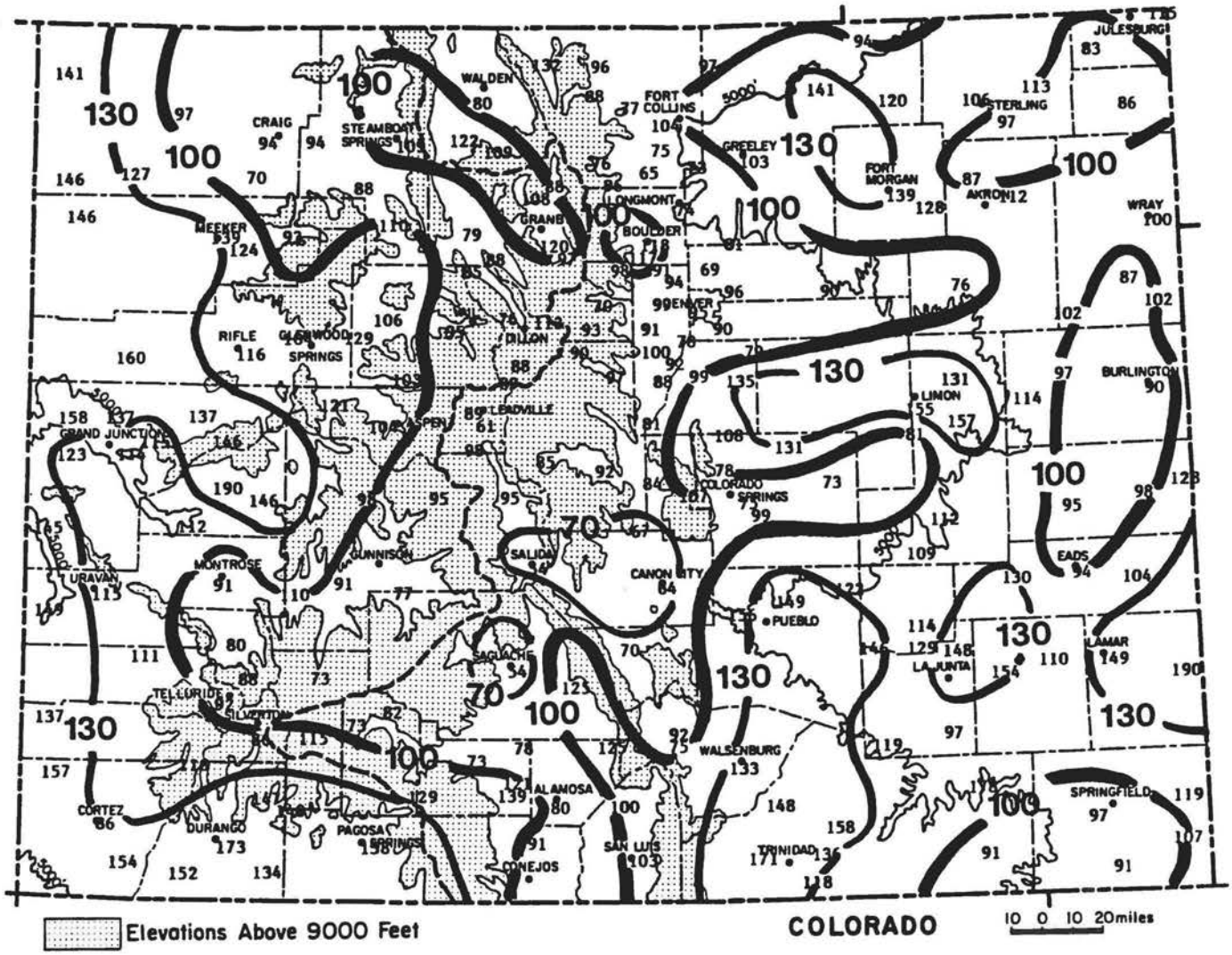
JANUARY 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.25"	43rd driest in 122 years of record (driest = 0.01" in 1933, 34, 52 and 65)
Durango	5.74"	4th wettest in 100 years of record (wettest = 6.95" in 1916)
Grand Junction	1.36"	7th wettest in 102 years of record (wettest = 2.46" in 1957)
Las Animas	0.23"	54th wettest in 127 years of record (wettest = 1.60" in 1944)
Pueblo	0.37"	44th wettest in 125 years of record (wettest = 1.45" in 1948)
Steamboat Springs	3.01"	28th wettest in 87 years of record (wettest = 5.80" in 1980)

1993 WATER YEAR PRECIPITATION

January 1993 precipitation helped raise water-year totals above average over the western quarter of Colorado. Durango has already received more than 12" of moisture, 173% of average. Totals also improved at higher elevations and are fairly close to average. January normally contributes little to water-year totals east of the mountains, so although January precipitation was low in some areas, most of the Eastern Plains are still near or above average for the first four months of the year. The only locations that are significantly drier than average are immediately east of the high mountains and have been shielded from most storms. Salida, for example, has received just 1.33" of moisture since 1 October 1992, just 54% of average. Statewide, wet areas outnumber dry areas, with most areas fairly near to the 1961-1990 average.





October 1992–January 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR JANUARY 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637						5844
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458	1325						5476
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93 *	20	55	71	337	921	1093	1130						3627
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211						4728
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331						4050
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064						3331
COLORADO SPRINGS	AVE	6	18	169	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	951	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179						3818
CORTEZ	AVE *	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051						3847
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408						4863
DELTA	AVE	0	10	125	403	774	1120	1221	888	719	435	186	30	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301	919	1192	967						M
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	9	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162						3756
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435						6275
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152						4052
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387						4748
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177						4499
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	820	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239						3942
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494						4345
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018						3384

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583						6162
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348						4120
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M						M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242						3794
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462						6504
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339						4280
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347						4174
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253						4327
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023						3747
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291						4957
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186						3790
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114						3862
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452						5447
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401						4343
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193						4866
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013						3541
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428						5904
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947						3151

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

JANUARY 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	31.2	10.6	20.9	-2.3	56	-10	1359	0	7	0.16	-0.19	45.7	4
STERLING	30.9	8.2	19.5	-4.6	49	-13	1401	0	0	0.24	-0.09	72.7	3
FORT MORGAN	27.3	5.9	16.6	-7.2	50	-12	1494	0	0	0.19	-0.01	95.0	1
AKRON FAA AP	31.5	12.5	22.0	-4.0	48	-6	1326	0	0	0.06	-0.26	18.7	3
AKRON 4E	28.9	9.9	19.4	-6.0	47	-9	1404	0	0	0.23	-0.10	69.7	4
HOLYOKE	33.5	12.3	22.9	-4.3	60	-9	1296	0	14	0.34	-0.12	73.9	4
JOES	33.0	11.6	22.3	-6.3	52	-9	1316	0	2	0.32	0.02	106.7	3
BURLINGTON	30.6	13.1	21.8	-6.2	49	-2	1331	0	0	0.10	-0.19	34.5	3
LIMON WSMO	33.1	10.1	21.6	-3.9	51	-8	1339	0	1	0.59	0.22	159.5	7
CHEYENNE WELLS	35.9	14.1	25.0	-3.8	54	-1	1229	0	4	0.37	0.16	176.2	4
EADS	32.8	13.0	22.9	-4.9	52	-7	1297	0	3	0.37	0.09	132.1	6
ORDWAY 21N	36.1	9.3	22.7	-3.3	58	-14	1302	0	16	0.37	0.08	127.6	3
ROCKY FORD 2SE	41.6	14.9	28.3	-0.8	66	1	1134	0	34	0.14	-0.10	58.3	4
LAMAR	33.0	9.8	21.4	-7.6	51	-16	1344	0	1	0.70	0.28	166.7	6
LAS ANIMAS	36.5	12.7	24.6	-4.9	58	-6	1242	0	12	0.23	-0.05	82.1	6
HOLLY	32.7	13.1	22.9	-4.9	49	-10	1296	0	0	0.83	0.56	307.4	8
SPRINGFIELD 7WSW	43.1	18.8	30.9	-0.9	66	-1	1045	0	42	0.53	0.15	139.5	3
TIMPAS 13SW	41.8	16.7	29.2	0.0	68	5	1100	0	37	0.28	-0.12	70.0	3

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	36.5	13.1	24.8	-2.9	57	-6	1239	0	12	0.36	-0.07	83.7	6
GREELEY UNC	31.5	11.1	21.3	-5.9	54	-9	1348	0	2	0.31	-0.06	83.8	4
ESTES PARK	37.7	15.9	26.8	-0.6	52	-10	1173	0	1	0.32	-0.04	88.9	5
LONGMONT 2ESE	34.3	8.3	21.3	-5.3	60	-10	1347	0	10	0.12	-0.27	30.8	2
BOULDER	39.0	17.6	28.3	-2.2	61	-6	1130	0	23	0.25	-0.36	41.0	4
DENVER WSFO AP	39.4	15.2	27.3	-2.4	61	-5	1162	0	31	0.25	-0.25	50.0	4
EVERGREEN	42.6	11.0	26.8	0.1	58	-8	1177	0	18	0.21	-0.28	42.9	2
CHEESMAN	43.7	5.1	24.4	-2.2	58	-9	1251	0	16	0.23	-0.16	59.0	2
LAKE GEORGE 8SW	31.7	-3.1	14.3	-0.2	44	-16	1565	0	0	0.42	0.15	155.6	2
ANTERO RESERVOIR	34.9	-1.4	16.7	3.0	46	-17	1489	0	0	0.21	0.03	116.7	2
RUXTON PARK	33.3	4.6	19.0	-1.1	54	-10	1420	0	3	0.47	-0.09	83.9	3
COLORADO SPRINGS	38.4	15.0	26.7	-2.1	58	-3	1179	0	19	0.38	0.09	131.0	5
CANON CITY 2SE	43.5	17.3	30.4	-3.1	65	-4	1064	0	51	0.15	-0.26	36.6	2
PUEBLO WSO AP	40.1	12.8	26.4	-3.2	66	-7	1186	0	39	0.37	0.05	115.6	6
WESTCLIFFE	40.4	10.4	25.4	3.2	52	-6	1220	0	1	0.38	-0.06	86.4	5
WALSENBURG	47.3	21.1	34.2	1.3	64	-1	947	0	47	0.58	-0.04	93.5	5
TRINIDAD FAA AP	47.2	16.9	32.0	0.8	69	1	1013	0	53	0.16	-0.27	37.2	2

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	31.5	5.9	18.7	2.8	40	-14	1428	0	0	0.41	-0.12	77.4	8
LEADVILLE 2SW	32.3	3.1	17.7	2.8	48	-14	1462	0	0	0.34	-0.56	37.8	15
SALIDA	42.6	13.6	28.1	1.2	54	0	1136	0	6	0.16	-0.22	42.1	2
BUENA VISTA	39.4	11.9	25.6	0.0	50	-2	1211	0	0	0.26	-0.02	92.9	7
SAGUACHE	31.8	1.1	16.5	-1.6	40	-14	1496	0	0	0.23	-0.04	85.2	6
HERMIT 7ESE	30.7	-11.9	9.4	-0.4	35	-25	1716	0	0	1.35	0.57	173.1	8
ALAMOSA WSO AP	29.2	-5.4	11.9	-2.8	42	-26	1637	0	0	0.25	-0.01	96.2	4
STEAMBOAT SPRINGS	29.6	6.1	17.9	3.0	43	-19	1452	0	0	3.01	0.64	127.0	15
YAMPA	36.2	11.4	23.8	4.9	46	-7	1270	0	0	2.25	1.25	225.0	11
GRAND LAKE 1NW	35.0	5.6	20.3	4.4	52	-22	1375	0	1	1.43	-0.23	86.1	17
GRAND LAKE 6SSW	27.5	-0.3	13.6	0.2	42	-27	1583	0	0	1.73	0.77	180.2	20
DILLON 1E	33.8	3.2	18.5	2.8	45	-17	1435	0	0	0.90	0.11	113.9	12
CLIMAX	29.9	4.1	17.0	4.1	42	-15	1481	0	0	1.48	-0.39	79.1	15
ASPEN 1SW	35.6	8.4	22.0	1.8	47	-14	1325	0	0	1.67	-0.53	75.9	15
CRESTED BUTTE	27.6	-1.8	12.9	2.0	38	-32	1609	0	0	3.73	1.23	149.2	16
TAYLOR PARK	25.3	-7.1	9.1	2.4	35	-35	1725	0	0	1.75	0.47	136.7	13
TELLURIDE	39.6	12.8	26.2	4.3	52	-10	1193	0	1	2.56	1.03	167.3	17
PAGOSA SPRINGS	37.5	8.6	23.0	2.9	47	-17	1291	0	0	4.42	2.74	263.1	12
SILVERTON	33.0	-0.5	16.3	1.2	47	-26	1502	0	0	2.51	1.00	166.2	14
WOLF CREEK PASS 1	25.9	8.8	17.4	0.1	44	-11	1468	0	0	8.67	4.98	235.0	17

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	30.1	8.6	19.3	1.8	43	-10	1408	0	0	1.67	0.47	139.2	12
HAYDEN	30.4	9.8	20.1	3.1	48	-13	1386	0	0	2.23	0.84	160.4	17
MEEKER NO. 2	37.0	11.7	24.4	1.2	47	-10	1253	0	0	1.55	0.86	224.6	13
RANGELY 1E	24.9	2.0	13.5	-2.9	47	-17	1588	0	0	1.02	0.53	208.2	6
EAGLE FAA AP	33.2	7.0	20.1	1.6	45	-20	1387	0	0	1.06	0.32	143.2	12
GLENWOOD SPRINGS	35.3	15.6	25.5	2.0	45	-5	1219	0	0	1.42	-0.02	98.6	11
RIFLE	39.8	17.7	28.8	6.4	49	-4	1114	0	0	1.83	0.93	203.3	12
GRAND JUNCTION WS	39.1	24.6	31.9	6.9	51	9	1018	0	1	1.36	0.80	242.9	11
CEDAREDGE	42.3	16.6	29.4	3.0	51	1	1094	0	1	3.65	2.77	414.8	13
PAONIA 1SW	41.9	22.0	32.0	6.6	52	6	1017	0	2	2.67	1.59	247.2	12
DELTA	43.6	23.5	33.6	7.5	56	5	967	0	10	1.36	1.03	412.1	4
COCHETOPA CREEK	31.8	0.7	16.2	6.5	41	-21	1504	0	0	0.80	0.07	109.6	8
MONTROSE NO. 2	42.1	21.3	31.7	6.9	55	7	1023	0	11	0.56	0.09	119.1	9
URAVAN	44.5	25.5	35.0	7.4	54	11	923	0	9	2.25	1.37	255.7	15
NORWOOD	39.4	18.0	28.7	6.1	52	-2	1117	0	1	1.61	0.65	167.7	9
YELLOW JACKET 2W	40.0	20.2	30.1	4.9	51	0	1075	0	1	4.32	3.24	400.0	15
CORTEZ	41.1	20.6	30.8	6.3	52	3	1051	0	1	1.54	0.66	175.0	12
DURANGO	37.8	17.4	27.6	2.6	49	-3	1152	0	0	5.74	4.14	358.7	15
IGNACIO 1N	35.8	13.4	24.6	2.2	46	-6	1245	0	0	3.88	2.71	331.6	10

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

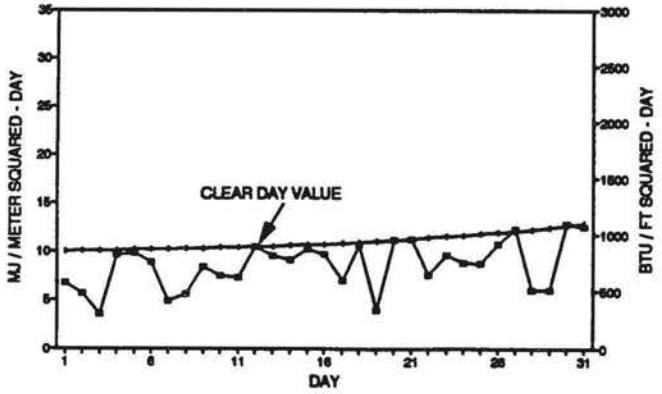
JANUARY 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	NA	NA	NA	--	--
Denver	11	11	9	70%	71%
Fort Collins	9	10	12	--	--
Grand Junction	8	3	20	58%	61%
Limon	10	11	10	--	--
Pueblo	NA	NA	NA	61%	75%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

Daylength began to increase slowly in January, but much of the sunshine didn't reach the ground, especially over western and southern portions of Colorado. Northeastern Colorado saw close to normal winter sunshine, while southwestern Colorado was much cloudier than usual.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
JANUARY 1993

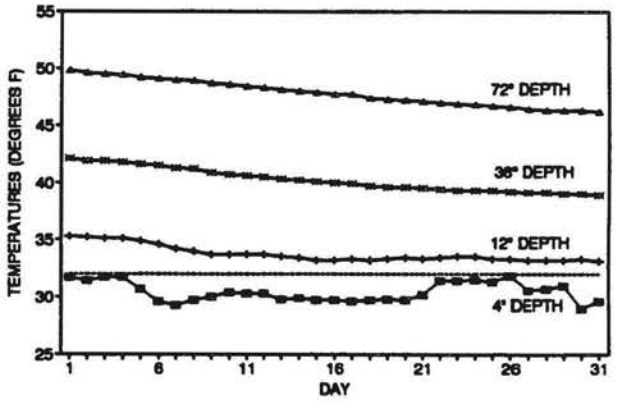


JANUARY 1993 SOIL TEMPERATURES

Deeper soil temperatures continued to cool steadily while near-surface temperatures remained fairly steady. By the end of January, the snowcover finally melted allowing more rapid daily changes in 4" soil temperatures.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
JANUARY 1993



HATS OFF TO: *The Weather Observers* at Dinosaur National Monument.

Most of the National Parks and Monuments in Colorado take cooperative weather observations for the NWS and the Colorado Climate Center. The care and commitment of the staff at Dinosaur National Monument has been particularly commendable. The dinosaurs are old, but their weather station is relatively new – dating back to 1962.

THAR' SHE BLOWS – WINDS IN COLORADO

An ever-present ingredient of our climate is the wind. Precipitation starts and stops, clouds come and go – but the air we live in is always moving. Sometimes winds blow madly while at other times the air is nearly still. But it never stops, or at least not for long.

The wind affects us in so many ways. Wind steers the clouds and carries moisture into and out of Colorado. Near the ground it carries odors from our bakeries, our refineries and our feedlots. It cleanses the air over cities when it blows briskly but traps our pollutants when it stagnates. Bikers and joggers know the two faces of the wind – sometimes pushing them, other times blocking them. The wind redirects golfers' tee shots and controls which runways aircraft land and take off on. Winds lift our kites, but wind can also power windmills and generate electricity. Winds carry insects and spores. When winds blow faster than average, the amount of Colorado's water supplies that evaporate into the air increases. When winds decrease, evaporation decreases and we get more useable water from our available supplies. In the summer we welcome a good breeze to help cool our bodies while in the winter we dread the wind and the painful effects of wind chill. Wind can influence our moods, and it can blow away our soil and rip off our shingles (or worse).

Old timers in Colorado knew the wind like they knew the back of their hands. Much folklore exists about the wind. "A windy winter denotes a rainy spring," Sir Francis Bacon said. That appears to have little truth. But other sayings like "A west wind, like an honest man, goes to bed at sundown," "The east wind doth blow, and we shall have snow" and "A veering wind (shifting clockwise), fair weather – a backing wind (shifting counterclockwise), foul weather," have some truth in them. The moisture-bearing "upslope winds" along the Front Range were well known long before we started hearing it described by the TV meteorologists on the 10 o'clock news. Likewise, the "Chinook" winds, the strong downslope warming winds east of the Rockies, were very familiar to the native Americans here centuries ago. Similarly, as long as people have lived in the mountains, they have known about valley wind circulations – winds that blow up the valleys toward the mountains during the day only to turn around almost every night and blow back down the valleys.

If winds are so interesting and important, why don't we talk about them more? In scanning over the nearly 100 special feature stories published here in **Colorado Climate** during the past decade, I only found two articles focusing on winds ("The warm winds of winter – the Chinook," November 1985 and "The wild winds of spring," January 1989). I don't have a good explanation for this. Perhaps the wind is such a common thing that we ignore it most of the time. When it blows strong enough to get our attention, then instead of being interesting it becomes a nuisance. That's just a theory. Maybe I just don't like writing about it.

One real reason for not dwelling much on wind has to do with the availability of data. Traditionally, wind data have been collected at many fewer sites in Colorado than temperature or precipitation. Until the relatively recent use of electronic sensors and data loggers, wind was normally measured with heavy-duty expensive instruments only at staffed National Weather Service offices and recorded on continuous paper charts. There are only 5 offices like that in Colorado. Aviation weather data requirements increased the data collection to about 20 locations in the State where weather observers at airports have evaluated the speed, direction and gusts each hour by watching a set of dials and averaging the readings for a one minute period. These data have been recorded on written forms and filed away at the National Climatic Data Center. Wind instruments have always been relatively expensive compared to basic temperature and precipitation instruments. More importantly, summarization of data to compute averages and variations were much more difficult than for temperature or precipitation. Proper wind analysis requires combining direction and speed information. Furthermore, the precise location of the wind instruments (height above the ground, distance from trees and buildings, etc.) are extremely critical to the accuracy and usefulness of the data. The result has been obvious – not much quality summarized data to work with. While we complain about inconsistencies in long-term temperature and snowfall records, we don't even talk about consistent long-term wind records. They simply don't exist here.

The good news is that it doesn't take a hundred years of consistent data to be able to describe the local wind climate. Wind characteristics, while very site specific, tend to be fairly similar from year to year at most locations near the mountains. As a result, a lot can be learned about the local wind climate with just a few years of data. For this reason, the recent proliferation of automated weather stations here in Colorado and all across the country is a real plus for gaining knowledge about wind. For example, from just 5 years of wind data collected by the University of Colorado's WTHRNET, reasonably confident estimates of average wind speeds and prevailing directions can be assessed. Wind speeds a few feet off the ground in Colorado's western valleys have all been found to be very light, averaging only a few miles per hour when all hours of the day and night are combined. Throughout western Colorado, daytime wind speeds are dramatically higher than at night. By comparison (and probably not a surprise), winds out on the Eastern Plains of Colorado blow much stronger. Daytime winds on the plains are stronger than nocturnal winds, but the differences are not as great as in western Colorado.

Next month we will delve into Colorado wind characteristics in more detail. Call me or drop me a note ASAP if there is a particular wind question that you want me to try to answer. And be ready for some first-hand experience with wind. Spring is the windiest time of year for all of Colorado except the high mountains (where winter is their windiest season).

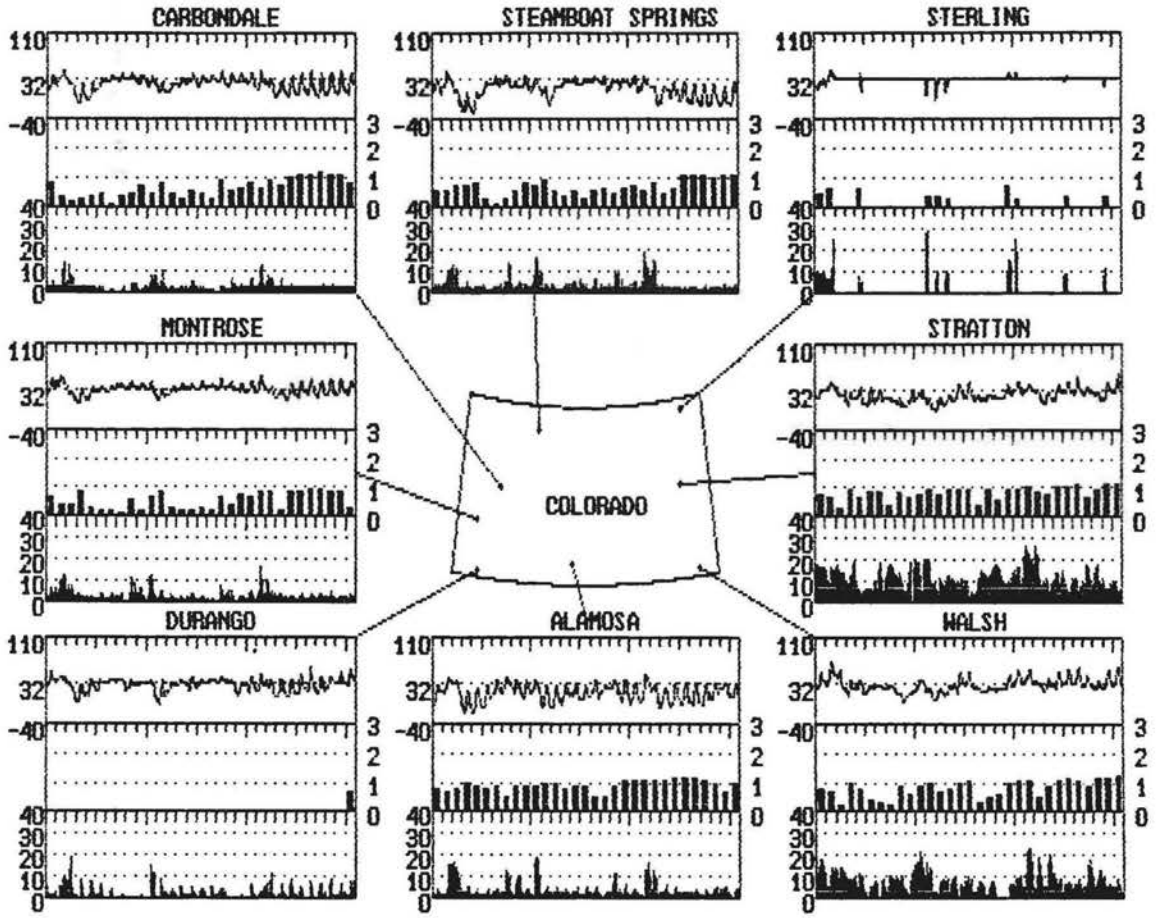
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

WTHRNET WEATHER DATA JANUARY 1993

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	13.2	26.3	22.2	30.0	14.0		21.2	27.0
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	42.3 22/15	55.6 27/13	46.0 2/14	53.6 22/12	44.2 2/14	44.8 2/15	56.7 31/15	65.1 2/14
minimum:	-21.8 4/ 7	-7.2 12/ 8	-12.5 4/ 8	5.9 4/ 8	-28.5 5/ 8	-5.6 13/ 6	-6.2 13/ 5	-4.5 9/22
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	86 / 1	86 / 17	87 / 12	86 / 21	69 / -0		81 / 10	79 / 17
11 AM	73 / 10	64 / 20	66 / 16	62 / 22	65 / 8		78 / 19	62 / 20
2 PM	56 / 13	61 / 22	48 / 15	52 / 21	49 / 8		74 / 22	56 / 20
5 PM	57 / 12	67 / 21	55 / 15	56 / 21	52 / 6		78 / 18	61 / 20
11 PM	82 / 4	86 / 20	84 / 15	84 / 22	70 / 3		78 / 10	79 / 18
monthly average wind direction (degrees clockwise from north)								
day	231	91	212	252	163		183	170
night	208	125	142	160	128		221	203
monthly average wind speed (miles per hour)	3.40	2.18	1.96	2.51	2.36		10.34	7.28
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	487	475	613	532	590		26	96
3 to 12	217	153	83	191	135		460	518
12 to 24	36	8	4	5	15		254	98
> 24	0	0	0	0	0		4	0
monthly average daily total insolation (Btu/ft²•day)	880		618		638		835	784
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	158		78		82	17	155	127
40-60%	83		61		76	12	88	77
20-40%	51		85		79	13	53	59
0-20%	18		60		41	8	5	43

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

FEBRUARY 1993

Volume 16 Number 5

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

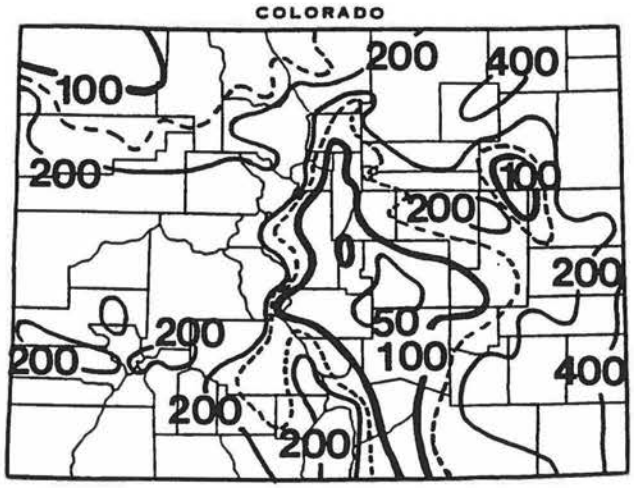
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

February Climate in Perspective—Heavy Snow West, Cold East

Several storms crossed Califonia in February, continuing the pattern that developed in late December, bringing drought-ending rains and snows to the southwestern U.S. and literally burying southwestern Colorado under record-breaking (and roof breaking) wet snows. At the same time, arctic air repeatedly visited eastern Colorado adding to the string of colder-than-average months that has characterized this winter on the plains.

Precipitation

The mountains and western valleys were besieged by frequent and heavy snows and low-elevation rains in February. Nearly all of western Colorado ended up with much above

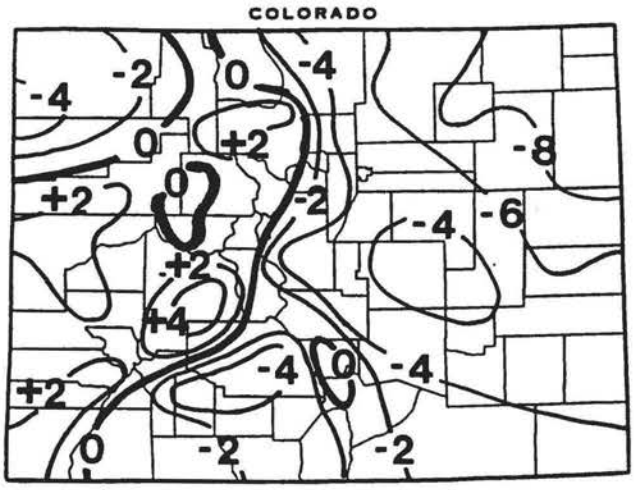


February 1993 precipitation as a percent of the 1961-1990 average.

average moisture. In extreme southwestern Colorado, where 3 to 4 times the average precipitation fell, this was one of the wettest February's on record. Much of eastern Colorado was also snowy as two storms in mid month left most of the Eastern Plains snowcovered and wetter than average in what is normally their driest month of the year. The only areas that were drier than average were parts of Moffat County and a band just east of the mountains from the foothills west of Denver south to Trinidad.

Temperatures

February provided an interesting battle between warm surges of moist Pacific air and intrusions of frigid arctic air. Pueblo, for example, experienced daytime temperatures in the single digits on February 16 and by the 19th it was 68°F. For the month as a whole, areas east of the mountains ended up considerably colder than average, while southwestern Colorado was slightly warmer than usual. Persisting snowcover encouraged cold temperatures, especially in the river valleys of eastern Colorado. Cloudiness compensated for the snowcover over western Colorado keeping temperatures above zero most nights.



Departure of February 1993 temperatures from the 1961-90 averages.

Inside This Issue

FEBRUARY 1993 DAILY WEATHER

1-4 A weak low pressure area aloft meandered across the central Rocky Mountain states, first moving across Colorado into Wyoming on the 1st and then dropping back across the State on the 3rd. Rain and snow fell over southwest Colorado on the 1st. Snow covered the northern and central mountain areas on the 2nd. Snow showers whitened parts of northeast Colorado on the 3rd. Finally, as the storm departed, southeast Colorado had scattered snow on the 4th. Temperatures began quite mild on the 1st, but cooled statewide. As skies cleared in western Colorado 3-4th, temperatures dipped. Subzero readings were widespread in the mountains early on the 4th.

5-7 Clear, dry weather prevailed 5-6th. The coldest temperatures of the month were reported early on the 5th across much of the mountains. Taylor Park Dam's -28°F was the coldest in the State. Then a sharp warming trend took over, especially east of the mountains. Temperatures in the 50s and 60s were common across eastern Colorado 6-7th, but clouds thickened on the 7th and precipitation began late in the day on the Western Slope.

8-11 Mountain snows and valley rains fell over western Colorado on the 8th and became heavy in the southwest, while eastern Colorado enjoyed seasonal weather. Lemon Dam, near Durango, reported 1.66" of moisture (13" of wet snow) in 24 hours. Precipitation continued on the 9th in the west and spread into eastern Colorado late in the day (rain changing to snow) as a cold front dropped down from the north. Snows diminished over western Colorado on the 10th, while a major snowstorm blasted eastern Colorado. Snow, cold temperature and strong winds closed roads and schools over much of eastern Colorado. The greatest reported snowfall was 13" near La Junta, and many locations reported 6-8". Pueblo and Colorado Springs managed to miss most of the storm. Snow ended on the 11th, but near the Kansas border, strong winds and temperatures at or below 20° made for an uncomfortable day.

12-14 A cool but mostly dry period for Colorado. A weak disturbance on the 12th triggering some mountain snows, while low elevations enjoyed sunshine. The 13th was sunny over most of the State. Then clouds increased on the 14th, and a very strong cold front reached northeast Colorado by evening.

15-17 Bitter cold gripped eastern Colorado with widespread snowfall and temperatures at least 30° colder than average. 2-5" of dry snow was common east of the mountains, but heavy snow blanketed portions of southeast Colorado. Lamar reported 10" with 0.74" of water content. Snows also developed across the mountains. Clouds and light snow continued statewide on the 16th, but the big story was the cold. High temperatures were only in the single digits across most of eastern Colorado. Clouds thinned, and eastern Colorado awoke to the coldest morning of the year on the 17th – -8° at Colorado Springs, -18° at Julesburg.

18-21 The frigid arctic air retreated, and temperatures east of the mountains soared. Denver started the 18th at -1° but ended up in the 50s. Most of the State was dry on the 18th, but winds in the mountains and foothills gusted to 50 mph or greater. Temperatures warmed even more on the 19th in advance of a powerful storm crossing California. Grand Junction reached 57° and Pueblo hit 68°F. Then heavy snow and rain moved into western Colorado. Extreme storm conditions clubbed the mountains on the 20th with intense, wind-blown snows. Heavy precipitation even managed to spill across to the downwind (eastern) side of the mountain barrier – Buena Vista and Estes Park, for example. Very low pressure (29.15" of mercury, corrected to sea level at Denver) was observed statewide and winds gusted to 65 mph and higher in some areas. Temperatures dropped in the mountains on the 21st, but snow and very strong winds continued. (An account of this memorable storm appears later in this report.)

22-25 Mountain snows continued. Snowpack throughout the mountains reached its greatest depth in several years. Ski areas wished for less snow, as plowing, grooming and avalanche control required all available time and resources. Winter weather also returned east of the mountains as an arctic air mass covered most of the central U.S. Low clouds and occasional light snow shrouded eastern Colorado 24-25th. Parts of southeast Colorado managed to escape and remained in sunshine with 40-55° temperatures.

26-28 Clearing and warmer for most of Colorado. Cold temperatures and fog lingered over parts of eastern Colorado on the 26th. Then skies cleared and a warming trend took over for the rest of the month. However, one last storm spread clouds and moisture into extreme southern Colorado 27-28th.

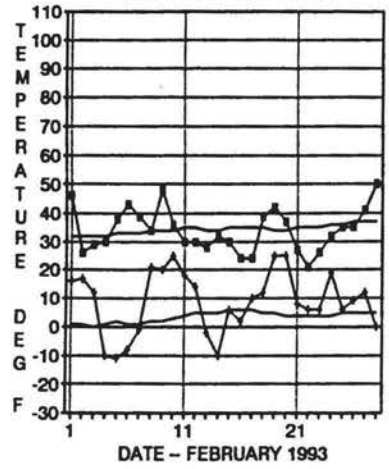
Weather Extremes

Highest Temperature	69°F	February 6	La Junta 20S
Lowest Temperature	-28°F	February 5	Taylor Park Reservoir
Greatest Total Precipitation	13.09"		Wolf Creek Pass 1E
Least Total Precipitation	0.08"		Fort Carson
Greatest Total Snowfall	166.0"		Wolf Creek Pass 1E
Greatest Snow Depth	148"	February 21	Wolf Creek Pass 1E

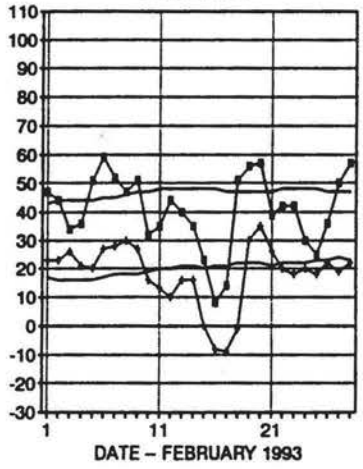
FEBRUARY 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

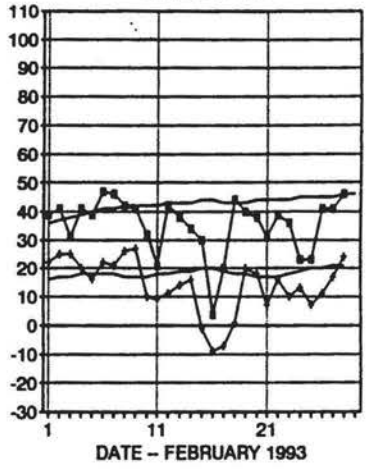
GRAND LAKE 1NW



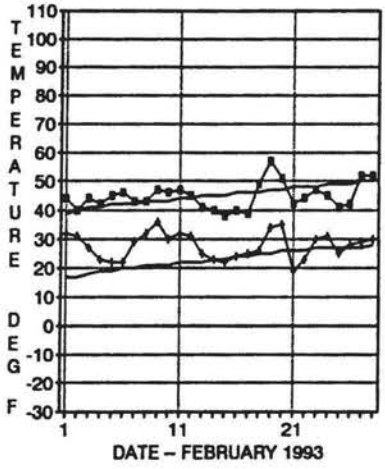
DENVER



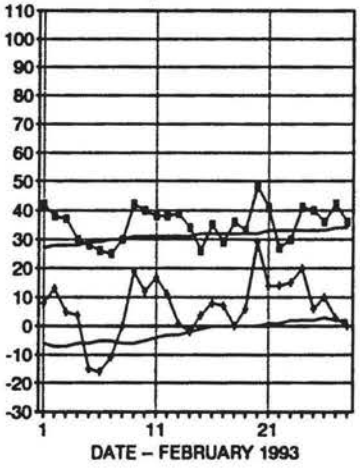
AKRON 1N



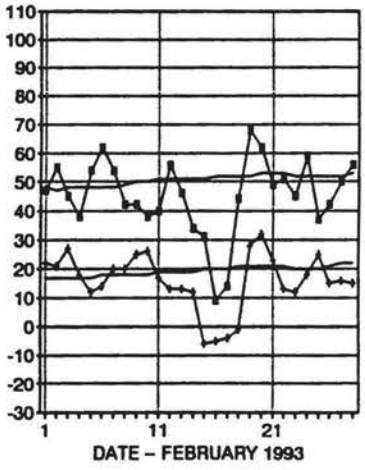
GRAND JUNCTION



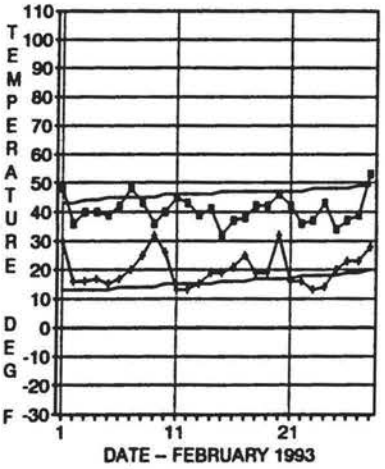
GUNNISON (COCHETOPA CRK.)



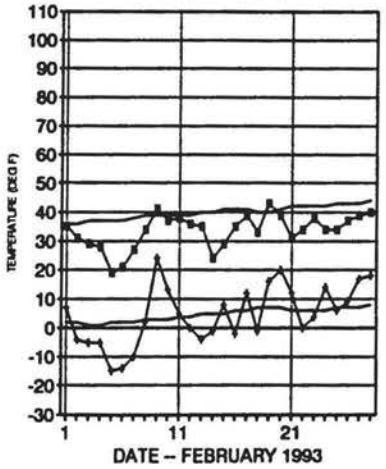
PUEBLO WSO



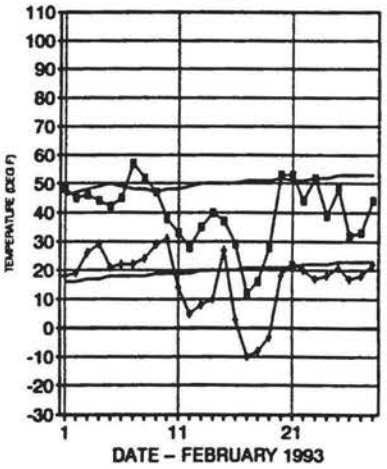
DURANGO



ALAMOSA



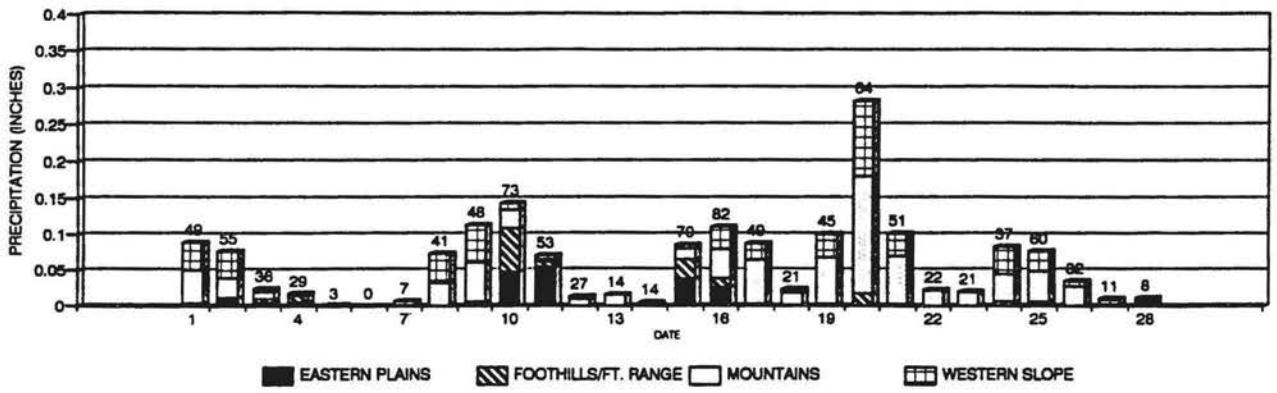
LAMAR



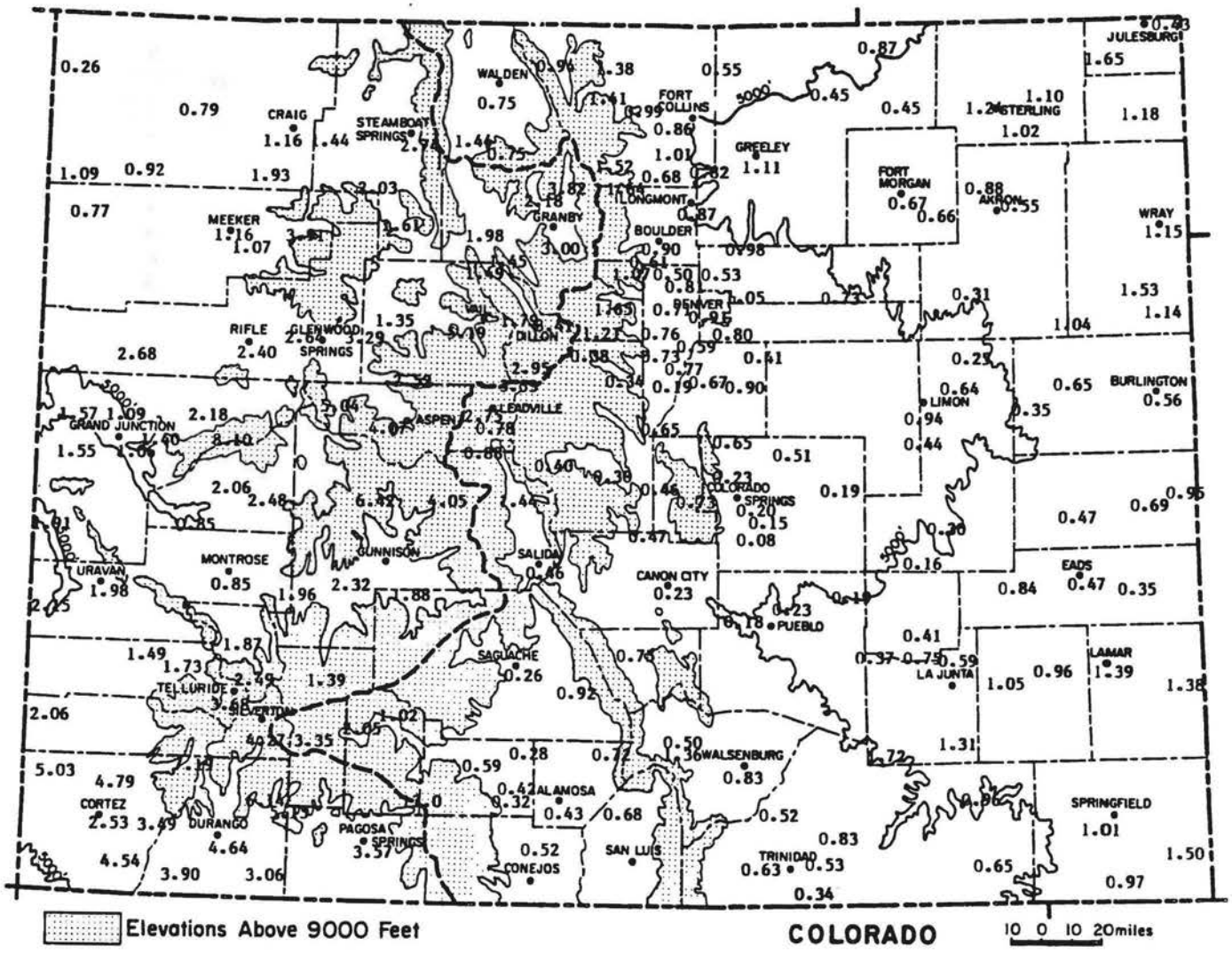
FEBRUARY 1993 PRECIPITATION

Storms struck western Colorado February 1-2nd and 7-10th, but it was the onslaught of storms during the last half of the month that closed highways, triggered countless avalanches and left fears of potential spring floods. February 20 was especially noteworthy with widespread heavy, wet and wind-driven snow across almost all mountain areas of the State. Meanwhile, precipitation east of the mountains was limited to some snowshowers early in the month and two significant storms 10-11th and 15-16th.

COLORADO DAILY PRECIPITATION - FEB 1993

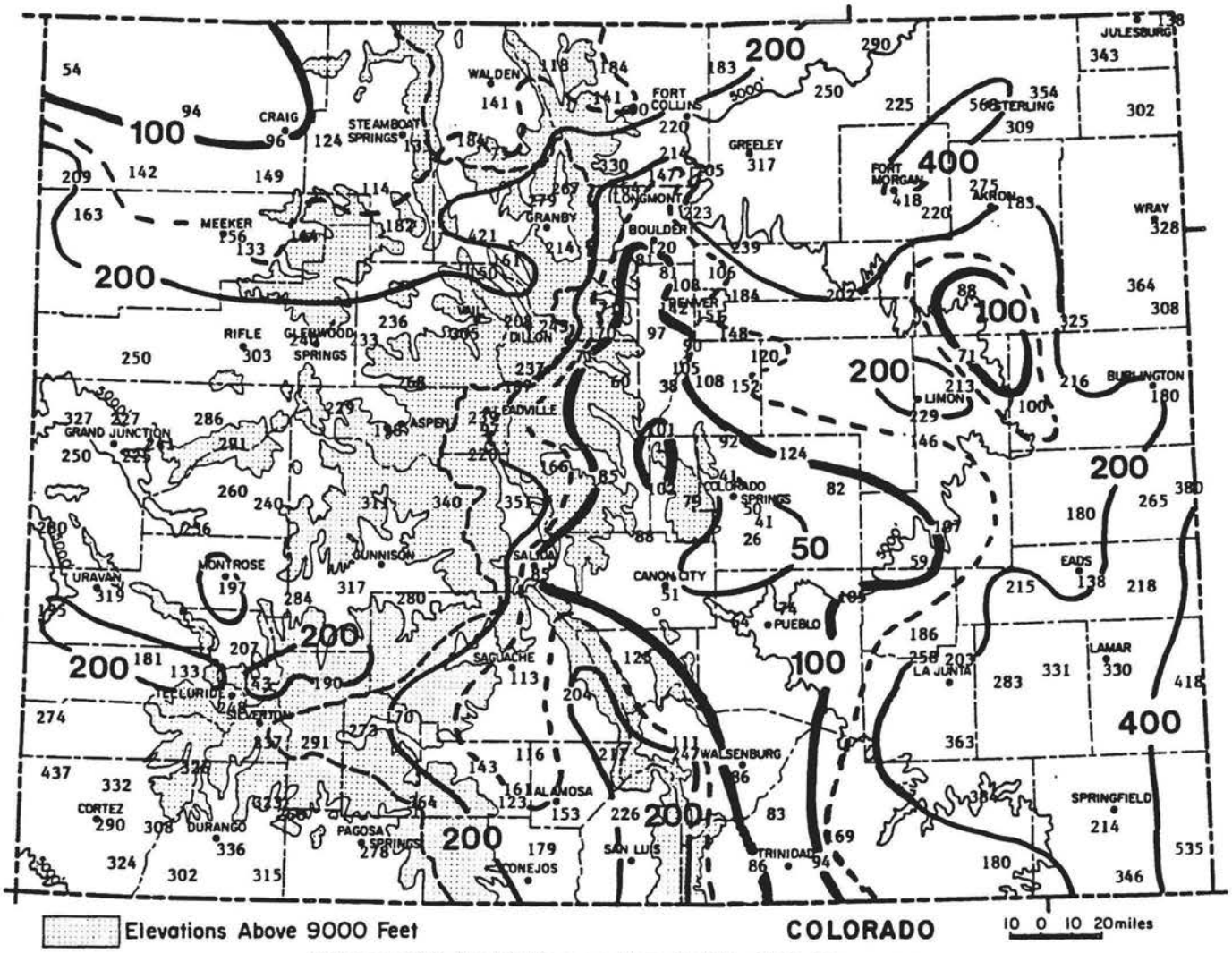


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

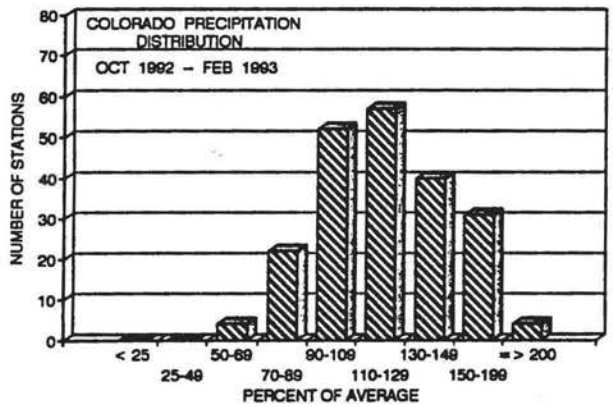


Precipitation Amounts (in inches) for February 1993.

FEBRUARY 1993 PRECIPITATION COMPARISON



February 1993 Precipitation as a Percent of the 1961–90 average.



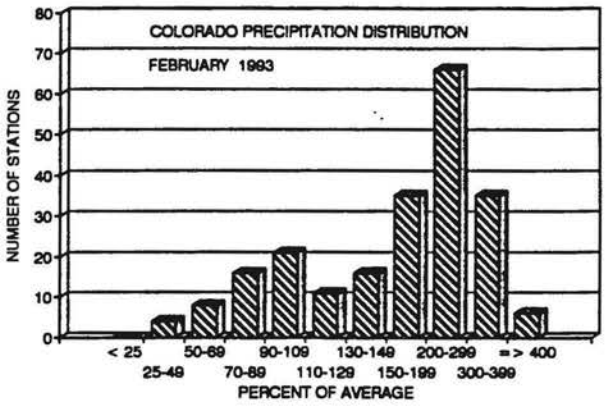
Statewide, February precipitation ranged from only 26% of average at Fort Carson to more than 400% of average at Yellow Jacket, Holly and a handful of other sites. Overall, wetter than average conditions outnumbered dry conditions about five to one across Colorado.

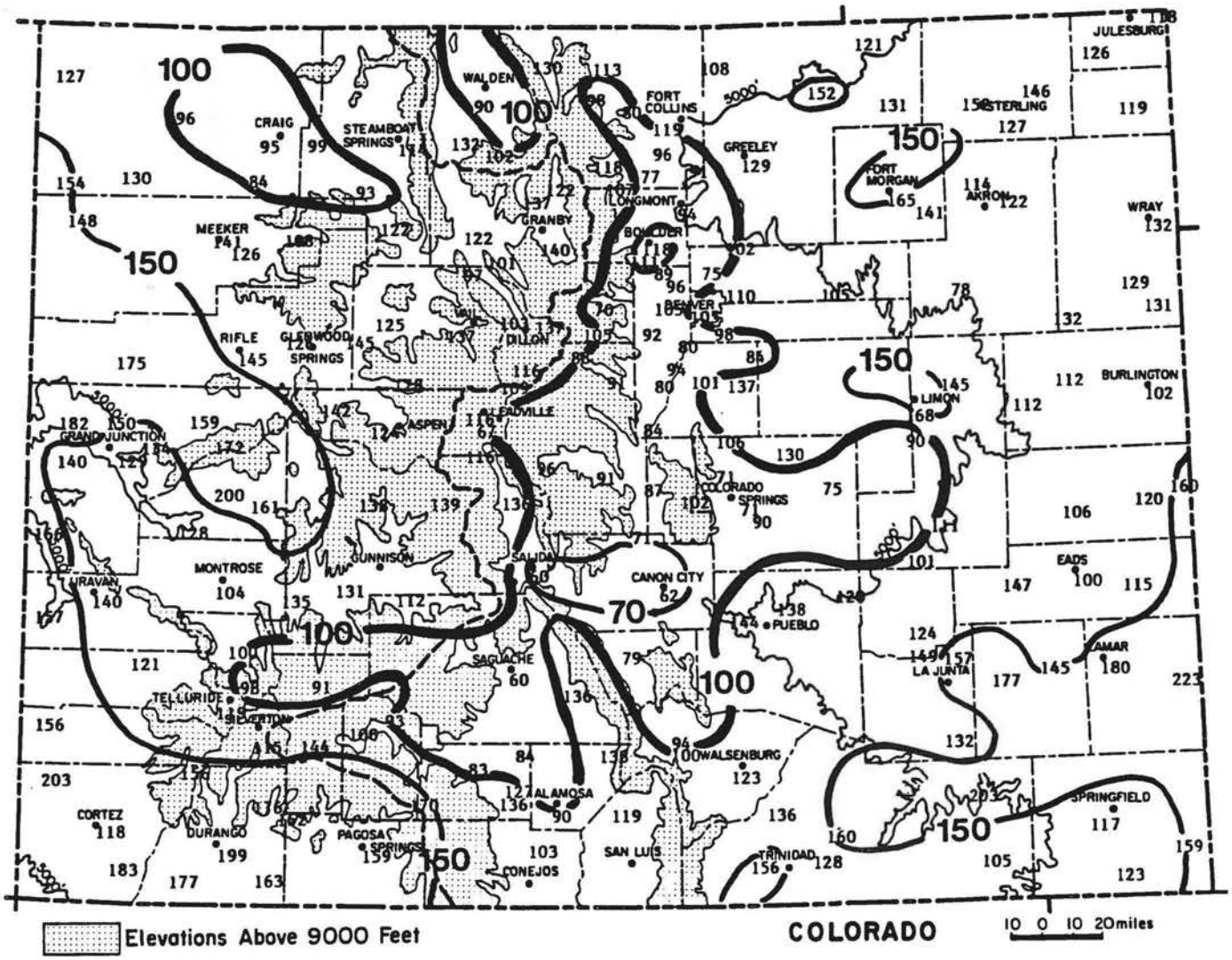
FEBRUARY 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	1.05"	16th wettest in 122 years of record (wettest = 2.01" in 1934)
Durango	4.64"	3rd wettest in 99 years of record (wettest = 7.02" in 1911)
Grand Junction	1.09"	14th wettest in 102 years of record (wettest = 1.77" in 1893)
Las Animas	1.05"	11th wettest in 127 years of record (wettest = 2.13" in 1903)
Pueblo	0.23"	44th drieest in 125 years of record (driest = <0.01" in 1880, 1916, '52, '70)
Steamboat Springs	2.74"	21st wettest in 88 years of record (wettest = 5.13" in 1936)

1993 WATER YEAR PRECIPITATION

February precipitation added significantly to water year totals for most areas of Colorado. Much of Colorado now stands at or above the 1961-1990 averages. Approximately 15% of the State is unusually wet and has received at least 50% more precipitation than average. The only significantly drier than average areas lie in a band just downwind (to the east) of the Continental Divide from southern Larimer County to the north end of the San Luis Valley. Canon City, Salida and Saguache are all about 60% of average. Despite a dry start to the year, Durango has now totalled 17.01" of precipitation (199% of average) since October 1, 1992. Their 14.62" December-February total is the greatest winter total since precipitation records began there in the 1890s. Holly, in extreme southeastern Colorado, is also off to a fast start. Their total of 5.07" is 223% of average. This has been the fourth consecutive wetter than average winter for much of the lower Arkansas Valley downstream from Fowler.





October 1992–February 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR FEBRUARY 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637	1280					7124
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458	1325	1197					6673
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921	1093	1130	958					4585
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211	1093					5821
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331	1103					5153
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064	885					4216
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179	991					4809
CORTEZ	AVE *	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051	880					4727
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408	1270					6133
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301	919	1192	967	783					M
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162	992					4748
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435	1273					7548
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152	966					5018
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387	1118					5866
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177	1083					5582
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239	1031					4973
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494	1202					5547
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018	799					4183

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583	1340					7502
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348	1073					5193
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M	M					M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242	956					4750
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462	1305					7809
LIMON	AVE	6	21	188	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339	1118					5398
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347	1063					5237
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253	1117					5444
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023	873					4620
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291	1096					6053
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186	959					4749
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114	900					4762
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452	1240					6687
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401	1188					5531
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193	1046					5912
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013	904					4445
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428	1313					7217
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947	875					4026

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

FEBRUARY 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
NEW RAYMER 21N	33.6	10.6	22.1	-7.4	60	-19	1196	0	7	0.87	0.57	290.0	9
STERLING	34.3	10.4	22.4	-8.1	57	-16	1188	0	4	1.24	1.02	563.6	7
FORT MORGAN	32.4	11.5	21.9	-8.7	45	-10	1202	0	0	0.67	0.51	418.7	5
AKRON FAA AP	35.4	14.0	24.7	-5.9	47	-9	1124	0	0	0.88	0.56	275.0	6
AKRON 4E	32.8	11.6	22.2	-7.9	49	-18	1190	0	0	0.55	0.25	183.3	8
HOLYOKE	34.3	11.4	22.9	-9.1	63	-14	1172	0	17	1.18	0.79	302.6	9
JOES	35.5	12.0	23.8	-9.8	60	-17	1147	0	8	1.04	0.72	325.0	4
BURLINGTON	35.4	15.5	25.4	-7.6	55	-14	1103	0	3	0.56	0.25	180.6	4
LIMON WSMO	35.7	13.9	24.8	-5.0	55	-11	1118	0	7	0.94	0.53	229.3	8
CHEYENNE WELLS	40.2	16.4	28.3	-5.0	63	-12	1018	0	15	0.69	0.43	265.4	4
EADS	38.9	17.7	28.3	-5.9	57	-9	1022	0	14	0.47	0.13	138.2	3
ORDWAY 21N	43.7	15.9	29.8	-2.2	67	-3	978	0	39	0.16	-0.11	59.3	5
ROCKY FORD 2SE	44.2	15.6	29.9	-5.2	62	-10	973	0	29	0.75	0.46	258.6	4
LAMAR	40.0	16.5	28.2	-6.8	57	-10	1023	0	9	1.39	0.97	331.0	6
LAS ANIMAS	43.7	17.3	30.5	-5.0	65	-4	956	0	36	1.05	0.68	283.8	4
HOLLY	38.4	17.5	27.9	-5.5	55	-10	1031	0	5	1.38	1.05	418.2	6
SPRINGFIELD 7WSW	49.6	21.3	35.4	-0.3	67	-4	823	0	78	1.01	0.54	214.9	5
TIMPAS 13SW	46.5	16.8	31.6	-1.9	68	-18	927	0	54	1.72	1.27	382.2	3

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	38.5	17.4	27.9	-4.5	56	-6	1031	0	7	0.86	0.47	220.5	7
GREELEY UNC	36.7	16.2	26.4	-6.5	51	-7	1073	0	1	1.11	0.76	317.1	9
ESTES PARK	37.1	13.5	25.3	-3.7	51	-8	1105	0	1	1.52	1.06	330.4	6
LONGMONT 2ESE	39.1	14.4	26.8	-4.6	59	-11	1063	0	13	0.87	0.48	223.1	7
BOULDER	40.9	20.2	30.6	-4.9	57	-8	958	0	16	0.90	0.15	120.0	7
DENVER WSFO AP	40.6	18.1	29.4	-4.0	59	-9	992	0	20	1.05	0.48	184.2	10
EVERGREEN	40.7	11.5	26.1	-2.6	57	-8	1083	0	15	0.76	-0.02	97.4	5
CHEESMAN	43.0	6.0	24.5	-4.4	57	-17	1126	0	14	0.65	0.01	101.6	6
LAKE GEORGE 8SW	32.1	-4.4	13.9	-5.0	44	-20	1425	0	0	0.30	-0.05	85.7	5
ANTERO RESERVOIR	32.5	-7.9	12.3	-4.8	44	-22	1469	0	0	0.40	0.16	166.7	9
RUXTON PARK	32.5	1.4	16.9	-4.4	50	-9	1338	0	0	0.73	-0.19	79.3	8
COLORADO SPRINGS	40.6	18.0	29.3	-2.7	61	-8	991	0	14	0.20	-0.20	50.0	4
CANON CITY 2SE	46.9	19.3	33.1	-4.1	64	-8	885	0	39	0.23	-0.22	51.1	3
PUEBLO WSO AP	45.4	15.7	30.6	-4.4	68	-6	959	0	40	0.23	-0.08	74.2	3
WESTCLIFFE	40.0	13.3	26.6	1.0	53	-15	1067	0	2	0.75	0.15	125.0	6
WALSENBURG	45.9	21.1	33.5	-2.1	64	-8	875	0	26	0.83	-0.13	86.5	5
TRINIDAD FAA AP	47.1	17.6	32.4	-2.5	62	-5	904	0	43	0.83	0.34	169.4	6

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	31.3	4.4	17.8	-1.1	40	-23	1313	0	0	0.75	0.22	141.5	13
LEADVILLE 2SW	31.5	4.7	18.1	1.1	50	-14	1305	0	0	0.78	-0.02	97.5	15
SALIDA	42.3	16.6	29.5	-0.2	52	1	988	0	3	0.46	-0.08	85.2	3
BUENA VISTA	38.8	12.6	25.7	-2.8	49	2	1093	0	0	1.44	1.03	351.2	11
SAGUACHE	34.3	5.9	20.1	-4.4	45	-13	1252	0	0	0.26	0.03	113.0	4
HERMIT 7ESE	27.2	-14.7	6.3	-7.9	35	-22	1641	0	0	2.05	1.30	273.3	7
ALAMOSA WSO AP	33.6	4.5	19.0	-3.0	43	-15	1280	0	0	0.43	0.15	153.6	6
STEAMBOAT SPRINGS	31.6	9.3	20.5	1.0	47	-13	1240	0	0	2.74	0.72	135.6	19
YAMPA	35.2	15.2	25.2	4.1	49	-1	1106	0	0	1.61	0.73	183.0	14
GRAND LAKE 1NW	34.4	8.8	21.6	2.5	50	-11	1209	0	0	3.82	2.39	267.1	22
GRAND LAKE 6SSW	28.7	5.1	16.9	0.5	39	-22	1340	0	0	2.18	1.40	279.5	18
DILLON 1E	32.0	6.6	19.3	0.8	45	-10	1273	0	0	1.79	0.93	208.1	18
CLIMAX	28.4	4.4	16.4	1.5	52	-7	1354	0	1	3.33	1.64	197.0	19
ASPEN 1SW	35.1	8.9	22.0	-1.0	46	-3	1197	0	0	4.07	2.02	198.5	20
CRESTED BUTTE	29.9	2.8	16.4	1.5	40	-26	1354	0	0	6.42	4.36	311.7	18
TAYLOR PARK	27.7	1.0	14.3	3.7	34	-28	1412	0	0	4.05	2.86	340.3	16
TELLURIDE	39.3	15.4	27.3	2.5	49	-1	1046	0	0	3.68	2.20	248.6	18
PAGOSA SPRINGS	39.9	11.4	25.6	-0.2	51	-6	1096	0	1	3.57	2.29	278.9	15
SILVERTON	33.4	1.6	17.5	-0.9	47	-16	1321	0	0	4.27	2.47	237.2	15
WOLF CREEK PASS 1	24.5	8.5	16.5	-1.9	39	-4	1352	0	0	13.09	9.50	364.6	24

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	28.7	10.1	19.4	-2.1	44	-6	1270	0	0	1.16	-0.04	96.7	12
HAYDEN	30.0	11.1	20.5	-1.2	44	-9	1237	0	0	1.44	0.28	124.1	15
MEEKER NO. 2	36.9	12.7	24.8	-2.7	49	-5	1117	0	0	1.16	0.42	156.8	14
RANGELY 1E	28.0	5.4	16.7	-7.6	44	-14	1347	0	0	0.77	0.30	163.8	5
EAGLE FAA AP	36.7	13.2	24.9	-0.4	46	-6	1118	0	0	1.35	0.78	236.8	15
GLENWOOD SPRINGS	37.9	18.4	28.2	-1.9	46	5	1024	0	0	2.64	1.54	240.0	18
RIFLE	43.4	21.9	32.6	2.5	50	9	900	0	0	2.40	1.61	303.8	14
GRAND JUNCTION WS	44.7	27.7	36.2	2.0	57	19	799	0	7	1.09	0.61	227.1	14
CEDAREDGE	43.6	20.3	32.0	-0.4	52	9	920	0	1	2.06	1.27	260.8	11
PAONIA 1SW	42.4	24.3	33.3	1.2	50	15	880	0	0	2.48	1.45	240.8	17
DELTA	46.2	27.4	36.8	2.9	57	17	783	0	10	0.85	0.49	236.1	8
COCHETOPA CREEK	35.2	6.5	20.9	5.4	48	-16	1229	0	0	1.88	1.21	280.6	14
MONTROSE NO. 2	43.0	24.1	33.5	1.9	54	17	873	0	4	0.85	0.42	197.7	13
URAVAN	47.5	27.4	37.4	1.8	59	20	764	0	12	1.98	1.36	319.4	15
NORWOOD	38.6	19.9	29.2	1.3	50	6	996	0	0	1.49	0.67	181.7	10
YELLOW JACKET 2W	42.2	20.5	31.4	1.6	52	10	933	0	2	5.03	3.88	437.4	16
CORTEZ	43.1	23.4	33.3	3.3	55	15	880	0	8	2.53	1.66	290.8	9
DURANGO	40.6	20.1	30.4	-0.8	53	13	966	0	2	4.64	3.26	336.2	13
IGNACIO 1N	38.4	17.4	27.9	-0.9	47	7	1033	0	0	3.06	2.09	315.5	14

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

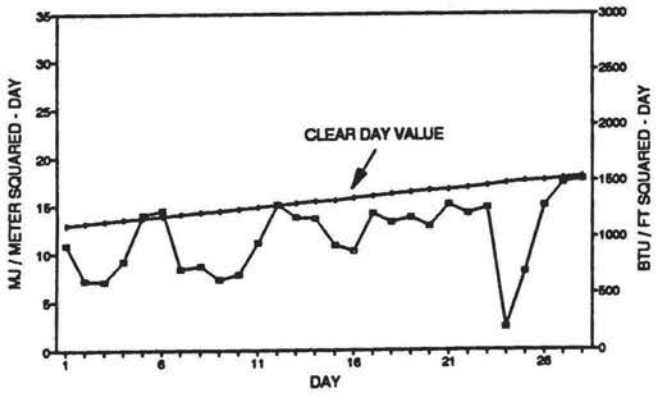
FEBRUARY 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Denver	8	10	10	66%	70%
Fort Collins	7	10	11	--	--
Grand Junction	4	6	18	67%	65%
Limon	8	6	14	--	--
Pueblo	NA	NA	NA	64%	73%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

February continued where previous winter months left off with more clouds and less sunshine than average. The combination of cold temperatures and reduced sunshine east of the mountains made it a difficult month for solar energy users.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
FEBRUARY 1993

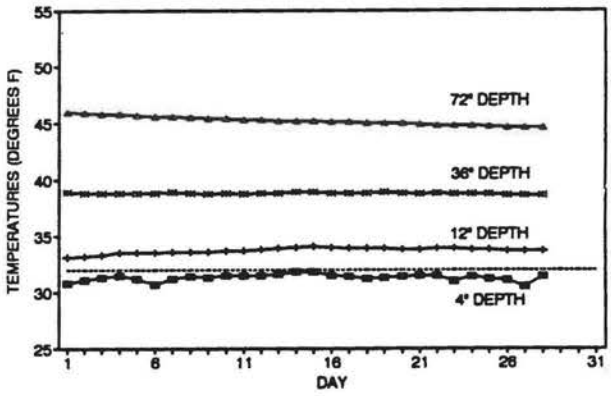


FEBRUARY 1993 SOIL TEMPERATURES

The ground remained frozen to a depth of about 10" throughout February. Snowcover moderated the effects of the mid-month coldwave, resulting in very little daily change in soil temperatures. At depths below three feet, however, soil temperatures continued their normal decline.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
FEBRUARY 1993



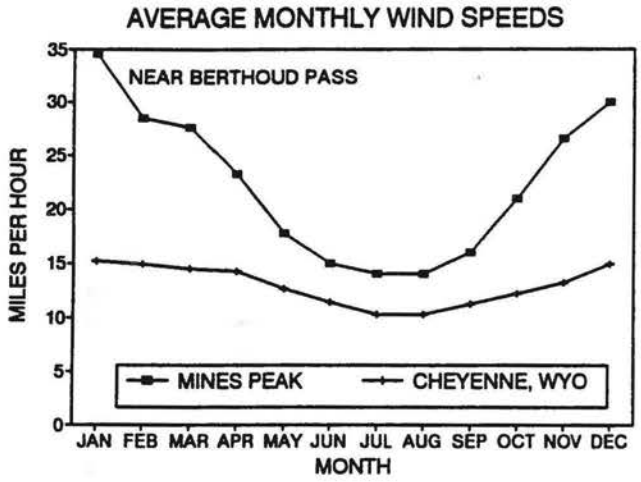
HATS OFF TO: *Shirley Diedrich* of Byers 5ENE

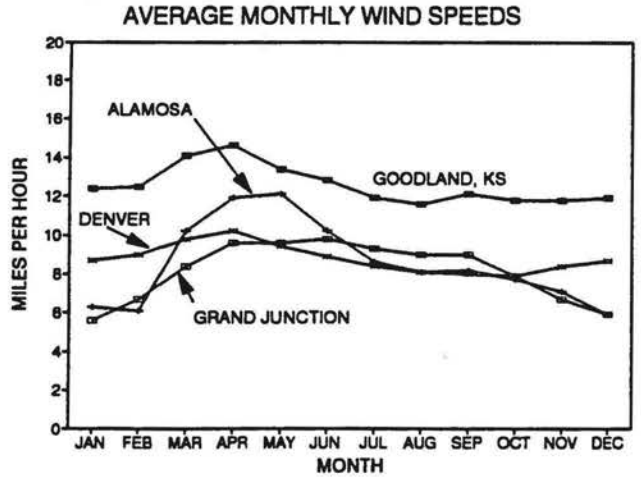
Mrs. Shirley Diedrich and her family have been excellent and dedicated cooperative weather observers since 1970. Their farm and dairy, northeast of Byers, has seen frightening thunder and hailstorms, a tornado, and some remarkable blizzards. All the while, they have carefully measured and reported each day's weather. Thanks so much, and keep up the great work.

WINDS IN COLORADO – PART II

Last month we introduced the topic of Colorado wind characteristics. I was pleased that several of you made the effort to contact us with questions and comments. I won't be able to address all of the excellent questions, but we'll do what we can.

Let's begin with the annual cycle. Down within a few feet of the ground, where most of us spend our time, winds follow a fairly systematic and repeatable annual cycle. Hourly and daily wind characteristics can be quite variable throughout the year, but when averaged together, most areas of Colorado experience the highest average wind speed in the spring months and the lowest speeds in the late summer. Curiously, not all locations share this trait. Up in the free atmosphere and at mountain-top level the strongest winds occur in mid winter.





The annual cycle of winds aloft are easily explained by the global circulation patterns and the southward migration and strengthening of the mid-latitude jet stream in winter and its northward retreat in the summer (all a result of temperature differences caused by the hemispheric distribution of solar energy). But why don't surface winds behave like the winds aloft? This too can be explained by the sun. The low angle of the winter sun and the short daylength provide very little ground-level heating here in Colorado in the winter. The air near the ground looses heat and becomes colder than the air above. Since air density increases as its temperature decreases, this becomes a very stable arrangement known as a temperature inversion. The result is the air near the ground is effectively detached from the air above. Winds aloft may be howling, but the winds do not erode into the stable layer near the ground. This is especially true in the lower river bottoms east of the mountains and in most valleys in and west of the mountains (see Alamosa's wind pattern).

The areas that do get the strong winter winds are the high peaks and ridges of the Rockies and also the mountain and foothill locations east of the crest of the Rockies where winds cascade down the lee side like water over a boulder in a fast-moving stream. The occasional reports of 100+ mph winds almost all occur in a few preferred locations along the Colorado Front Range where local topography favors this phenomenon. Winter winds also increase near the Wyoming border as the lowered elevation of the Continental Divide near the I-80 corridor allows air to funnel through at high speeds.

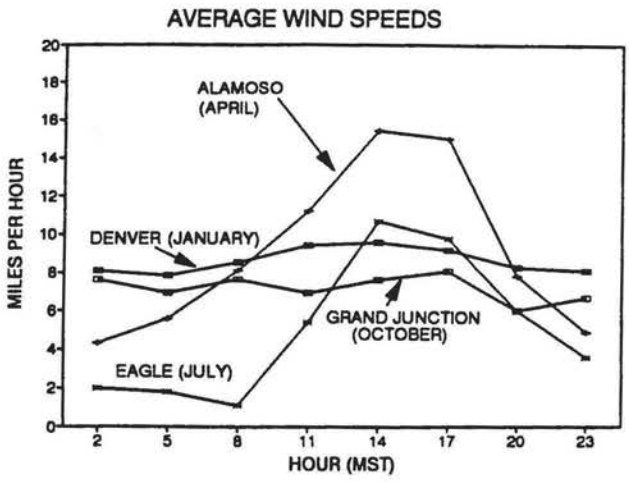
During the spring, winds aloft begin to weaken but are still quite strong. Rapidly increasing solar heating, as days get longer and the sun climbs higher in the sky, heats the air near the ground causing inversions to become much less frequent. This arrangement allows air to easily mix vertically causing winds aloft to sweep down to ground level only slowed by friction.

Summer winds tend to be light both aloft and near the ground as hemispheric temperature gradients become weak. Local factors such as mountain-valley wind circulations then dominate wind patterns. The strongest winds of the summer are usually very localized and are normally produced by downdrafts from summer thunderstorms. These gusts commonly reach 50-60 mph but are short lived. The day-night cycle is very dominant in summer.

One might expect autumn winds to mimic the spring, but it isn't so. The winds aloft do increase, but the rapidly shortening days and lowering sun angle mean a stabilizing atmosphere with less vertical mixing. The result is fairly light winds except when storms pass.

The day-night wind speed oscillations are also fascinating. Here too, the effects of sunshine and topography are obvious and dramatic. During the day, as the atmosphere is heated from the ground up, winds increase. The afternoon peak in average wind speed is a primarily the result of mixing higher-speed air from above down to ground level, but it also includes local circulations caused by local temperature differences. It is possible, for example, on an otherwise calm day, to develop a nice breeze from a lush irrigated field to a dry adjacent field simply due to temperature differences that result from dissimilar land surfaces.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.



When the sun is down, winds become light as the air near the ground cools. Nighttime wind speeds are especially low in valley bottoms where cool air collects (see Alamosa and Eagle). Local wind circulations can also develop at night with surface winds normally blowing gently down valleys from higher elevations to lower elevations. There are a few locations in Colorado where these nighttime winds can be quite strong and help keep temperatures warmer than they would otherwise be. One of these areas is the Western Slope fruit district near Grand Junction. The people in Palisade expect the winds to actually increase during the evening instead of decrease. Cool air drains gently down the Colorado River Valley but then accelerates through the DeBeque Canyon. The air warms by compression as it spills down on Palisade making this possibly the best place in Colorado to grow peaches. Denver also experiences modest nighttime drainage winds.

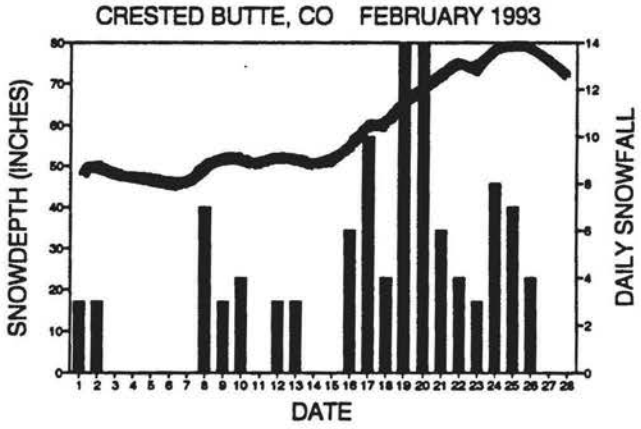
There is plenty more to say about wind, but we're running out of room again. We'll save more for next time when we discuss wind direction and the potential for harnessing wind energy. Again, if you have a particular question, please contact me and I'll try to get you an answer.

THE MOUNTAIN SNOWSTORM OF FEBRUARY 15-26, 1993

Most Coloradans who live in the mountains like snow. The ski areas depend on it. Many people earn their livings shovelling, plowing and grooming it. But every now and then stormy episodes strike that make us yell, "Stop, I can't take it any more". February 15-26, 1993 in the mountains came close to being one of those episodes.

The statistics really didn't seem all that remarkable. High in the mountains snow fell by the feet, but that happens every now and then. Wolf Creek Pass totalled more than 9 feet of new snow during the 12-day period. Down in the mountain towns snowfall totals were large but not unprecedented. From Steamboat Springs and Grand Lake in the north down to Gunnison and Pagosa Springs, typical totals were around 30 inches. Snowfall at lower elevations on the Western Slope were not impressive – 6" at Craig, 7" at Grand Junction and only 4" at Cortez.

There have certainly been longer snow sieges (November-December 1983) and worse individual storms (December 29-31, 1951). Still, the episode of February 15-26, 1993 will be remembered for a long time. What was it about this storm period that caught our attention? As February began, the Colorado mountains were enjoying a good snow year with average snowpack in the northern mountains and much-above average in the southwest. Storms February 1-4 and 8-10 added to the totals (nearly another 4 feet at Wolf Creek Pass). The 12-14th brought more light snow. As a result, snow was already plenty deep – about three feet deep on the level in the mountains towns and much deeper up on the passes – as the late February siege began.



Several factors combined that caused the snow of February 15-26th to have an unusually large impact – overall snowdepth, unusually dense snows (large water content), strong winds and the vast number of large avalanches that resulted. And while snow accumulated moderately over a long period of time, it was one particular day, February 20th, that will be most remembered. Wet snow accumulated rapidly beginning on the 19th and peaking on the 20th across all the mountains of western Colorado. It was so wet, that rain mixed with the snow all the way up to elevations of 8,000–9,000 feet at times. Winds of 50 mph or greater were clocked at many valley locations in western Colorado where winter winds are normally quite light. More than likely, winds were close to 100 mph over some of the mountain peaks and ridges producing zero visibilities, loading huge quantities of dense snow on

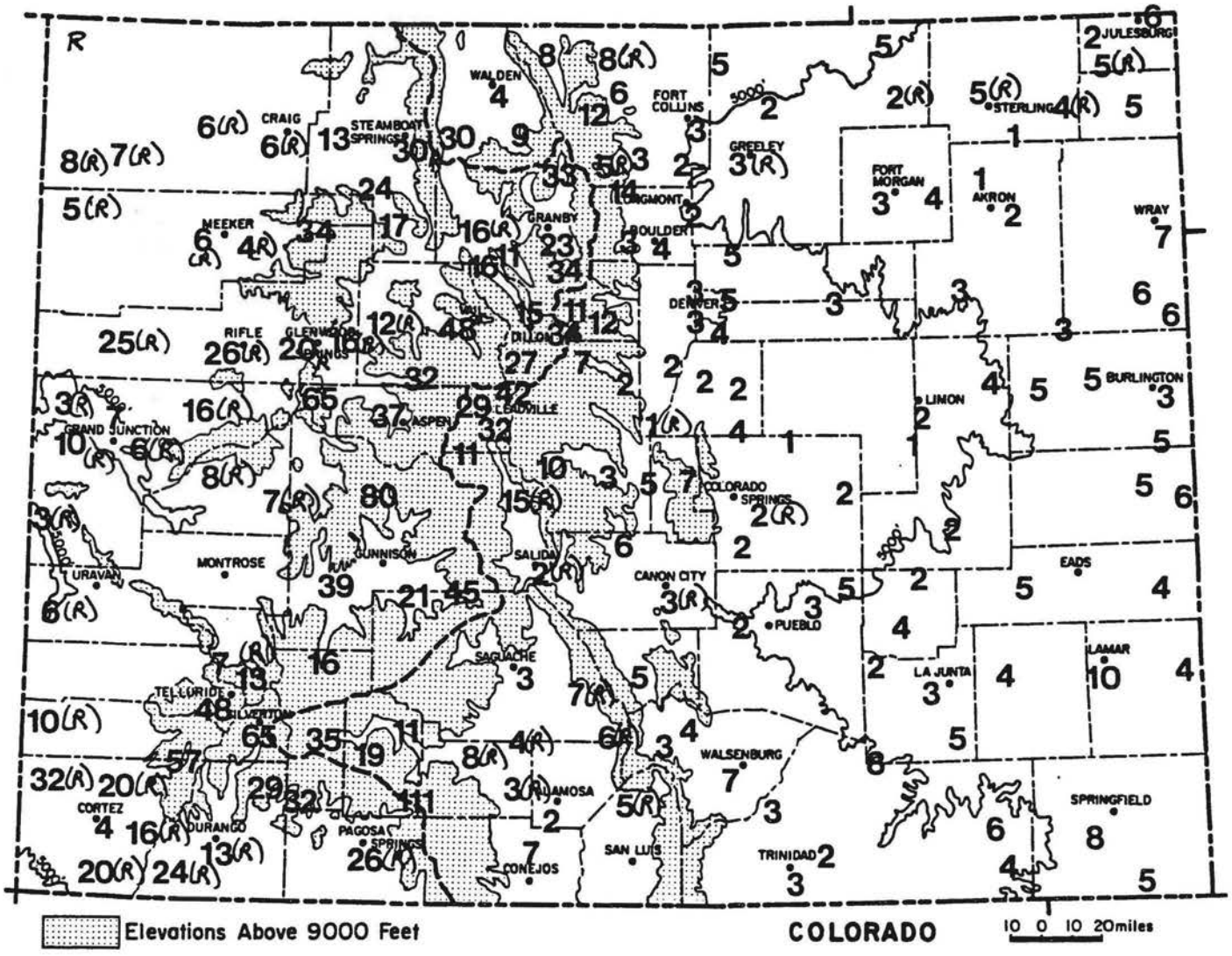
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

mountain ridges, crests and slopes, and making outdoor activities and travel nearly impossible. That was the day that the amazing story of 5 missing cross-country skiers near Aspen began to unfold. At times like this, with howling winds, little visibility, and avalanches crashing down by the hundreds, it becomes all so obvious that the power of the natural world still maintains the upper hand. Looking back from a climate perspective, what may have saved those skiers was the fact that temperatures remained mild throughout the storm (an essential ingredient for Colorado's heaviest snowstorms). Even up to 11,000 feet, temperatures on the 20th were only slightly below the freezing point.

Following this powerful blast, all highways crossing the mountains of southwest Colorado were closed for several days and sections of roads remained closed in other sections of the mountains. Snows continued to pile up but became lighter and fluffier as temperatures cooled aloft. Unfortunately, strong winds continued until finally tapering off on the 24th.

When the snows finally ended on the 26th and 27th, Colorado's mountain residents dug out from the deepest snows that have been observed in several years. At Crested Butte, for example, snow was 80" deep on the level. In the town of Vail, the snow was close to 60" deep. Even in relatively dry mountains locations like Dillon, the snow was at least a foot and a half deep. They quit measuring the snowdepth near Wolf Creek Pass when the snowdepth surpassed 150 inches.

The map below shows 12-day snowfall totals for selected locations in Colorado. Ski area reports are not included in this analysis. Most were quite a bit greater than our reports, most of which are taken down in the towns. "R" on the map means that at least some of the precipitation fell as rain. As you can see, low elevation snowfall was not exceptional for this period. East of the mountains most of the snow fell February 15-16th. Then the 19-21st was relatively warm and windy with some scattered rain showers and even some thunder. Anybody who watches their barometer, however, was well aware that something unusual was going on. Pressures corrected to sea level were 29.20" or lower across much of the State on the 20th – the lowest pressures seen for several years.



Snowfall (inches) for February 15-26, 1993. (R) equals some of precipitation falls as rain.

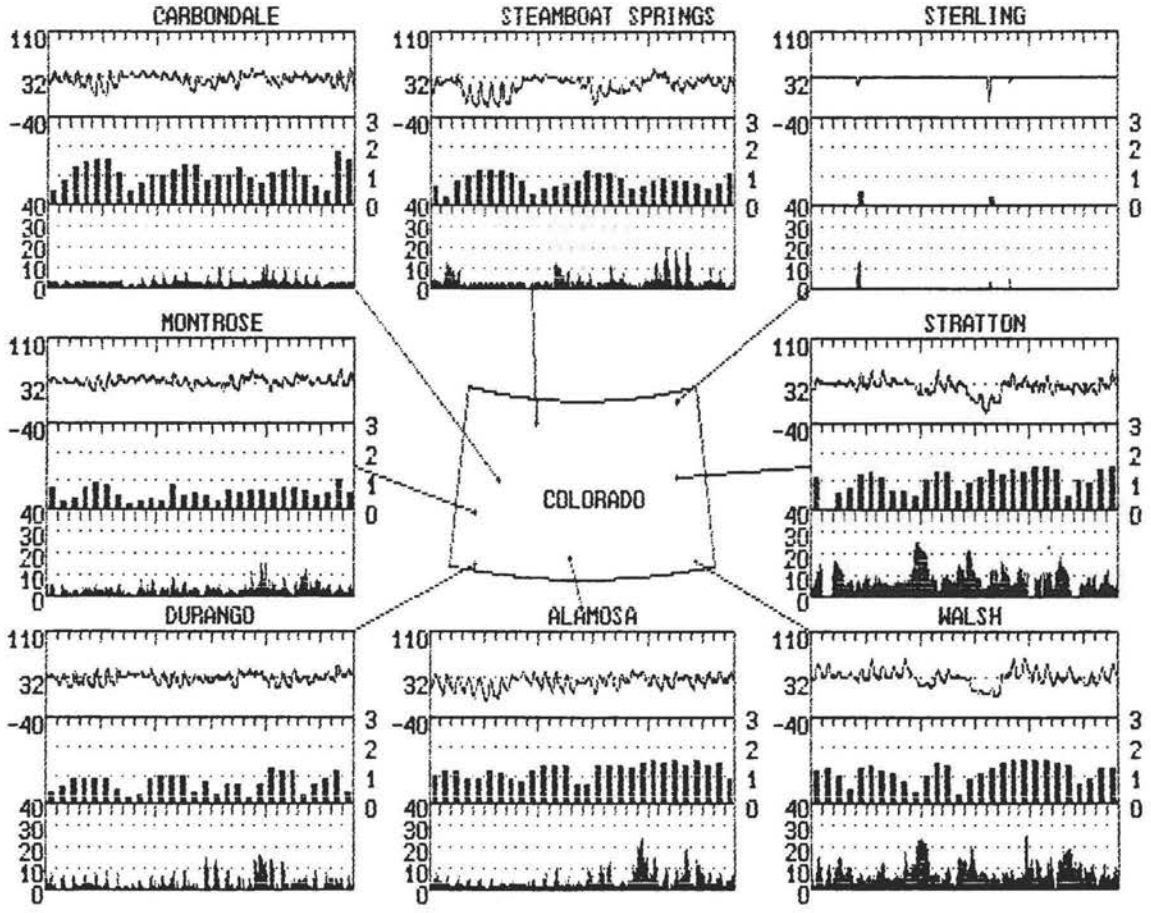
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

WTHRNET WEATHER DATA FEBUARY 1993

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	21.8	27.9	26.6	32.6	16.7	31.6	24.8	30.4
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	45.7 19/15	50.7 27/17	44.4 19/14	52.5 19/13	43.5 19/17	32.0 1/ 1	55.2 28/12	64.6 20/14
minimum:	-11.7 6/ 8	9.5 5/ 8	-1.3 5/ 8	14.0 5/ 6	-19.8 5/ 7	-10.8 17/ 6	-19.3 16/23	-2.9 17/22
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	90 / 9	88 / 18	93 / 18	90 / 25	90 / 8	0 /-40	70 / 5	85 / 20
11 AM	67 / 17	66 / 24	75 / 24	75 / 29	82 / 16	3 /-38	69 / 18	66 / 24
2 PM	48 / 16	66 / 25	67 / 26	62 / 28	71 / 19	0 /-40	66 / 22	53 / 22
5 PM	52 / 17	64 / 24	69 / 25	62 / 27	78 / 18	0 /-40	73 / 20	53 / 21
11 PM	83 / 15	85 / 22	90 / 21	83 / 24	90 / 11	0 /-40	82 / 15	84 / 22
monthly average wind direction (degrees clockwise from north)								
day	216	179	242	244	182	1	127	175
night	209	89	168	166	125	4	177	208
monthly average wind speed (miles per hour)	4.23	2.94	1.85	2.95	2.76	0.12	7.58	8.02
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	345	419	561	394	470	664	109	71
3 to 12	292	189	99	264	163	4	454	482
12 to 24	34	28	0	7	19	4	102	116
> 24	1	0	0	0	0	0	7	3
monthly average daily total insolation (Btu/ft²•day)	1169	701	1060	583	801	28	1072	1102
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	165	14	48	15	69	2	127	130
40-60%	59	117	79	38	84	3	59	80
20-40%	50	81	57	112	78	2	50	44
0-20%	16	92	46	126	54	0	11	25

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

MARCH 1993

Volume 16 Number 6

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

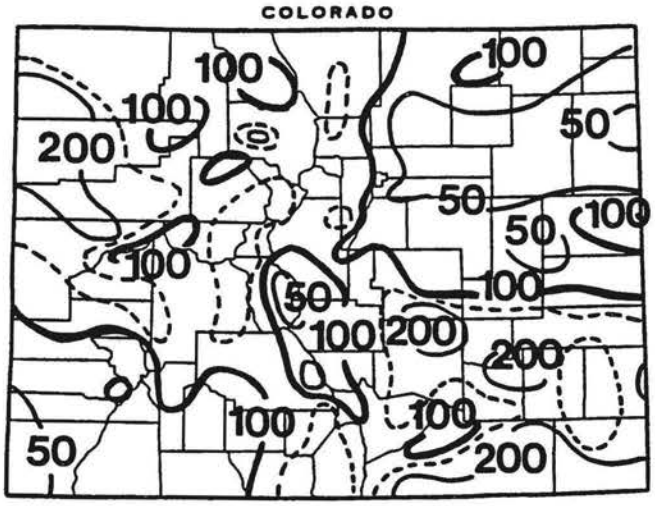
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

March Climate in Perspective – Fairly Typical

There was rain, wet snow, a little thunder, some sunny weather, warm days, cold days and plenty of wind. High mountain snow continued to accumulate while most snow at elevations below 9000 feet melted off by the end of March. This is exactly the combination of weather which typifies March in Colorado. Precipitation was highly varied across the State but with equal areas above and below average. Temperatures for the month were a little warmer than usual.

Precipitation

Several storms affected Colorado in March. None were exceptionally strong or widespread, and each followed a different track. The resulting precipitation pattern was

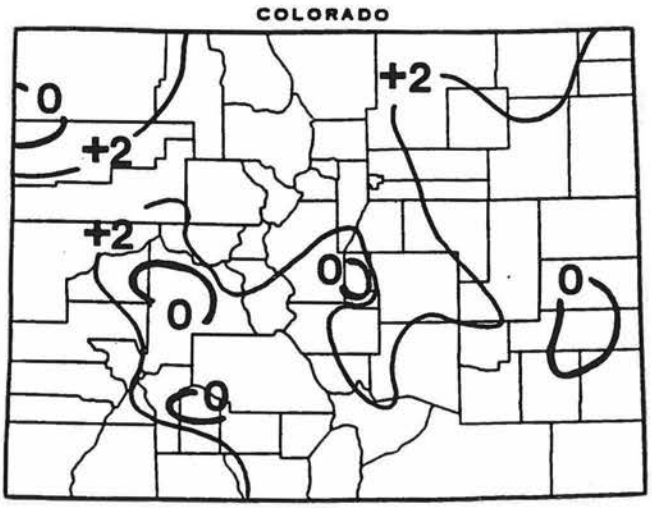


March 1993 precipitation as a percent of the 1961-1990 average.

complex, with above average precipitation across most of the Northern and Central Mountains, the western and northwestern valleys, most of the Front Range and nearly all of southeastern Colorado. Less precipitation than average fell over southwest Colorado and the northeast quarter of the State. However, there were also a number of local dry areas embedded within the wet regions such as North Park (Walden), northern portions of the Flattop Mountain area and the Collegiate Valley (Buena Vista to Salida).

Temperatures

March saw a fairly typical variety of warm and cold days. The greatest ranges and day-to-day changes were observed east of the Continental Divide – again, quite typical. What wasn't typical was the very uniform pattern of departures from average. Most locations in Colorado ended up about 2 degrees Fahrenheit warmer than average. There were just a few local points that ended up slightly cooler than average. The warmest areas, with respect to 1961-1990 averages, were near the mountains. Leadville, Climax and Grand Lake were all close to 4 degrees F warmer than average.



Departure of March 1993 temperatures from the 1961-90 averages.

Inside This Issue

MARCH 1993 DAILY WEATHER

1 An upper-level low pressure area moved across New Mexico leaving northern Colorado unscathed but striking southeast Colorado with cold rain, wet snow and strong winds. Las Animas totalled 1.18" of moisture on the 1st including 3" of snow. Walsenburg was covered with 17" of wet snow.

2-8 Brisk northerly winds blew 2-4th, especially east of the mountains, and temperatures stayed a bit cooler than average. An upper air disturbance crossed the area from late on the 3rd into the morning of the 4th setting off a period of light snow from the Front Range out onto the Eastern Plains. Most snowfall reports were less than 1 inch. Subzero temperatures were common in the mountains 3-4th. Taylor Park Reservoir was the coldest in the State for March with -25°F early on the 4th. The mountains got a light dusting of fresh snow 5-6th from a minor disturbance, but for most of Colorado, the 5-8th brought dry, breezy and warm weather. Low elevation daytime temperatures reached into the 60s with a few reports in the 70s. This warm spell finally melted the snow east of the mountains. Some areas on the plains had experienced continuous snowcover since November 20.

9-13 It was still warm on the 9th until a sharp cold front crossed northern and eastern Colorado during the day. Southwest Colorado enjoyed another nice day on the 10th, but elsewhere clouds thickened and temperatures dipped. Snow developed in the mountains and spread to the northeastern plains by evening. Fort Collins picked up 4" of snow. Light snow and cold temperatures became widespread on the 11th. Snow and winds increased late in the day as a new, stronger surge of arctic air reached Colorado. Travel became extremely hazardous during the evening. By the time the snow ended early on the 12th, all stations east of the mountains had reported some snow. Boulder totalled 11 inches. Skies cleared on the 12th, but stiff northerly winds and very cold temperatures were the rule. High temperatures only reached the low teens at many of Colorado's ski areas, with 20s at lower elevations. This arctic air, plunging toward the Gulf of Mexico, served as a catalyst for the incredible storm that developed explosively on the 12th and raced up the East Coast on the 13th. While the East was being pummelled by the "Storm of the Century", Colorado awoke to a very chilly morning on the 13th (0°F at Springfield and Sterling) followed by a pleasant afternoon.

14-21 Colorado's weather remained unsettled. It was mild east of the mountains on the 14th, but clouds increased as an upper air disturbance raced across the State. The mountains received a good shot of snow – 6-12" in many areas by late on the 15th. Winds also increased, gusting in excess of 60 mph in some areas along and east of the Front Range. A new arctic cold front invaded the Eastern Plains on the 16th while western Colorado enjoyed mild and dry weather. Scattered showers gave way to low clouds, fog and freezing drizzle east of the mountains. On the 18th, the shallow cold air retreated from the plains, but another burst of Pacific moisture (mountain snows with valley rains) reached the mountains. It was dry and pleasant statewide on the 19th, but low clouds and cooler temperatures slipped back into eastern Colorado on the 20th. Brisk winds and scattered showers bothered the State on the 21st as another disturbance raced past.

22-26 Nearly cloudless skies with warm temperatures were observed statewide 22-24th followed by increasing clouds and southwesterly winds 25-26th. Daytime temperatures soared into the 70s at lower elevations with 40s and 50s in the mountains. Low elevation snowpack melted quickly on the Western Slope making plenty of mud but little flooding. Holly hit 83° on the 25th, the warmest in the State. Rain, snow and thundershowers began spreading into southwest Colorado on the 26th.

27-31 Two storm systems marched across Colorado in succession. The first system moved directly across the State 27-28th. This brought the only heavy precipitation of the month to southwest Colorado with more than 1" of moisture reported at several locations. As the storm moved northeastward, Aspen got nearly 16" of wet snow in 24 hours. Much of the State received moisture on the 28th, but most totals were less than 0.50". Then the second storm drifted slowly across southern Colorado 29-30th bringing widespread clouds and cool temperatures. This time, the heaviest precipitation fell along the Front Range corridor from Fort Collins to Trinidad with storm totals of 0.50" to 1.00" of rain (with some thunder). Above 7000 feet, 6-15" of snow accumulated. Precipitation diminished and sunshine increased on the 31st, but cold winds and scattered showers were still common east of the mountains.

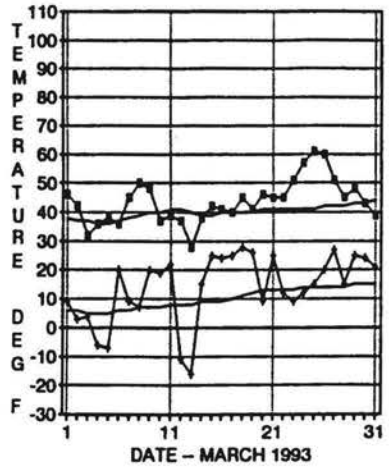
Weather Extremes

Highest Temperature	83°F	March 25	Holly
Lowest Temperature	-25°F	March 4	Taylor Park Reservoir
Greatest Total Precipitation	3.95"		Bonham Reservoir
Least Total Precipitation	0.20"		Placerville
Greatest Total Snowfall	45.1"		Buckhorn Mountain
Greatest Snow Depth	can't find stake		Wolf Creek Pass 1E

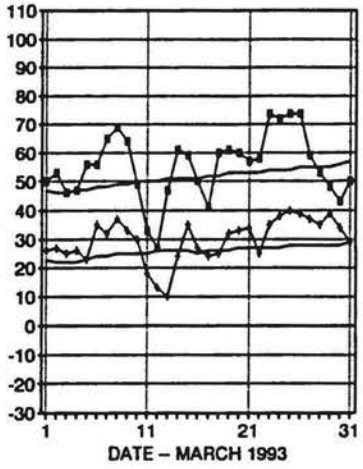
MARCH 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

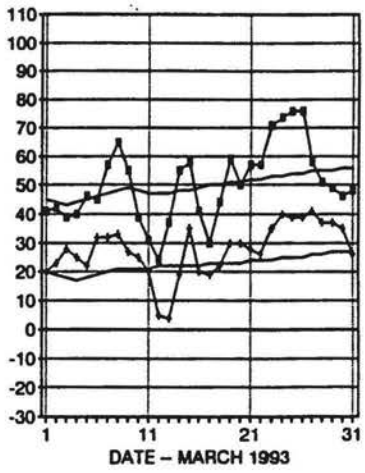
GRAND LAKE 1NW



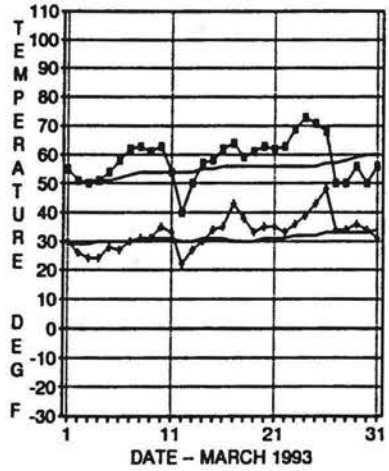
DENVER



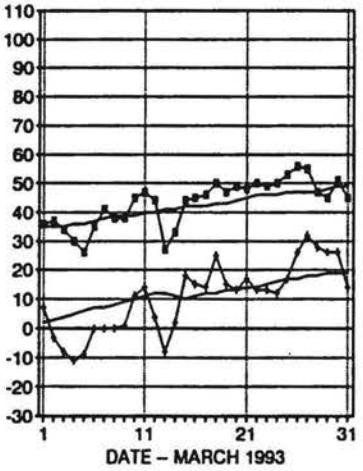
AKRON 1N



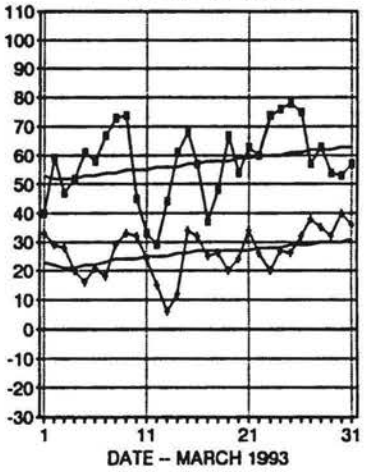
GRAND JUNCTION



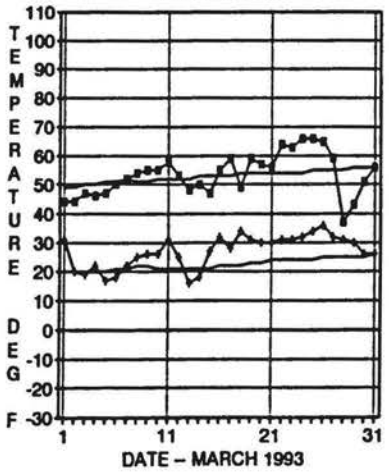
GUNNISON (COCHETOPA CRK.)



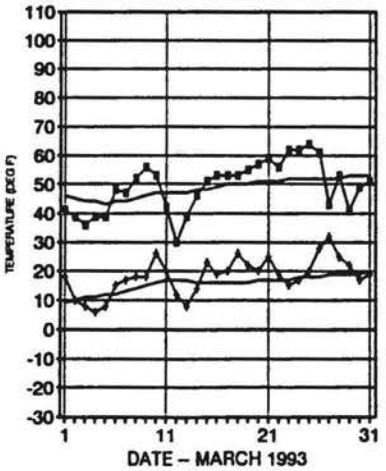
PUEBLO WSO



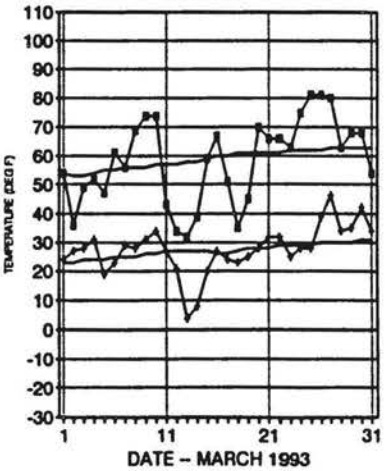
DURANGO



ALAMOSA



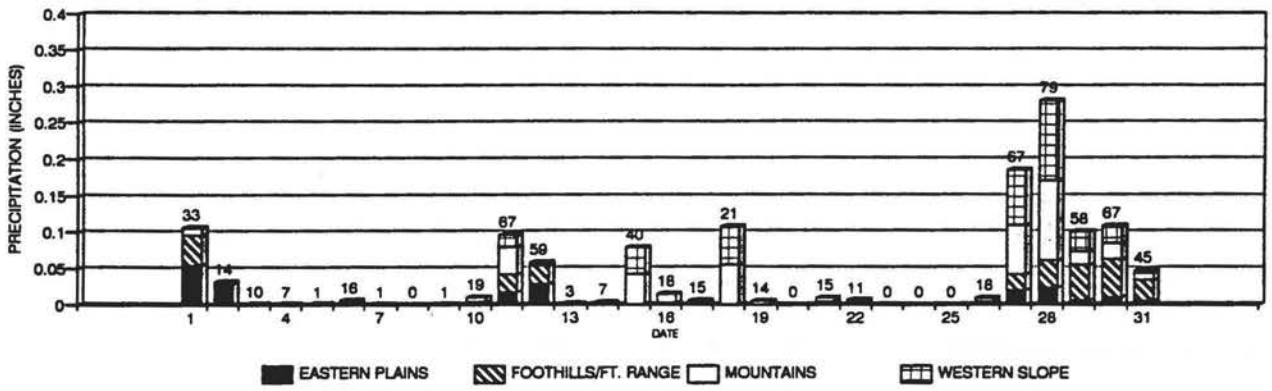
LAMAR



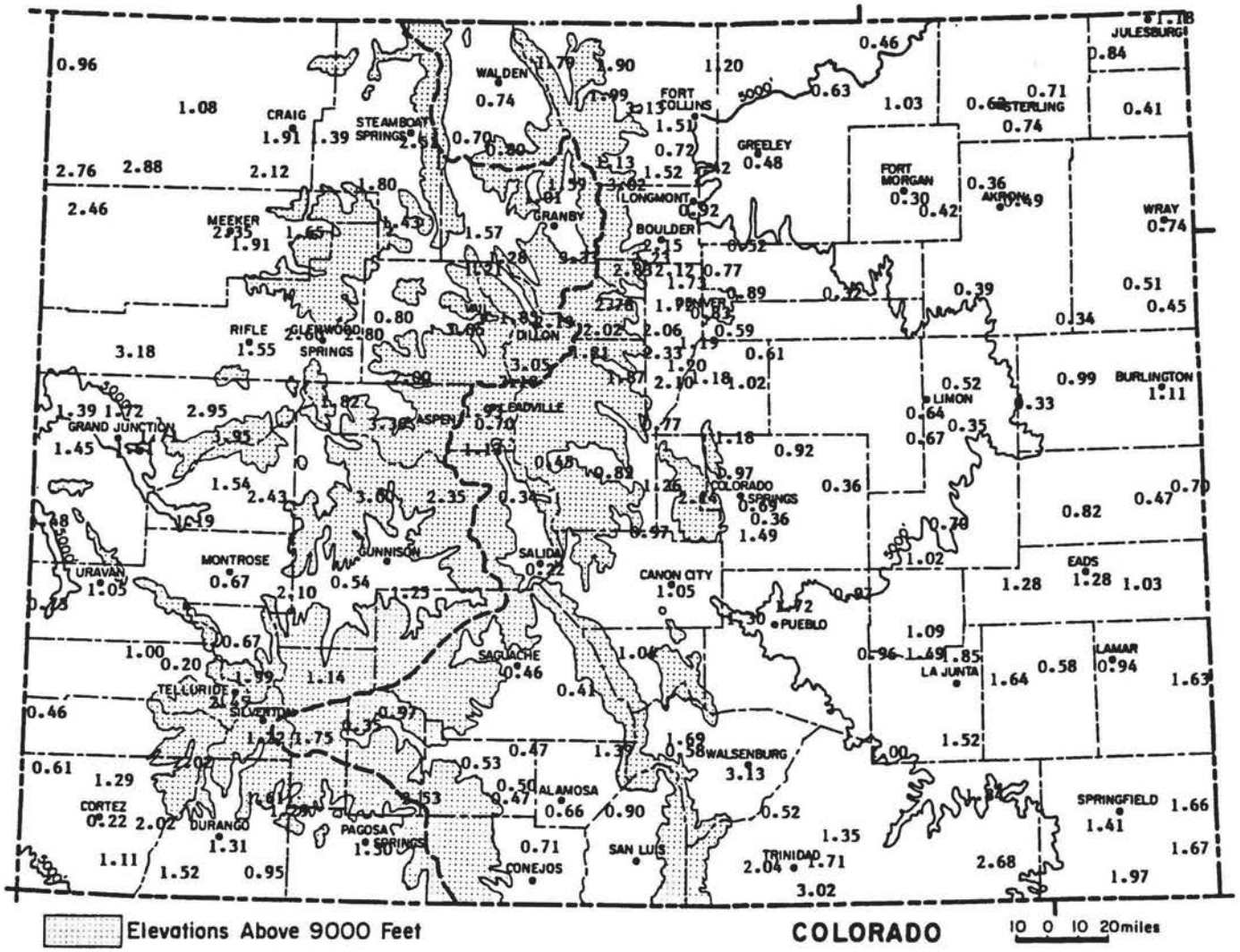
MARCH 1993 PRECIPITATION

The heaviest precipitation in March fell on the 1st, 10-12th, and 27-30th. There were also respectable mountain snows 14-15th and 18th. All parts of the State were affected by at least one storm, but only the precipitation of March 11, 27 and 30 covered most of Colorado. In terms of contributing to statewide water supplies, the events of March 27-30th were by far the most notable. This period produced more than 0.70" of precipitation averaged over the entire State, more than all the precipitation for the rest of the month combined.

COLORADO DAILY PRECIPITATION - MAR 1993

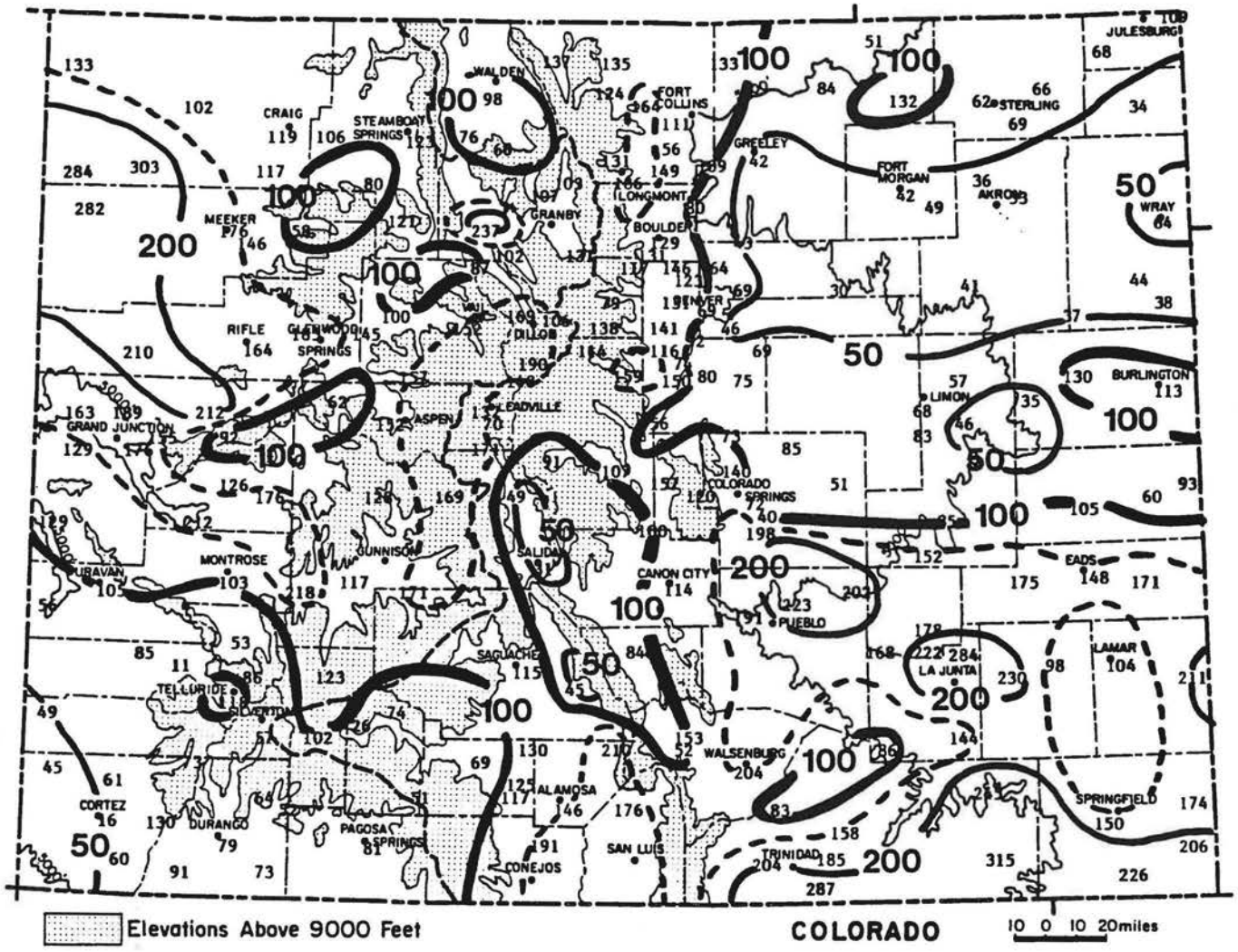


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

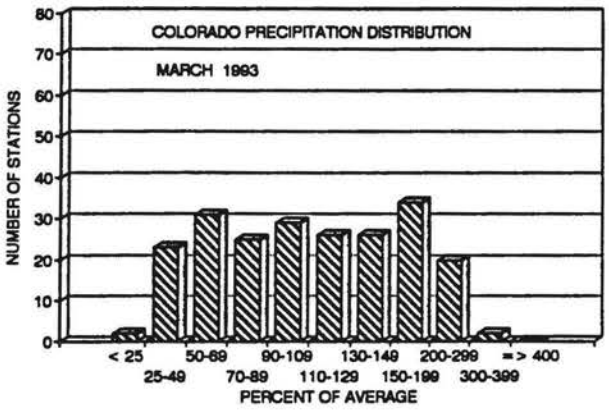


Precipitation Amounts (in inches) for March 1993.

MARCH 1993 PRECIPITATION COMPARISON



March 1993 Precipitation as a Percent of the 1961–90 average.



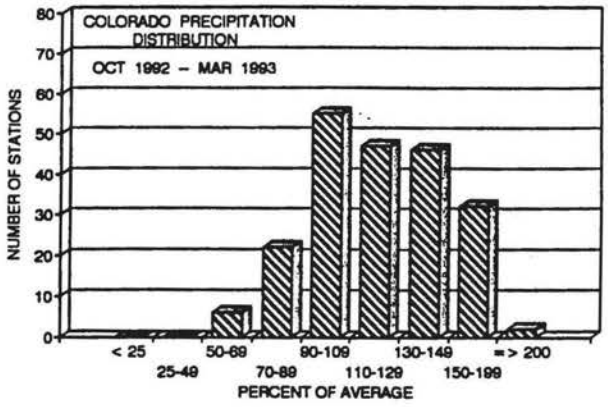
Statewide, March precipitation ranged from less than 20% of average at Cortez and Placerville to more than 300% of average at Kim 10SSE (Las Animas County) and Masadona 3E (Moffat County). Overall, wetter than average areas slightly outnumbered dry areas across Colorado.

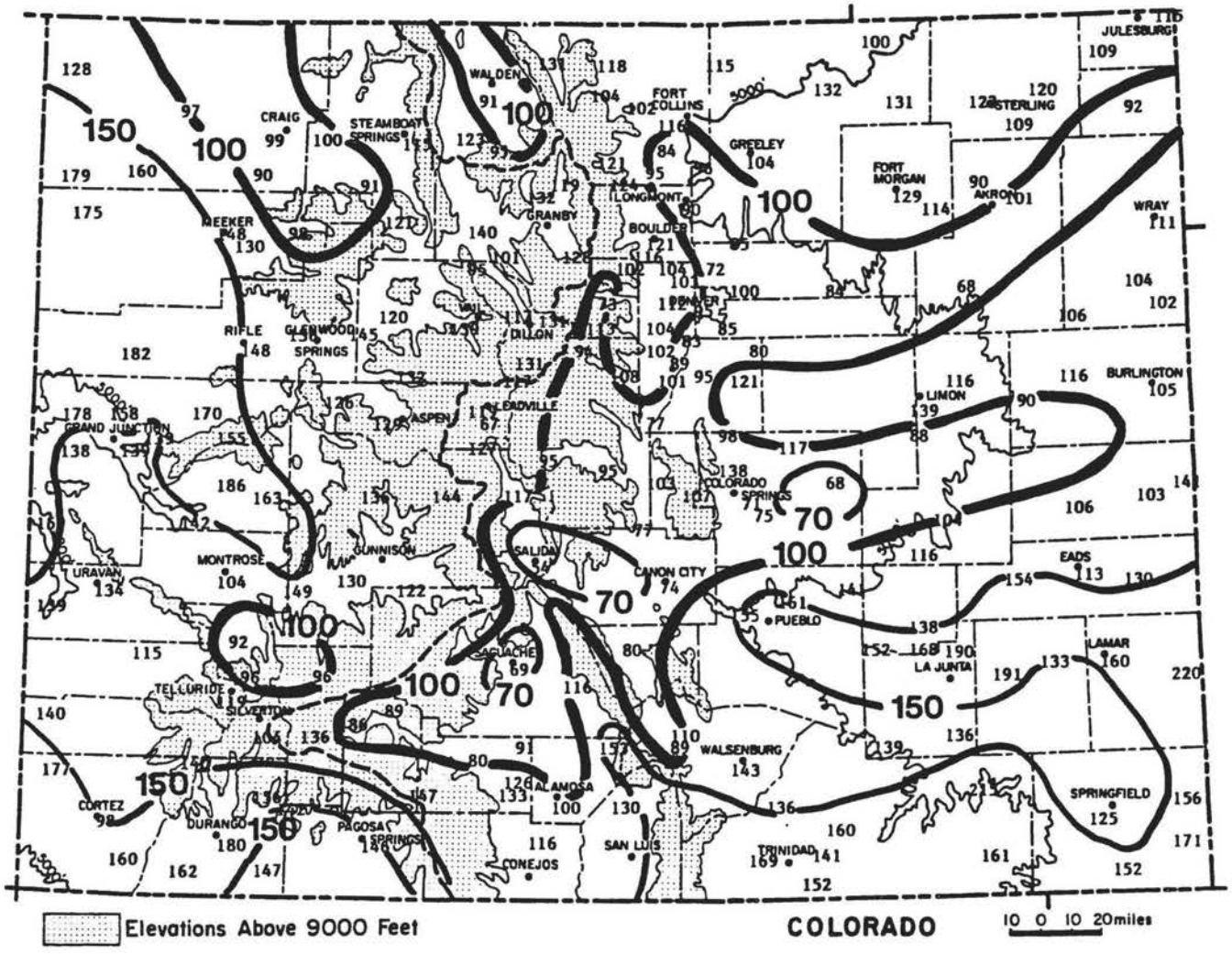
MARCH 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.89"	54th driest in 122 years of record (driest = 0.11" in 1908)
Durango	1.31"	49th wettest in 99 years of record (wettest = 4.87" in 1938)
Grand Junction	1.72"	9th wettest in 102 years of record (wettest = 2.36" in 1912)
Las Animas	1.64"	13th wettest in 127 years of record (wettest = 3.06" in 1973)
Pueblo	1.72"	7th wettest in 125 years of record (wettest = 3.06" in 1905)
Steamboat Springs	3.40"	10th wettest in 88 years of record (wettest = 5.71" in 1929)

1993 WATER YEAR PRECIPITATION

Drier and warmer than average conditions in March brought welcome relief from this winter's snowy onslaught in southwestern Colorado and diminished the threat of spring flooding for that area. Warm and dry March weather was also appreciated in northeast Colorado where snowcover and persistent cold temperatures had dominated since November. For the State as a whole, accumulated precipitation for the first 6 months of the 1993 Water Year is at or above average across most of Colorado and is at the highest level statewide since 1985. The only areas that are running less than 90% of average are in central Colorado including Salida (54% of average), Rush (68%), Saguache (69%), Northglenn (72%), and Canon City (74%). More than 1/3 of Colorado has abundant moisture with more than 130% of average to date. The wettest areas compared to average are in western, southern and southeastern Colorado. Cedaredge currently stands at 186% of average. Holly has totalled 6.70" since October 1, 220% of average.





October 1992–March 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR MARCH 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637	1280	958				8082
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458	1325	1197	1039				7712
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	661	321	192	93	5161
	92-93	20	55	71	337	921	1093	1130	958	697				5282
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211	1093	907				6728
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331	1103	773				5926
CANON CITY	AVE #	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064	885	668				4884
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179	991	776				5585
CORTEZ	AVE #	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051	880	760				5487
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408	1270	976				7109
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	M	71	301	919	1192	967	783	649				M
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162	992	686				5434
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435	1273	1220				8768
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152	966	768				5786
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387	1118	894				6760
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177	1083	879				6461
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239	1031	706				5679
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494	1202	789				6336
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018	799	597				4780

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583	1340	1197				8699
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348	1073	705				5898
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M	M	M				M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242	956	648				5398
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462	1305	1209				9018
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339	1118	850				6248
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347	1063	721				5958
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253	1117	859				6303
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023	873	687				5307
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291	1096	915				6968
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186	959	703				5452
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114	900	711				5473
STEAMBOAT SPRINGS	AVE #	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452	1240	1063				7750
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401	1188	739				6270
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193	1046	981				6893
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013	904	699				5144
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428	1313	1153				8370
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947	875	684				4710

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

MARCH 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	49.2	23.9	36.6	3.0	73	-2	876	0	81	0.46	-0.44	51.1	8
STERLING	53.5	28.1	40.8	3.2	80	0	739	0	117	0.63	-0.38	62.4	3
FORT MORGAN	52.0	26.8	39.4	1.2	76	4	789	0	93	0.30	-0.40	42.9	2
AKRON FAA AP	50.4	27.5	39.0	2.1	76	4	798	0	89	0.36	-0.64	36.0	9
AKRON 4E	50.1	26.7	38.4	2.0	77	2	817	0	89	0.49	-0.42	53.8	6
HOLYOKE	51.0	27.3	39.1	0.0	79	1	794	0	102	0.41	-0.79	34.2	5
JOES	51.7	26.0	38.9	0.4	80	-2	804	0	106	0.34	-0.56	37.8	3
BURLINGTON	52.2	27.5	39.8	0.3	79	3	773	0	112	1.11	0.13	113.3	2
LIMON WSMO	49.3	25.3	37.3	0.8	71	8	850	0	76	0.64	-0.30	68.1	9
CHEYENNE WELLS	53.5	27.3	40.4	0.2	78	4	755	0	118	0.47	-0.31	60.3	5
EADS	53.5	28.7	41.1	-0.6	81	4	733	0	126	1.28	0.42	148.8	3
ORDWAY 21N	56.4	25.9	41.1	2.6	80	2	730	0	153	1.02	0.35	152.2	6
ROCKY FORD 2SE	59.2	27.4	43.3	0.4	80	8	666	0	175	1.49	0.82	222.4	7
LAMAR	58.5	27.6	43.0	-0.1	81	4	674	0	181	0.94	0.04	104.4	4
LAS ANIMAS	58.5	29.3	43.9	0.2	81	6	648	0	180	1.64	0.93	231.0	6
HOLLY	56.6	29.6	43.1	1.6	83	7	673	0	163	1.63	0.86	211.7	6
SPRINGFIELD 7WSW	58.9	29.7	44.3	1.9	79	0	637	0	173	1.41	0.47	150.0	4
TIMPAS 13SW	57.2	28.9	43.0	1.8	80	3	675	0	158	1.00	-0.15	87.0	5

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	55.3	28.7	42.0	3.7	73	10	706	0	127	1.51	0.15	111.0	9
GREELEY UNC	54.8	29.3	42.0	1.7	76	13	705	0	125	0.48	-0.65	42.5	6
ESTES PARK	46.6	24.7	35.6	2.6	64	-13	903	0	32	1.13	0.27	131.4	5
LONGMONT 2ESE	56.3	26.5	41.4	3.5	76	11	721	0	144	0.92	-0.23	80.0	6
BOULDER	54.0	30.7	42.4	2.9	72	5	697	0	106	2.15	0.49	129.5	9
DENVER WSFO AP	55.4	29.7	42.5	3.5	74	10	686	0	122	0.89	-0.39	69.5	7
EVERGREEN	51.5	21.4	36.4	3.4	68	-9	879	0	82	2.06	0.60	141.1	6
CHEESMAN	53.8	15.3	34.5	0.4	69	-7	937	0	99	0.77	-0.60	56.2	7
LAKE GEORGE 8SW	44.1	12.9	28.5	1.8	66	-10	1125	0	23	0.82	0.06	107.9	6
ANTERO RESERVOIR	42.7	10.0	26.3	2.4	57	-18	1191	0	13	0.45	-0.04	91.8	6
RUXTON PARK	35.5	12.8	24.2	-1.3	48	-15	1259	0	0	2.14	0.36	120.2	11
COLORADO SPRINGS	52.7	26.9	39.8	2.6	72	0	776	0	97	0.69	-0.26	72.6	8
CANON CITY 2SE	56.7	29.7	43.2	2.5	76	6	668	0	145	1.05	0.13	114.1	8
PUEBLO WSO AP	57.5	26.5	42.0	0.3	78	6	703	0	162	1.72	0.95	223.4	8
WESTCLIFFE	49.1	18.3	33.7	1.6	63	-8	963	0	57	1.04	-0.19	84.6	7
WALSENBURG	56.4	28.9	42.7	1.9	75	1	684	0	136	3.13	1.60	204.6	9
TRINIDAD FAA AP	57.4	27.0	42.2	1.2	75	5	699	0	154	1.35	0.50	158.8	8

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	41.3	13.9	27.6	2.2	61	-14	1153	0	16	0.74	-0.01	98.7	8
LEADVILLE 2SW	39.6	11.8	25.7	3.7	54	-8	1209	0	4	0.70	-0.30	70.0	17
SALIDA	53.5	22.4	37.9	1.4	67	5	829	0	87	0.22	-0.48	31.4	2
BUENA VISTA	49.1	22.0	35.5	1.5	65	5	907	0	45	0.34	-0.35	49.3	4
SAGUACHE	47.8	21.7	34.7	1.5	64	8	932	0	41	0.46	0.06	115.0	4
HERMIT 7ESE	30.1	-4.7	12.7	-7.0	36	-12	1616	0	0	0.35	-0.96	26.7	3
ALAMOSA WSO AP	49.4	18.3	33.8	1.5	64	6	958	0	56	0.66	0.21	146.7	5
STEAMBOAT SPRINGS	43.2	17.7	30.5	2.2	61	-4	1063	0	17	2.51	0.47	123.0	14
YAMPA	43.2	22.1	32.6	4.6	58	1	995	0	11	1.43	0.25	121.2	8
GRAND LAKE 1NW	43.6	14.4	29.0	3.8	61	-16	1107	0	17	1.59	0.05	103.2	19
GRAND LAKE 6SSW	39.3	13.1	26.2	2.6	55	-17	1197	0	3	1.01	0.07	107.4	14
DILLON 1E	38.5	12.4	25.5	1.4	53	-13	1220	0	4	1.85	0.76	169.7	14
CLIMAX	38.1	9.6	23.9	4.9	54	-11	1267	0	4	3.18	1.04	148.6	15
ASPEN 1SW	45.5	17.1	31.3	2.8	59	-5	1039	0	15	3.36	1.16	152.7	12
CRESTED BUTTE	39.4	5.5	22.4	-0.3	50	-19	1311	0	0	3.00	0.66	128.2	12
TAYLOR PARK	39.3	0.9	20.1	2.2	50	-25	1385	0	0	2.35	0.96	169.1	7
TELLURIDE	50.1	16.3	33.2	3.7	62	0	981	0	40	2.45	0.38	118.4	11
PAGOSA SPRINGS	51.8	18.5	35.2	2.3	69	5	915	0	62	1.30	-0.29	81.8	6
SILVERTON	44.0	7.7	25.8	1.8	57	-10	1206	0	7	1.22	-0.89	57.8	6
WOLF CREEK PASS 1	36.5	11.8	24.1	2.2	45	-1	1259	0	0	2.53	-2.39	51.4	9

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	44.8	21.9	33.3	1.9	66	-2	976	0	40	1.91	0.31	119.4	6
HAYDEN	43.5	21.3	32.4	2.0	62	-4	1006	0	24	1.39	0.08	106.1	10
MEEKER NO. 2	50.4	23.7	37.1	1.9	67	3	859	0	62	2.35	1.02	176.7	7
RANGELY 1E	46.7	22.2	34.5	-2.0	71	-1	940	0	54	2.46	1.59	282.8	5
EAGLE FAA AP	49.6	22.2	35.9	2.0	66	2	894	0	45	0.80	-0.00	100.0	7
GLENWOOD SPRINGS	52.5	24.9	38.7	1.1	70	10	810	0	75	2.60	1.20	185.7	9
RIFLE	57.1	26.4	41.7	3.0	70	13	711	0	126	1.55	0.61	164.9	7
GRAND JUNCTION WS	58.2	32.9	45.5	2.4	73	22	597	0	139	1.72	0.81	189.0	8
CEDAREDGE	55.5	25.5	40.5	0.9	70	11	753	0	102	1.54	0.32	126.2	5
PAONIA 1SW	48.5	30.8	39.7	-0.1	65	18	776	0	17	2.43	1.05	176.1	10
DELTA	58.5	29.3	43.9	2.1	74	17	649	0	146	1.19	0.63	212.5	5
COCHETOPA CREEK	43.3	10.5	26.9	0.2	56	-11	1174	0	9	1.25	0.52	171.2	7
MONTROSE NO. 2	56.4	28.8	42.6	3.1	68	16	687	0	112	0.67	0.02	103.1	7
URAVAN	60.5	30.6	45.5	2.2	75	22	593	0	180	1.05	0.05	105.0	10
NORWOOD	51.4	25.5	38.5	3.7	64	12	790	0	57	1.00	-0.17	85.5	6
CORTEZ	54.5	26.0	40.2	2.9	68	13	760	0	97	0.22	-1.12	16.4	2
DURANGO	53.1	26.9	40.0	2.3	66	16	768	0	77	1.31	-0.34	79.4	7
IGNACIO 1N	51.9	23.4	37.6	1.3	65	12	841	0	68	0.95	-0.34	73.6	5

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

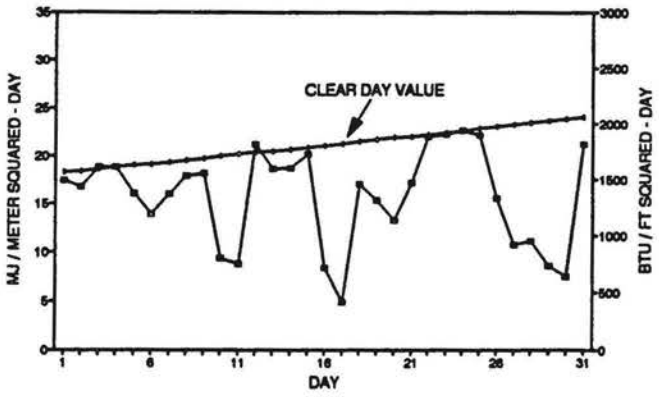
MARCH 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	NA	NA	NA	--	--
Denver	5	14	12	66%	69%
Fort Collins	9	11	11	--	--
Grand Junction	12	9	10	83%	64%
Limon	9	9	13	--	--
Pueblo	NA	NA	NA	72%	74%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

After months with more cloudiness than average, sunshine made a strong comeback over western Colorado in March. East of the mountains, where springtime often brings frequent cloudiness, sunshine and solar radiation were fairly normal.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
MARCH 1993

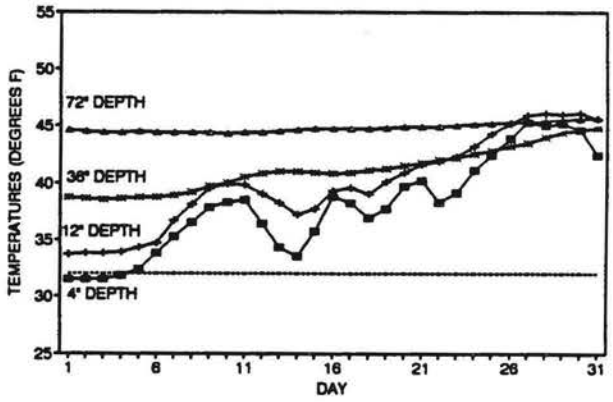


MARCH 1993 SOIL TEMPERATURES

Frozen soil persisted for the first few days of March, but sun, wind and mild temperatures eventually took command. Soil temperatures began their springtime ascent, and water from melting snow quickly soaked into the ground.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
MARCH 1993



HATS OFF TO: *Dan Knott* of Pyramid

The Pyramid weather station is tucked away in the mountains southwest of Steamboat Springs. Other than some hunters, fishermen and a few nearby ranchers, few people have ever been there. Dan Knott has been recording each rain shower and snow storm since 1964. Thanks so much for your efforts, and keep it up!!!

A FINAL LOOK AT THE 1992–1993 WINTER

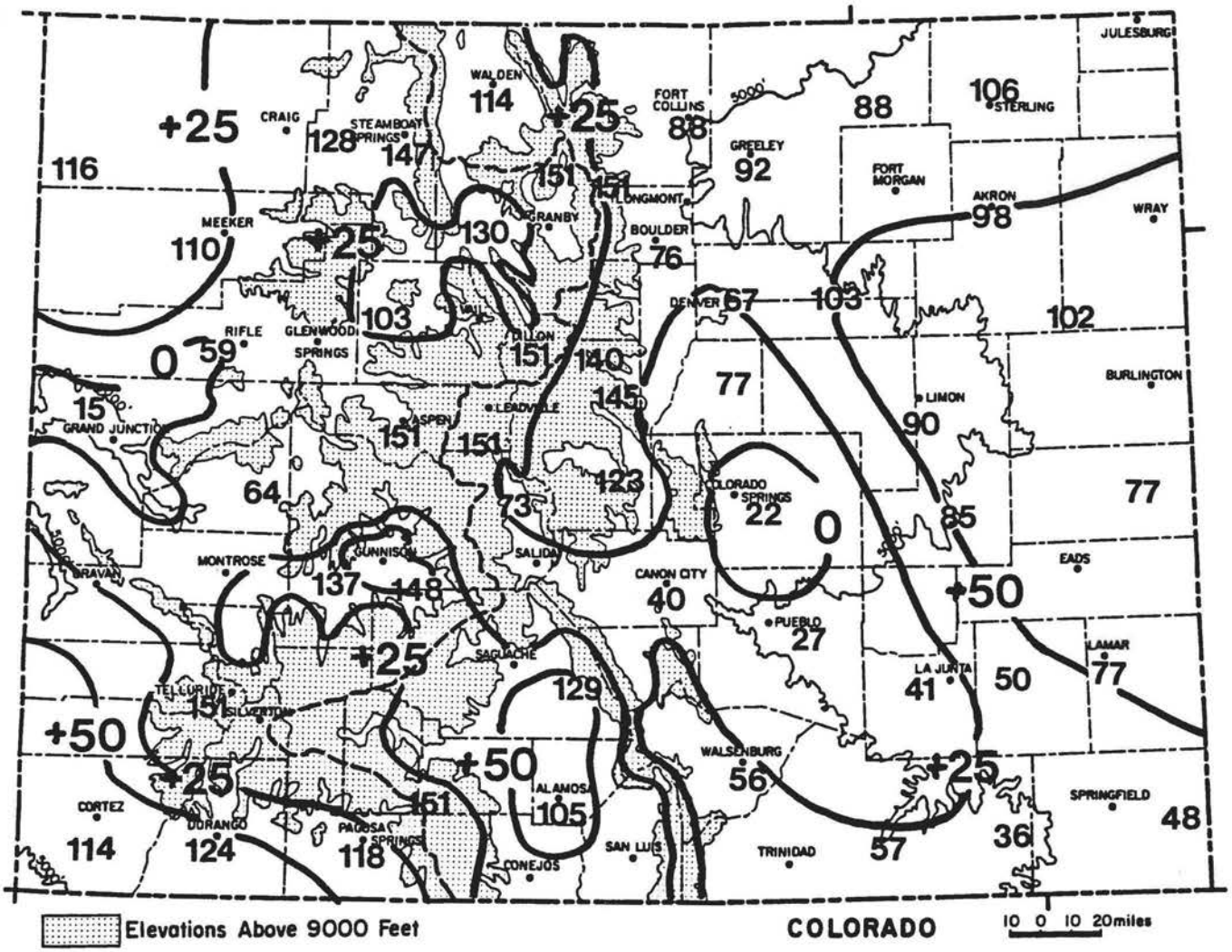
Temperatures are climbing and the snow is melting. At last, winter is over. For some of you, this may have been one of the first Colorado winters that you have ever experienced. I know that a few of you have seen at least 80 Colorado winters. Regardless of the number, soon we will move on to other matters of life, and this winter will be forgotten.

Before we forget everything, let's document a few things so that we will always be able to keep the winter of 1992-1993 in perspective. For the purpose of this story, we will focus on the months of November through March. As usual, some winter weather greets Colorado before November, and there is always more snow in April and May. But it is those five mid-winter months that have the most impact on our lifestyles and on our wallets.

It was a winter of few record-breaking temperatures, either hot or cold. Most areas of Colorado had at least a few sub-zero days, but severe cold was not a problem. The coldest temperature all winter in Colorado was -35°F at Taylor Park Reservoir on December 24. I know that sounds dreadfully cold, but most winters there have at least a few colder days. Denver's coldest was -9°F while out at Grand Junction it never got below 0°F all winter.

There were several winter downslope wind storms along the Front Range and strong winds blew on the peaks and passes, but nothing was out of the ordinary. At Rocky Flats northwest of Denver (one of Colorado's windiest locations for winter winds descending the east slopes of the Rockies), the highest wind gust recorded for the winter was 75 mph on January 21st. While I know that sounds pretty strong, such winds are fairly typical there a few times each winter.

Temperature extremes and winds may have been unspectacular, but several factors about the 1992-1993 winter are worth remembering. It was a fairly cloudy winter for Colorado with fewer days of winter sunshine than we are



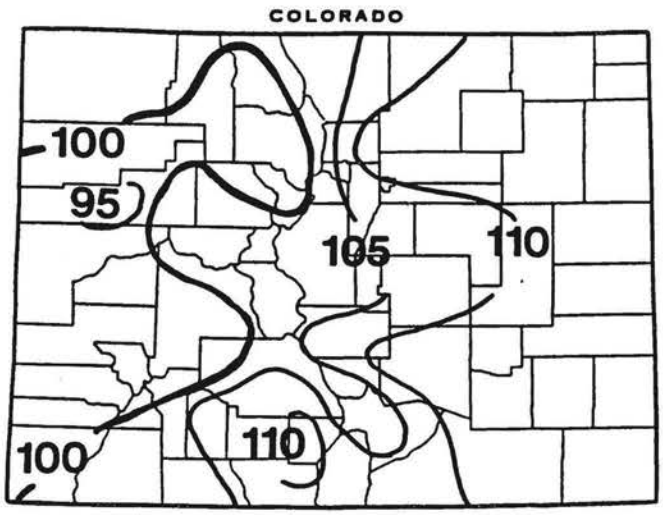
Number of days, November 1992–March 1993, with ≥ 1" snow on the ground and contours of departures from the 1961-1990 average.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

accustomed to. Grand Junction reported 73 cloudy days, a few more than normal. Snowfall was above average for much of the State, especially the mountains and southeastern plains. For southwestern Colorado, the 2-month period from late December to late February will go down in history because of the frequent very wet snows (and winter rains) which accumulated to record depths and weights and damaged or collapsed many roofs. During the 56-day period from December 28, 1992 through February 21, 1993, Durango received 11.03" of moisture, with at least 4" of that total falling as rain. Meanwhile, up higher, Wolf Creek Pass totalled 24.51" of water equivalent precipitation (250" of snow) during that same period. As a result, engineers may be changing some of their design criteria for building roofs.

It was a winter of sorrow for many families as at least a dozen people lost their lives in Colorado to avalanches. It was a winter of joy, however, for the many thousands of water users and providers in the State. After six consecutive years with below average snowpack accumulation and runoff, surface water supplies are abundant again. With high snowpack comes a higher risk of spring flooding, but we won't know that outcome for several more weeks.

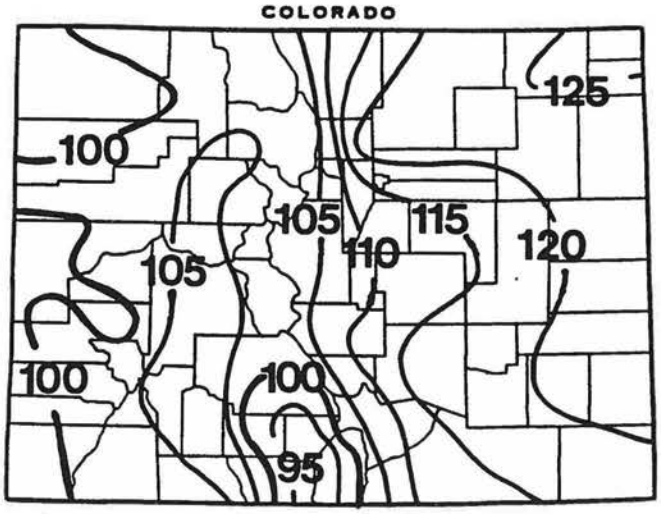
The most unusual features of the 1992-1993 winter, from a climatologists point of view, were fairly passive features – snowcover and heating degree days. Neither of these elements make headline news, but they affect us in surprisingly significant ways. The number of days when the ground was covered by snow were considerably more than usual across most of Colorado. This influenced our perception of the length and severity of winter. It made life harder for commuters, livestock, wildlife, ranchers, builders and anyone who needed to work outdoors during the winter. In recent decades, many people have moved to Colorado's Front Range because we can enjoy occasional bursts of winter weather or drive into the mountains to experience it while not having to suffer through long, dreary, snowcovered winters. This year, winter in eastern Colorado was more like Greenbay, Wisconsin. The map on the previous page shows the number of snowcover days this winter compared to average. In a typical winter, areas east of the mountains in Colorado can expect 40-60 days with snowcover with only 20-30 days down in the Arkansas Valley. This year, only the Colorado Springs-Pueblo area was relatively snowfree (and the Grand Junction area on the Western Slope). Many locations had more than double the average snowcover days. Areas of eastern and southwestern Colorado had at least 50 more days of snowcover than average. Even in the mountains where continuous winter snowcover is expected, this winter had more. Only a handful of winters during the past century have had more persisting snowcover.



Accumulated Heating Degree Days for November 1992-March 1993 as a percent of the 1961-1990 average.

Heating degree days are computed from daily temperatures and serve as a simple measure of how much energy may be needed to heat our homes, schools and businesses. Heating degree day totals were 5 to 15% greater than average this winter east of the mountains and dramatically more than the previous winter. This translates directly into higher heating bills, more wood splitting, or more discomfort. This was especially unusual since there really weren't many days of severe cold. Instead, it was the persistent nagging cold that set the winter of 1992-1993 apart.

For those of you who like to study numbers, the table on the following page provides some comparative statistics for selected locations in Colorado. I hope this will keep you occupied for a while. You will also notice that I am including some snowfall statistics even after all the bad things I have said about snowfall data. Please know that these data may include some inconsistencies, but so many of you have asked for more Colorado snowfall data that I will try to accommodate you. Please know that we are also working hard to secure funding to prepare a special book on snow, its characteristics, and how to measure it more accurately. We hope that our snow measurements of the future will be more accurate.



Accumulated Heating Degree Days for November 1992-March 1993 as a percent of November 1991-March 1992.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

Winter Climate Summary Statistics November 1992-March 1993
and comparison with 1961-1990 averages for the November-March period for selected Colorado locations

Location	Snowfall (inches)		Number of days ≥ 1" snow on ground		Heating Degree Days		
	1992-93	Average	1992-93	Average	1992-93	Average	Last Year
Akron 1N	25	32	98	51	5604	5033	4641
Alamosa AP	28	28	105	46	6952	6292	7640
Aspen 1SW	179	–	151	135	6291	6022	5995
Boulder	91	62	76	44	4799	4262	4008
Buena Vista	43	28	73	45	5632	5501	5516
Cheyenne Wells	27	inc	77	–	5167	4717	4208
Cochetopa Creek (Gunnison)	60	45	148	80	6784	6947	6256
Colorado Springs AP	26	34	22	32	5037	4812	4505
Denver AP	57	45	67	45	4985	4619	4293
Dillon 1E	91	84	151	112	6754	6970	6624
Durango	119	68	124	72	5193	5069	5093
Eagle FAA	50	37	103	77	5928	5856	5496
Fort Collins	58	45	88	45	5138	4835	4339
Grand Junction AP	21	22	15	36	4527	4627	4726
Greeley UNC	43	33	92	48	5408	4920	4397
Hayden	102	104	128	113	6202	6146	6179
Lamar	56	23	77	23	5349	4539	4434
Las Animas	33	19	50	21	5050	4545	4059
Limon NWS	41	26	90	36	5603	5181	4817
Pueblo AP	31	27	27	23	4989	4436	4268
Rifle	78	48	59	55	4942	5230	4838
Rocky Ford 2ESE	35	20	41	18	4891	4401	4178
Steamboat Springs	176	145	147	127	6585	6738	6530
Sterling	48	30	106	50	5750	5123	4514
Walsenburg	108	69	56	30	4351	4204	3954
Wolf Creek Pass 1E	421	378	151	146	7020	6602	6429

THE COLDEST TEMPERATURE EACH WINTER

Here is a list of the coldest temperatures recorded each winter for the past 20 years and the location. As you can see, the winter of 1992-1993 was ho-hum, or downright toasty depending on your point of view.

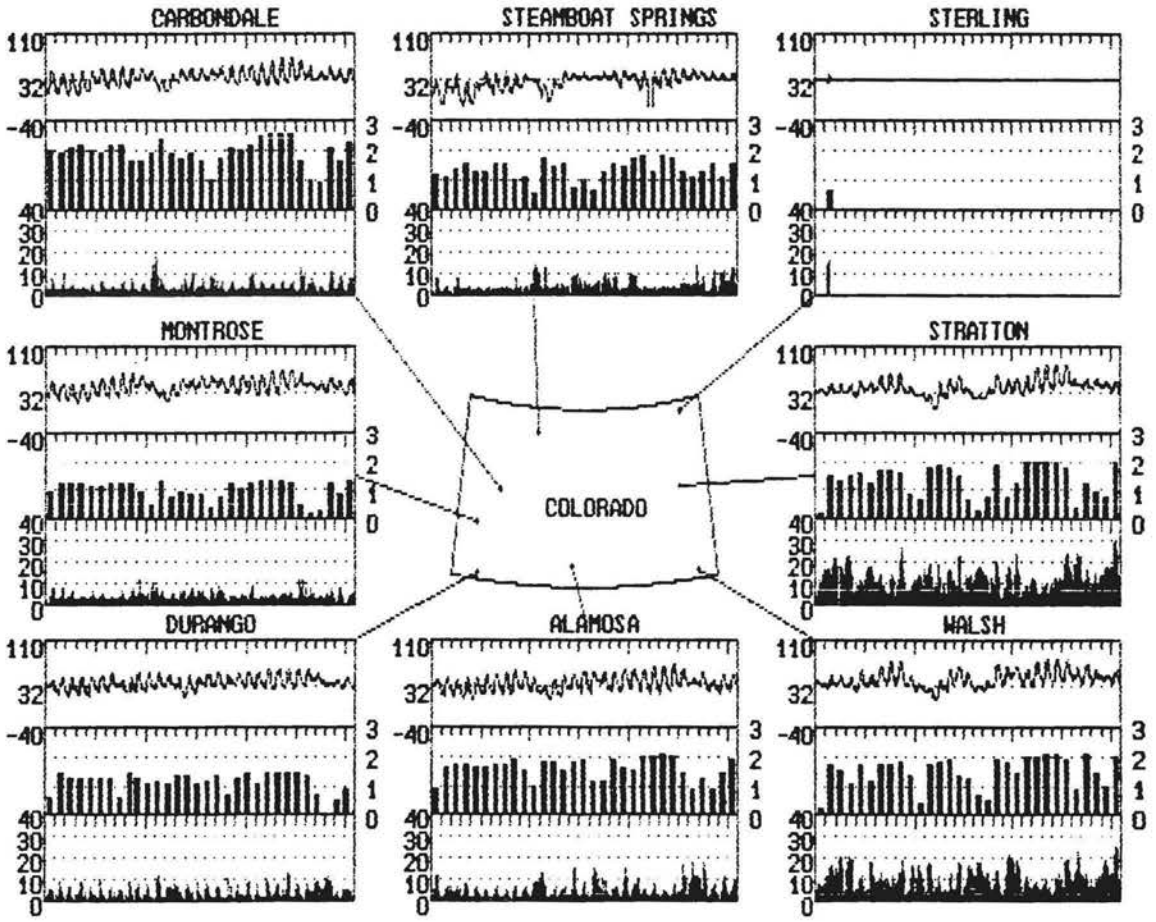
Season	Lowest Temp.	Date	Location
1992-93	-35°F	Dec. 24	Taylor Park Reservoir
1991-92	-32°	Jan. 3	Taylor Park Reservoir
1990-91	-49°	Dec. 24	Taylor Park Reservoir
1989-90	-38°	Dec. 22	Briggsdale
1988-89	-56°	Jan. 13	Taylor Park Reservoir
1987-88	-54°	Jan. 20	Taylor Park Reservoir
1986-87	-53°	Dec. 10	Taylor Park Reservoir
1985-86	-45°	Feb. 10	Taylor Park Reservoir
1984-85	-61°	Feb. 1	Maybell
1983-84	-53°	Jan. 19	Taylor Park Reservoir
1982-83	-38°	Feb. 3	Taylor Park Reservoir
1981-82	-54°	Feb. 6	Taylor Park Reservoir
1980-81	-34°	Jan. 13	Taylor Park Reservoir
1979-80	-46°	Feb. 14	Rio Grande Reservoir
1978-79	-60°	Jan. 1	Maybell
1977-78	-47°	Jan. 2	Taylor Park Reservoir
1976-77	-37°	Nov. 28	Hot Sulphur Springs
1975-76	-41°	Jan. 2	Antero Reservoir
1974-75	-42°	Dec. 25	Taylor Park Reservoir and Antero Reservoir
1973-74	-46°	Jan. 4	Kremmling

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)								
	33.9	35.4	35.1	39.9	27.1	32.0	38.2	41.9
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	65.8 25/15	60.1 21/15	68.0 25/16	67.6 24/16	52.2 25/16	40.3 2/11	77.4 24/15	78.3 24/15
minimum:	5.7 13/ 6	11.7 13/ 5	3.6 4/ 7	13.3 4/ 6	-17.1 23/ 3	25.5 2/ 7	0.5 13/ 6	4.8 13/ 6
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	87 / 17	81 / 20	91 / 22	81 / 24	90 / 17	0 /-40	83 / 25	77 / 25
11 AM	39 / 16	55 / 25	59 / 28	53 / 29	71 / 24	2 /-38	55 / 26	48 / 27
2 PM	29 / 15	47 / 25	46 / 28	43 / 28	60 / 25	0 /-40	51 / 28	38 / 24
5 PM	28 / 13	44 / 24	47 / 26	38 / 25	66 / 26	0 /-40	51 / 27	35 / 21
11 PM	61 / 17	70 / 23	78 / 25	67 / 25	90 / 21	0 /-40	75 / 25	65 / 24
monthly average wind direction (degrees clockwise from north)								
day	247	179	250	258	171	1	101	193
night	189	79	190	159	125	1	184	227
monthly average wind speed (miles per hour)								
	4.37	3.09	2.57	3.43	2.80	0.11	11.03	9.46
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	318	441	553	347	517	738	34	31
3 to 12	403	302	187	388	207	1	419	497
12 to 24	23	1	4	1	4	5	280	214
> 24	0	0	0	0	0	0	11	2
monthly average daily total insolation (Btu/ft²•day)								
	1566	1087	1927	999	1312	23	1345	1481
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	209	4	74	52	150	2	156	184
40-60%	81	212	51	63	87	1	57	72
20-40%	51	73	42	79	79	1	65	36
0-20%	17	65	11	119	31	1	55	54

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

APRIL 1993

Volume 16 Number 7

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

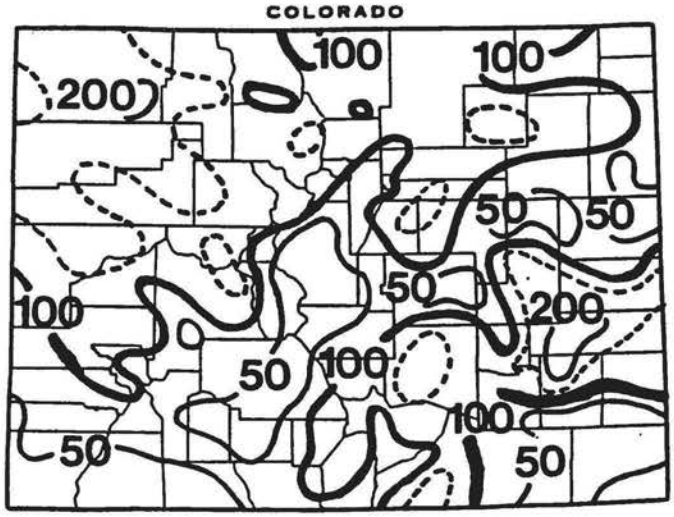
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

April Climate in Perspective – Fast Moving Storms

No less than 7 significant storm system crossed Colorado during April with several other minor disturbances. Weather patterns continued to move and change all month keeping Colorado's weather watchers on their toes. Precipitation ended up above average over the majority of Colorado with temperatures a little cooler than average.

Precipitation

A progressive jet stream pattern in April kept storm systems on the move from west to east and brought frequent, but usually brief, periods of rain and snow to Colorado.

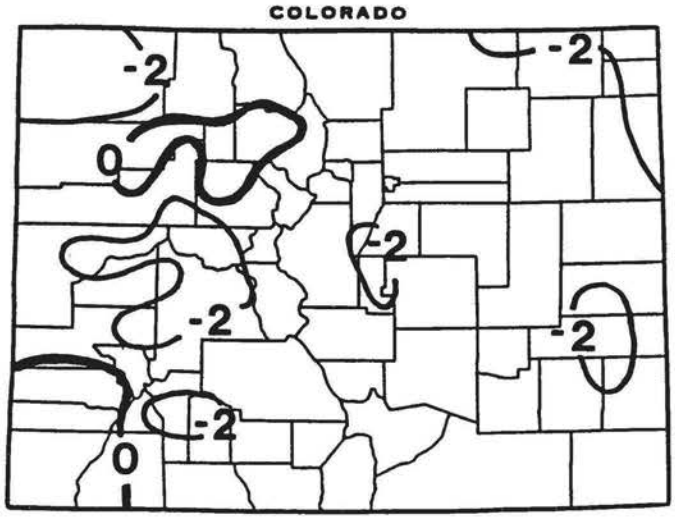


April 1993 precipitation as a percent of the 1961-1990 average.

Measurable precipitation fell on more than 20 days over portions of the Northern and Central Mountains. The storms only brushed southern Colorado, however, and some areas east of the Continental Divide were shadowed from much of the moisture. Monthly totals ended up well above average across the Northern and Central Mountains and northwestern valleys with some wet areas east of the mountains. Drier than average conditions were observed in extreme southeast Colorado and in a band from the Four-Corners area northeastward to Limon, Burlington and Wray.

Temperatures

April temperatures hopped up and down like a bunny all month with no lasting or unusual extremes of either warmth or cold. For the majority of the State, the cool days slightly dominated the warm days leaving a pattern of cooler than average temperatures for the month as a whole. Only two small areas in western Colorado ended up slightly above average. This was the second consecutive month with a surprisingly homogeneous statewide pattern of temperature departures from average.



Departure of April 1993 temperatures from the 1961-90 averages.

Inside This Issue

APRIL 1993 DAILY WEATHER

1-4 Colorado enjoyed a nice day on the 1st, but clouds increased as a storm approached from the west. Rain showers with mountains snows spread across the State on the 2nd. Thunder rumbled in some areas. The storm strengthened over southeastern Colorado late on the 2nd. Cold, north-northeasterly winds developed east of the mountains along with widespread and locally heavy precipitation. Fort Morgan was soaked with 1.25" of rain, but Fort Collins only totalled 0.01 inch. Several inches of snow fell in the mountains. Cold rain changed to wet snow over parts of eastern Colorado on the 3rd. Cheyenne Wells totalled 4" of snow but Walsenburg reported 14" with even more in some of the southern foothills. Trinidad Lake recorded 1.87" of moisture. After some morning fog on the 4th, skies cleared, and temperatures began to rebound.

5-7 A second major storm took aim at Colorado sending showers with some thunder and snow into western Colorado on the 5th spreading across to the northern Front Range later that evening. Precipitation, low elevation rains with mountain snows, became quite heavy early on the 6th and then tapered off. Grand Junction totalled 0.83" of moisture in 24-hours on the 6th – a lot for that near-desert climate. Craig 4SW measured more than one inch and Meeker got close to 1.50" from the storm. Wolf Creek Pass totalled 1.45" of moisture from wet snow – their only major storm of the month. It remained very chilly, windy and showery on the 7th as the storm pushed slowly eastward.

8-11 Colorado enjoyed sunny, dry weather with a short warming trend. Clouds increased on the 9th, and a brief burst of heavy snow hit the Northern Mountains, ending on the 10th, as a disturbance raced across the State. Winter Park measured 5" of new snow and Climax added 7" early on the 10th. Strong winds gusting locally in excess of 60 mph accompanied the system. Southern Colorado was not affected. Dry and fairly warm weather returned on the 11th with some temperatures in the 70s across eastern Colorado, but a cold front moved across the State during the day.

12-14 A chilly and unsettled stretch of weather as a large low pressure trough moved steadily across the Rockies. Significant precipitation fell across northern Colorado 12-13th including wet snow across Front Range cities north from Colorado Springs. Fort Collins received 5" of snow with 1.14" of moisture. More than a foot of snow was common in the northeastern foothills. Freezing temperatures were observed at night in Colorado's Western Slope fruit district. Bonham Reservoir, on Grand Mesa, had the State's low for the month of -14°F on the 14th.

15-17 Gradually warming but still unsettled as minor upper-air disturbances triggered scattered showers and mountain snows, especially 15-16th. Winter Park picked up another 4" of snow.

18-20 Mild, springlike weather on the 18th deteriorated quickly as a sharp cold front crossed the State. Some thunderstorms accompanied the front on the Eastern Plains, but little rain fell. Heavy snows developed in the Northern Mountains, and strong winds gusting over 50 mph buffetted areas from the mountains eastward on through the 19th. Steamboat Springs picked up 0.94" of moisture from wet snows, and Winter Park added 9" of new snow. The snow was still 56" deep on the level there early on the 20th – close to their maximum for the winter. More freezing temperatures were observed at low elevations 19-20th including fruit areas.

21-24 Cool temperatures with some morning fog on the 21st gave way to a sharp warming trend. Denver hit 82°F on the 22nd. Another cold front with strong winds plowed through on the 23rd. Then a significant precipitation event developed on the 24th that included melting snows in Denver, 12" of snow in Vail and 0.56" of rain at Pueblo.

25-30 Clearing and warmer on the 25th and very warm on the 26th. Lamar reached 85°F. Holly's 87°F matched Las Animas for the warmest in the State in April. A weak Pacific cold front then dropped temperatues again east of the mountains, while temperatures remained mild over western Colorado. Mountain snow showers early on the 27th were followed by thundershowers later east of the mountains. Haswell got 1.03" of rain, and Lamar got pelted with small hail. Another round of scattered thunderstorms erupted on the 28th. Arapahoe reported more than 1" of precipitation including lots of small hail. Threatening clouds appeared again on the 29th but with little rain. Then on the 30th, another storm pushed across the State accompanied by strong winds and some mountain snow showers.

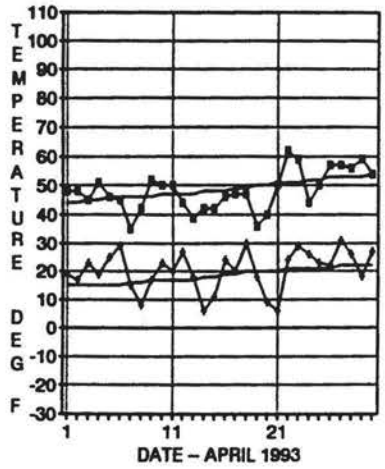
Weather Extremes

Highest Temperature	87°F	April 23 and 26	Las Animas and Holly, respectively
Lowest Temperature	-14°F	April 14	Bonham Reservoir
Greatest Total Precipitation	5.15"		Bonham Reservoir
Least Total Precipitation	0.03"		Saguache
Greatest Total Snowfall	61"		Climax
Greatest Snow Depth	> 88" – snowstake relocated 4/25		Wolf Creek Pass 1E

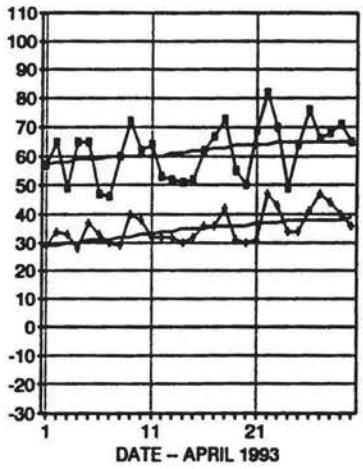
APRIL 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

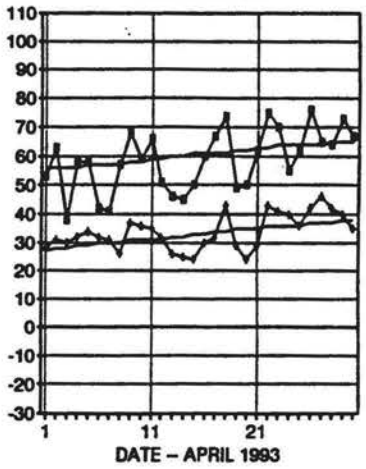
GRAND LAKE 1NW



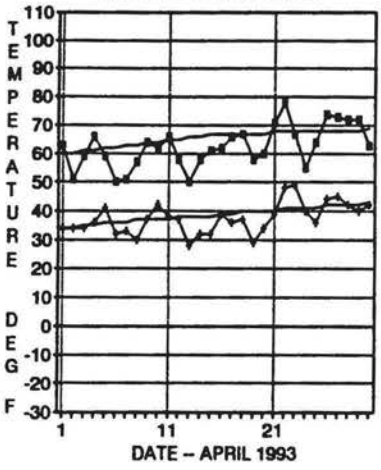
DENVER



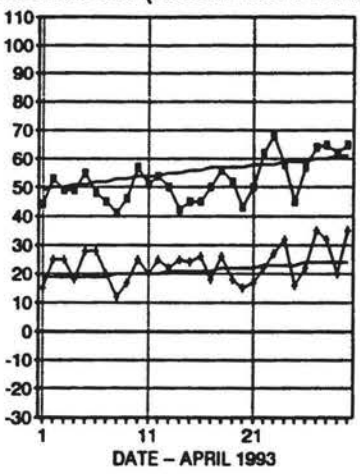
AKRON 1N



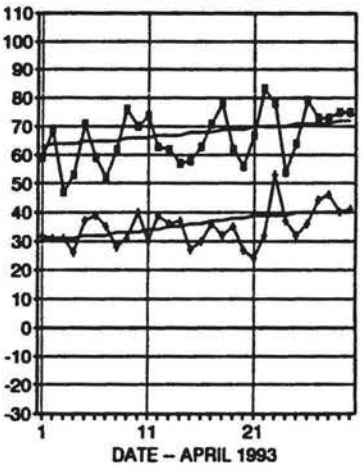
GRAND JUNCTION



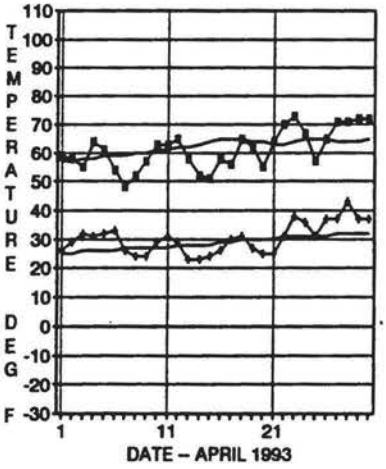
GUNNISON (COCHETOPA CRK.)



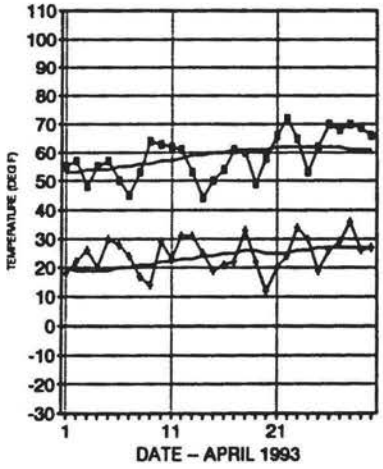
PUEBLO WSO



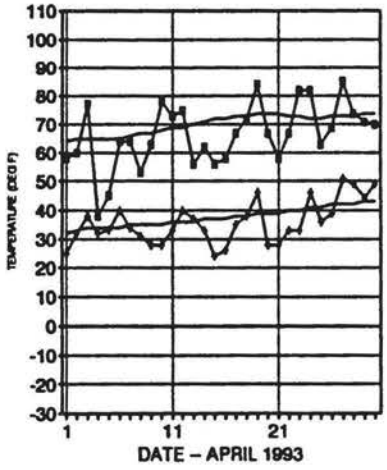
DURANGO



ALAMOSA



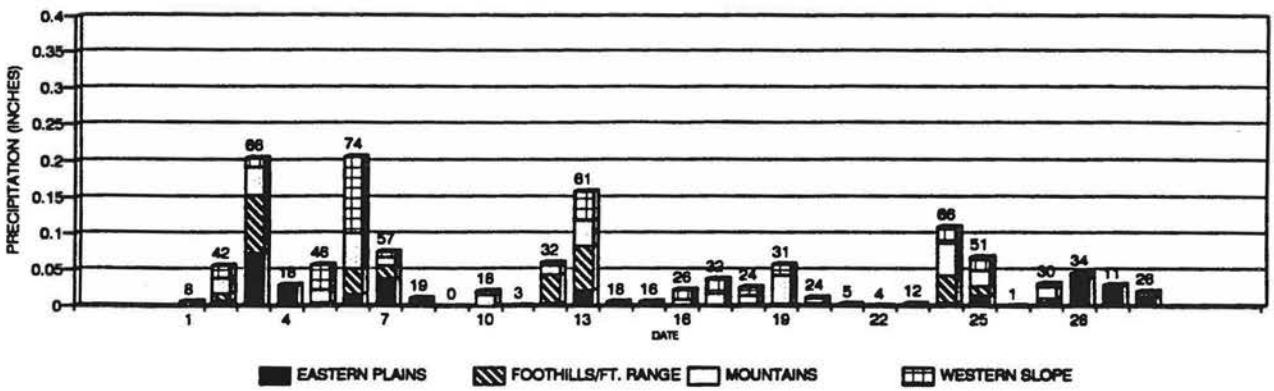
LAMAR



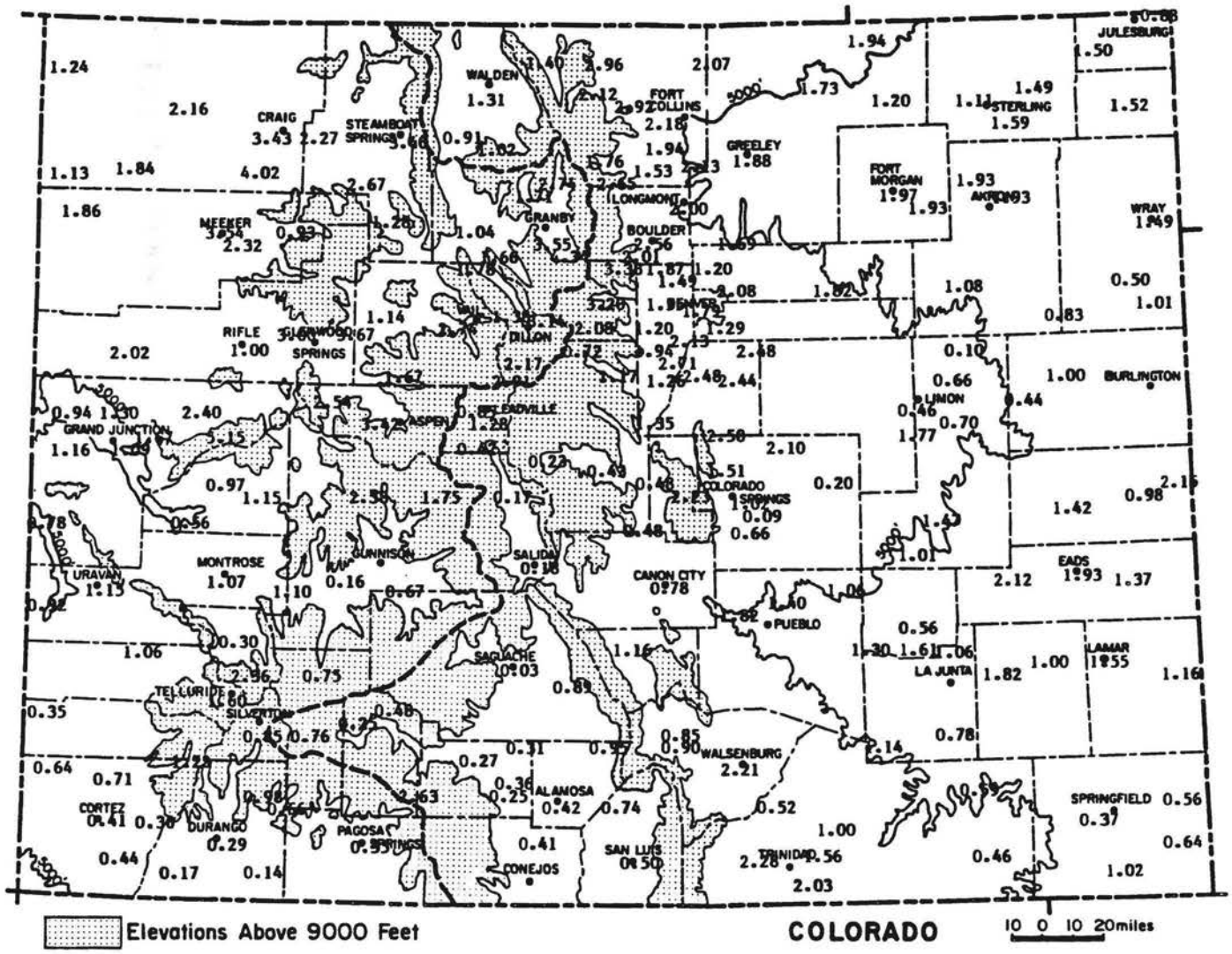
APRIL 1993 PRECIPITATION

April precipitation fell frequently, but most storms passed too quickly to deposit heavy widespread precipitation totals. Storms on April 2-3rd, 6-7th, 12-13th and 24-25th were the heaviest and most widespread. The moisture falling April 15-19th was concentrated over western Colorado while moisture near the end of themonth fell predominantly east of the mountains. There were only 6 days during the month when less the 10% of the selected weather stations received measurable rain or snow. Statewide precipitation for the month averaged 1.33 inch.

COLORADO DAILY PRECIPITATION - APR 1992

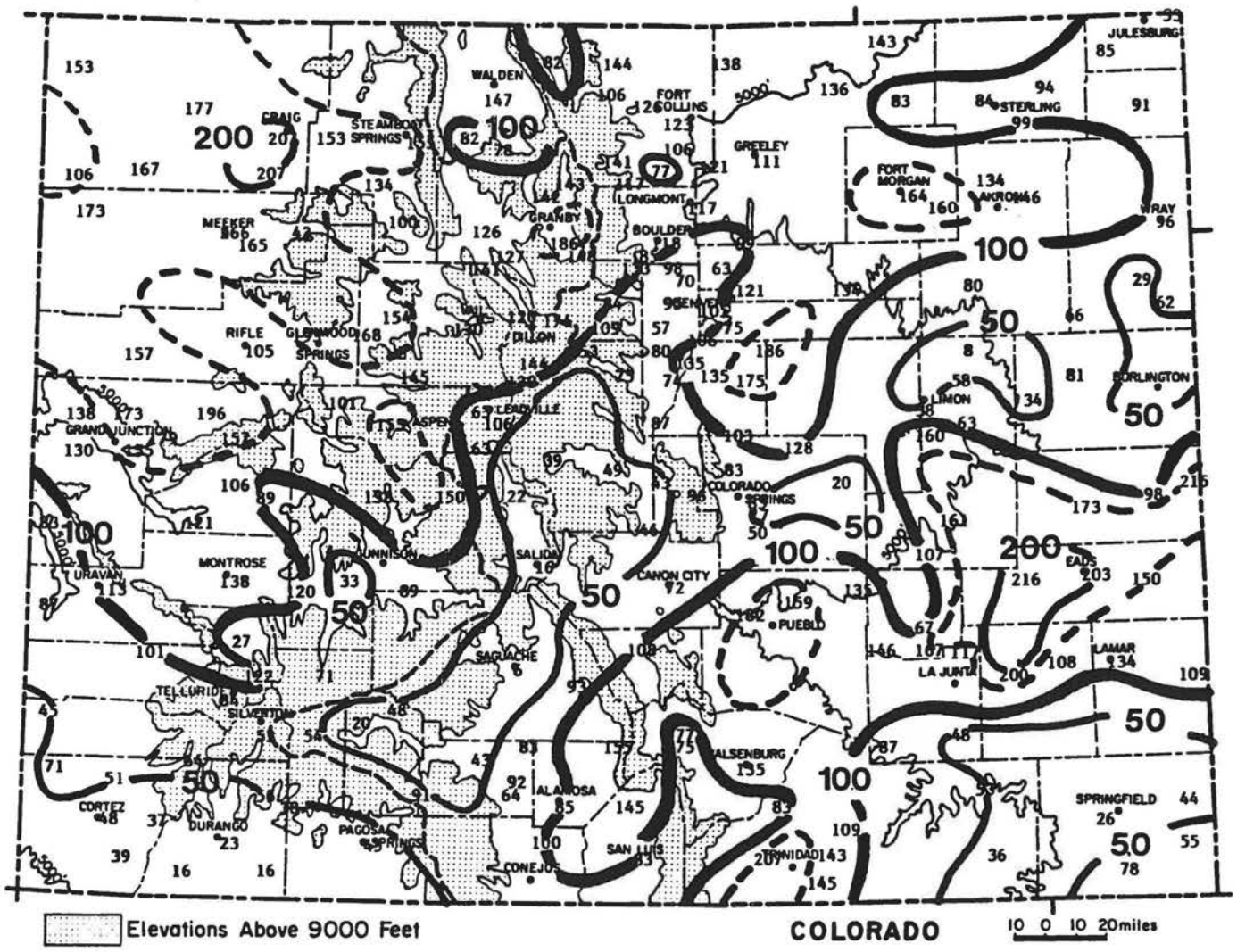


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

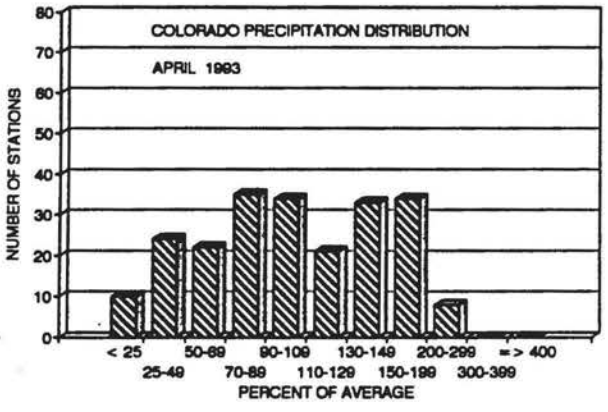


Precipitation Amounts (in inches) for April 1993.

APRIL 1993 PRECIPITATION COMPARISON



April 1993 Precipitation as a Percent of the 1961–90 average.



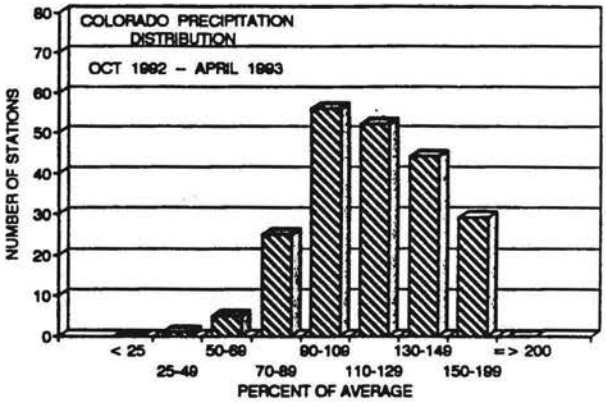
Statewide, April precipitation ranged from less than 20% of average at Salida, Ignacio and a few other sites to more than 200% of average at Craig, Hamilton, Eads and Trinidad Lake. Overall, wetter than average reporting stations slightly outnumbered areas with below average precipitation across Colorado.

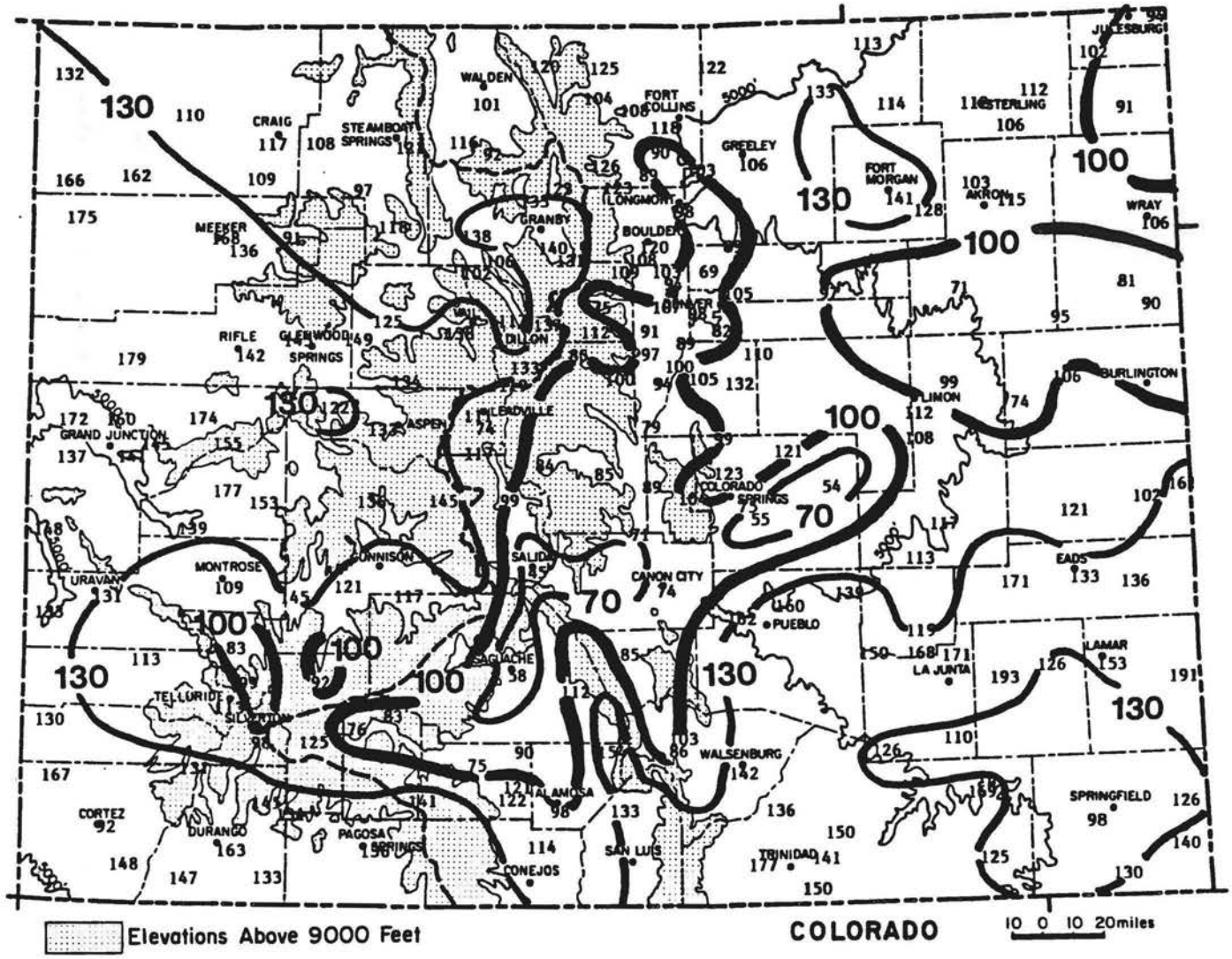
APRIL 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	2.08"	50th wettest in 122 years of record (wettest = 8.24" in 1900)
Durango	0.29"	12th driest in 99 years of record (driest = <0.01" in 1895, 1899, and 1989)
Grand Junction	1.30"	14th wettest in 102 years of record (wettest = 1.95" in 1965)
Las Animas	1.28"	46th wettest in 127 years of record (wettest = 7.54" in 1900)
Pueblo	1.40"	41st wettest in 124 years of record (wettest = 8.13" in 1900)
Steamboat Springs	3.40"	12th wettest in 88 years of record (wettest = 5.13" in 1920)

1993 WATER YEAR PRECIPITATION

The wet and cooler than average April weather across the Northern and Central Mountains added to mountain snowpack and increased the likelihood for high water during the coming runoff season. Meanwhile, drier than average weather in the San Juans continued to lessen the chances for major spring flooding there. Overall, accumulated precipitation for the October-April winter season in Colorado has been very good and greatly appreciated by Colorado's many water providers and users. Totals in excess of 130% of average are found over much of central, west-central and southwestern Colorado along with parts of Weld and Morgan counties in northeastern Colorado and a sizable area in southeastern Colorado. Some drier than average areas have persisted, however, with localized areas below 70% of average. Drier than average areas include the north end of the San Luis Valley, the Salida-Canon City area, a narrow band along the Front Range and an area from Byers eastward to the Kansas border.





October 1992–April 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR APRIL 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637	1280	958	692			8774
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458	1325	1197	1039	901			8613
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921	1093	1130	958	697	514			5796
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211	1093	907	735			7463
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331	1103	773	531			6457
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064	885	668	482			5366
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179	991	776	558			6143
CORTEZ	AVE *	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051	880	760	578			6065
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408	1270	976	765			7874
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	10	71	301	919	1192	967	783	649	469			5367
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162	992	686	489			5923
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435	1273	1220	1011			9779
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152	966	768	569			6355
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387	1118	894	641			7401
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177	1083	879	722			7183
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239	1031	706	519			6198
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6160
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494	1202	789	509			6845
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018	799	597	446			5226

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1203	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949			9648
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348	1073	705	502			6400
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M	M	M	M			M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	58	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242	956	618	360			5758
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033			10051
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339	1118	850	615			6863
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347	1063	721	534			6492
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253	1117	859	644			6947
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023	873	687	571			5878
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291	1096	915	714			7682
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186	959	703	428			5880
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114	900	711	536			6009
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452	1240	1063	812			8562
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401	1188	739	501			6771
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193	1046	981	743			7636
TRINIDAD	AVE	0	7	87	361	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013	904	699	450			5594
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428	1313	1153	899			9269
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947	875	684	461			5171

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

APRIL 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	54.5	29.1	41.8	-2.2	70	19	690	0	107	1.94	0.59	143.7	13
STERLING	60.9	35.2	48.0	-0.1	77	26	501	0	186	1.11	-0.21	84.1	7
FORT MORGAN	60.8	34.9	47.9	-0.7	78	29	509	0	176	1.97	0.77	164.2	5
AKRON FAA AP	58.8	33.7	46.3	-0.5	76	24	556	0	157	1.93	0.49	134.0	11
AKRON 4E	58.0	32.6	45.3	-1.1	76	23	582	0	146	1.93	0.61	146.2	12
HOLYOKE	57.2	34.4	45.8	-3.6	76	25	569	0	148	1.52	-0.15	91.0	11
JOES	59.8	32.7	46.2	-0.8	80	20	557	0	167	0.83	-0.42	66.4	5
BURLINGTON	62.7	33.7	48.2	-1.6	80	23	431	0	173	0.06	-1.18	4.8	2
LIMON WSMO	57.9	30.6	44.2	-0.8	73	22	615	0	141	0.46	-0.75	38.0	8
CHEYENNE WELLS	63.3	33.3	48.3	-1.9	81	17	493	0	215	0.98	-0.01	99.0	6
EADS	62.6	35.2	48.9	-2.7	82	25	474	0	207	1.93	0.98	203.2	4
ORDWAY 21N	64.6	33.8	49.2	-0.3	81	24	463	0	233	1.01	0.07	107.4	5
ROCKY FORD 2SE	69.9	36.2	53.1	0.1	84	27	353	2	306	1.61	0.65	167.7	5
LAMAR	66.4	35.6	51.0	-2.9	85	24	417	3	260	1.82	0.67	158.3	5
LAS ANIMAS	68.2	37.8	53.0	-1.2	87	27	360	8	294	1.28	0.37	140.7	6
HOLLY	67.2	35.8	51.5	-1.3	87	23	396	1	275	1.16	0.10	109.4	5
SPRINGFIELD 7WSW	71.2	34.9	53.0	1.0	85	23	340	1	317	0.37	-1.04	26.2	2
TIMPAS 13SW	66.1	35.0	50.6	-0.7	86	25	399	1	241	1.14	-0.16	87.7	2

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	59.2	35.6	47.4	-0.1	73	25	519	0	148	2.18	0.42	123.9	10
GREELEY UNC	60.3	35.8	48.0	-1.1	76	27	502	0	167	1.88	0.20	111.9	8
ESTES PARK	52.7	28.8	40.7	0.5	67	14	719	0	77	1.76	0.52	141.9	4
LONGMONT 2ESE	61.6	32.4	47.0	-0.5	77	25	534	0	184	2.00	0.30	117.6	12
BOULDER	60.3	34.9	47.6	-0.2	75	27	514	0	165	2.56	0.40	118.5	15
DENVER WSFO AP	61.6	35.4	48.5	0.3	82	28	489	0	184	2.08	0.37	121.6	8
EVERGREEN	55.3	23.7	39.4	-1.7	70	7	709	0	99	1.20	-0.90	57.1	5
CHEESMAN	57.4	20.4	38.9	-3.3	75	8	777	0	131	1.35	-0.19	87.7	10
LAKE GEORGE 8SW	50.2	22.1	36.1	-0.3	66	11	857	0	50	0.43	-0.44	49.4	5
ANTERO RESERVOIR	48.0	20.1	34.1	0.7	61	2	921	0	29	0.23	-0.35	39.7	4
RUXTON PARK	38.6	15.6	27.1	-6.5	49	5	1132	0	0	2.23	-0.07	97.0	13
COLORADO SPRINGS	58.9	33.2	46.1	-0.5	76	23	558	0	151	1.02	-0.17	85.7	11
CANON CITY 2SE	62.8	34.6	48.7	-1.1	79	24	482	0	203	0.78	-0.29	72.9	7
PUEBLO WSO AP	66.1	34.8	50.5	-1.3	83	24	428	1	253	1.40	0.52	159.1	10
WESTCLIFFE	54.9	25.3	40.1	-0.7	70	6	740	0	99	1.16	0.09	108.4	4
WALSENBURG	64.3	34.4	49.3	0.4	78	20	461	0	227	2.21	0.58	135.6	6
TRINIDAD FAA AP	64.5	34.9	49.7	-0.4	81	22	450	0	238	1.00	0.09	109.9	3

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	47.1	22.5	34.8	-0.2	64	8	899	0	24	1.31	0.42	147.2	14
LEADVILLE 2SW	43.9	16.9	30.4	0.0	56	4	1033	0	8	0.74	-0.46	61.7	16
SALIDA	58.6	28.0	43.3	-1.4	74	13	644	0	141	0.18	-0.92	16.4	1
BUENA VISTA	54.4	26.1	40.2	-1.1	70	15	735	0	91	0.17	-0.60	22.1	3
SAGUACHE	56.3	25.5	40.9	-0.5	71	17	715	0	115	0.03	-0.47	6.0	1
HERMIT 7ESE	34.6	8.8	21.7	-8.5	42	5	1291	0	0	0.25	-0.96	20.7	3
ALAMOSA WSO AP	58.7	24.6	41.6	0.2	72	12	692	0	143	0.42	-0.07	85.7	5
STEAMBOAT SPRINGS	50.6	24.8	37.7	-1.1	67	10	812	0	61	3.40	1.22	156.0	18
YAMPA	50.9	28.1	39.5	2.5	67	14	756	0	55	1.28	-0.00	100.0	14
GRAND LAKE 1NW	48.1	20.3	34.2	0.6	62	6	916	0	31	2.74	0.83	143.5	20
GRAND LAKE 6SSW	44.8	21.4	33.1	-0.4	56	9	949	0	15	1.71	0.51	142.5	20
DILLON 1E	43.6	18.3	30.9	-1.8	60	8	1011	0	17	1.38	0.23	120.0	15
CLIMAX	39.2	10.6	24.9	-1.1	53	-9	1194	0	2	2.91	0.67	129.9	20
ASPEN 1SW	47.7	21.6	34.7	-3.8	62	11	901	0	34	3.42	1.22	155.5	23
CRESTED BUTTE	43.9	15.9	29.9	-2.6	57	-4	1048	0	10	2.38	0.66	138.4	12
TAYLOR PARK	41.5	10.0	25.7	-3.1	53	-10	1171	0	5	1.75	0.59	150.9	9
TELLURIDE	55.7	24.1	39.9	2.2	69	13	743	0	110	1.60	-0.29	84.7	13
PAGOSA SPRINGS	58.1	23.9	41.0	-0.3	70	16	714	0	134	0.55	-0.65	45.8	3
SILVERTON	45.9	15.4	30.7	-2.3	58	7	1022	0	22	0.85	-0.75	53.1	10
WOLF CREEK PASS 1	39.3	16.8	28.2	-1.2	50	6	950	0	0	2.63	-0.26	91.0	9

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	50.8	27.6	39.2	-3.0	69	19	765	0	64	3.43	1.78	207.9	16
HAYDEN	53.6	28.6	41.1	-1.2	68	20	708	0	84	2.27	0.79	153.4	13
MEEKER NO. 2	57.3	29.1	43.2	0.3	73	19	623	0	121	3.54	2.21	266.2	12
RANGELY 1E	58.3	33.5	45.9	-1.8	75	26	567	0	139	1.86	0.79	173.8	8
EAGLE FAA AP	56.8	29.9	43.3	1.1	75	21	641	0	121	1.14	0.40	154.1	10
GLENWOOD SPRINGS	56.3	31.3	43.8	-2.1	74	23	628	0	116	3.00	1.45	193.5	16
RIFLE	61.2	32.5	46.9	-0.1	78	22	536	0	180	1.00	0.05	105.3	7
GRAND JUNCTION WS	62.6	37.3	49.9	-2.0	78	28	446	0	195	1.30	0.55	173.3	8
CEDAREDGE	61.6	29.8	45.7	-1.8	76	20	570	0	184	0.97	0.06	106.6	7
PAONIA 1SW	60.1	33.5	46.8	-1.3	77	25	539	0	164	1.15	-0.13	89.8	8
DELTA	63.1	35.0	49.1	-1.5	79	26	469	0	204	0.56	0.10	121.7	7
COCHETOPA CREEK	52.4	23.0	37.7	0.7	68	12	811	0	68	0.67	-0.08	89.3	8
MONTROSE NO. 2	59.2	32.2	45.7	-2.3	74	25	571	0	153	1.07	0.30	139.0	5
URAVAN	66.5	34.3	50.4	-1.2	79	28	431	0	257	1.15	0.14	113.9	6
NORWOOD	56.8	28.9	42.9	0.4	69	15	657	0	115	1.06	0.02	101.9	4
YELLOW JACKET 2W	61.5	31.2	46.4	2.0	72	20	547	0	182	0.64	-0.25	71.9	6
CORTEZ	61.9	28.9	45.4	1.0	75	20	578	0	188	0.41	-0.44	48.2	4
DURANGO	61.3	30.2	45.7	0.3	73	23	569	0	178	0.29	-0.92	24.0	3
IGNACIO 1N	60.4	26.2	43.3	-0.9	70	16	642	0	164	0.14	-0.73	16.1	5

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

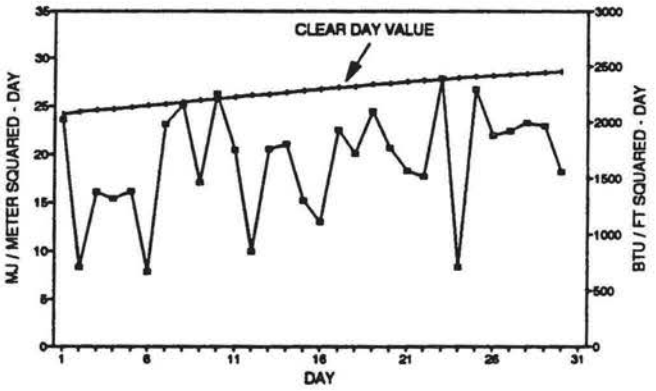
APRIL 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	NA	NA	NA	--	--
Denver	6	11	13	61%	67%
Fort Collins	6	11	13	--	--
Grand Junction	5	8	17	82%	69%
Limon	4	11	15	--	--
Pueblo	NA	NA	NA	76%	74%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

Clear days were few across Colorado in April, but the sun managed to peak out at least a little on most days. Despite the many clouds, total solar energy was fairly close to average.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
APRIL 1993

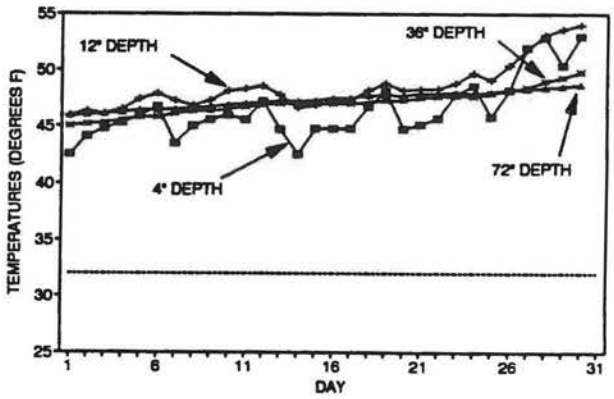


APRIL 1993 SOIL TEMPERATURES

Near-surface soil temperatures warmed gradually in April and finally surged upward near the end of the month. The normal springtime reversal of vertical temperature gradients in the soil took place during the month.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
APRIL 1993



HATS OFF TO: *Dillon 1E Weather Observers*

The Dillon 1E weather station is one of several cooperative weather stations in Colorado that is operated by staff of the Denver Water Department. I wish I had room to thank everyone personally, but you all know who you are. The current Dillon weather station has been collecting data since the reservoir was completed in the early 1960s. Continuous daily weather reports from the old town of Dillon date back to 1909.

PRECIPITATION, BAR GRAPHS, AND FLOODS

A graphical approach to daily precipitation

Back in November 1991 we began a new and more graphical approach to presenting monthly climate information in **Colorado Climate**. One of the graphs that we began experimenting with was the Colorado Daily Precipitation Graph which appears on page 4 of each monthly summary. This was our attempt to combine daily precipitation from dozens of locations representing all regions of Colorado into one graphic in an effort to show day-to-day characteristics of precipitation quantities and areal coverage. It may be a little difficult to decipher and interpret all the information it contains, but as time goes on I am becoming more and more fond of it.

The graph is composed of the following information. Each month we receive daily precipitation records from about 220 locations across Colorado. Maps of monthly and water-year precipitation include data from this entire array of stations. We then select a subset of about 80 stations which are divided into four regions, each representing roughly 25% of the area of Colorado. Approximately 20 weather stations have been selected to portray significant climate features within these four regions: Eastern Plains, Foothills/Adjacent Plains (Front Range corridor), Mountains and Interior Valleys, and the Western Valleys (Western Slope). This is the same set of stations that are listed in the Climate Data tables on page 8-9 each month. Most of these stations have been in existence for at least 30 years, and some date back 100 years or longer. They represent the majority of Colorado's population centers and geographic and agricultural regions.

Daily precipitation totals from each station in each of the four regions are summed and averaged (total accumulated regional precipitation for that day divided by the number of stations in that region). The percent of the area receiving precipitation is also calculated (number of stations receiving measurable precipitation divided by the total number of stations). For example, if on a particular day half of the 20 stations on the Western Slope reported 1.00" of precipitation and the other half reported zero, the regional total would be 10.00" divided by the total number of stations (20) would give a regional average of 0.50" and an areal coverage of 50%. We recognize that in using only 20 sites to define the precipitation patterns over nearly 25,000 square miles (1/4 the total land area of Colorado) that absolute accuracy is limited. These are obviously approximations, and on any given day they could either overestimate or underestimate true regional precipitation and areal coverage. But when we compare these results to what we obtain using the entire 220 stations, we have found the results to be remarkably representative.

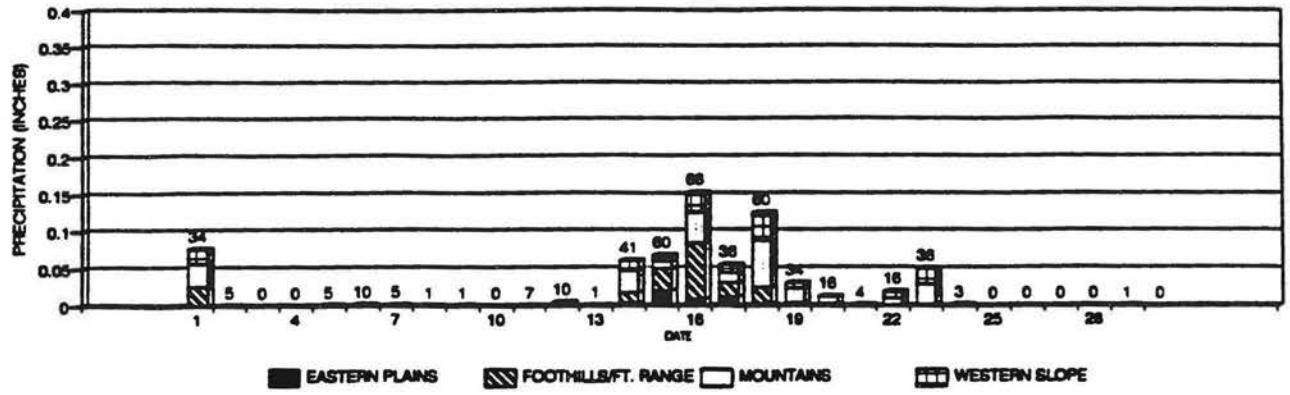
It would be nice if we could show each region of the State separately, but we simply don't have the space. Therefore, all four regions are combined onto one graph by summing each region's contribution to statewide precipitation and statewide areal coverage. The way this works is as follows. If, for example, each of the 20 mountain stations got 0.40" of precipitation on April 2 while no precipitation fell anywhere else in Colorado, the statewide average precipitation for that day would be 0.10" with 25% areal coverage. By the type of shading used on the bar graph, readers would be able to tell that the mountains accounted for all of the precipitation.

Some examples

Let's look at some examples. The following two graphs show statewide daily precipitation for April 1992 and August 1992. April was exceptionally dry last year, compared to average. Many days had little or no precipitation anywhere in the State. The wettest day was April 16 when statewide precipitation averaged 0.15" with 68% of the weather stations reporting measurable precipitation that day. The Foothills/ Front Range area was responsible for half of that 0.15", which means that precipitation in the Front Range region averaged about 0.30" giving it a contribution to statewide precipitation of about 1/4 of 0.30" or 0.075". Precipitation for the entire month, averaged across the state, can then be computed by simply adding each daily value. Last April, the statewide average was about 0.63". By comparison, this month (April 1993, see page 4), statewide average precipitation exceeded 0.15" on 3 separate days and the monthly total was over 1.30".

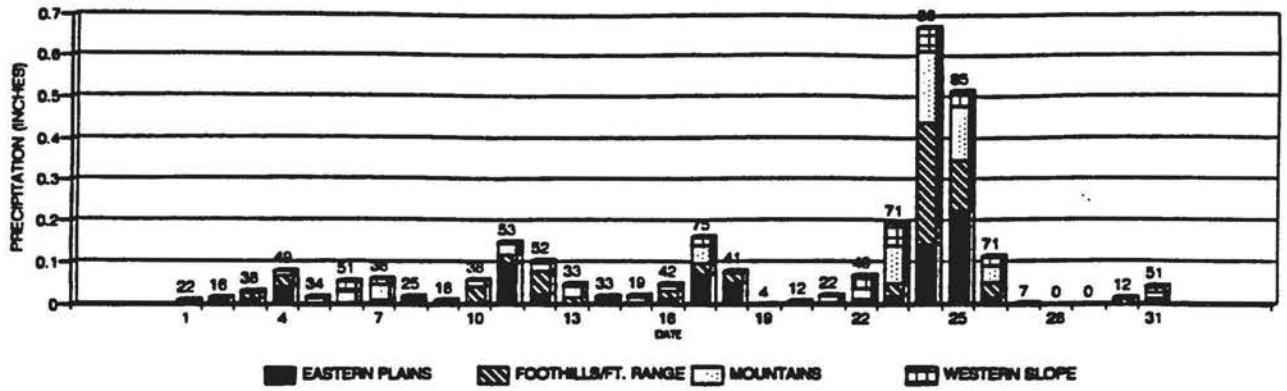
The August 1992 graph showed a much different situation. Rain fell almost every day of the month with an

COLORADO DAILY PRECIPITATION - APR 1992



Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

COLORADO DAILY PRECIPITATION - AUG 1992



exceptional storm August 23-25th. Practically all of Colorado was affected as the remnants of Pacific hurricane Lester crossed the State. That was the heaviest single storm to hit Colorado since we began using this graph format. The monthly total, statewide was 2.51".

There is one problem that complicates the interpretation of the graph. One of the characteristics of the National Weather Service's cooperative weather observing program is that most stations are volunteer weather observers. To accommodate volunteers, the NWS has a tradition of allowing local observers to select the time of the daily observation for their convenience. The result is that not all weather stations report at the same time. About 50% of the stations read their raingage in the morning around 8 am. About 33% of the stations read in the evening between 4 pm and 7 pm. The remaining station read at midnight. This has great significance since this means that afternoon rain at stations that read in the evening or at midnight will be reported that day while the morning observers will report that same rain on the next day. In terms of our graph, that means that most storms, even if they crossed Colorado in just one day, will normally be reported on two days. This also affects the reporting of areal coverage. I wish we didn't have to deal with this problem, but it isn't reasonable to ask all the volunteer observers to stay up until midnight to read their instruments.

Not many big storms

Looking back over the past 18 months, there have been 76 days with statewide precipitation of 0.10" or greater. Only 11 individual days have received statewide precipitation of at least 0.25", and 9 days (not necessarily the same days) received measurable precipitation at 80% or more of the weather stations. We have yet to see a storm bring precipitation to every one of the 80 stations on the same reporting day. No precipitation was recorded on just 87 days, although this number would be greater if all weather stations took their observations for the identical 24-hour period. Storms often appear as multi-day episodes, and a few large storm periods contribute a large fraction of the total precipitation. The most frequent daily precipitation has been observed during the summer months (only 3 days June-August 1992 with no precipitation) while the most widespread areal coverage has occurred during the fall and spring.

For each storm episode that we have tracked during the past 18 months, I have wished I could compare them with similar graphs from memorable storms and droughts from previous decades. Unfortunately, it is no small task to assemble this much daily precipitation data. Prior to 1948, most of the data for Colorado haven't even been keyed for computer applications. If I were retired, and my eyesight was still decent, I might be tempted to dig through the precious old files down in our library and reconstruct some famous weather from the past – April 1900 (the wettest recorded month in Colorado history, December 1913 (the all-time record snowstorm for Colorado's Front Range cities), June 1921 (the great Pueblo flood), etc., etc. But alas, other things take priority.

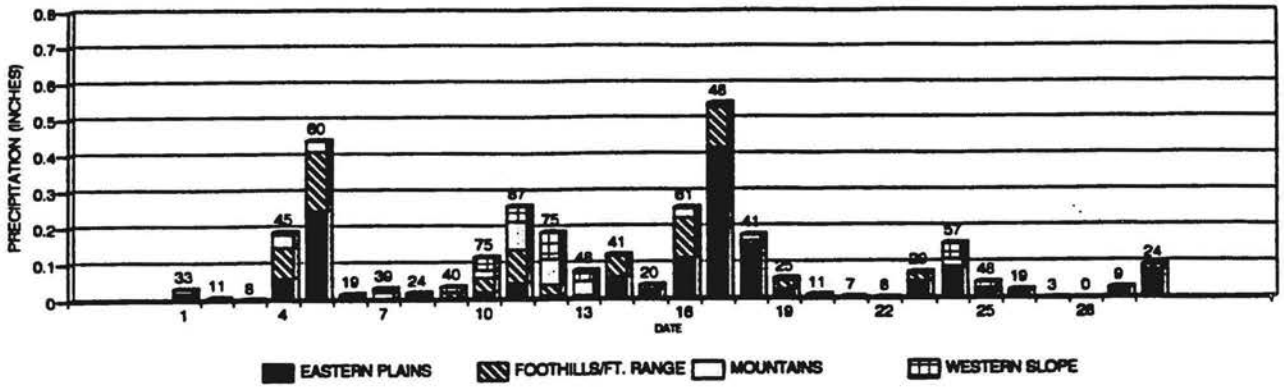
Storms of the Past

All the snow this winter and the talk of flooding this spring aroused my curiosity enough to motivate me to reconstruct a few memorable storms from the past. Anyone who was alive, well and living in Colorado in 1965 probably still has vivid memories of June 14-18th, 1965. As it turns out, the daily precipitation graph results weren't as impressive as I expected (but please note that the vertical scale had to be doubled, compared to what we usually use, in order to display the daily events). For one thing, while eastern Colorado was doused June 4-5th and again June 14-18th, the mountains and Western Slope were relatively dry. (There were some exceptions, as long-time residents of Breckenridge will attest to.) During most of that period less than 50% of the State received rain on any one day. But then again, a contribution to statewide precipitation of 0.41" on June 17 just from the Eastern Plains means that the Plains averaged more than 1.60". Over 25,000 square miles of land that was already wet from many days of showers – that's a lot of water. It is also important to remember that snowpack in 1965 was very abundant, and June streamflows from mountain watersheds like the South Platte and the Arkansas would have been large even without more rain. With the additional help of local "cloudbursts", tributaries such as Bijou Creek looked more like the Mississippi River than their normal nearly-dry appearance.

I also looked at the May 4-8, 1969 storm. (Sorry, I got lazy any of the other days of that month.) That storm was concentrated along the Front Range and actually dropped

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

COLORADO DAILY PRECIPITATION - JUN 1965

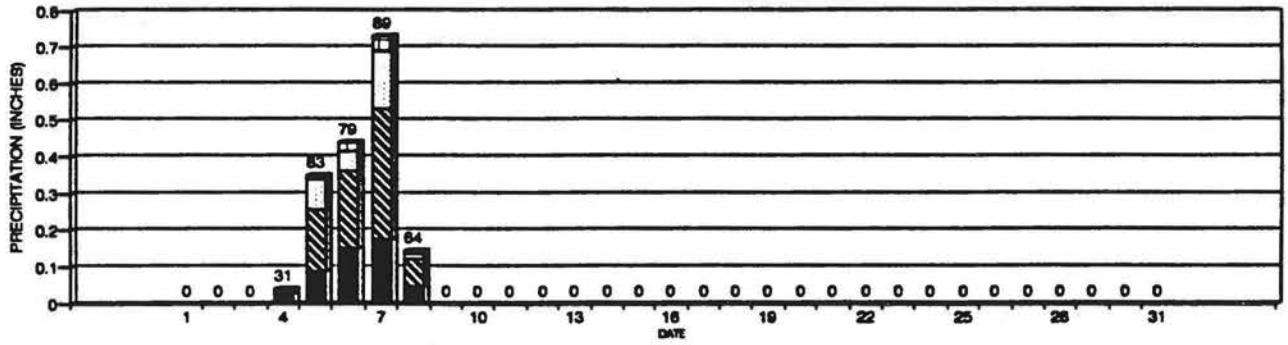


more precipitation than the June 1965 storms. While the quantities of rain were excessive and widespread, hourly rainfall rates were much lower and, being so early in the season, snowmelt was not a large factor. As a result, plenty of water tumbled down the Front Range rivers and streams making lots of people nervous, but flood damage was relatively minor. Three-day precipitation, May 5-7, 1969 produced a statewide figure of 1.50", slightly more than last August's heavy storm.

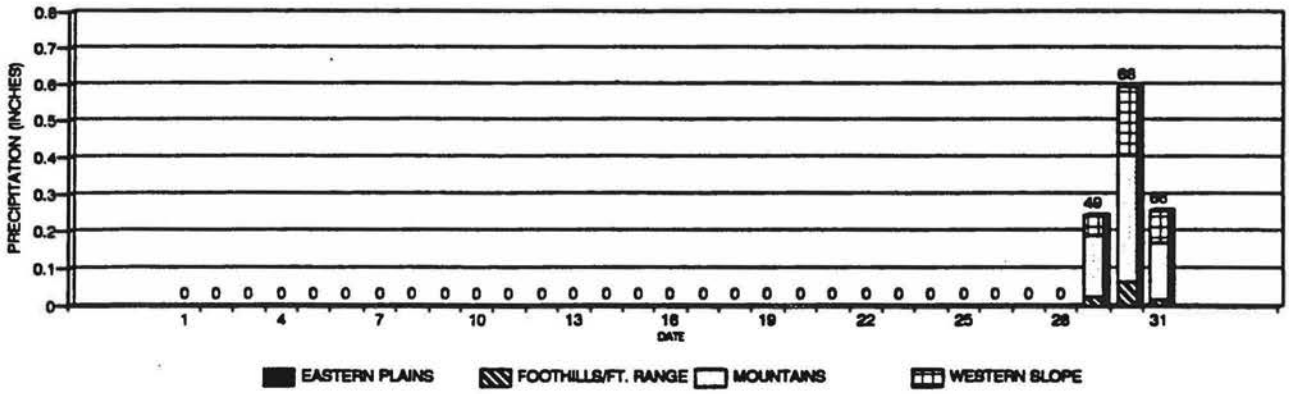
Finally, I've always wanted to learn more about the December 29-31 mountain snowstorm of 1951. Many of the reports we received this winter from the February 19-21, 1993 snowstorm and ensuing avalanche cycle, made it sound like this was among the worst storms to have ever hit our mountains. Indeed, it was similar to the 1951 storm in some ways, but as old-timers may have recalled, the 1951 storm was indeed much worse. Both storms were concentrated from the mountains westward, included lower-elevation rains and produced only traces of moisture out on the plains. But when matched back to back, the 1951 storm dropped more than twice as much precipitation as this year's storm with a 3-day statewide total of 1.10" compared to 0.48" from February 19-21, 1993. Please note on the graph below that I did not analyze daily precipitation for the whole month, but only for the storm days in question.

We hope to continue to produce Colorado Daily Precipitation graphs, and I hope they are as informative for you as they are to us. In time, perhaps we can construct more views of the past, but don't stay up waiting for them. A lot of Colorado's older daily precipitation data have never been computerized, so this becomes a time-consuming task. If you have any questions, please feel free to give us a call or drop us a note. If there was a particular large-scale storm or drought that you have studied, please bring it to my attention and perhaps I can work it up.

COLORADO DAILY PRECIPITATION - MAY 1969



COLORADO DAILY PRECIPITATION - DEC 1951

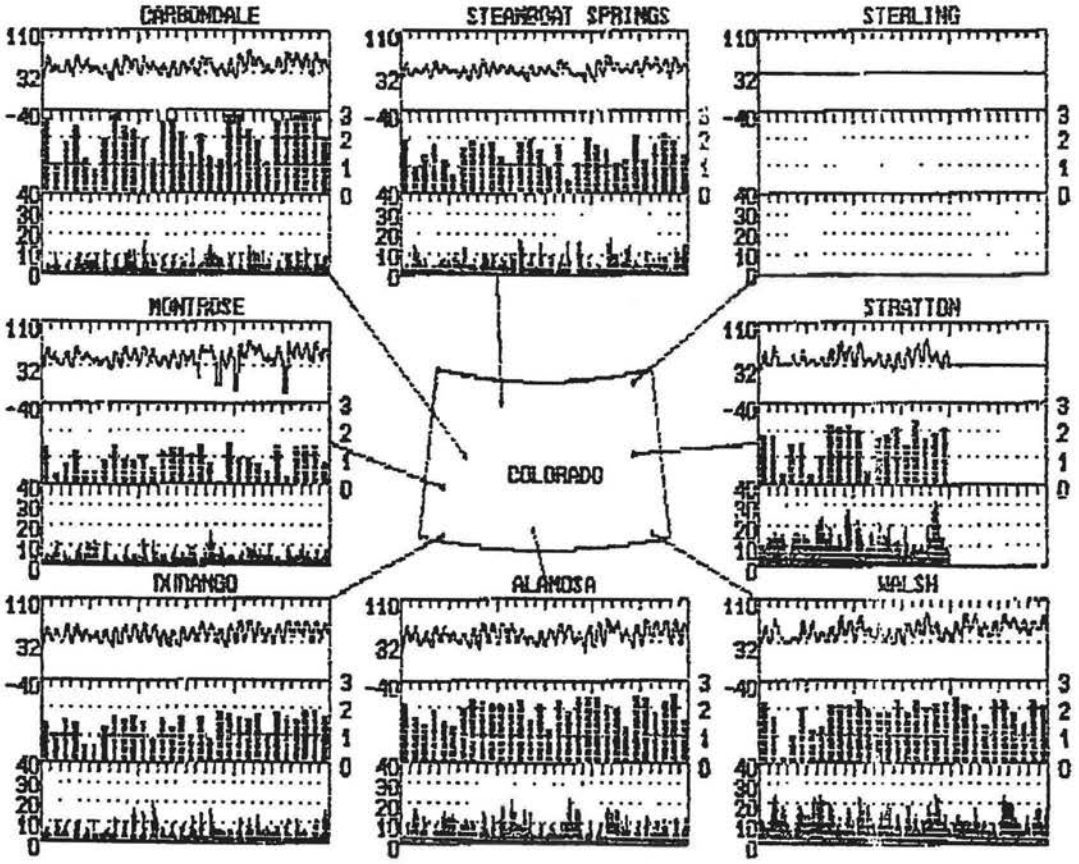


WTHRNET WEATHER DATA APRIL 1993

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	43.2	43.1	42.8	45.8	37.4	32.0	38.7	50.5
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	72.5 22/13	68.7 22/16	71.6 22/14	72.3 22/13	65.5 22/14	32.0 1/ 1	75.6 18/14	82.2 26/15
minimum:	12.7 20/ 5	20.1 14/ 6	19.4 8/ 6	n/a n/a	16.7 14/ 6	32.0 1/ 1	21.4 15/ 5	23.7 15/ 3
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	64 / 29	70 / 30	86 / 33	62 / 31	96 / 29	0 / 32	50 / 32	68 / 39
11 AM	25 / 52	40 / 51	55 / 49	48 / 47	71 / 42	0 / 32	35 / 43	39 / 58
2 PM	20 / 57	33 / 56	44 / 53	37 / 52	62 / 46	0 / 32	27 / 47	27 / 63
5 PM	25 / 55	30 / 56	45 / 52	37 / 56	58 / 47	0 / 32	27 / 46	26 / 62
11 PM	39 / 40	52 / 39	65 / 40	52 / 42	84 / 35	0 / 32	47 / 35	53 / 45
monthly average wind direction (degrees clockwise from north)								
day	216	190	251	241	215	0	75	185
night	194	97	208	182	139	0	113	209
monthly average wind speed (miles per hour)	6.76	4.57	3.81	4.08	4.03	0.00	7.58	10.50
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	162	307	370	291	326	720	266	26
3 to 12	458	380	339	426	343	0	257	448
12 to 24	100	33	7	3	27	0	183	244
> 24	0	0	0	0	0	0	14	2
monthly average daily total insolation (Btu/ft²·day)	1927	1393	2089	982	1474	0	1222	1839
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	206	10	75	38	122	0	110	182
40-60%	85	223	61	61	106	0	43	82
20-40%	52	105	75	102	95	0	35	63
0-20%	20	51	25	159	62	0	49	37

The State-Wide Picture

The figure below shows monthly weather at NTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

MAY 1993

Volume 16 Number 8

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

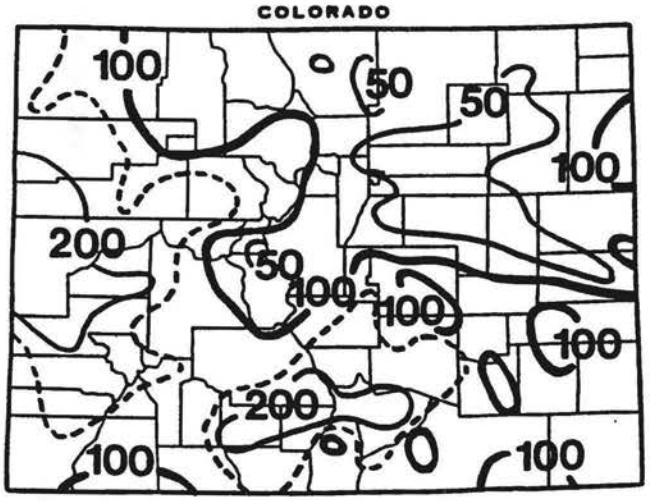
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

May Climate in Perspective – Thundery with Melting Snow

Large widespread storm systems early in May, complete with strong winds, cold temperatures and snow, gave way to summerlike weather the last half of the month with numerous daily thundershowers. Several reports of hail and tornadoes were confirmed late in the month, but little damage was reported. Warm temperatures in the mountains throughout late May were accompanied by local heavy thunderstorms. Colorado's many rivers ran very high, and some sloshed out of their banks on the Western Slope.

Precipitation

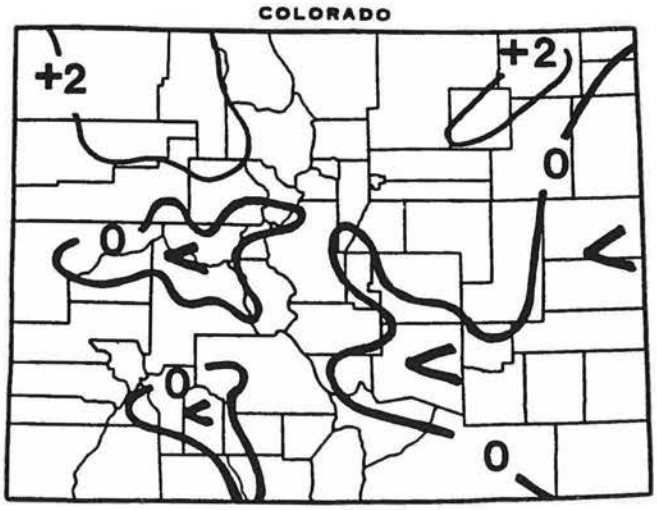
There were opportunities for precipitation somewhere in Colorado nearly every day during May. Western Colorado received the greatest quantities during the first 18 days of the month. Then the liveliest storms shifted their attention to eastern Colorado. Precipitation totals ended up much above average over most of western and south-central Colorado. The 4.07" total at Colorado National Monument was by far their greatest May total on record. Eastern Colorado also had frequent precipitation opportunities, but accumulations were not so impressive. Denver reported 15 days with measurable rain but only 38% of their normal total rainfall. Most of northeast Colorado ended up considerably drier than average.



May 1993 precipitation as a percent of the 1961-1990 average.

Temperatures

There were no unusual extremes or persistence of either warm or cold temperatures in May. After some cool periods in early May, temperatures generally remained on the mild side for the rest of the month. In particular, nighttime temperatures stayed warm resulting in no late freezes for Colorado's farmlands and allowing rapid snowmelt from the mountains. May temperatures ended up a little below average across southeast Colorado and parts of the mountains. Warmer than average temperatures were the rule across most of northern Colorado.



Departure of May 1993 temperatures from the 1961-90 averages.

Inside This Issue

MAY 1993 DAILY WEATHER

1-3 A spring storm crossed southern Colorado on the 1st accompanied by cold rains, chilling winds and some snow. Walsenburg received 9" of wet snow and Canon City had more than 1". Northern Colorado stayed dry. Skies cleared on the 2nd, and some of the coldest temperatures of the month were observed. Climax reported subzero readings, while the Eastern Plains experienced their last widespread killing freeze of the season. Temperatures began to warm on the 3rd, and a few convective sprinkles developed.

4-9 Colorado enjoyed a warm, dry day on the 4th, but a major storm began delivering rain to western counties by evening. A deep low pressure area traversed Colorado on the 5th accompanied by rain and snow over western Colorado and very strong winds with local blowing dust over the remainder of the State. Ouray received 9" of wet snow. Big thunderstorms developed near the Kansas border as drier air swept in. The weather remained chilly and unsettled on the 6th. Then a secondary disturbance spread more rain and snow into western Colorado on the 7th. Glenwood Springs received 0.88" of moisture. It was cool and showery statewide on the 8th as a large low pressure trough lingered overhead. Crested Butte awoke to a 12°F temperature that morning. Skies gradually cleared on the 9th, but chilly temperatures remained and some convective showers still developed.

10-14 Bright sunshine and rising temperatures embraced Colorado on the 10th, but the remnants of the previous storm backed into eastern Colorado with clouds, cool temperatures and a few showers 11-12th. At the same time, western Colorado enjoyed sunshine and very warm temperatures (83° at Grand Junction) which quickly accelerated the spring snowmelt. All portions of Colorado were clear to partly cloudy and warm 13-14th, but a few afternoon thundershowers developed.

15-18 A subtle combination of Pacific moisture, a weak upper disturbance and abundant low-level moisture east of the mountains allowed slow-moving thunderstorms to develop across most of the State in what otherwise looked like a warm and quiet weather pattern. Surprisingly heavy storms were observed on the Western Slope. Flash flooding occurred near Rifle on the 16th. Fruita reported 1.45" of rain at their morning observation on the 17th, and 1.90" was reported at Colorado National Monument – the 2nd greatest 24-hour rainfall total in that station's 52-year history. Local storms gave way to more gentle but widespread rains and cool temperatures on the 17th affecting all of Colorado except the northeast plains. More than 1" of moisture fell at some locations along the southern Front Range. Drier and warmer weather returned on the 18th.

19-23 Typical May weather brought scattered thundershowers each day, some containing small hail, most numerous east of the mountains. Storms strengthened on the 22nd as a Pacific cold front crossed the State and diminished somewhat on the 23rd as drier air moved into western Colorado. There were still some strong storms on the 23rd in southeastern Colorado.

24-25 High pressure north of Colorado pushed cool but moist air into eastern Colorado. Numerous thunderstorms erupted on the 24th and continued on the 25th in southern Colorado. Springfield 7WSW was soaked with 1.77" of rain, and Walsenburg added 1.47" with a report of a tornado near LaVeta.

26-27 With southwesterly flow aloft, eastern Colorado experienced the warmest weather so far this year. Denver hit 86° on the 26th and Holly's 95° on the 27th was the warmest in the State in May. But moisture slipped into western Colorado bringing significant rains and slightly cooler temperatures. Wolf Creek Pass 1E measured 1.15" of cold rain on the 27th, and Aspen had a 2-day total of 0.89".

28-31 Cooler air drifted into northeastern Colorado again, helping to trigger two days of severe weather with hail and tornado reports. Greeley reported 0.92" of rain on the 28th, and many people (including me) observed a weak tornado near Loveland. More warnings were issued as storms erupted on the 29th. Drier air then inhibited storm development 30-31st, but a few storms formed over the plains. Very warm weather in the mountains resulted in rapid snowmelt and gushing rivers. Many rivers reached their highest levels in several years.

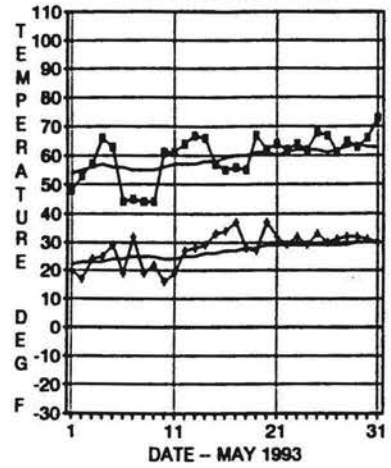
Weather Extremes

Highest Temperature	95°F	May 27	Holly
Lowest Temperature	-8°F	May 1	Climax
Greatest Total Precipitation	5.03"		Walsenburg
Least Total Precipitation	0.37"		Leadville 2SW
Greatest Total Snowfall	22"		Wolf Creek Pass 1E
Greatest Snow Depth	73"	May 9	Wolf Creek Pass 1E

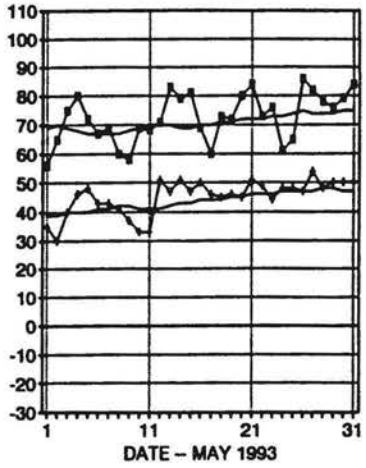
MAY 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

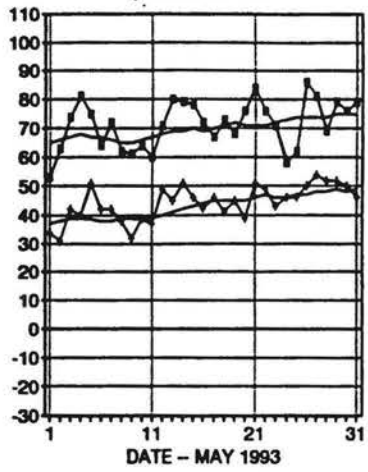
GRAND LAKE 1NW



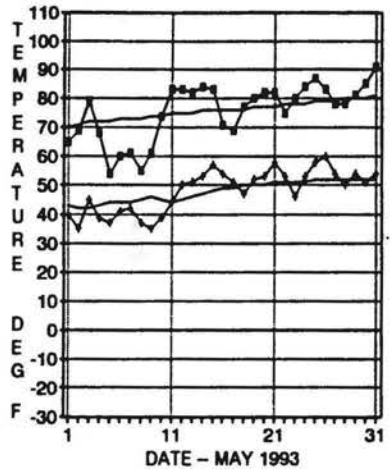
DENVER



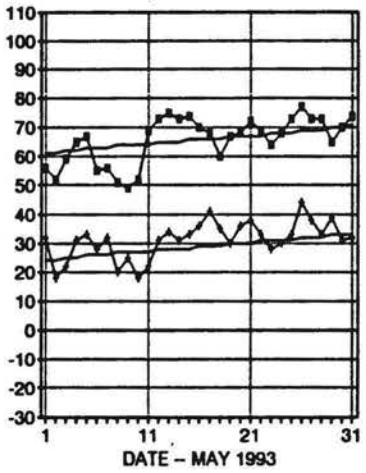
AKRON 1N



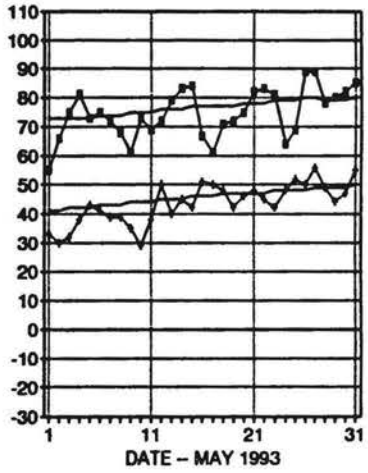
GRAND JUNCTION



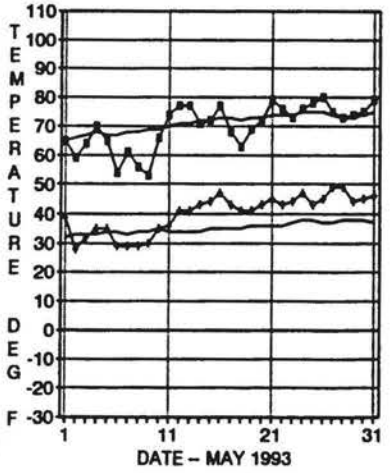
GUNNISON (COCHETOPA CRK.)



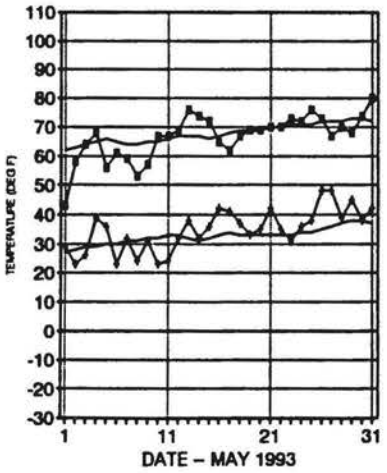
PUEBLO WSO



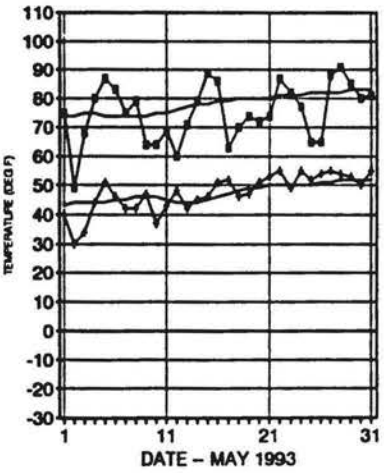
DURANGO



ALAMOSA



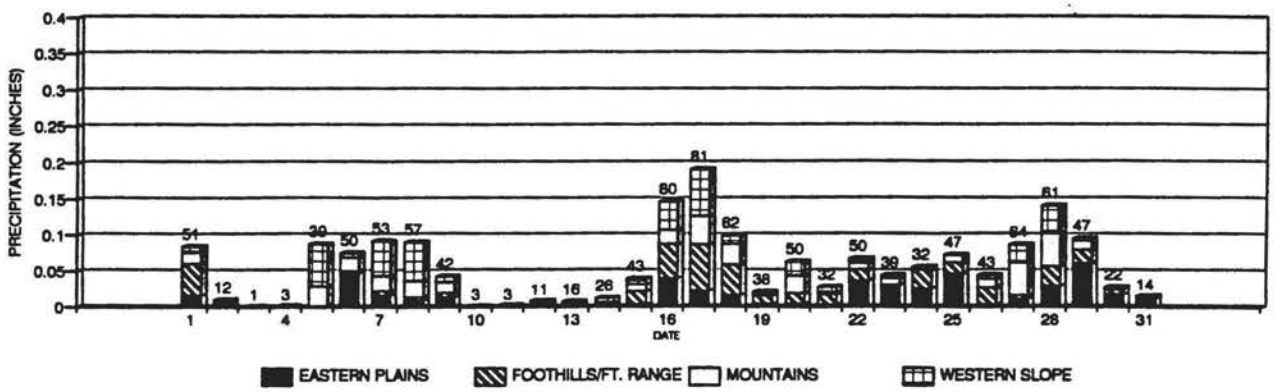
LAMAR



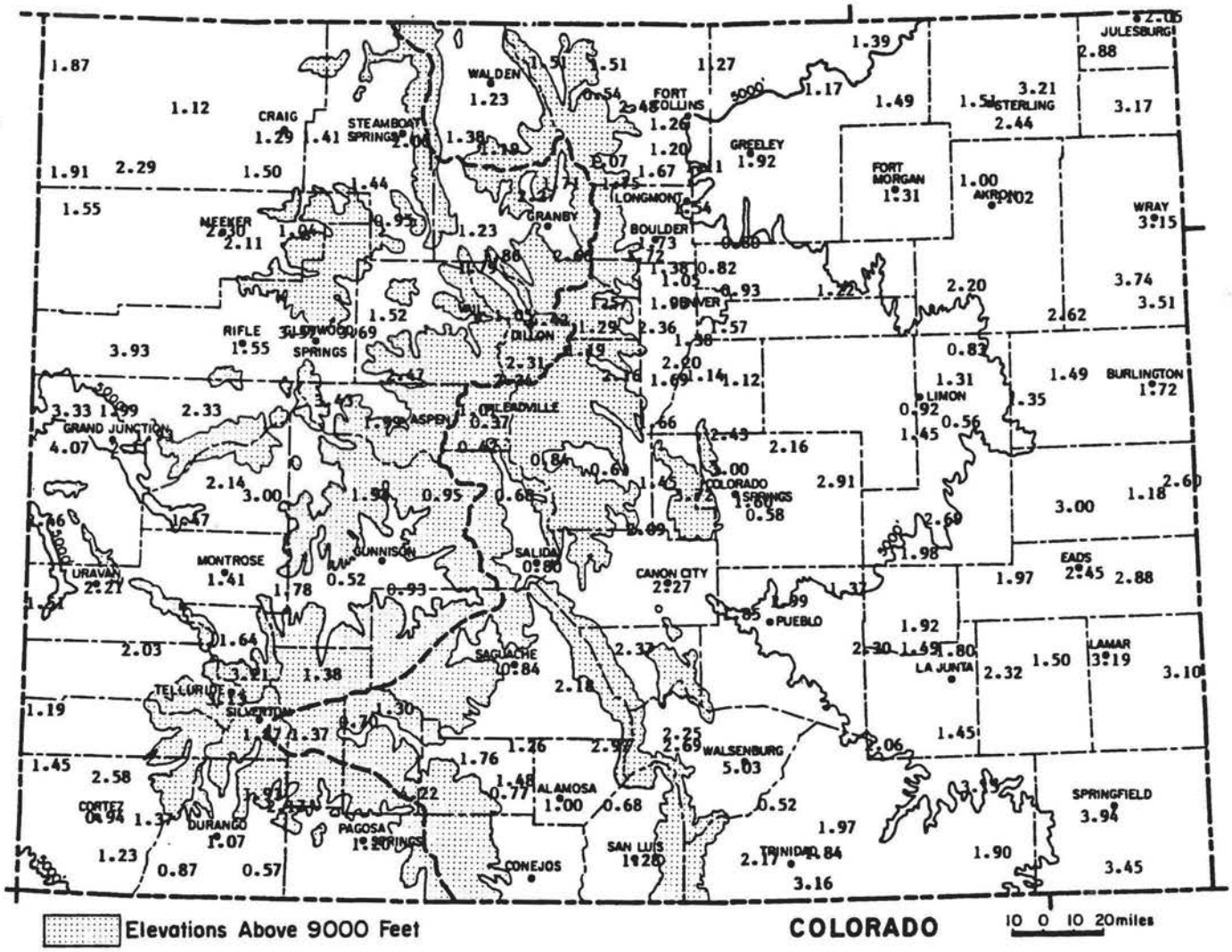
MAY 1993 PRECIPITATION

Statewide precipitation in May averaged about 1.66". The heaviest widespread storm episodes were May 5-8th and 15-18th. These accounted for much of May's moisture across the western half of Colorado. But a persisting pattern of low pressure west of California and high pressure east of Colorado during the last 13 days of the month encouraged scattered showers and thunderstorms to develop each day, some of which were locally heavy.

COLORADO DAILY PRECIPITATION - MAY 1993

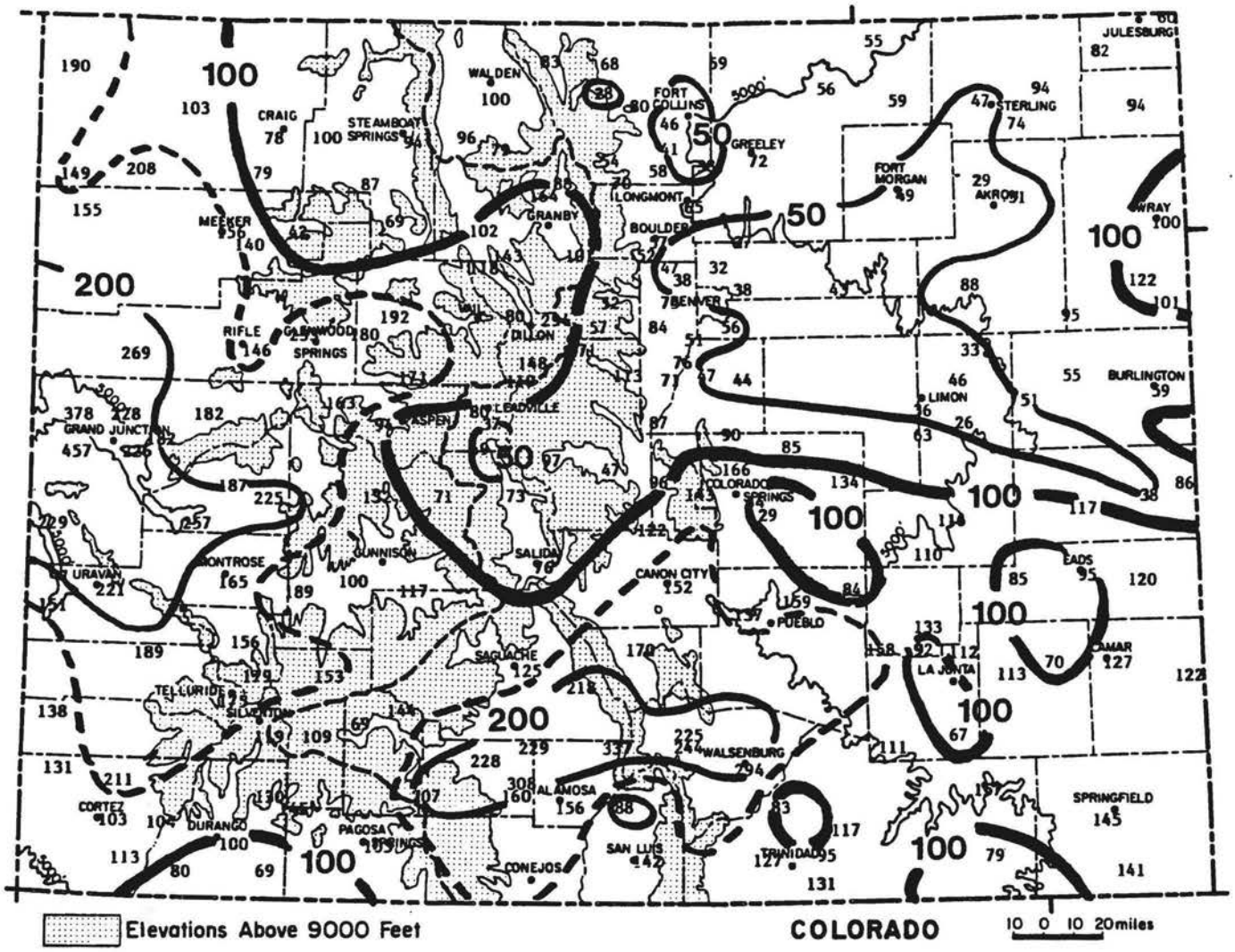


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

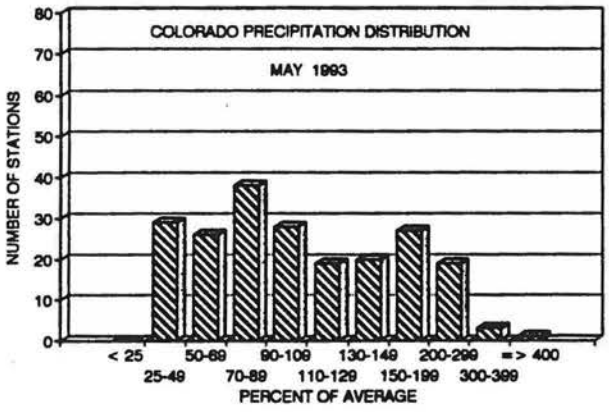


Precipitation Amounts (in inches) for May 1993.

MAY 1993 PRECIPITATION COMPARISON



May 1993 Precipitation as a Percent of the 1961–90 average.



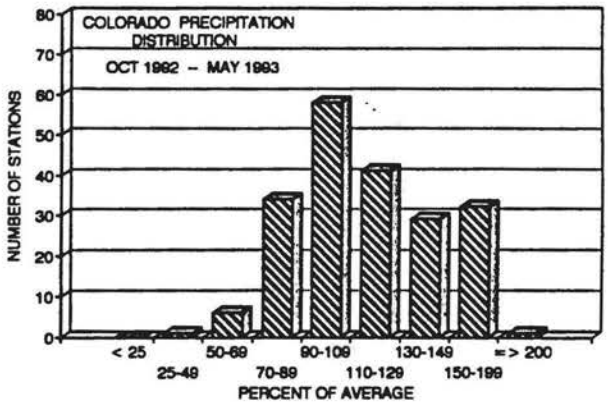
As is often the case, there was a wide range in precipitation across Colorado in May ranging from close to 25% of average east of Denver to nearly 400% of average near Grand Junction. Overall, drier and wetter than average areas were about equal across Colorado, but dry reporting stations outnumbered the wet ones.

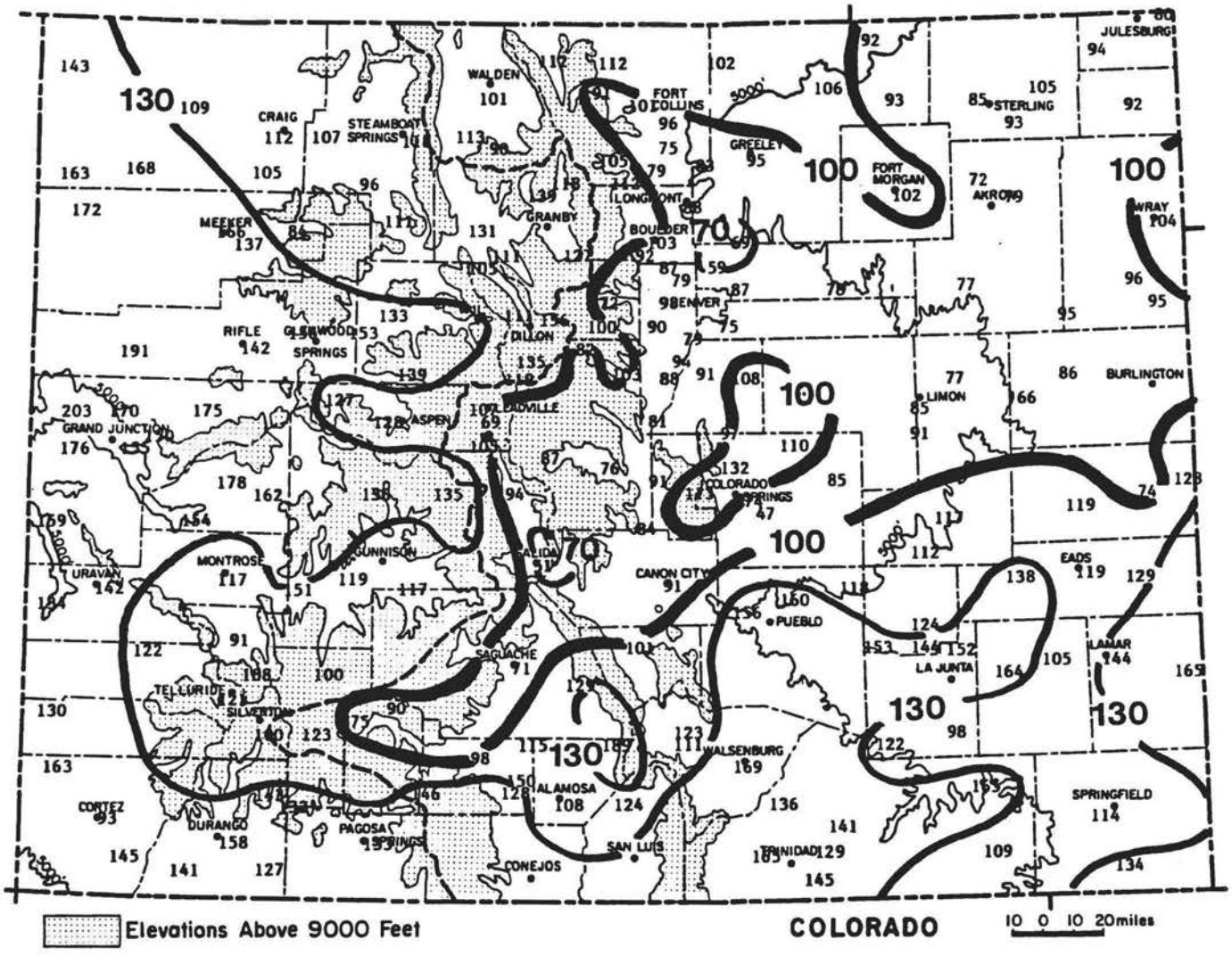
MAY 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.93"	19th driest in 122 years of record (driest = 0.06" in 1974)
Durango	1.07"	43rd wettest in 99 years of record (wettest = 3.72" in 1947)
Grand Junction	1.99"	2nd wettest in 102 years of record (wettest = 2.74" in 1906)
Las Animas	2.32"	46th wettest in 128 years of record (wettest = 5.63" in 1944)
Pueblo	1.99"	32nd wettest in 125 years of record (wettest = 5.43" in 1957)
Steamboat Springs	2.00"	39th wettest in 87 years of record (wettest = 5.42" in 1981)

1993 WATER YEAR PRECIPITATION

Colorado's precipitation totals this water year are near or well above average over much of the State. For the mountains and Western Slope, this is the most optimistic water supply situation since the mid 1980s. Nearly one quarter of the State, mostly in the west and south, has received more than 130% of average with locally nearly 200% of average near Grand Junction. This plentiful precipitation has helped to cause mudslides in several areas and to bring river levels to near flood stage. But at the same time, drier than average conditions have begun to expand across northeastern Colorado as spring rains there have been a little stingy. Dry areas also still remain in parts of central Colorado which were shielded from the onslaught of Pacific storms this past winter. Little adverse impacts from these dry conditions have been observed due to abundant surface water supplies and adequate carry-over soil moisture from the previous year.





October 1992–May 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR MAY 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637	1280	958	692	435		8774
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458	1325	1197	1039	901	557		8613
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921	1093	1130	958	697	519	233		5796
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211	1093	907	735	496		7463
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331	1103	773	531	219		6457
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064	885	668	482	199		5366
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179	991	776	558	286		6143
CORTEZ	AVE *	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051	880	760	578	282		6065
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408	1270	976	765	369		7874
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	10	71	301	919	1192	967	783	649	469	181		5367
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162	992	686	489	195		5923
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435	1273	1220	1011	693		9779
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152	966	768	569	302		6355
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387	1118	894	641	352		7401
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177	1083	879	722	479		7183
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239	1031	706	519	209		6198
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494	1202	789	509	156		6845
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018	799	597	446	144		5226

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949	648		9648
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348	1073	705	502	182		6100
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M	M	M	M	M		M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242	956	618	360	128		5758
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	91-92	343	369	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033	736		10051
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339	1118	850	615	335		6863
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347	1063	721	534	228		6492
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253	1117	859	644	335		6947
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023	873	687	571	241		5878
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291	1096	915	714	422		7682
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186	959	703	428	195		5880
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114	900	711	536	244		6009
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452	1240	1063	812	458		8562
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401	1188	739	501	162		6771
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1261	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193	1046	981	743	550		7636
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013	904	699	450	205		5594
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428	1313	1153	899	592		9269
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947	875	684	461	210		5171

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

MAY 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	68.1	38.7	53.4	-0.1	85	26	354	3	288	1.39	-1.11	55.6	7
STERLING	75.1	45.6	60.4	2.5	91	29	162	26	406	1.51	-1.66	47.6	8
FORT MORGAN	74.0	47.8	60.9	2.5	86	32	156	35	402	1.31	-1.33	49.6	6
AKRON FAA AP	71.4	44.2	57.8	1.3	86	31	225	10	344	1.00	-2.43	29.2	7
AKRON 4E	71.2	41.7	56.4	0.0	87	27	267	9	340	1.02	-2.23	31.4	8
HOLYOKE	70.6	46.3	58.4	-0.6	85	30	208	13	342	3.17	-0.19	94.3	10
JOES	71.4	43.0	57.2	-0.8	88	25	242	9	347	2.62	-0.13	95.3	9
BURLINGTON	71.5	44.8	58.1	-1.1	87	30	219	13	349	1.72	-1.19	59.1	11
LIMON WSMO	68.2	39.9	54.0	0.4	80	25	335	1	289	0.92	-1.58	36.8	15
CHEYENNE WELLS	72.5	44.3	58.4	-1.2	85	28	205	8	361	1.18	-1.85	38.9	8
EADS	73.4	46.6	60.0	-0.7	88	31	179	33	382	2.45	-0.12	95.3	5
ORDWAY 21N	74.6	43.9	59.3	0.3	88	26	191	18	394	1.98	0.19	110.6	11
ROCKY FORD 2SE	78.1	45.4	61.7	-0.4	91	28	135	39	444	1.49	-0.12	92.5	14
LAMAR	75.2	47.4	61.3	-1.2	91	30	146	41	414	3.19	0.69	127.6	14
LAS ANIMAS	77.4	47.7	62.6	-0.9	93	28	128	62	444	2.32	0.28	113.7	13
HOLLY	76.1	47.7	61.9	-0.1	95	32	137	49	425	3.10	0.57	122.5	13
SPRINGFIELD 7WSW	77.6	45.3	61.5	0.9	89	32	135	34	437	3.94	1.24	145.9	15
TIMPAS 13SW	74.6	46.2	60.4	-0.1	85	30	159	24	404	2.06	0.21	111.4	7

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	70.7	45.5	58.1	1.7	82	30	209	2	336	1.26	-1.43	46.8	15
GREELEY UNC	72.7	46.0	59.4	1.5	87	30	182	13	374	1.92	-0.74	72.2	13
ESTES PARK	62.2	37.1	49.6	1.4	74	22	468	0	202	1.07	-0.91	54.0	10
LONGMONT 2ESE	73.7	41.5	57.6	0.5	87	27	228	4	375	1.54	-0.80	65.8	11
BOULDER	70.5	44.5	57.5	0.5	83	32	233	4	333	1.73	-1.27	57.7	15
DENVER WSFO AP	72.6	45.0	58.8	1.6	86	30	195	10	361	0.93	-1.47	38.7	15
EVERGREEN	65.0	33.6	49.3	0.4	77	10	479	0	239	2.36	-0.42	84.9	14
CHEESMAN	67.5	29.3	48.4	-2.1	80	16	508	0	278	1.66	-0.23	87.8	9
LAKE GEORGE 8SW	60.1	33.7	46.9	1.0	75	22	552	0	168	0.61	-0.68	47.3	11
ANTERO RESERVOIR	60.5	29.2	44.8	1.8	70	12	616	0	179	0.84	-0.02	97.7	10
RUXTON PARK	48.9	26.9	37.9	-4.6	61	11	834	0	44	3.72	1.13	143.6	17
COLORADO SPRINGS	68.1	43.1	55.6	0.2	81	28	286	2	292	1.60	-0.55	74.4	15
CANON CITY 2SE	72.3	45.7	59.0	0.7	85	29	199	20	370	2.27	0.78	152.3	12
PUEBLO WSO AP	74.6	43.5	59.0	-2.0	89	29	195	18	394	1.99	0.74	159.2	12
WESTCLIFFE	64.2	31.7	48.0	-1.3	77	19	522	0	233	2.37	0.98	170.5	10
WALSENBURG	71.9	44.2	58.0	0.3	83	28	210	4	353	5.03	3.32	294.2	12

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	61.7	29.5	45.6	1.5	73	16	592	0	198	1.23	0.01	100.8	15
LEADVILLE 2SW	55.5	26.5	41.0	1.2	68	14	736	0	116	0.37	-0.63	37.0	10
SALIDA	68.5	36.5	52.5	0.5	80	22	381	0	296	0.80	-0.25	76.2	7
BUENA VISTA	65.8	34.8	50.3	0.3	75	24	446	0	255	0.68	-0.25	73.1	7
SAGUACHE	65.2	35.7	50.5	0.5	77	22	445	0	243	0.84	0.17	125.4	10
HERMIT 7ESE	52.2	25.6	38.9	-2.6	71	16	801	0	102	0.70	-0.31	69.3	3
ALAMOSA WSO AP	66.7	34.8	50.8	0.4	80	23	435	0	270	1.00	0.36	156.2	13
STEAMBOAT SPRINGS	65.2	34.7	49.9	2.1	77	24	458	0	248	2.00	-0.11	94.8	17
YAMPA	63.6	38.6	51.1	4.3	76	23	424	0	222	0.95	-0.42	69.3	8
GRAND LAKE 1NW	59.7	27.8	43.8	1.0	73	16	648	0	170	1.71	-0.22	88.6	21
GRAND LAKE 6SSW	58.7	30.2	44.5	0.8	73	19	628	0	155	2.27	0.89	164.5	21
DILLON 1E	56.0	28.8	42.4	0.3	67	16	693	0	122	1.05	-0.26	80.2	10
CLIMAX	49.1	19.7	34.4	-0.8	58	-8	939	0	38	2.14	0.26	113.8	10
ASPEN 1SW	62.0	31.5	46.7	-0.3	82	18	557	0	206	2.42	0.32	115.2	18
CRESTED BUTTE	56.1	27.9	42.0	-1.2	68	12	706	0	122	1.94	0.48	132.9	14
TAYLOR PARK	53.9	25.0	39.4	-0.8	67	12	783	0	97	0.95	-0.37	72.0	7
TELLURIDE	62.5	31.5	47.0	0.5	72	20	550	0	204	3.13	1.35	175.8	18
PAGOSA SPRINGS	67.6	34.8	51.2	2.0	78	23	422	0	282	1.20	0.06	105.3	13
SILVERTON	56.6	28.2	42.4	-0.2	67	16	693	0	128	1.87	0.31	119.9	15
WOLF CREEK PASS 1	48.7	26.7	37.7	-1.5	60	10	839	0	45	4.22	2.19	207.9	16

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	66.8	39.2	53.0	2.5	79	28	364	0	269	1.29	-0.36	78.2	13
HAYDEN	68.9	38.9	53.9	2.2	84	26	338	0	302	1.41	0.01	100.7	12
MEEKER NO. 2	68.7	39.2	54.0	2.5	81	27	335	0	299	2.30	0.83	156.5	16
RANGELY 1E	71.0	44.0	57.5	0.8	82	31	237	11	339	1.55	0.55	155.0	10
EAGLE FAA AP	70.1	36.6	53.4	2.2	82	24	352	0	320	1.52	0.73	192.4	14
GLENWOOD SPRINGS	68.6	40.4	54.5	-0.1	80	29	318	0	296	3.57	2.04	233.3	15
RIFLE	73.1	40.7	56.9	1.3	88	28	244	2	367	1.55	0.49	146.2	12
GRAND JUNCTION WS	75.6	48.2	61.9	-0.1	91	35	144	56	435	1.99	1.12	228.7	11
CEDAREDGE	72.8	36.7	54.8	-1.8	85	24	310	0	362	2.14	1.00	187.7	9
PAONIA 1SW	71.9	43.7	57.8	0.7	85	29	221	4	350	3.00	1.67	225.6	14
DELTA	74.8	44.7	59.8	0.4	88	23	181	24	403	1.47	0.90	257.9	10
COCHETOPA CREEK	65.7	31.2	48.5	2.1	77	18	507	0	252	0.93	0.14	117.7	10
MONTROSE NO. 2	70.8	43.7	57.2	0.0	82	32	241	8	337	1.41	0.56	165.9	7
URAVAN	77.5	46.4	62.0	0.8	88	33	138	48	445	2.21	1.21	221.0	14
NORWOOD	67.4	38.3	52.9	1.6	84	24	368	0	276	2.03	0.96	189.7	8
YELLOW JACKET 2W	70.4	40.5	55.5	1.4	82	27	289	0	323	1.45	0.35	131.8	10
CORTEZ	72.5	39.0	55.8	2.4	84	27	282	3	359	0.94	0.03	103.3	12
DURANGO	70.0	40.0	55.0	1.5	80	28	302	0	319	1.07	-0.00	100.0	12
IGNACIO 1N	69.7	35.4	52.6	-0.3	81	24	377	0	315	0.57	-0.25	69.5	10

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

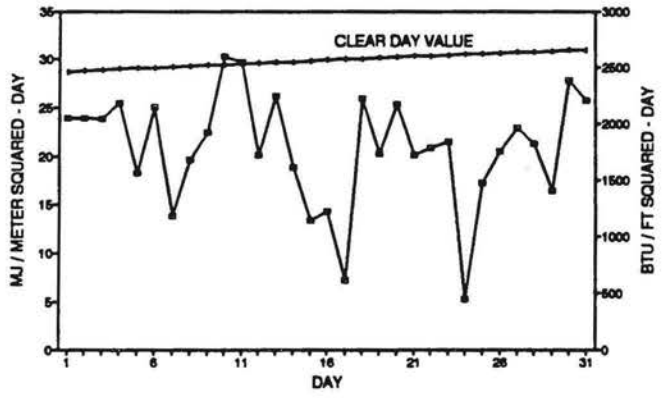
MAY 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	NA	NA	NA	--	--
Denver	6	13	12	53%	65%
Fort Collins	3	20	8	--	--
Grand Junction	14	7	10	85%	73%
Limon	5	11	15	--	--
Pueblo	NA	NA	NA	75%	74%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

Clouds developed most days during May, with the greatest cloudiness east of the mountains – normal for the spring months. Solar radiation ranged from near or somewhat more than average over western Colorado to near or less than average in the east.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
MAY 1993

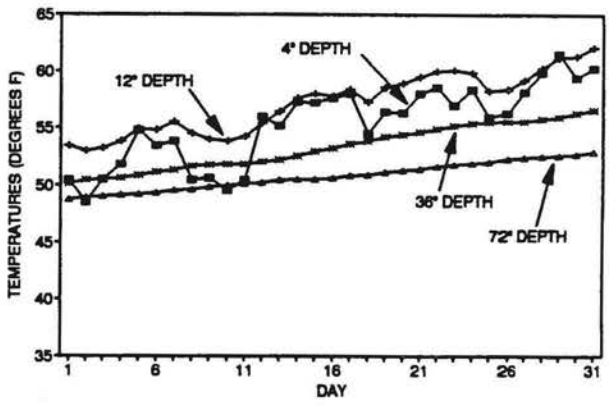


MAY 1993 SOIL TEMPERATURES

Soil temperatures at all measured depths moved upward in May. Deep soil temperatures showed a steady incline while near-surface soil temperatures responded to the observed fluctuations in air temperature.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
MAY 1993



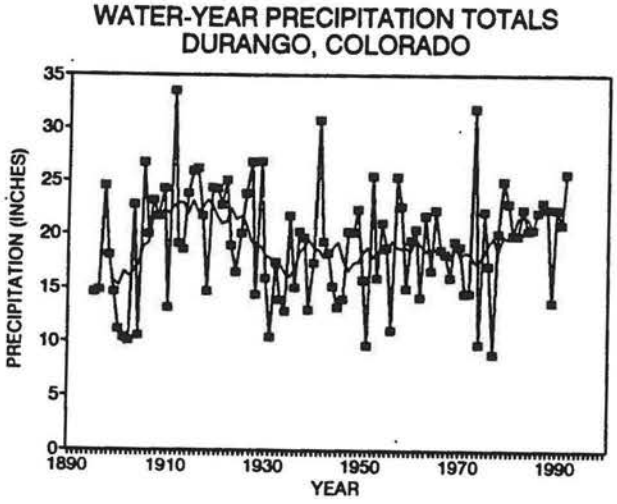
HATS OFF TO: *Telluride Weather Observers*

William Mahoney retired this month after more than 20 years of recording Telluride's temperatures, precipitation and snowfall. During his observing career, he measured a total of 4873 inches of snowfall at his station. He also enjoyed many days of sunshine. Thanks so much for your service. We will miss you.

CLIMATE VARIABILITY – SOME MUSINGS

Have you ever wondered why so many people don't go to bed at night until after they've watched the evening weather forecast on TV? Have you ever wondered why it seemed like our climate was changing long before scientists began making such a stink about global warming? Have you ever wondered why we still have weather stations to observe the weather and document the climate? Wouldn't you think after more than 100 years of taking observations here in Colorado that we would have it all figured out by now? Have you ever wondered why as you get older, it isn't at all obvious that you are actually getting wiser? Have you ever wondered why no two years are ever the same?

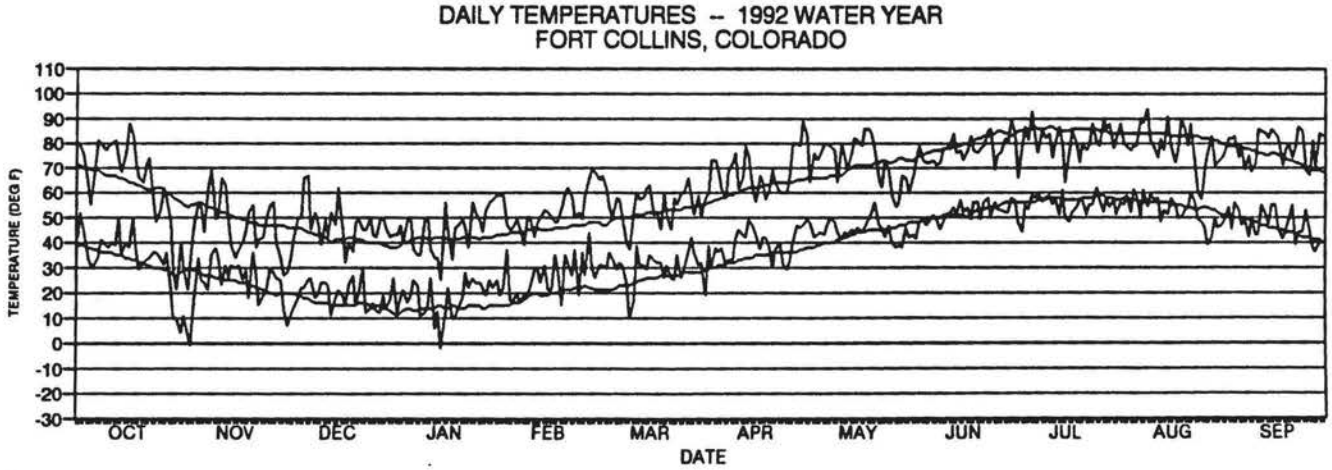
I wonder about these things a lot, and I think the answer lies somewhere hidden in the graphs below or on any other graph that shows the marvelous behavior of our climate.



The fact is that our weather changes day to day and our climate is variable. It probably always has been and it probably always will be. Despite these constant variations, many things remain certain and predictable – winters are colder than summers, water freezes at temperatures below 32°F, pressure decreases with increasing height, evaporation rates vary as a function of temperature, wind speed, humidity and solar radiation, etc., etc. Many physical rules govern the climate system, and they don't change. But the climate itself does vary, which means our climate is always changing. We're not the first people to ever recognize and wonder about that, either. Folklore and weather mythology has developed for centuries along with ancient civilizations as all humans before us have attempted to comprehend and explain those variations.

I've been an avid weather watcher since I was 5 years old. It was probably in my earliest observations of the annual cycle where I first came face to face with natural climate variability. The amazing process of the changing seasons, that annual progression that marks the passage of time for all of us, but which for children can open the door of curiosity to the entire natural world, is where we all learn about natural variability. Every year the same things happen – warmth, buds, blossoms, winds, leaves, rains, puddles, fruits, bugs, harvests, celebrations, preparations, then autumn chills, falling leaves, winter rest, survival, sometimes death – and then along comes the warmth again . . . and it all starts anew. Every time the cycle is the same and yet every time it is so different. And so I suppose by the time I was 6 or 7 I already understood climate variability and so did you. We didn't even need CD-ROMS, 200 megabyte hard drives, 486 processors and global data sets.

Well, as you can probably tell from these musings, I am just about ready to take a few weeks of vacation (and it sounds like I need one badly). When I return, I have all sorts of climate goodies to share with you. Drought studies, long-term changes in extreme high and low temperatures, soil temperature climatologies, snowpack variations and climate data for snow removal planning are just a few of the things that we will be writing about in **Colorado Climate** in the months ahead. Have a good summer, and sit back and enjoy climate variability!! After all, we all have to live with it. We might as well enjoy it.



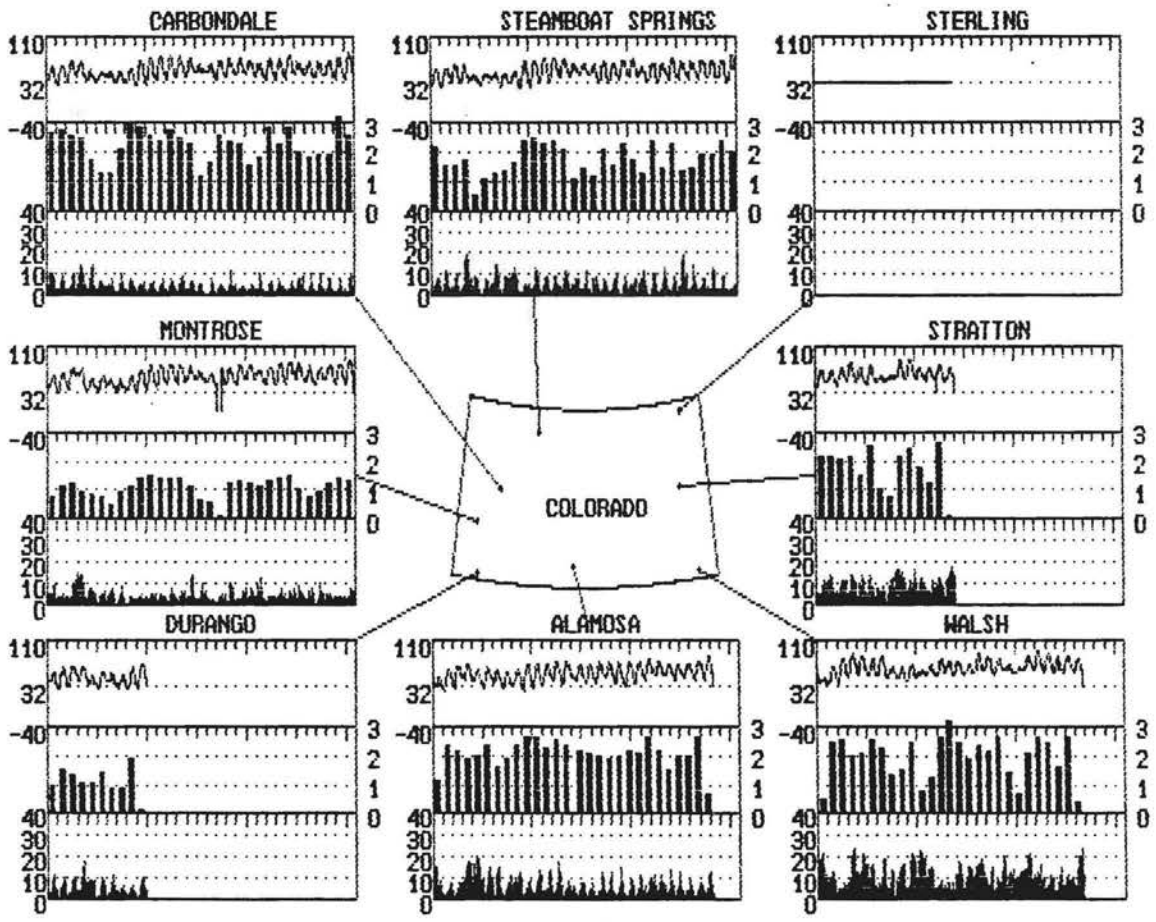
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

WTHRNET WEATHER DATA MAY 1993

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)	49.5	35.8	52.2	56.1	48.9	32.0	44.5	56.2
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	79.5 31/14	68.5 10/16	81.1 31/15	83.7 31/14	77.0 31/15	32.0 18/ 1	85.8 26/15	89.2 27/15
minimum:	22.5 10/ 5	25.3 2/ 5	25.0 2/ 6	-3.1 18/ 5	21.6 10/ 5	32.0 18/ 1	32.0 30/ 5	32.0 30/ 0
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	79 / 29	26 / 8	91 / 36	73 / 34	97 / 34	0 /-18	35 / 17	67 / 36
11 AM	27 / 24	17 / 10	51 / 41	43 / 40	56 / 42	0 /-18	24 / 22	38 / 35
2 PM	19 / 19	13 / 10	43 / 39	36 / 35	50 / 40	0 /-18	20 / 21	34 / 34
5 PM	22 / 20	13 / 9	43 / 38	36 / 35	50 / 40	0 /-18	21 /-21	31 / 31
11 PM	52 / 28	21 / 9	71 / 38	60 / 36	84 / 39	0 /-18	34 / 21	59 / 38
monthly average wind direction (degrees clockwise from north)								
day	173	62	241	249	216	0	55	131
night	162	32	190	153	117	0	89	191
monthly average wind speed (miles per hour)	5.15	1.45	2.81	3.64	3.52	0.00	3.66	8.73
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	256	604	491	351	403	744	426	128
3 to 12	430	134	245	379	311	0	272	396
12 to 24	58	6	4	14	14	0	46	219
> 24	0	0	0	0	0	0	0	1
monthly average daily total insolation (Btu/ft²•day)	1935	414	2242	1111	1747	0	850	1724
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	195	0	77	62	151	0	78	171
40-60%	99	59	79	82	116	0	37	81
20-40%	66	42	68	92	116	0	41	55
0-20%	18	39	25	186	51	0	36	54

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, up to 4000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

JUNE 1993

Volume 16 Number 9

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

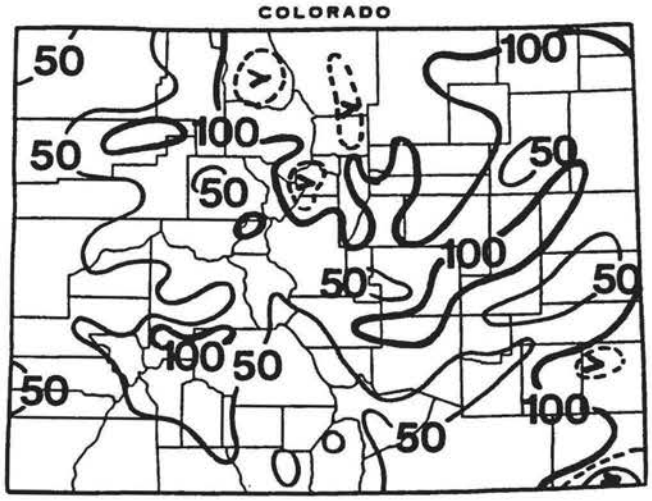
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

June Climate in Perspective – Summer Gradually Emerges

Springlike storm systems with strong winds and mountain snows made parts of June feel more like April or May. But episodes of severe thunderstorms, and a period of dry, hot weather late in June, assured us that summer had arrived. For the month as a whole, temperatures were cooler than average. Precipitation totals were mostly below average.

Precipitation

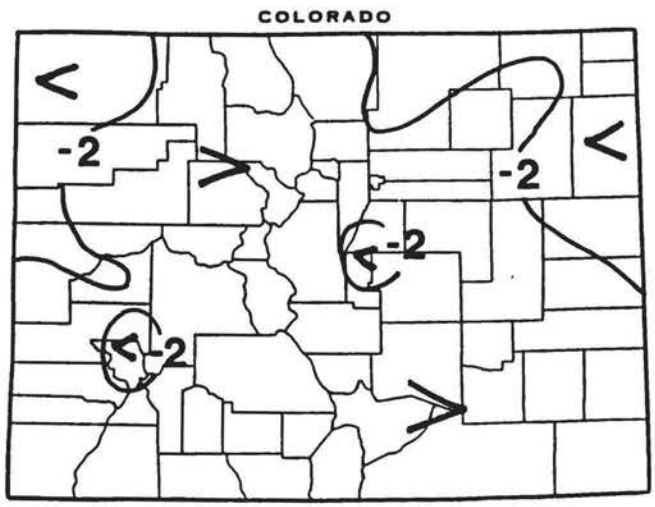
There were fewer days with measurable rainfall in June than average. Individual storms, however, were quite heavy. Overall, rainfall totals were very low across western Colorado and much greater but highly variable east of the mountains. Much of the Western Slope received less than 50% of average. Only 0.03" fell at Grand Junction. Much drier than average conditions were also found in the San Luis Valley and in portions of east central and northeast Colorado and the Pikes Peak area. Wetter than average conditions occurred in extreme southeast Colorado (4.27" at Lamar), along a narrow band from Canon City into western Kit Carson County and over a fairly large portion of the north Front Range and northern mountains (hit hard by the June 17-18th storm). Boulder totalled 3.38".



June 1993 precipitation as a percent of the 1961-1990 average.

Temperatures

June brought a combination of very warm and very cool days to Colorado with more dramatic daily changes than are often observed at this time of year. For the month as a whole, temperatures ended up one to three degrees Fahrenheit cooler than the 1961-1990 average over practically the entire State. The coolest areas, compared to average, were found in the northeastern and northwestern corner of the State. This is the second consecutive year with the summer getting off to a cool start. The previous three Junes (1989-1991) had each been warmer than average.



Departure of June 1993 temperatures from the 1961-90 averages.

Inside This Issue

JUNE 1993 DAILY WEATHER

1-4 June 1 was mild and mostly dry. Then a strong springlike storm system pushed in from the west and north. Thunderstorms, some heavy, dampened parts of northern and eastern Colorado on the 2nd. The storms strengthened overnight, surprising residents of the Front Range with crashing thunder and hail between midnight and 8 a.m. on the 3rd. In the mountains, rain changed to snow (4" at Leadville). Another round of storms developed during the day on the 3rd and spread across the Eastern Plains. Temperatures stayed in the 50s across much of northern Colorado on the 3rd. Precipitation ended, but clouds and cool temperatures remained on the 4th. Morning lows on the 4th were in the 20s in the mountains with low 40s across most low elevation areas. Rainfall totals for the entire period were locally heavy. 1.37" fell at Marvine Ranch (east of Meeker), 2.09" fell near New Raymer and 2.35" was reported south of Burlington. Meanwhile much of southwest Colorado received nothing. Hail reports were numerous including baseball-sized stones at Genoa and 5" of hail on the ground south of Burlington. Some small tornadoes were also spotted.

5-10 Pleasant weather on the 5th was followed by a new strong storm system pushing inland across California. Southwest winds aloft strengthened and a deep low pressure area formed. Winds gusted to 50 mph or more across western Colorado on the 6th, and temperatures in southeast Colorado shot up into the 90s. Showers developed on the Western Slope late in the day as a sharp cold front raced eastward. The Shoshone Power Plant (Glenwood Canyon) measured 1.08". After midnight, strong thunderstorms erupted along the Front Range, the 2nd siege of nocturnal storms in 4 days. Rains changed to snow in the mountains (4" at Breckenridge). Climax had a high of just 31° and a low of 17° (the coldest in the State in June). It was very blustery east of the mountains with many wind gusts over 40 mph. The weather 8-10th remained unsettled and much cooler than average as a trough of low pressure aloft lingered over the region. Scattered thundershowers developed each day over the mountains and east. Buena Vista totalled 0.55" of rain 9-10th. Mountain campers had to tolerate freezing nighttime temperatures.

11-14 Temperatures warmed 11-12th as dry, southwest winds aloft developed. Las Animas hit 102° on the 12th. Then a Pacific cool front crossed Colorado late in the day. Severe thunderstorms hit Julesburg and extreme northeast Colorado late that evening. It was dry and pleasant statewide on the 13th. A few storms developed in southeast Colorado early on the 14th, and patches of dense fog appeared. A few thunderheads billowed that afternoon, and temperatures west of the mountains shot up into the 90s.

15-19 Gusty winds and hot temperatures were the rule on the 15th. Denver hit 97°F. Scattered evening thunderstorms moved across the plains with local reports of hail and even a tornado near Holyoke. Winds and clouds increased on the 16th as a deep low pressure area developed. Scattered storms on the 16th turned into widespread rains early on the 17th across northeast Colorado as a very strong push of cold air moved down from the north. With moist easterly winds, it rained all day (17th) along the Front Range with temperatures only in the 50s. Late in the day, heavy thunderstorms spread over the northern mountains. Dillon recorded 1.20" of rain and hail in a few hours – one of their heaviest June rains on record. Chilly rain and drizzle continued on the 18th along the Front Range while strong storms hit portions of southeast Colorado. Lamar picked up 1.83" of rain in about an hour. 2.46" was reported at the Campo 7S station. After a chilly morning on the 19th, skies cleared and temperatures began moderating. Storm totals included 2.60" at Boulder and 4.99" at Campo 7S. The Mt. Evans Research Center picked up 2.53" including 3" of snow.

20-25 Seasonally warm with just some scattered late-day thundershowers 20-22nd. A Pacific cold front crossed Colorado 22-23rd bringing cool, low-humidity air but triggering severe storms in extreme eastern Colorado. Julesburg was hit hard late on the 22nd. There were numerous reports of large hail on the plains on the 23rd. Southeast Colorado had heavy rains after midnight early on the 25th (1.40" at Las Animas). Meanwhile the mountains enjoyed pleasant days but very chilly nights with lows in the 20s 24-25th. Several record low temperatures were set including Colorado Springs' 43° reading on the 24th.

26-30 Typical late-June weather with consecutive hot, dry days and just widely scattered late-day thundersprinkles. The hottest day for most of the State was the 29th. Las Animas was the hottest with 105°F, but many other locations from Sterling to Pueblo reached at least 100°F. Cooler, moister air returned on the 30th with an increase in thundershowers.

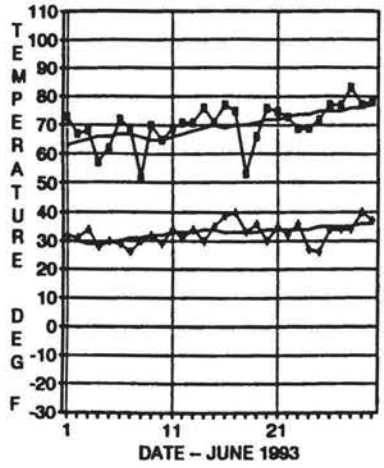
Weather Extremes

Highest Temperature	105°F	June 29	Las Animas
Lowest Temperature	17°F	June 7	Climax
Greatest Total Precipitation	6.16"		Campo 7S
Least Total Precipitation	0.03"		Grand Junction
Greatest Total Snowfall	8.6"		Mt. Evans Research Center
Greatest Snow Depth	15"	June 1	Climax

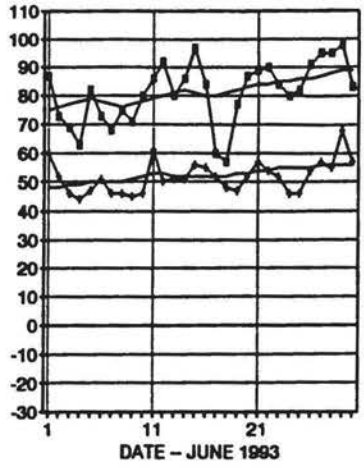
JUNE 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

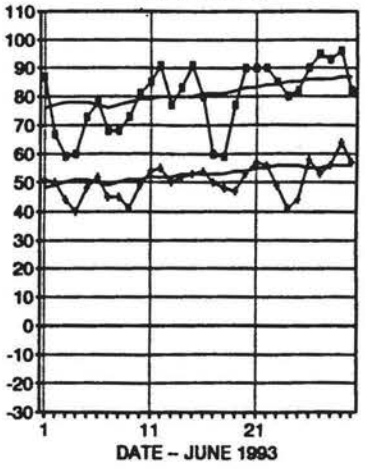
GRAND LAKE 1NW



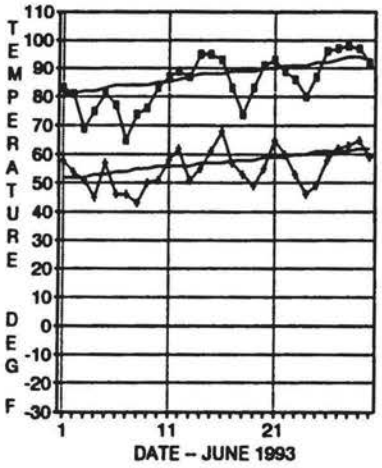
DENVER



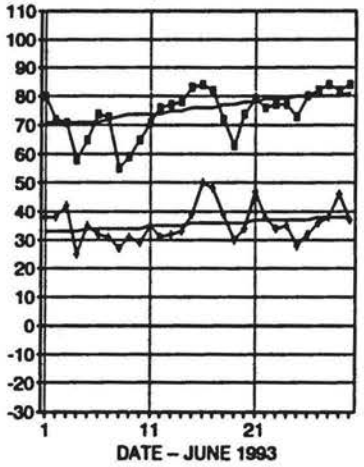
AKRON 1N



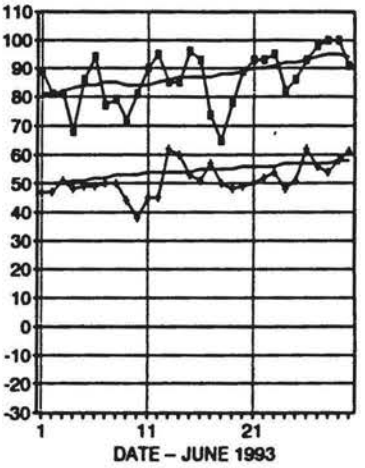
GRAND JUNCTION



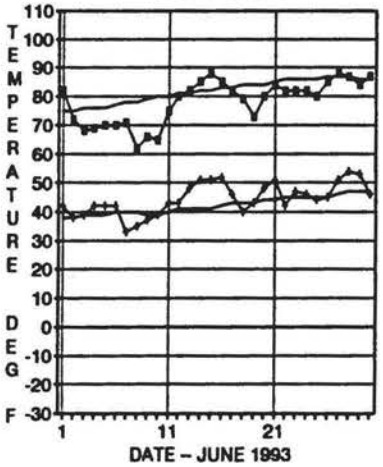
GUNNISON (COCHETOPA CRK.)



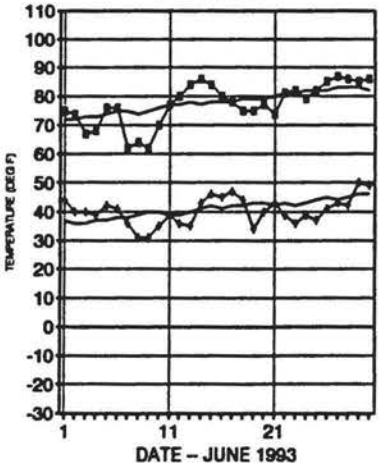
PUEBLO WSO



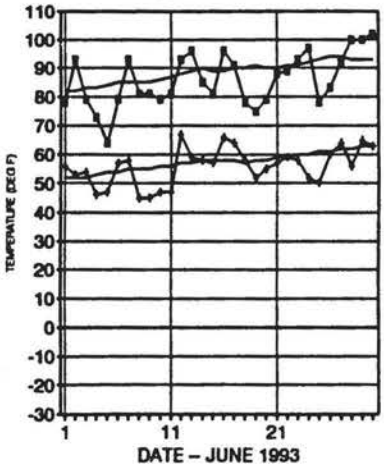
DURANGO



ALAMOSA



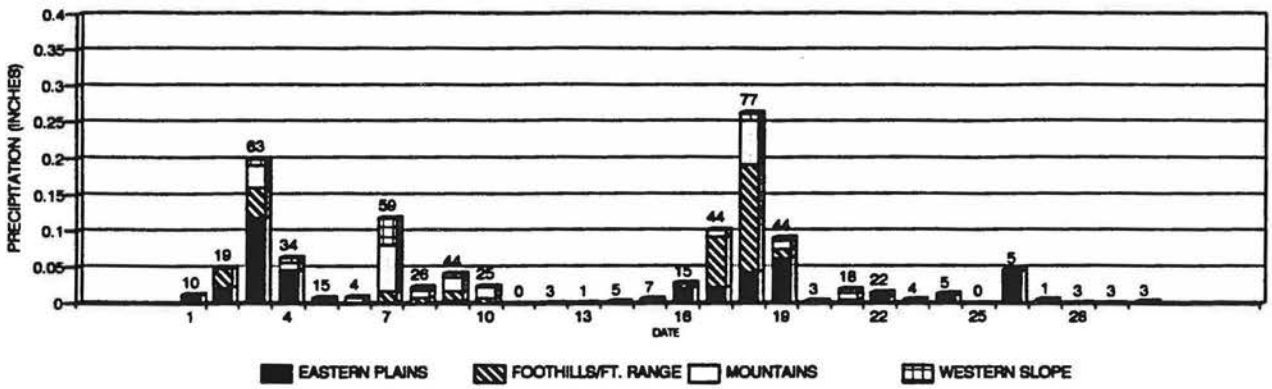
LAMAR



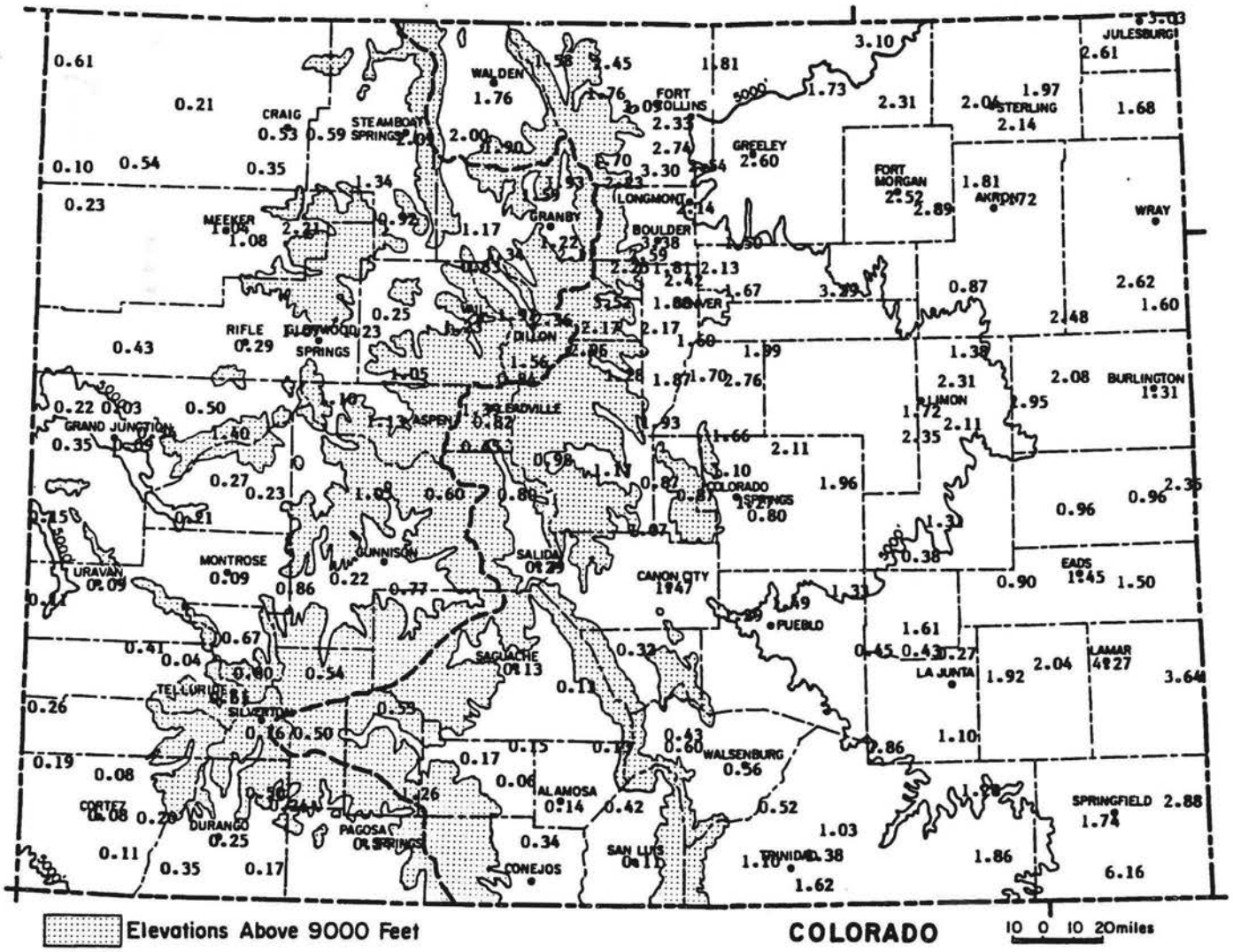
JUNE 1993 PRECIPITATION

Precipitation totalled slightly more than 1.10" (statewide composite) in June, considerably below average. Many days brought showers to localized areas of Colorado. There were very few days, however, with widespread precipitation. Storms June 2-3rd and 16-18th accounted for most of the months' moisture. Very little rain fell during the last 11 days of June, but historically this is a time when precipitation probabilities are diminished across much of Colorado.

COLORADO DAILY PRECIPITATION - JUN 1993

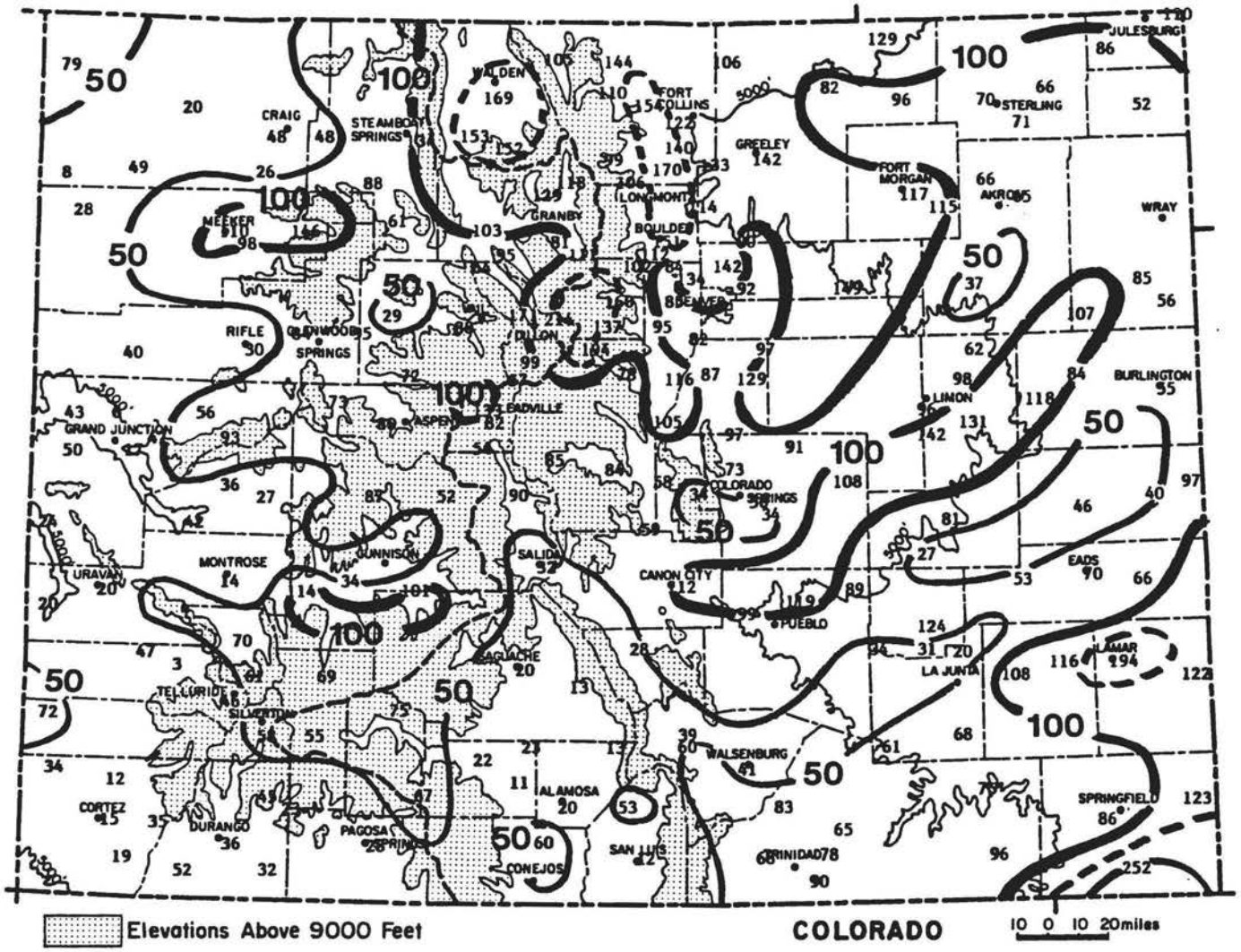


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

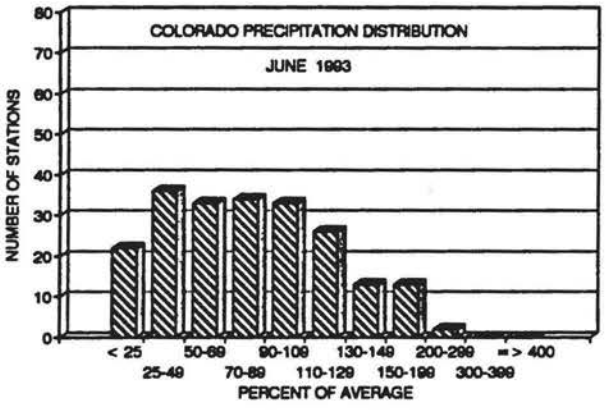


Precipitation Amounts (in inches) for June 1993.

JUNE 1993 PRECIPITATION COMPARISON



June 1993 Precipitation as a Percent of the 1961–90 average.



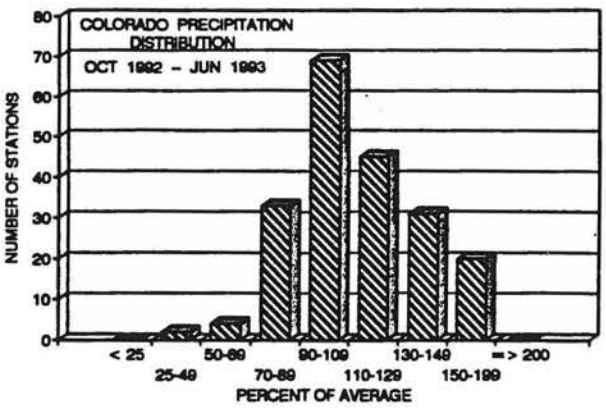
The majority of Colorado weather stations experienced drier than average weather conditions in June, especially in western Colorado. Dry Junes on the Western Slope are not rare. Durango's 0.25" total was just 36% of average. Still, they have been drier than this 30 times in the past 99 years.

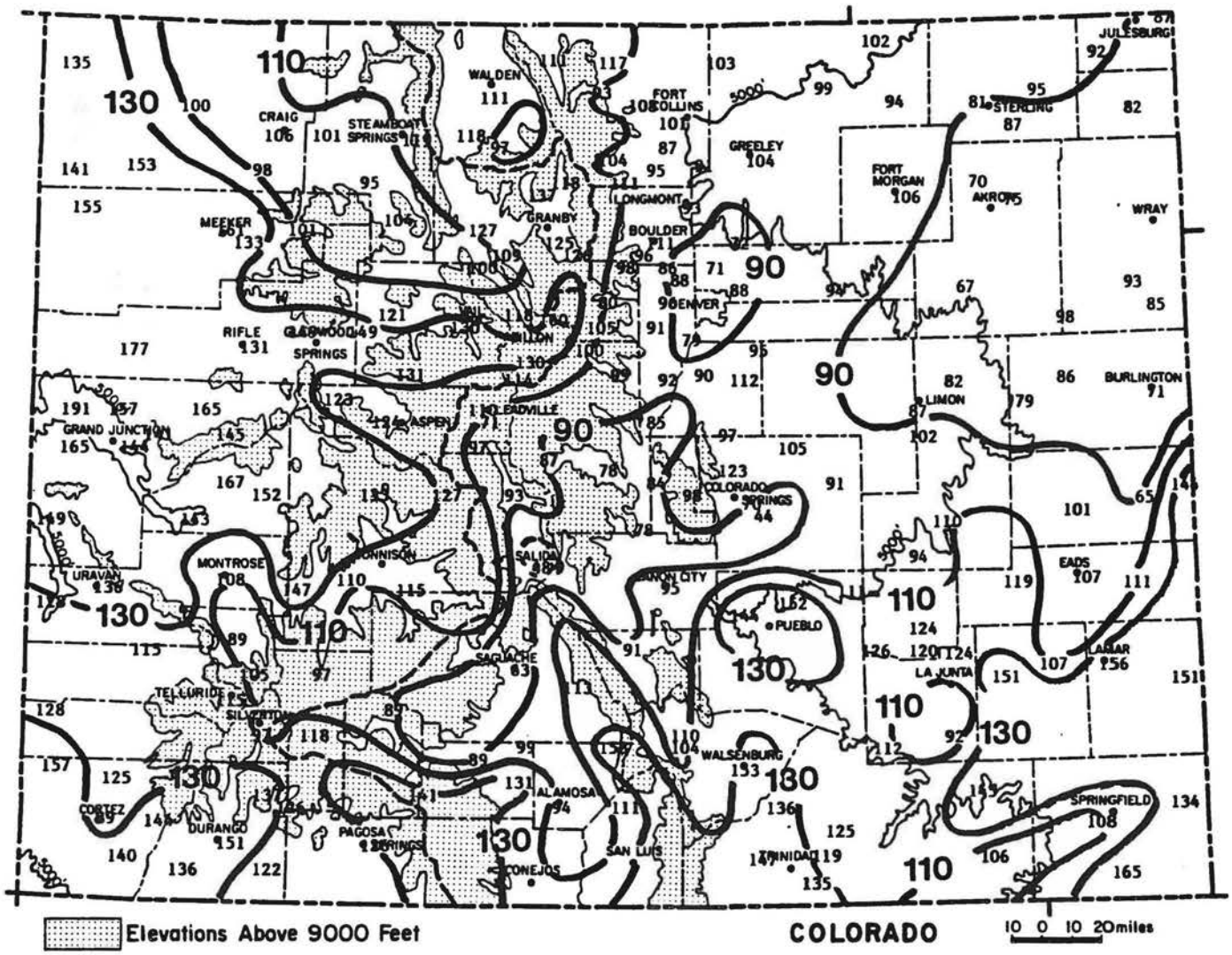
JUNE 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	1.67"	47th wettest in 122 years of record (wettest = 4.96" in 1882)
Durango	0.25"	31st driest in 99 years of record (driest < 0.01" in 1980 & 6 prior years)
Grand Junction	0.03"	11th driest in 102 years of record (driest = < 0.01" in 1980, 1961 and 1916)
Las Animas	1.92"	39th wettest in 128 years of record (wettest = 5.67" in 1965)
Pueblo	1.49"	41st wettest in 124 years of record (wettest = 7.14" in 1921)
Steamboat Springs	2.09"	23rd wettest in 87 years of record (wettest = 4.31" in 1945)

1993 WATER YEAR PRECIPITATION

Colorado's rivers and streams flowed high and fast in June, the greatest snowmelt runoff for the State since the mid 1980s. With cooler than average temperatures in June across Colorado, the snowmelt progressed steadily with no further flood peaks. Although June precipitation was less than average across most of Colorado (with the exception of parts of the Northern Mountains and most of the Front Range from Douglas County northward to Wyoming), few people noticed the dryness since surface water supplies were so abundant. In fact, predominantly dry weather has been sneaking into parts of Colorado for several months. For example, at the end of February, Durango was showing 200% of their average water year precipitation and was headed towards a new record. Since March 1, they have received 3.04" of additional precipitation, only 47% of average. For the first 9 months of the 1993 water year, precipitation totals are still well above average over most of western Colorado and the extreme southeast corner of the State. Areas with below average totals have expanded gradually across central and northeastern counties.





October 1992–June 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR JUNE 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	91-92	33	51	280	630	1263	1849	1963	1459	1093	535	350	179	9685
	92-93	97	131	295	607	1281	1796	1637	1280	958	692	435	185	9394
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	91-92	104	112	335	610	1106	1369	1410	1124	980	660	487	351	8648
	92-93	249	228	361	583	1272	1458.	1325	1197	1039	901	557	363	9533
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	91-92	17	7	121	403	831	911	901	700	664	321	192	93	5161
	92-93	20	55	71	337	921	1093	1130	958	697	514	233	91	6120
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	91-92	63	87	M	580	1056	1265	1246	1048	901	568	391	247	M
	92-93	107	148	305	536	1119	1302	1211	1093	907	735	446	232	8141
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	91-92	13	14	106	462	903	1004	1021	751	639	360	173	61	5507
	92-93	5	39	74	372	928	1301	1331	1103	773	531	219	68	6744
CANON CITY	AVE #	0	11	91	325	645	896	933	756	688	408	193	41	4987
	91-92	8	0	105	379	800	945	870	688	604	331	167	63	4960
	92-93	2	29	73	305	882	976	1064	885	668	482	199	55	5620
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	91-92	16	16	145	453	954	1048	998	788	717	383	219	96	5833
	92-93	21	53	91	383	990	1101	1179	991	776	558	286	84	6513
CORTEZ	AVE #	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	91-92	13	8	161	423	947	1227	1310	892	744	458	266	114	6563
	92-93	18	42	122	373	965	1276	1051	880	760	578	282	106	6453
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	91-92	27	13	230	582	1080	1517	1556	1078	809	497	270	161	7820
	92-93	67	64	234	498	1139	1453	1408	1270	976	765	364	203	8441
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	91-92	0	2	88	383	832	1302	1486	874	625	273	86	29	5980
	92-93	6	10	71	301	919	1192	967	783	649	469	181	52	5600
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	91-92	6	4	118	449	902	982	1022	714	673	309	158	35	5372
	92-93	10	35	58	346	926	1219	1162	992	686	489	195	71	6189
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	91-92	316	321	521	788	1210	1447	1517	1306	1144	805	609	458	10442
	92-93	364	381	525	744	1346	1480	1435	1273	1220	1011	693	480	10952
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	91-92	6	2	152	379	940	1179	1305	935	745	430	267	123	6463
	92-93	34	49	139	371	988	1319	1152	966	768	569	302	136	6793
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	91-92	26	6	208	563	972	1358	1387	970	809	466	289	150	7204
	92-93	47	73	209	503	1140	1389	1387	1118	894	641	352	169	7922
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	91-92	83	92	311	627	988	1078	1123	939	887	541	410	242	7321
	92-93	103	167	238	540	1074	1200	1177	1083	879	722	479	226	7888
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	91-92	11	1	145	457	891	1002	1029	736	681	356	193	56	5558
	92-93	22	55	87	377	940	1222	1239	1031	706	519	209	83	6490
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	91-92	5	4	89	437	947	1025	1193	756	652	332	163	41	5644
	92-93	12	40	38	352	937	1472	1494	1202	789	509	156	64	7065
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	91-92	0	2	37	304	815	1193	1390	788	608	195	53	8	5393
	92-93	0	6	25	222	868	1245	1018	799	597	446	144	33	5403

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	91-92	220	255	427	739	1169	1468	1735	1354	1118	751	534	383	10153
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949	648	380	10676
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	91-92	8	5	119	450	925	1011	1088	724	665	310	181	37	5523
	92-93	14	43	59	374	948	1334	1348	1073	705	502	182	82	6664
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	91-92	131	151	371	698	1120	1597	1707	1167	940	661	452	292	9287
	92-93	208	M	M	617	1278	M	M	M	M	M	M	M	M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	91-92	1	3	59	350	896	966	943	712	539	242	107	24	4842
	92-93	0	11	33	304	937	1267	1242	956	648	360	128	9	5895
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1039	726	439	10870
	91-92	343	364	538	826	1245	1461	1471	1296	1186	852	656	495	10733
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033	736	489	11276
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	91-92	19	14	171	503	1000	1095	1161	827	734	436	272	104	6336
	92-93	16	54	133	442	1018	1278	1339	1118	850	615	335	113	7311
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	91-92	12	6	133	489	936	1047	1124	786	730	391	201	60	5915
	92-93	20	61	77	388	982	1299	1347	1063	721	534	228	105	6825
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	91-92	24	7	221	553	1003	1367	1490	1025	758	446	280	138	7312
	92-93	23	44	152	426	1123	1306	1253	1117	859	644	335	183	7465
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	91-92	0	0	135	404	901	1312	1385	911	683	324	176	48	6279
	92-93	15	43	87	332	1000	1247	1023	873	687	571	241	104	6223
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	91-92	44	37	289	568	1116	1362	1477	1087	899	577	392	251	8099
	92-93	120	126	317	538	1123	1442	1291	1096	915	714	422	261	8365
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	91-92	1	0	76	380	927	1014	958	759	608	309	125	41	5198
	92-93	0	15	58	390	1009	1132	1186	959	703	428	195	30	6105
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	91-92	1	1	143	475	906	1185	1283	804	660	352	142	57	6009
	92-93	12	31	113	375	976	1241	1114	900	711	536	244	94	6347
STEAMBOAT SPRINGS	AVE #	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	91-92	127	141	394	742	1140	1626	1680	1126	863	595	383	263	9080
	92-93	160	119	316	570	1247	1583	1452	1240	1063	812	458	275	9295
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	91-92	5	1	92	437	930	1028	1191	731	645	352	142	36	5590
	92-93	14	36	70	400	949	1473	1401	1188	729	501	162	66	6999
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	91-92	175	163	339	595	1013	1264	1291	1057	946	565	450	285	8143
	92-93	180	189	313	529	1194	1268	1193	1046	981	743	550	380	8566
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	91-92	3	2	107	377	876	1004	946	774	642	289	186	50	5256
	92-93	0	18	61	321	991	1137	1013	904	699	450	205	39	5838
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	91-92	193	209	452	776	1217	1422	1547	1234	1025	700	500	349	9624
	92-93	270	283	433	709	1310	1471	1428	1313	1153	899	592	384	10245
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	91-92	6	5	90	337	818	915	870	717	634	309	163	60	4924
	92-93	5	29	54	271	894	951	947	875	684	461	210	42	5423

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

JUNE 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	73.4	44.1	58.8	-3.6	91	33	204	23	351	3.10	0.70	129.2	12
STERLING	82.6	52.3	67.4	-0.9	101	43	66	149	506	2.04	-0.87	70.1	7
FORT MORGAN	82.4	54.5	68.5	-0.1	101	44	64	171	529	2.52	0.37	117.2	6
AKRON FAA AP	79.7	50.5	65.1	-1.8	96	40	93	103	465	1.81	-0.90	66.8	8
AKRON 4E	79.8	48.0	63.9	-2.7	99	38	114	90	441	1.72	-0.90	65.6	8
HOLYOKE	77.2	53.6	65.4	-3.4	96	43	91	110	466	1.68	-1.50	52.8	6
JOES	80.6	50.8	65.7	-2.8	101	41	84	113	467	2.48	0.18	107.8	8
BURLINGTON	82.2	52.5	67.3	-2.4	103	44	68	145	498	1.31	-1.07	55.0	5
LIMON WSMO	78.0	48.1	63.0	-1.8	97	40	113	60	424	1.72	-0.06	96.6	7
CHEYENNE WELLS	84.1	51.4	67.7	-1.7	103	39	54	145	521	0.96	-1.42	40.3	5
EADS	83.8	53.8	68.8	-2.0	100	44	37	159	529	1.45	-0.62	70.0	3
ORDWAY 21N	86.9	52.6	69.7	0.2	101	43	32	181	544	0.38	-0.99	27.7	6
ROCKY FORD 2SE	90.0	53.0	71.5	-0.4	101	45	10	211	575	0.43	-0.93	31.6	7
LAMAR	85.9	55.8	70.9	-1.1	102	45	23	206	586	4.27	2.08	195.0	7
LAS ANIMAS	88.5	56.6	72.6	-0.8	105	46	9	241	605	1.92	0.15	108.5	5
HOLLY	87.4	57.2	72.3	-0.2	103	44	14	238	608	3.64	0.66	122.1	5
SPRINGFIELD 7WSW	88.6	54.7	71.6	1.1	103	44	12	217	603	1.74	-0.28	86.1	6
TIMPAS 13SW	86.2	53.8	70.0	-0.6	99	46	24	180	563	0.86	-0.54	61.4	2

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	77.9	50.3	64.1	-1.6	94	41	83	64	441	2.33	0.43	122.6	6
GREELEY UNC	79.3	51.7	65.5	-2.5	97	43	82	105	469	2.60	0.77	142.1	7
ESTES PARK	70.8	39.9	55.3	-1.5	83	32	291	5	320	1.70	-0.01	99.4	8
LONGMONT 2ESE	81.3	47.5	64.4	-2.0	100	38	105	93	457	2.14	0.27	114.4	6
BOULDER	79.3	49.7	64.5	-1.0	94	40	91	83	458	3.38	1.15	151.6	8
DENVER WSFO AP	81.1	51.7	66.4	-0.5	98	44	71	121	491	1.67	-0.13	92.8	6
EVERGREEN	73.6	41.4	57.5	-0.5	91	34	226	10	358	2.17	-0.10	95.6	8
CHEESMAN	77.3	36.7	57.0	-3.0	90	29	235	2	409	1.93	0.10	105.5	8
LAKE GEORGE 8SW	70.7	39.1	54.9	-0.2	81	26	298	0	317	1.17	-0.21	84.8	5
ANTERO RESERVOIR	68.4	34.2	51.3	-0.6	77	20	403	0	283	0.98	-0.16	86.0	8
RUXTON PARK	60.1	35.5	47.8	-3.4	80	24	509	0	173	0.87	-1.68	34.1	7
COLORADO SPRINGS	79.3	50.6	64.9	-0.3	95	39	84	89	466	1.27	-0.99	56.2	11
CANON CITY 2SE	81.3	51.7	66.5	-1.2	95	44	55	108	497	1.47	0.16	112.2	6
PUEBLO WSO AP	86.3	51.3	68.8	-2.2	100	38	30	152	532	1.49	0.24	119.2	5
WESTCLIFFE	74.0	39.9	56.9	-1.2	84	28	241	9	375	0.32	-0.80	28.6	4
WALSENBURG	81.8	51.3	66.6	-0.2	93	43	42	97	512	0.56	-0.78	41.8	3
TRINIDAD FAA AP	83.6	51.8	67.7	-0.9	97	43	39	127	523	1.03	-0.55	65.2	7

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	68.7	35.2	51.9	-1.7	82	29	384	0	288	1.76	0.72	169.2	6
LEADVILLE 2SW	65.8	31.2	48.5	-0.3	75	22	489	0	245	0.82	-0.18	82.0	5
SALIDA	78.2	42.9	60.5	-0.2	89	30	151	24	431	0.29	-0.61	32.2	5
BUENA VISTA	75.3	38.7	57.0	-2.2	85	21	232	0	387	0.80	-0.08	90.9	6
SAGUACHE	75.0	41.1	58.0	-0.5	85	31	203	1	382	0.13	-0.49	21.0	3
ALAMOSA WSO AP	77.2	40.2	58.7	-0.7	87	31	185	6	413	0.14	-0.53	20.9	3
STEAMBOAT SPRINGS	73.1	38.2	55.7	0.3	85	27	275	3	355	2.09	0.54	134.8	11
YAMPA	71.7	41.6	56.6	1.6	81	31	249	4	339	0.92	-0.57	61.7	7
GRAND LAKE 1NW	70.4	32.6	51.5	0.2	83	26	397	0	316	1.93	0.30	118.4	7
GRAND LAKE 6SSW	69.2	35.0	52.1	-0.2	77	28	380	0	296	1.59	0.36	129.3	7
DILLON 1E	64.7	32.9	48.8	-1.9	76	26	480	0	232	1.97	0.82	171.3	7
CLIMAX	58.3	30.9	44.6	-0.9	68	17	605	0	152	0.84	-0.62	57.5	6
ASPEN 1SW	69.3	36.0	52.7	-2.8	79	20	363	0	296	1.13	-0.28	80.1	6
CRESTED BUTTE	66.8	32.5	49.7	-1.8	78	24	452	0	266	1.05	-0.15	87.5	7
TAYLOR PARK	64.0	32.1	48.1	-1.9	73	23	501	0	216	0.60	-0.54	52.6	3
TELLURIDE	68.8	35.4	52.1	-2.8	79	26	380	0	291	0.61	-0.69	46.9	6
PAGOSA SPRINGS	76.5	35.7	56.1	-1.5	87	28	261	0	405	0.24	-0.59	28.9	4
SILVERTON	65.9	33.0	49.4	-0.8	76	26	460	0	245	0.76	-0.53	58.9	4
WOLF CREEK PASS 1	57.8	34.9	46.3	-1.5	69	22	549	0	142	1.26	-0.61	67.4	9

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	74.2	42.6	58.4	-2.2	86	31	203	12	371	0.53	-0.57	48.2	7
HAYDEN	76.4	41.3	58.9	-1.6	88	29	184	8	400	0.59	-0.63	48.4	7
MEEKER NO. 2	77.3	41.9	59.6	-1.4	90	31	183	29	419	1.04	0.10	110.6	6
RANGELY 1E	80.3	48.2	64.2	-2.5	94	36	86	70	458	0.23	-0.59	28.0	3
EAGLE FAA AP	79.1	39.8	59.4	-0.6	90	30	169	11	438	0.25	-0.61	29.1	4
GLENWOOD SPRINGS	78.7	43.2	61.0	-2.6	93	33	142	27	429	1.07	-0.19	84.9	7
RIFLE	82.1	44.6	63.3	-0.9	94	34	94	53	468	0.29	-0.66	30.5	6
GRAND JUNCTION WS	85.2	55.0	70.1	-2.3	98	43	33	193	576	0.03	-0.47	6.0	1
CEDAREDGE	81.7	43.1	62.4	-3.8	92	30	117	49	465	0.27	-0.48	36.0	2
PAONIA 1SW	82.3	48.8	65.6	-0.8	93	37	69	93	491	0.23	-0.61	27.4	4
DELTA	84.7	49.6	67.2	-1.1	96	41	52	125	510	0.21	-0.29	42.0	4
COCHETOPA CREEK	74.2	35.7	54.9	-0.2	84	25	299	2	370	0.77	0.01	101.3	7
MONTROSE NO. 2	79.6	47.6	63.6	-3.0	90	37	104	68	473	0.09	-0.52	14.8	1
URAVAN	87.7	51.9	69.8	-0.9	100	42	28	180	547	0.09	-0.36	20.0	2
NORWOOD	76.0	43.9	60.0	-0.6	87	32	175	32	415	0.41	-0.45	47.7	3
YELLOW JACKET 2W	79.6	45.8	62.7	-1.3	90	31	116	52	451	0.19	-0.36	34.5	1
CORTEZ	81.3	42.8	62.1	-0.0	92	35	106	27	463	0.08	-0.44	15.4	2
DURANGO	78.2	44.3	61.3	-0.8	88	33	136	30	431	0.25	-0.43	36.8	4
IGNACIO 1N	78.5	40.5	59.5	-2.6	89	32	169	11	431	0.17	-0.35	32.7	2

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

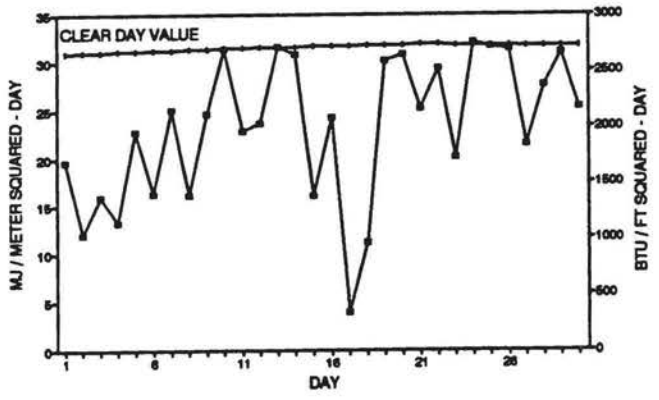
JUNE 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Denver	15	8	7	67%	71%
Fort Collins	12	8	10	--	--
Grand Junction	15	9	6	91%	80%
Limon	12	11	6	--	--
Pueblo	NA	NA	NA	87%	79%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

June was a very sunny month for western and southern portions of Colorado. Grand Junction totalled more than 400 hours with sunshine in June, 91% of the maximum possible sunshine. Dense cloudiness was limited to June 3-4 and 16-18th and was most widespread over northeast Colorado.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
JUNE 1993

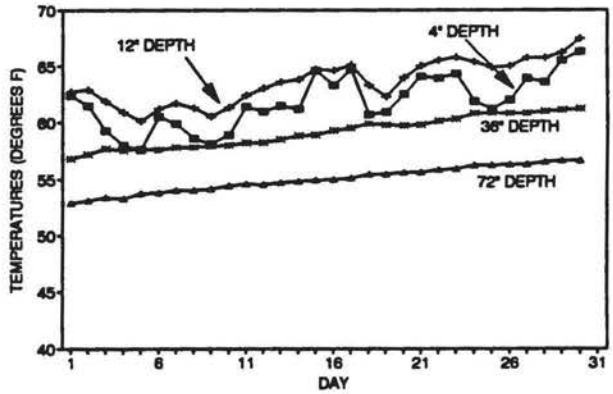


JUNE 1993 SOIL TEMPERATURES

Soil temperatures near the surface remained a little cooler than normal in June and fluctuated in response to daily weather changes. Meanwhile, deep soil temperatures continued to climb steadily throughout the month.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
JUNE 1993



HATS OFF TO: *Edward Fellhauer, Fowler 1SE*

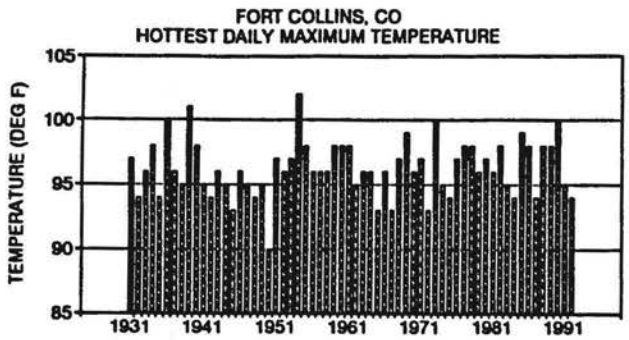
Mr. and Mrs. Fellhauer have been taking daily weather observations at their home near Fowler (southeast of Pueblo) since 1967. In total, Ed has nearly 46 years experience as an official observer. He started back in 1947 sharing observing responsibility at the Fowler Soil Conservation District Office. Thanks so much for your care and commitment.

HOW HOT CAN IT GET??

Last summer, Colorado (especially the eastern half) had one of its coolest summers in years. This year has been warmer, but it hasn't come close to the heat of other recent years such as 1988, 1989 and 1990. Those years had several days when temperatures soared past the 100°F mark. But even in a cool summer like 1992, there were a number of hot days, and some readings did surpass 100° in southeast Colorado.

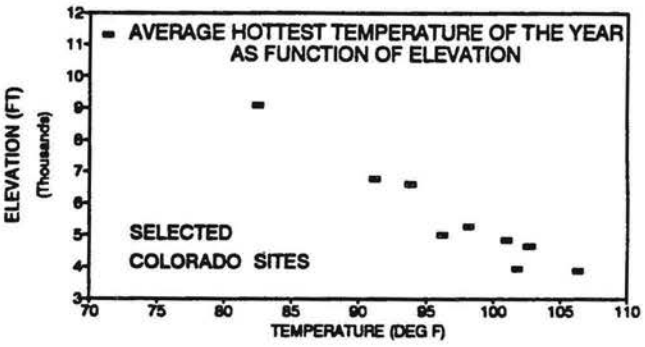
How hot will it get this summer, and will we set any records? We seem to pay more attention to these questions ever since the issue of global warming became prominent. A specific forecast may not be possible, but let's look at some historic climate records to get an idea what we can expect.

We identified the hottest temperature each year for the last 60 years or so for 9 long-term weather stations in Colorado: Denver, Dillon, Durango, Fort Collins, Grand Junction, Las Animas, Pueblo, Steamboat Springs and Sterling. It would be interesting to look at more mountain stations, but as we have said before, consistent long-term data from the Colorado high country is almost non-existent. Frequency distributions for 8 of these sites are shown below.

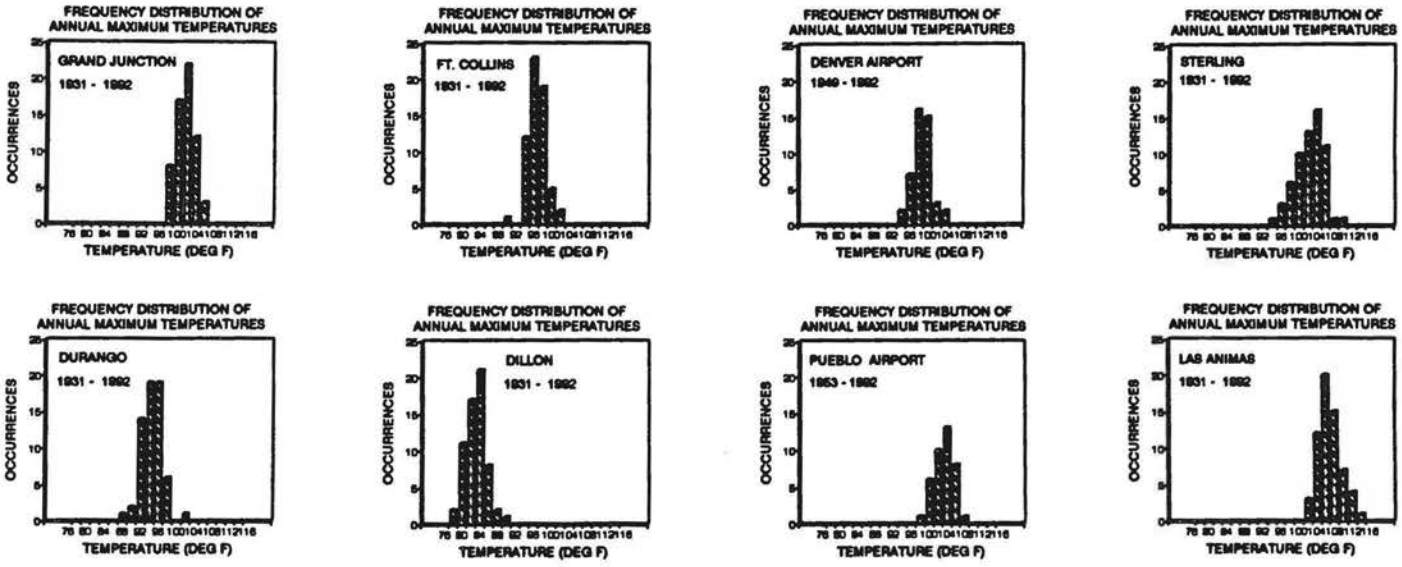


The hottest temperature of the year varies a bit. At Fort Collins for example, the highest temperature of the year has been as low as 90° in 1950 and as high as 102° in the scorching summer of 1954. The average over the past 62 years (since 1931) has been 96°F, and in about 2 out of every 3 years the highest temperature of the year is within 2 degrees above or below that average. Nearly all years are within 6 degrees F above or below the average. If I had to predict what the hottest temperature would be in Fort Collins in 1993 I would say 96° and I would have a pretty good chance of being right.

It is no great surprise that the hottest temperatures occur in southeastern Colorado while mountain stations are much cooler. Las Animas is typically the hottest weather station in Colorado. Their average value is 106° for the hottest day of the year, but they have been as high as 114°F. By comparison, Dillon averages a comfortable 83°F. Based on a shorter record of just 20 years on Berthoud Pass (elevation 11,310 ft), the average value for their hottest temperature each year was 71°F. There is a very good association between elevation and the expected hottest temperature of the year, as the graph below demonstrates. Other factors such as latitude and local exposure (nearby trees, irrigated grass, bare ground, etc.) make a difference, but elevation is a primary control.



There is a lot more we can learn by studying annual extremes. Next month we will look at long-term trends in extreme temperatures and how they relate to overall summer temperatures.



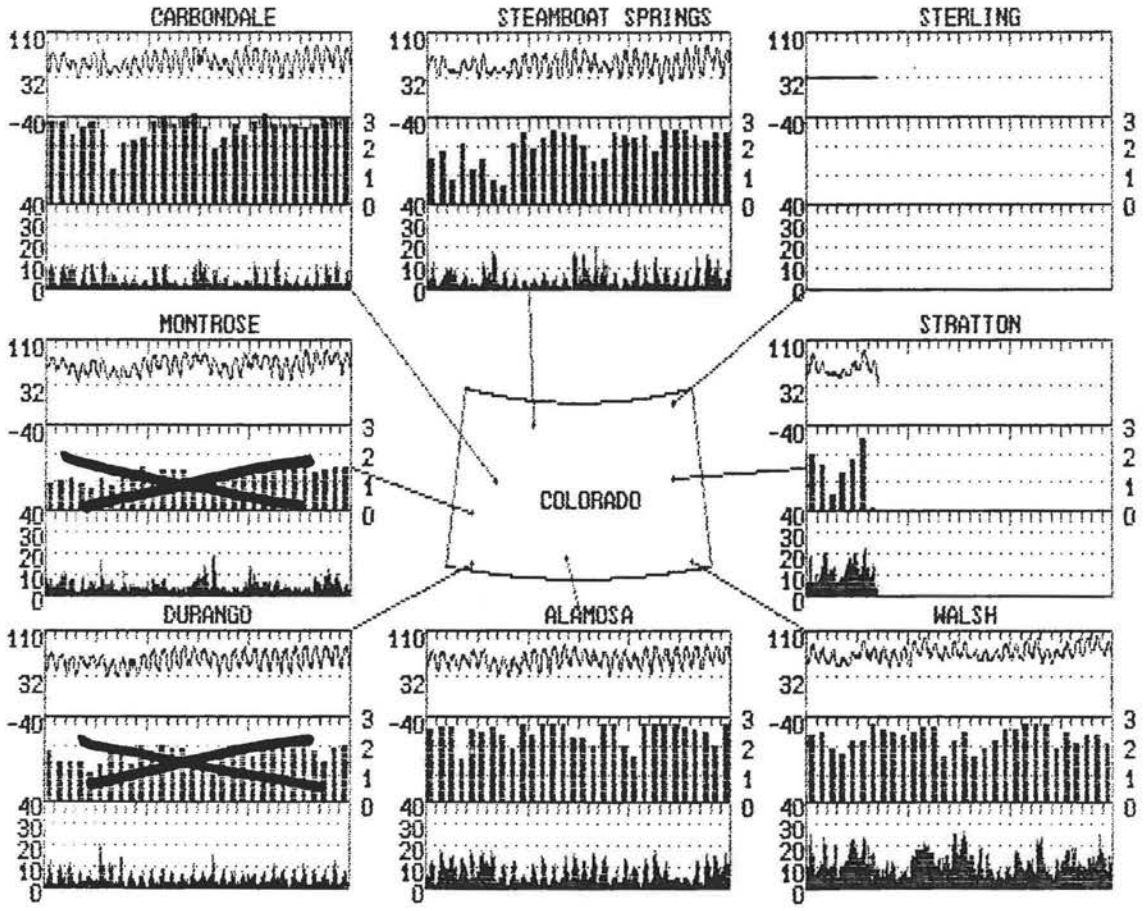
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

WTHRNET WEATHER DATA JUNE 1993

	Alamosa	Durango	Carbondale	Montrose	Steamboat Springs	Sterling	Stratton	Walsh
monthly average temperature (°F)								
	60.0	57.6	59.0	64.7	54.1	n/a	n/a	70.8
monthly temperature extremes and time of occurence (°F day/hour)								
maximum:	84.2 14/15	82.9 27/16	87.3 27/14	89.1 28/15	86.9 27/15	n/a	n/a	100.8 29/14
minimum:	30.7 9/ 5	31.8 7/ 3	30.0 4/ 5	34.5 8/ 5	22.3 24/ 5	n/a	n/a	45.3 9/ 5
monthly average relative humidity / dewpoint (percent / °F)								
5 AM	72 / 42	72 / 41	88 / 40	50 / 50	97 / 36	n/a	n/a	72 / 59
11 AM	20 / 70	35 / 68	34 / 70	25 / 73	46 / 66	n/a	n/a	37 / 77
2 PM	16 / 74	28 / 71	24 / 75	20 / 76	34 / 71	n/a	n/a	27 / 83
5 PM	16 / 73	24 / 72	23 / 74	20 / 76	36 / 69	n/a	n/a	26 / 83
11 PM	33 / 55	57 / 49	56 / 53	35 / 60	81 / 46	n/a	n/a	54 / 65
monthly average wind direction (degrees clockwise from north)								
day	196	207	255	242	238	n/a	n/a	155
night	184	67	190	161	122	n/a	n/a	197
monthly average wind speed (miles per hour)								
	6.72	4.14	3.25	4.28	3.59	n/a	n/a	11.33
wind speed distribution (hours per month for hourly average mph range)								
0 to 3	172	337	478	267	416	n/a	n/a	26
3 to 12	428	367	238	440	264	n/a	n/a	393
12 to 24	120	16	4	13	32	n/a	n/a	287
> 24	0	0	0	0	0	n/a	n/a	14
monthly average daily total insolation (Btu/ft²•day)								
	2438		2642		2008	n/a	n/a	2289
"clearness" distribution (hours per month in specified clearness index range)								
60-80%	284		56		200	n/a	n/a	242
40-60%	85		61		105	n/a	n/a	95
20-40%	34		26		68	n/a	n/a	46
0-20%	9		16		50	n/a	n/a	30

The State-Wide Picture

The figure below shows monthly weather at WTHRNET sites around the state. Three graphs are given for each location: the top graph displays the hourly ambient air temperature, ranging from -40°F to 110°F, the middle one gives the daily total solar radiation on a horizontal surface, from 0 to 3000 Btu/ft²/day, and the bottom graph illustrates the hourly average wind speed between 0 and 40 miles per hour.



COLORADO CLIMATE

JULY 1993

Volume 16 Number 10

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

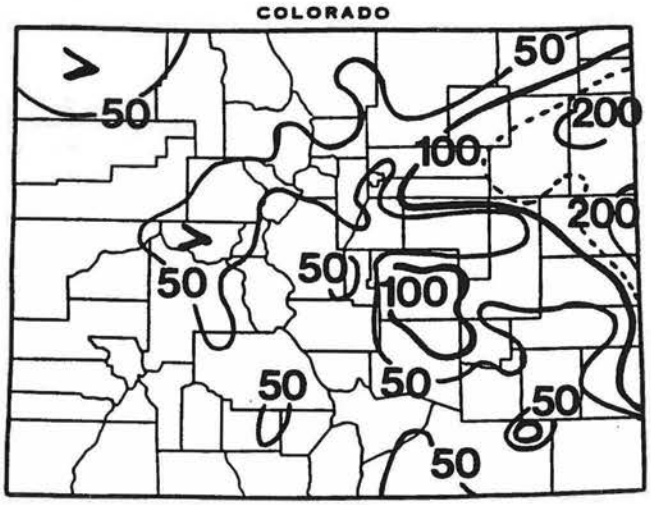
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

July Climate in Perspective – Cool, Dry and Ferocious

July 1993 is going down as a month of remarkable extremes for the United States – extreme flooding in the Midwest, extreme heat in the southeast, extreme drought in the South and extreme cold in the Northwest. Here in Colorado, we were in the combat zone and ended up with a little of each. Overall, cooler and drier than average conditions prevailed statewide. But extremes of heat and cold, severe tornadoes and hail, flooding rains, a record windstorm and mountain snow all took place during the month.

Precipitation

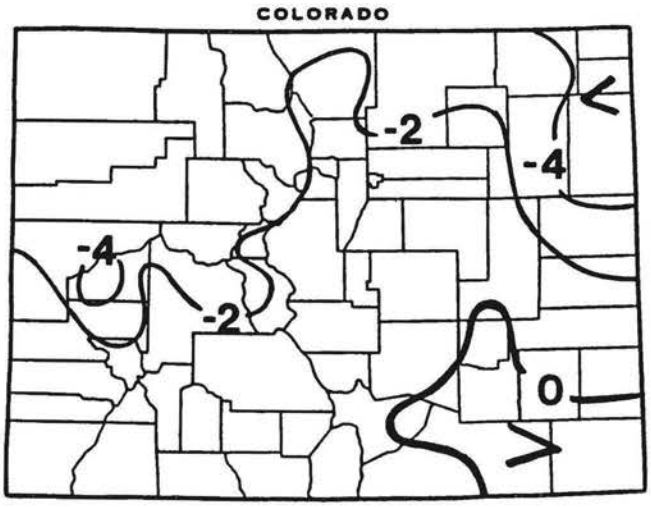
The Southwest Monsoon, which normally provides moisture to fuel frequent thunderstorms across Colorado in July, failed to develop. Instead, an unusually strong and active jet stream in combination with a stationary front that spent much of July over Colorado, helped trigger many large and often severe thunderstorm complexes over eastern Colorado. These same systems continued eastward across the Midwest and dropped huge quantities of rain. The resulting rainfall pattern showed most of Colorado much drier than average for July with no rain at all in parts of southwest Colorado. At the same time, 2 to 3 times the normal rainfall was observed in northeast and east central counties of the State.



July 1993 precipitation as a percent of the 1961-1990 average.

Temperatures

Temperatures for July ended up two to four degrees below average across the northern half of Colorado, one to two degrees below average across southwest Colorado, and slightly warmer than average on the southeastern plains. Eastern Colorado experienced frequent temperature variations throughout the month, while temperatures were much more consistent in and west of the mountains. With little rain, and low humidity, nighttime temperatures were particularly chilly throughout the month up in the mountains. Fraser recorded minimum temperatures of 32°F or below on 17 days in July.



Departure of July 1993 temperatures from the 1961-90 averages.

Inside This Issue

JULY 1993 DAILY WEATHER

1-2 July got off to a normal start with hot temperatures, low humidity, lots of sunshine and just a few thunderstorms on the northeast plains.

3-6 A remarkably strong (for July) low pressure area and cold front moved across Colorado on the 3rd triggering thunderstorms most numerous in the Northern and Central Mountains. Aspen recorded 0.71" of rain. Strong southwest winds preceded the front, and temperatures in southeast Colorado shot well past the 100° mark. The barometer dropped to 29.25" at Denver. Then a powerful wind storm developed across the Front Range and Eastern Plains. Wind gust of at least 60 mph were common, but in west Fort Collins wind gusts clocked at close to 90 mph downed many large trees and damaged cars and buildings. By late on the 3rd, several inches of snow had fallen in the mountains. Cold, windy weather continued on the 4th with some showers on the plains and more mountain rain and snow. The high temperature in Vail only reached 48°F, with 0.82" of moisture. Fireworks celebrations were postponed in many mountain communities. Many areas of western Colorado awoke to record cold temperatures on the 5th. The 23° reading at Climax was the coldest in the State. Grand Junction's low of 44° was their coldest July temperature on any date this century. It was still cool and breezy on the 6th, but a warming trend was underway.

7-10 Sunshine and hot temperatures were the rule as west winds aloft persisted. A few large thunderstorms erupted in eastern Colorado on the 7th and again on the 9th. A damaging tornado struck Bethune on the 7th. Shaw measured 1.55" of rain from a storm on the 9th. The 8th brought widespread but mostly light thundershowers. The storms skipped southeast Colorado, and temperatures soared to their highest levels of the summer. Several locations hit 107°F. Hot, dry, windy weather continued on the 10th, and several wildfires spread rapidly out of control.

11-15 Cooler, humid air invaded eastern Colorado and helped firefighters extinguish Front Range forest fires. An afternoon storm on the 11th dumped 1.01" at Colorado Springs. Temperatures remained warm in western Colorado but cooled a bit as the first hint of monsoon moisture for the summer arrived from the southwest 12-14th. Western Slope thundershowers produced more wind than rain, but some areas received beneficial moisture. Storms were especially numerous and locally heavy east of the mountains. Stratton recorded 1.95" late on the 13th. Parker added 1.60" on the 14th. There were numerous reports of hail and some tornado sightings.

16-17 The 16th was dry and hot across most of Colorado with only isolated thundershowers. Unfortunately, extreme winds from one storm destroyed a mobile home and killed one of its occupants in northeast Colorado. Much cooler air slipped back into eastern Colorado on the 17th. Temperatures stayed in the 60s across portions of the plains. Severe storms were predicted, but only some showers developed along the southern Front Range.

18-23 Severe weather took aim on east-central and northeast Colorado as hot, dry air from the southwest combined with cool, moist air from the east. While western Colorado remained very dry, intense storms developed each evening east of the Front Range. A large tornado just missed Lindon on the 19th. Burlington was flooded with more than 2" of rain. Loveland was pelted by damaging hail on the 20th. Heavy rains fell from Akron to Wray late on the 21st. Numerous storms raged late on the 22nd, and another large tornado was spotted. The humid air finally slid eastward on the 23rd but not before one more round of heavy rain and hail soaked the same areas. The Yuma 10NW weather station totalled 4.56" of rain in 3 days.

23-25 Another strong cold front brought fallish weather to the Northern Mountains. Maybell enjoyed 0.53" of gentle rain as the system moved through. Some snow fell on the higher mountains early on the 24th. Temperatures rebounded on the 25th, and some thunderstorms sprinkled northeast Colorado.

26-31 Severe storms developed north of Colorado on the 26th as a lively disturbance crossed the region. Julesburg was nicked by the southern edge of the line of storms. This system pushed on across the entire Midwest bringing in cool, dry air and finally breaking the weather pattern that had persisted for so many weeks and brought so much rain and flooding to the Midwest. For the remainder of the month, winds aloft over Colorado finally weakened to their normal summertime magnitudes. Without moist air from either the south or east, sunny, hot and dry weather prevailed. Uravan hit 101° on the 28th – the hottest so far in western Colorado this summer. Denver's 98° on the 29th set a new record for the date. A few thundershowers managed to pop up across the state, especially on the 30th, but little moisture reached the ground.

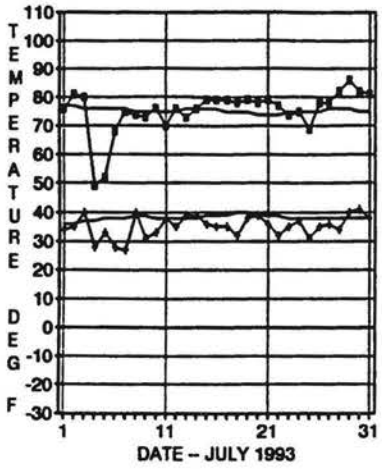
Weather Extremes

Highest Temperature	107°F	July 8	Las Animas, La Junta 20S, Springfield 7WSW
Lowest Temperature	23°F	July 5	Climax
Greatest Total Precipitation	6.98"		Yuma 10NW
Least Total Precipitation	0.00"		Cortez, Mesa Verde National Park
Greatest Total Snowfall	5.0"		Climax
Greatest Snow Depth	3"	July 5	Climax

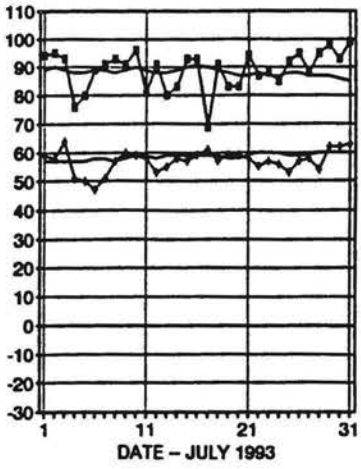
JULY 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

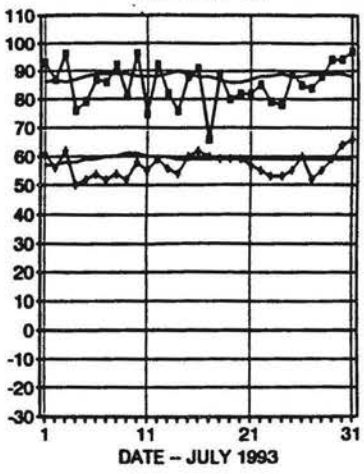
GRAND LAKE 1NW



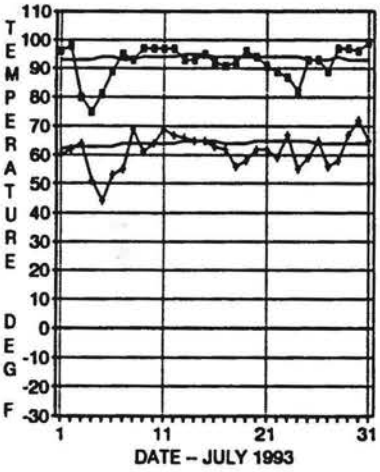
DENVER



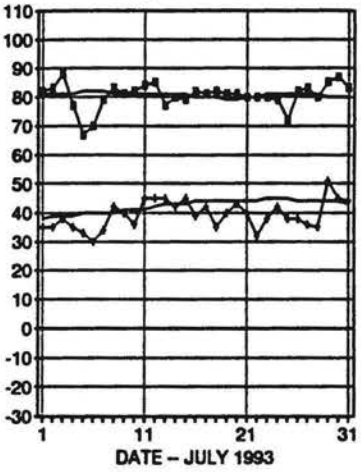
AKRON 1N



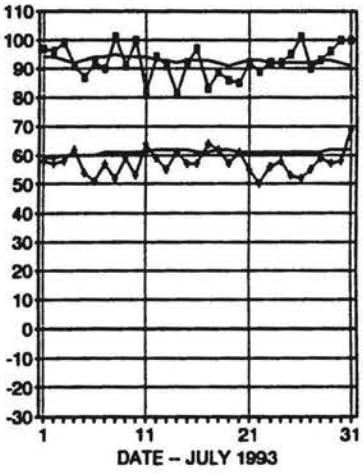
GRAND JUNCTION



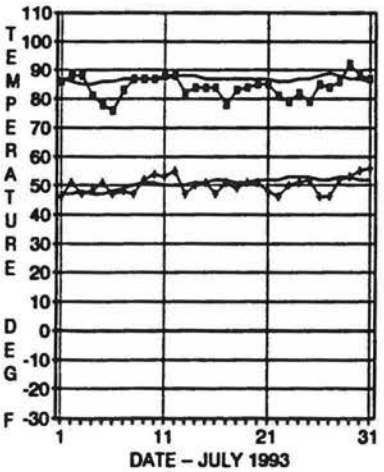
GUNNISON (COCHETOPA CRK.)



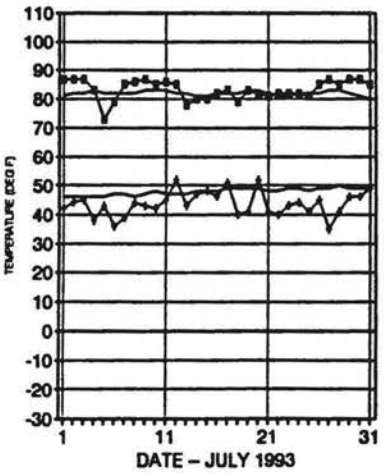
PUEBLO WSO



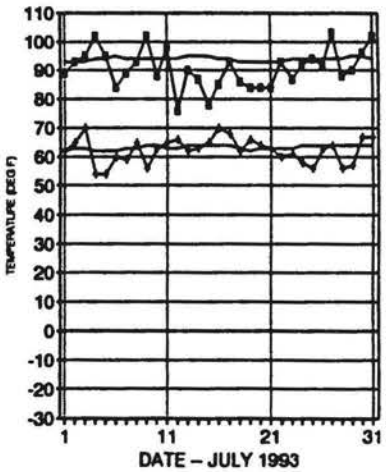
DURANGO



ALAMOSA



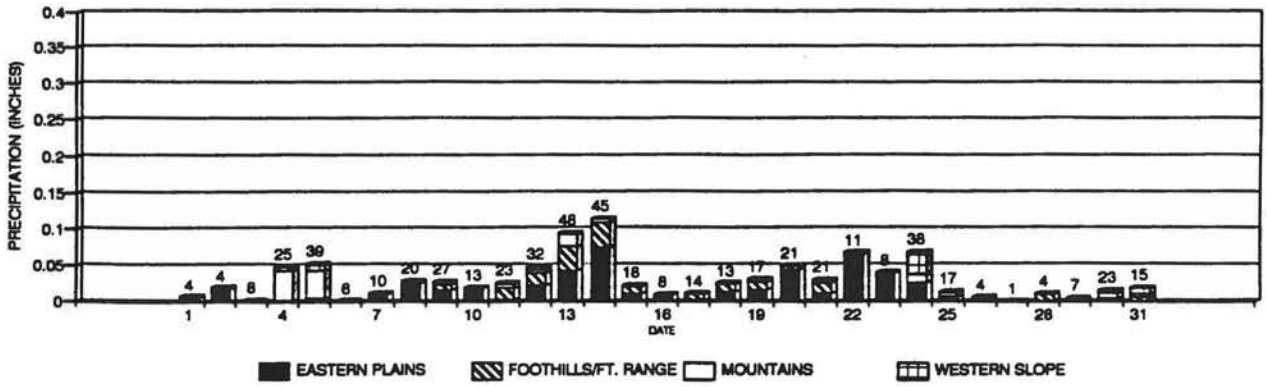
LAMAR



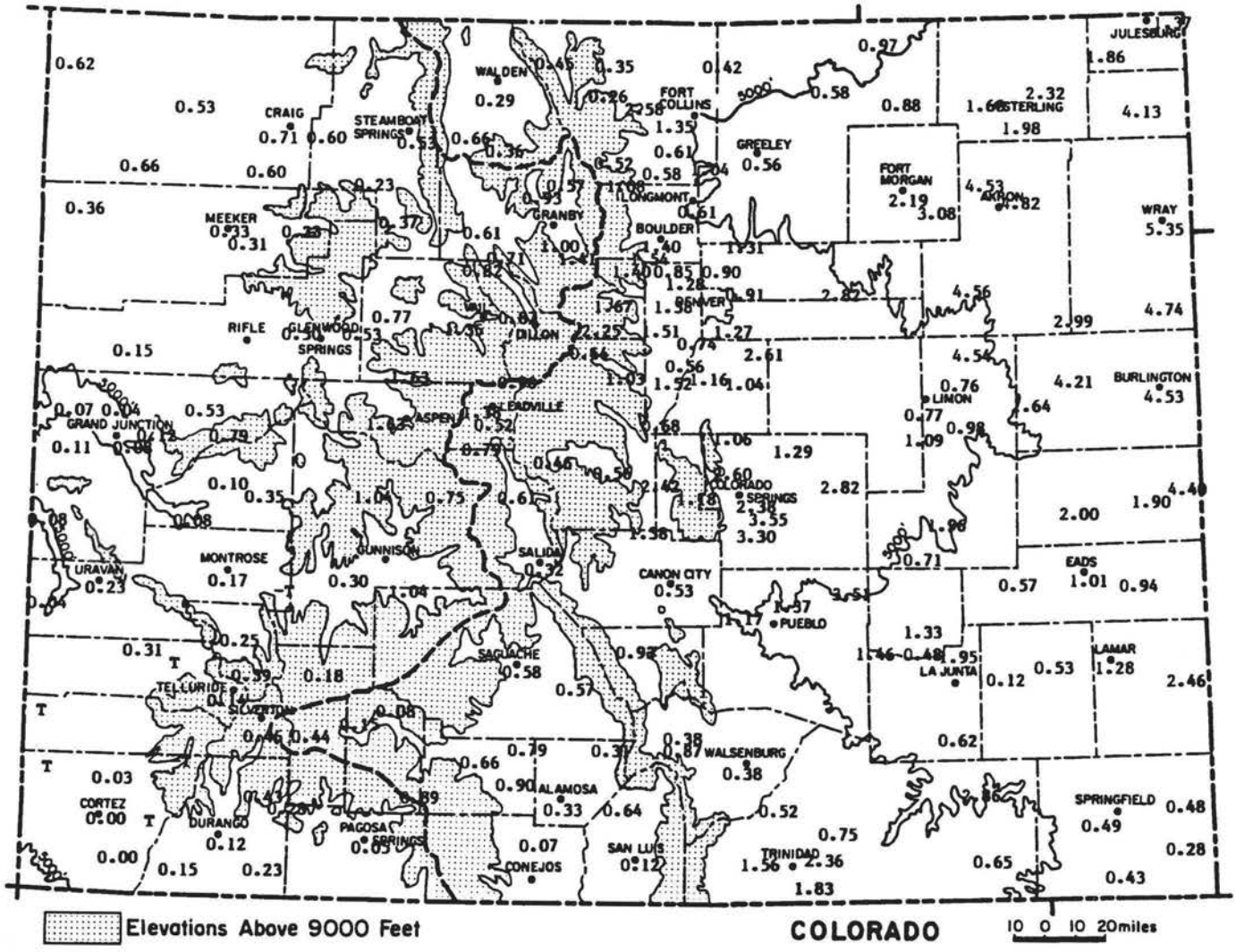
JULY 1993 PRECIPITATION

There were many reports of severe storms and heavy rains in July, but most storms were quite localized. Statewide precipitation in July (which is often the wettest month of the year) was 0.90", much less than average. The eastern Plains accounted for half of this total. There were only two days all month when at least 40% of the weather stations recorded measurable rainfall. The 3-4th (indicated on the graph as 4-5th due to the typical morning observation times of most weather stations in the mountains) was the only period with widespread mountain precipitation.

COLORADO DAILY PRECIPITATION - JUL 1992

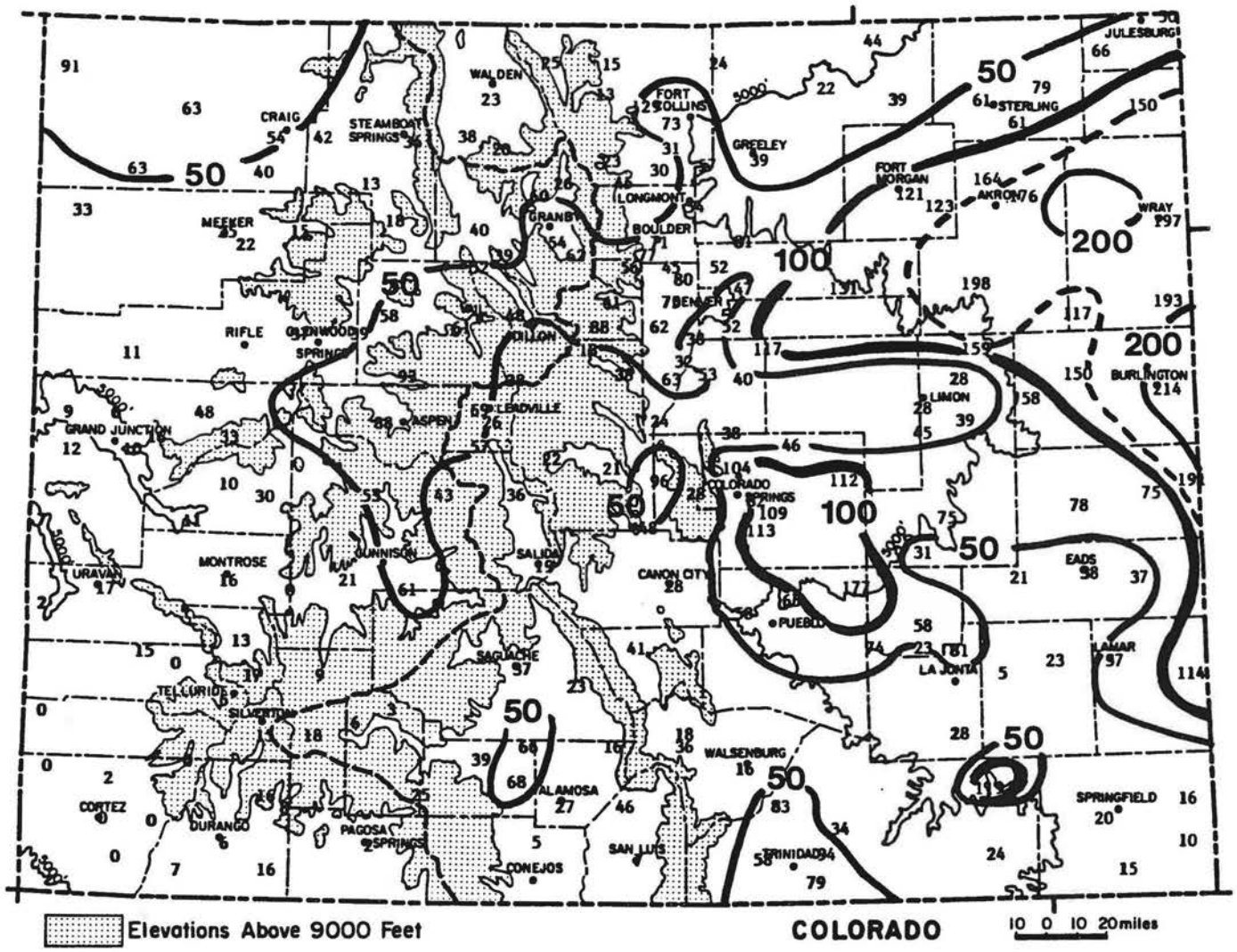


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

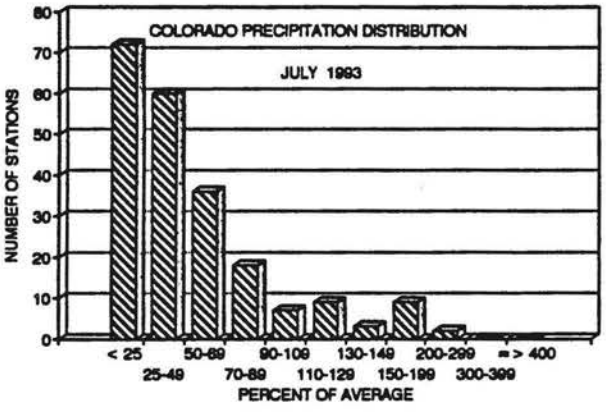


Precipitation Amounts (in inches) for July 1993.

JULY 1993 PRECIPITATION COMPARISON



July 1993 Precipitation as a Percent of the 1961–90 average.



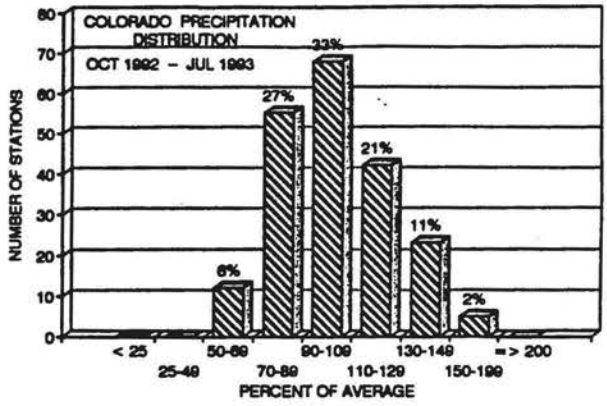
The vast majority of Colorado weather stations experienced drier than average weather conditions in July. 60% of all stations received less than 50% of average. For several parts of western and southern Colorado this was one of the 5 driest July's in the past 100 years. Dry July's are more unusual than dry June's.

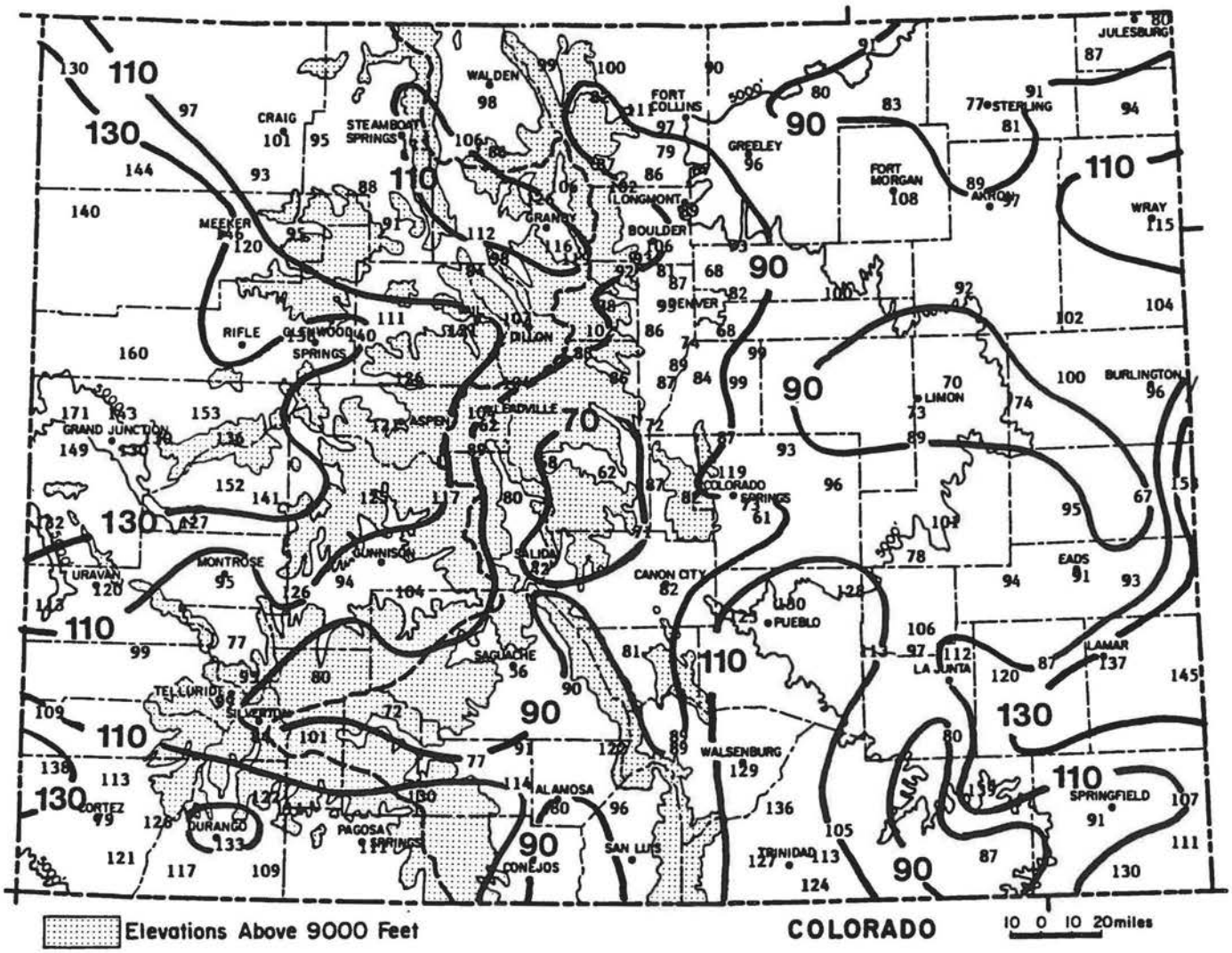
JULY 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.91"	34th driest in 122 years of record (driest = 0.01" in 1901)
Durango	0.12"	2nd driest in 99 years of record (driest = 0.02" in 1900)
Grand Junction	0.04"	4th driest in 102 years of record (driest < 0.01" in 1898)
Las Animas	0.12"	4th driest in 128 years of record (driest < 0.01" in 1901)
Pueblo	1.37"	52nd driest in 124 years of record (driest = 0.09" in 1987)
Steamboat Springs	0.53"	10th driest in 87 years of record (driest < 0.01" in 1898)

1993 WATER YEAR PRECIPITATION

Coloradans are now very thankful for the snowy winter we had in the mountains this year. Streamflow and reservoir supplies remain in good shape nearly everywhere in the State even though summer precipitation is at its lowest in several years. Grand Junction has totalled only 0.07" of rain since June 1, and Mesa Verde National Park has received just 0.11". Cooler than average temperatures have slowed plant development and reduced evapotranspiration a little across Colorado this summer, but this has been balanced by an increase in wind speeds. Some areas in the mountains have seen higher evaporation rates than in much warmer summers. Overall, the State precipitation pattern remains in fairly good shape with about one-third of the State near average (90-110% of average). Dry areas have been expanding this summer, and there are now about equal areas above 110% and below 90% of average. The driest areas are the Arkansas Valley from Canon City to Buena Vista, South Park, areas along the Front Range including Denver and Colorado Springs and local areas near Limon and Sterling. Salida has received only 3.60" of moisture since 1 October 1992, 42% of average.





October 1992–July 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR JULY 1993

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	92-93	97	131	295	607	1281	1796	1637	1280	958	692	435	185	9394
	93-94	51												51
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	92-93	249	228	361	583	1272	1458	1325	1197	1039	901	557	363	9533
	93-94	232												232
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	92-93	20	55	71	337	921	1093	1130	958	697	514	233	91	6120
	93-94	5												5
BUENA VISTA	AVE	50	111	318	620	960	1243	1259	1047	992	729	477	197	8003
	92-93	107	148	305	536	1119	1302	1211	1093	907	735	446	232	8141
	93-94	83												83
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	92-93	5	39	74	372	920	1301	1331	1103	773	531	219	68	6744
	93-94	0												0
CANON CITY	AVE #	0	11	91	325	645	896	933	756	688	408	193	41	4987
	92-93	2	29	73	305	882	976	1064	885	668	482	199	55	5620
	93-94	0												0
COLORADO SPRINGS	AVE	6	18	141	468	816	1091	1122	924	859	558	302	87	6415
	92-93	21	53	91	383	990	1101	1179	991	776	558	286	84	6513
	93-94	0												0
CORTEZ	AVE #	0	11	146	474	828	1163	1237	958	853	594	322	81	6667
	92-93	18	42	122	373	965	1276	1051	880	760	578	282	106	6453
	93-94	10												10
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	92-93	67	64	234	498	1139	1453	1408	1270	976	765	364	203	8441
	93-94	87												87
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	38	5927
	92-93	6	10	71	301	919	1192	967	783	649	469	181	52	5600
	93-94	13												13
DENVER	AVE	0	0	144	429	780	1051	1094	885	806	504	253	71	6020
	92-93	10	35	58	346	926	1219	1162	992	686	489	195	71	6189
	93-94	1												1
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	92-93	361	381	525	744	1346	1480	1435	1273	1220	1011	693	480	10952
	93-94	327												327
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	92-93	34	49	139	371	988	1319	1152	966	768	569	302	136	6793
	93-94	6												6
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	92-93	47	73	209	503	1140	1389	1387	1118	894	641	352	169	7922
	93-94	53												53
EVERGREEN	AVE	78	122	319	651	945	1194	1218	1039	1011	741	512	234	8094
	92-93	103	167	238	540	1074	1200	1177	1083	879	722	479	226	7888
	93-94	85												85
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	92-93	22	55	87	377	940	1222	1239	1031	706	519	209	83	6490
	93-94	5												5
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	92-93	12	40	38	352	937	1472	1494	1202	789	509	156	64	7065
	93-94	0												0
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	92-93	0	6	25	222	868	1245	1018	799	597	446	144	33	5403
	93-94	4												4

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

Heating Degree Data — Colorado Climate Center (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1476	1600	1361	1203	945	660	381	10542
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949	648	380	10676
	93-94	297												297
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6306
	92-93	14	43	59	374	948	1334	1348	1073	705	502	182	82	6664
	93-94	4												4
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	92-93	208	M	M	617	1278	M	M	M	M	M	M	M	M
	93-94	M												M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	92-93	0	11	33	304	937	1267	1242	956	648	360	128	9	5895
	93-94	0												0
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033	736	489	11276
	93-94	354												354
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	6961
	92-93	16	54	133	442	1018	1278	1339	1118	950	615	335	113	7311
	93-94	7												7
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	92-93	20	61	77	388	982	1299	1347	1063	721	534	228	105	6825
	93-94	12												12
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	92-93	23	44	152	426	1123	1306	1253	1117	859	644	335	183	7465
	93-94	54												54
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	92-93	15	43	87	332	1000	1247	1023	873	687	571	241	104	6223
	93-94	14												14
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	92-93	120	126	317	538	1123	1442	1291	1096	915	714	422	261	8365
	93-94	94												94
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	- 722	396	152	10	5413
	92-93	0	15	58	390	1009	1132	1186	959	703	428	195	30	6105
	93-94	0												0
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	92-93	12	31	113	375	976	1241	1114	900	711	536	244	94	6347
	93-94	M												M
STEAMBOAT SPRINGS	AVE #	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	92-93	160	119	316	570	1247	1583	1452	1240	1063	812	458	275	9295
	93-94	166												166
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	92-93	14	36	70	400	949	1473	1401	1188	739	501	162	66	6999
	93-94	0												0
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	92-93	180	189	313	529	1194	1268	1193	1046	981	743	550	380	8566
	93-94	228												228
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	92-93	0	18	61	321	991	1137	1013	904	699	450	205	39	5838
	93-94	0												0
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	92-93	270	283	433	709	1310	1471	1428	1313	1153	899	592	384	10245
	93-94	286												286
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	92-93	5	29	54	271	894	951	947	875	684	461	210	42	5423

= AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

JULY 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	80.8	51.2	66.0	-3.7	94	41	45	85	510	0.97	-1.23	44.1	9
STERLING	86.6	58.9	72.7	-2.0	101	51	0	250	663	1.60	-1.02	61.1	12
FORT MORGAN	87.5	60.1	73.8	-1.4	100	51	0	280	691	2.19	0.39	121.7	6
AKRON FAA AP	85.5	56.9	71.2	-2.4	97	50	4	202	621	4.53	1.78	164.7	15
AKRON 4E	84.4	54.5	69.5	-3.9	98	46	10	157	580	4.82	2.09	176.6	11
HOLYOKE	81.0	58.9	69.9	-4.8	98	53	1	161	611	4.13	1.38	150.2	11
JOES	83.5	57.5	70.5	-4.5	101	51	1	176	620	2.99	0.44	117.3	8
BURLINGTON	85.5	58.0	71.7	-3.9	101	54	0	216	646	4.53	2.42	214.7	10
LIMON WSMO	84.5	53.8	69.2	-1.3	94	45	7	145	576	0.77	-1.89	28.9	6
CHEYENNE WELLS	91.2	57.2	74.2	-1.1	103	49	1	293	664	1.90	-0.63	75.1	10
EADS	90.4	60.3	75.3	-1.4	103	56	0	329	703	1.01	-1.61	38.5	2
ORDWAY 21N	93.4	58.8	76.1	0.2	102	52	0	351	692	0.71	-1.51	32.0	6
ROCKY FORD 2SE	94.7	59.5	77.1	0.3	104	53	0	385	713	1.56	-0.48	76.5	6
LAMAR	90.7	62.3	76.5	-1.1	103	54	0	364	742	1.28	-0.95	57.4	4
LAS ANIMAS	95.3	62.6	78.9	-0.2	107	55	0	438	755	0.12	-1.96	5.8	2
HOLLY	93.4	62.7	78.0	-0.4	106	53	0	410	755	2.46	0.31	114.4	6
SPRINGFIELD 7WSW	96.5	60.6	78.5	2.8	107	51	0	429	730	0.49	-1.96	20.0	3

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	84.0	55.4	69.7	-1.8	96	46	5	158	602	1.35	-0.48	73.8	7
GREELEY UNC	86.0	56.4	71.2	-2.2	100	50	4	204	620	0.56	-0.85	39.7	4
ESTES PARK	79.0	47.5	63.2	0.6	90	35	94	46	484	0.52	-1.72	23.2	5
LONGMONT 2ESE	87.2	51.9	69.6	-2.8	98	43	12	161	579	0.61	-0.50	55.0	4
BOULDER	84.4	54.6	69.5	-1.5	96	46	5	150	591	1.40	-0.57	71.1	10
DENVER WSFO AP	89.0	57.0	73.0	-0.5	99	47	1	256	650	0.91	-1.00	47.6	8
EVERGREEN	79.6	45.3	62.5	-1.3	90	37	85	15	466	1.51	-0.90	62.7	9
CHEESMAN	85.9	38.8	62.3	-3.2	94	30	99	25	527	0.68	-2.10	24.5	6
LAKE GEORGE 8SW	76.6	44.1	60.3	-0.7	84	35	140	2	421	0.56	-2.02	21.7	5
ANTERO RESERVOIR	75.2	38.7	56.9	-1.0	82	27	242	0	396	0.46	-1.57	22.7	6
RUXTON PARK	67.4	41.8	54.6	-1.5	74	32	317	0	278	1.18	-2.97	28.4	5
COLORADO SPRINGS	84.7	56.7	70.7	-0.3	94	49	0	183	619	2.38	-0.52	82.1	10
CANON CITY 2SE	87.1	56.7	71.9	-1.7	95	46	0	223	654	0.53	-1.35	28.2	8
PUEBLO WSO AP	92.4	57.4	74.9	-2.1	101	50	0	317	675	1.37	-0.73	65.2	8
WESTCLIFFE	80.6	42.7	61.6	-1.6	86	32	101	5	486	0.93	-1.32	41.3	6
WALSENBURG	89.1	56.2	72.6	0.3	94	47	0	246	655	0.38	-1.94	16.4	3
TRINIDAD FAA AP	91.4	54.7	73.0	-1.0	98	45	0	258	637	0.75	-1.44	34.2	6

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	75.3	35.6	55.4	-3.6	89	28	286	0	398	0.29	-0.94	23.6	6
LEADVILLE 2SW	71.3	35.4	53.3	-1.0	78	28	354	0	337	0.52	-1.48	26.0	5
SALIDA	84.0	46.5	65.2	-0.4	91	37	34	52	526	0.32	-1.33	19.4	6
BUENA VISTA	80.8	44.2	62.5	-2.2	88	37	83	12	484	0.61	-1.08	36.1	7
SAGUACHE	79.4	45.1	62.3	-1.4	85	40	86	10	463	0.58	-0.97	37.4	8
HERMIT 7ESE	77.5	34.0	55.8	-0.2	85	28	279	0	433	0.15	-2.33	6.0	2
ALAMOSA WSO AP	82.7	43.8	63.2	-1.7	87	33	51	6	512	0.33	-0.86	27.7	2
STEAMBOAT SPRINGS	80.2	38.9	59.6	-2.3	89	30	166	5	474	0.53	-1.00	34.6	5
YAMPA	77.1	43.6	60.3	-0.7	83	33	138	1	427	0.37	-1.64	18.4	4
GRAND LAKE 1NW	75.2	35.2	55.2	-1.6	86	27	297	0	398	0.57	-1.56	26.8	12
GRAND LAKE 6SSW	73.0	37.4	55.2	-2.9	82	30	297	0	364	0.93	-0.60	60.8	12
DILLON 1E	71.7	36.6	54.2	-2.4	79	29	327	0	346	0.87	-0.92	48.6	5
CLIMAX	64.5	33.8	49.1	-2.6	72	23	484	0	236	0.90	-1.46	38.1	4
ASPEN 1SW	74.8	39.6	57.2	-4.8	81	29	232	0	392	1.64	-0.21	88.6	6
CRESTED BUTTE	73.4	35.9	54.6	-2.5	81	29	313	0	370	1.04	-0.92	53.1	4
TAYLOR PARK	69.9	35.6	52.8	-3.2	76	29	369	0	313	0.75	-1.01	42.6	3
TELLURIDE	76.2	38.6	57.4	-2.8	82	31	228	0	413	0.14	-2.46	5.4	3
PAGOSA SPRINGS	83.6	40.3	61.9	-2.4	89	34	94	6	523	0.05	-1.83	2.7	2
SILVERTON	73.9	36.6	55.3	-0.2	82	31	295	0	377	0.46	-2.52	15.4	4
WOLF CREEK PASS 1	65.5	41.1	53.3	0.1	73	35	357	0	248	0.89	-2.65	25.1	5

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	81.3	45.3	63.3	-3.9	90	35	87	40	493	0.71	-0.59	54.6	4
HAYDEN	82.1	44.4	63.2	-3.7	90	32	78	29	501	0.60	-0.81	42.6	4
MEEKER NO. 2	84.5	44.4	64.5	-2.7	92	38	54	45	528	0.33	-0.95	25.8	7
RANGELY 1E	87.1	53.0	70.0	-3.4	96	42	22	185	598	0.36	-0.70	34.0	1
EAGLE FAA AP	84.2	44.5	64.3	-2.1	94	36	53	41	525	0.77	-0.54	58.8	9
GLENWOOD SPRINGS	86.1	48.5	67.3	-2.7	94	38	30	109	542	0.50	-0.85	37.0	3
GRAND JUNCTION WS	92.1	61.3	76.7	-2.1	99	44	4	371	732	0.04	-0.61	6.2	1
CEDAREDGE	87.9	48.2	68.1	-4.0	94	33	24	126	557	0.10	-0.83	10.8	1
PAONIA 1SW	88.3	53.8	71.1	-1.7	97	44	9	207	608	0.35	-0.80	30.4	4
DELTA	86.7	51.1	68.9	-4.8	96	44	13	144	574	0.08	-0.61	11.6	3
COCHETOPA CREEK	80.5	39.3	59.9	-1.4	88	30	156	4	479	1.04	-0.66	61.2	7
MONTROSE NO. 2	86.5	53.7	70.1	-2.4	95	41	14	180	613	0.17	-0.84	16.8	2
URAVAN	94.7	57.1	75.9	-1.1	101	51	0	345	673	0.23	-1.08	17.6	3
NORWOOD	83.0	50.5	66.7	0.3	90	40	23	84	547	0.31	-1.66	15.7	3
YELLOW JACKET 2W	87.7	52.1	69.9	-0.5	97	44	6	162	592	0.00	-1.45	0.0	0
CORTEZ	87.4	49.6	68.5	0.5	94	42	10	126	572	0.00	-1.20	0.0	0
DURANGO	84.2	49.9	67.0	-1.7	92	46	6	81	548	0.12	-1.73	6.5	1

Data are received by the Colorado Climate Center for more locations than appear in these tables. Please contact the Colorado Climate Center if additional information is needed.

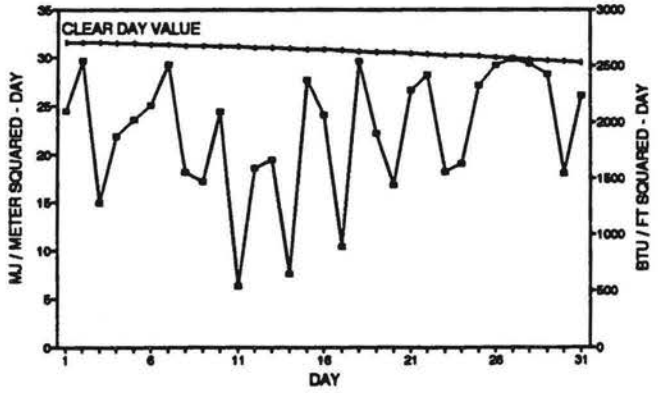
JULY 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days CLR	PC	CLDY	Percent Possible Sunshine	Average % of Possible
Denver	9	18	4	76%	71%
Fort Collins	11	13	7	–	–
Grand Junction	21	6	4	92%	78%
Limon	11	14	6	–	–
Pueblo	NA	NA	NA	90%	78%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

July was a very sunny month for much of Colorado. The greatest cloudiness was found from the Front Range out across the northeast plains. But even those areas had about normal sunshine. For Grand Junction, this was the sunniest July since 1982.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
JULY 1993

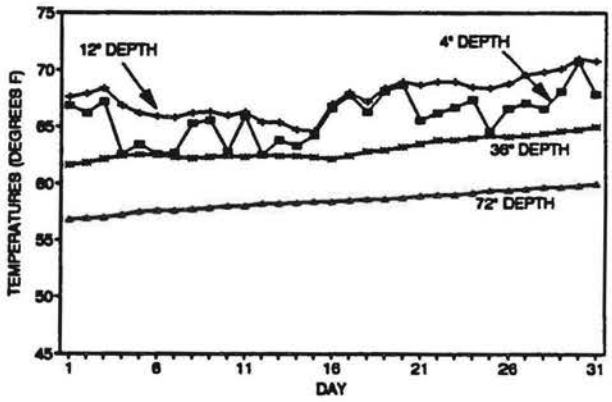


JULY 1993 SOIL TEMPERATURES

Soil temperatures leveled off early in July and then climbed to their highest values so far this year near the end of the month.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
JULY 1993



A MOMENT OF SILENCE FOR:

Mabel Wright of Hermit

We lost a special friend this summer. Mabel began her observing career 48 years ago at her ranch in SW Colorado. She was already well over 40 years old. At age 94, the years finally caught up with her. We miss you, Mabel, but we'll never forget all that you did.

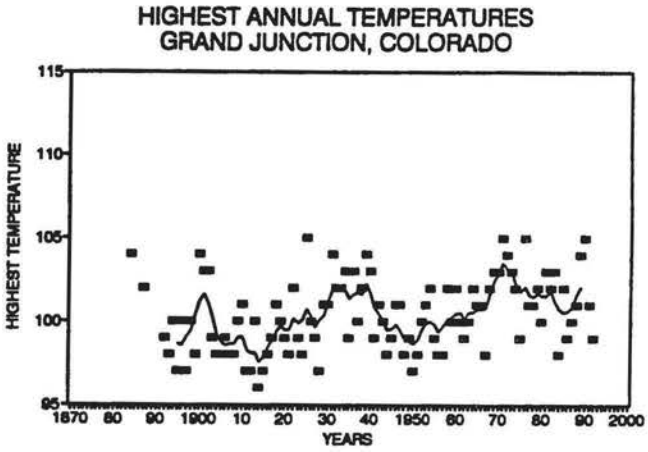
How Hot Can it Get?? – Part 2

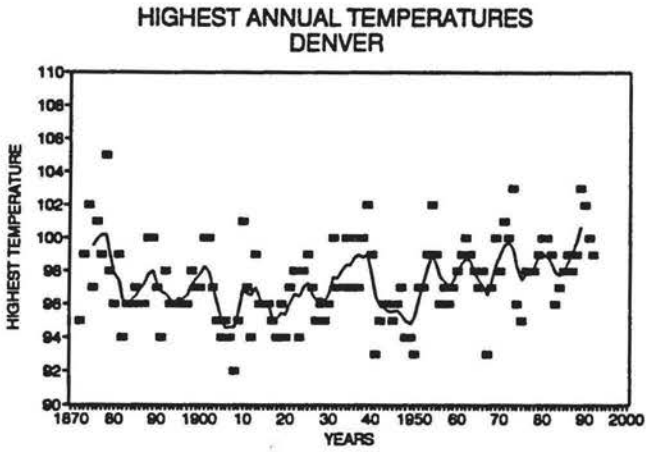
Last month we took a glimpse at what we can expect for the hottest temperature each year based on past records during the 20th Century. We noted the magnitude of year to year variation here in Colorado. For the most part, the highest temperature for the year at any particular point in the State falls within a narrow window about 10 degrees F wide. Elevation has a huge effect on the highest temperature with a very predictable decrease in highest temperature with increasing elevation.

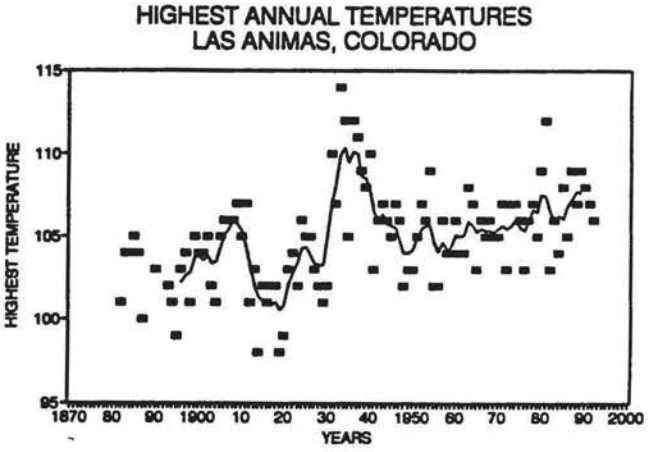
We didn't talk much about when the highest temperature of the year occurs, but that is also quite reliable. The majority of highest temperatures occur from late June into early August but there have been occurrences from as early as late May and as late as early September. Every now and then we have found the highest temperature of the year reported in other months of the year. Invariably, those reports were found to be errors. For most of our country (and for much of the Northern Hemisphere, for that matter) June-August is when the highest temperatures occur. But there are exceptions. Coastal areas of California, for example, often experience their hottest temperatures of the year in September and sometimes as late as October.

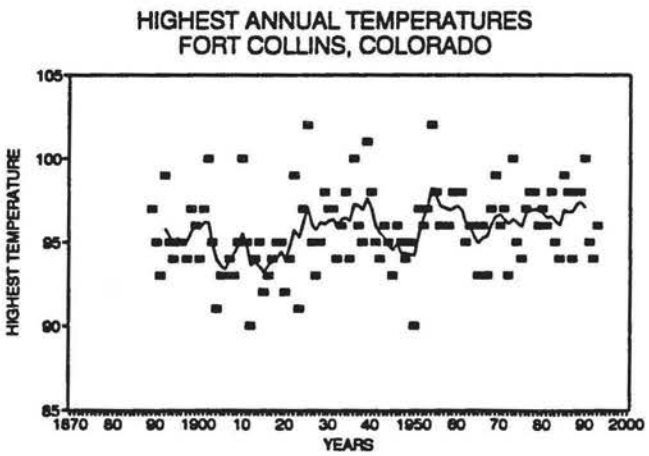
Is there anything we can learn by looking at time series of the hottest temperature of the year? Let's take a peek. The graphs below show how the hottest temperature of the year has varied over time at Denver, Fort Collins, Grand Junction, Las Animas and Dillon. The thin line represents a 7-year centrally weighted smoothing function to give a better visual depiction of multi-year variations. For these stations we went back as many years as we could to explore their extreme temperature patterns.

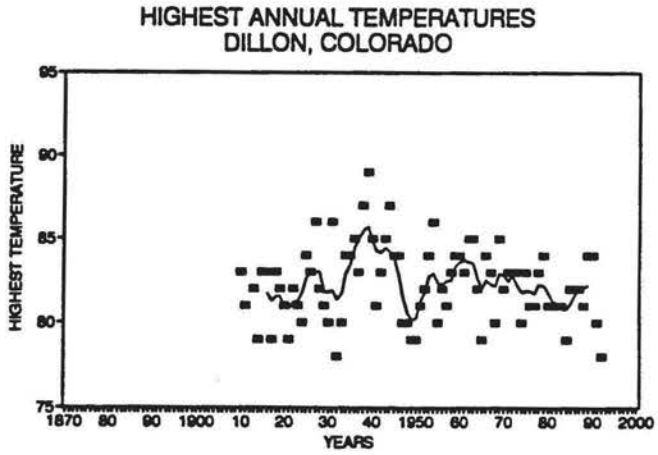
Each graph has some of its own unique characteristics, but there are also some common traits among these stations. My first impression was that the hottest temperature of the year goes up and down more or less randomly, like many other aspects of climate. But on closer inspection, it appears there may be some systematic behavior











Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

worthy of study. There were some very hot days back around the turn of the century. This corresponded to one of the worst drought periods on record for southwest Colorado 1898-1903. From then until the early 1920s was a period with lower extreme maximum temperatures. This corresponded to the period when large portions of Colorado were homesteaded and cultivated for the first time. It was a wet period favorable for many agricultural activities. Then along came the 1930s. Climatologists still don't have all the answers for what happened back then, but it is clear from these graphs that extremely hot days became much more common in all portions of Colorado. The most dramatic changes were note on Colorado's Eastern Plains. At Las Animas, for example, the highest temperature each year was nearly 10 degrees Fahrenheit higher during the 1930s than during the previous two decades. We theorize that the extreme temperatures measured during the 1930s were partially the result of the temporary devegetation of the plains region. Summer daytime temperatures over bare ground are almost always warmer than over surrounding lush adequately-watered vegetation. The massive cultivation (plowing under the native grasslands) that occurred in the previous decades, followed by intense multi-year drought, left thousands of square miles nearly without vegetation during the 1930s.

The return to cooler maximum temperatures in the 1940s was equally dramatic. Since then, the patterns have not been consistent at all stations. There were more extremely high maximum temperatures during the 1950s (another major drought period), but with less year-to-year consistency than the 1930s. The early 1970s again brought some extreme heat. The mid-1980s (a very wet period in Colorado) showed cooler values even though the 1980s were a decade when large-scale warming of mean annual temperatures were observed in Colorado and in much of the Northern Hemisphere. This culminated in very high "highest temperatures of the year" for 1989 and 1990 for Denver, Dillon and many other parts of Colorado. Fear of drought and global warming spread quickly. But this trend also reversed quickly. 1991 and 1992 lacked extreme hot days, and 1993 has so far behaved similarly.

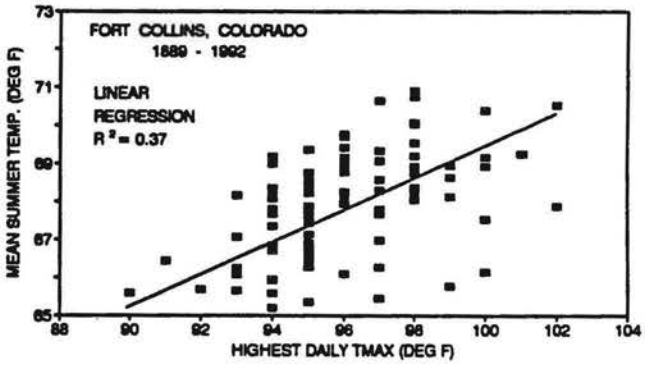
When looking at these data (or any data for that matter), it is critical to remember that not all the variations and changes you see are meteorological differences. At Denver, for example, the source of the official records changed in 1950 from a downtown site (on the roof of the Post Office Building) to Stapleton Airport. That station move produced a decrease in mean temperatures but an increase in extreme temperatures of about one degree. The situation at Dillon is also interesting. That is the only station that appears to have a downward trend in maximum temperatures. The station was moved around 1960 when Lake Dillon was under construction. The station is now a few hundred feet from the shore of the lake. Their highest temperature in 1992 was only 78°F, the coolest high on record.

Finally, we looked at variations in the hottest temperature statewide. This is tricky to analyze since the same weather stations have not all been in existence the whole period. Since 1931 the hottest temperature in the State has been 114° (Las Animas 1933 and Sedgwick 1954). The coolest years were 1941 and 1949 when the hottest temperature only reached 104°F. By far the hottest decade was the 1930s and the coolest was the 1940s. Since the mid 1950s nearly all of the hottest temperatures of the year have been in the range of 105° to 110°F. The location of the hottest temperature of the year is normally in the Arkansas Valley or in extreme eastern Colorado near the Kansas or Nebraska borders. In a few instances, the annual extreme has occurred in extreme western Colorado in valleys near the Utah border. Below is a list of recent hottest temperatures:

Year	Hottest Temp.	Date	Location
1992	106°F	July 7	Las Animas, Ordway 2ENE
1991	108	July 6	Holly
1990	111	June 28	Springfield 7WSW
1989	110	July 7	Uravan
1988	108	July 13	Holly
1987	110	July 31	Campo 7S
1986	107	July 30	Campo 7S, Holly
1985	109	June 8	Campo 7S
"	"	July 9	Wray 1E
1984	106	July 9	Holly
1983	109	Aug. 22	Wray
1982	105	July 24	Ft. Morgan, Sterling
1981	112	July 21	Las Animas

I have also wondered if the hottest temperature of the year is an indicator of how hot the entire summer season is. To investigate this relationship, I made a scatter plot of the hottest temperature of the year plotted against the mean temperature for the entire summer using 1889-1992 Fort Collins data for my example.

RELATIONSHIP BETWEEN THE HIGHEST DAILY TEMPERATURE AND THE MEAN SUMMER TEMP.



Results show that there is a relationship between the highest temperature of the year and the mean temperature for the whole summer. However, only about 37% of the variance in mean summer temperatures can be explained this way. Likewise, we looked at the relationship between summer precipitation and summer temperatures. Again, the correlations are not spectacular, but there is a tendency for the hottest temperature of the year to be lower during wet summers than during dry summers.

Next month we are going to make a dramatic shift (just like our weather often does) and begin talking about snow. We have been developing climate information to make it easier to plan ahead for snow removal across our State. It might seem more appropriate to write about that during the winter, but the right time to plan is now.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

COLORADO CLIMATE

AUGUST 1993

Volume 16 Number 11

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

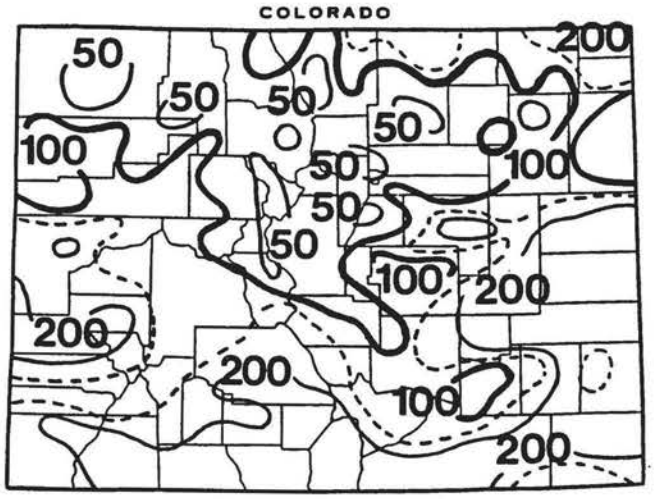
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

August Climate in Perspective – The Monsoon Arrived

Following one of the driest June-July periods in the Colorado mountains in several years, the weather patterns reversed and moisture streamed into southern Colorado in August. Episodes of very cloudy and abnormally chilly weather affected most of eastern and southern Colorado during the month. Northwestern Colorado escaped the changeable weather and enjoyed stable and rather dry conditions.

Precipitation

Rain fell on only a few days in August across northern Colorado, but southern portions of the State had as many as 22 days with rain. There were nearly 70 reports of

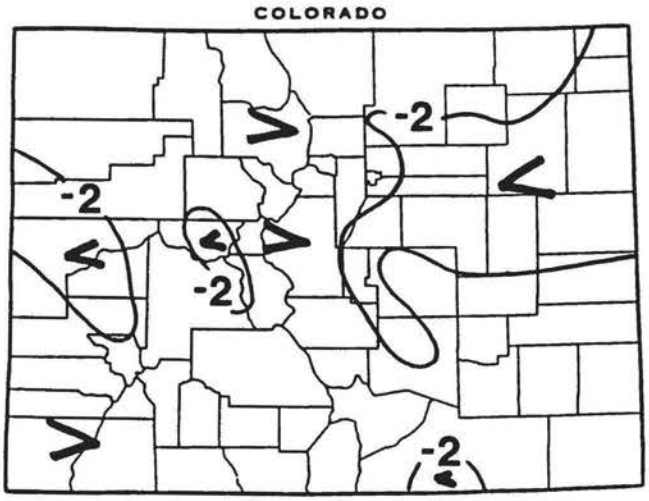


August 1993 precipitation as a percent of the 1961-1990 average.

24-hour rainfall totals in excess of 1" from official reporting stations during the month – an unusually large number for Colorado. August precipitation totals ended up much above average across southern and southeastern Colorado. North central and northwestern Colorado remained drier than average. The wettest areas, compared to average ran from Durango eastward to Alamosa and Trinidad and also in an area from Limon and Burlington south to Springfield. The Arapahoe 14N weather station totalled 8.11" of rain for the month. The 5.40" total at Alamosa exceeded the wettest month ever recorded there this century.

Temperatures

Strong August cold fronts and periods of dense cloudiness resulted in several situations with daytime temperatures more than 20° cooler than normal over eastern and southern Colorado. The high temperature at Hourglass Reservoir on August 30th only reached 40°F, one of the coldest August days ever reported anywhere in Colorado. Overall, statewide temperatures ended up about two degrees Fahrenheit cooler than average. This was the third consecutive month with cooler than expected temperatures across the entire State. There were some hot days in August, but no persisting hot spells.



Departure of August 1993 temperatures from the 1961-90 averages.

Inside This Issue

AUGUST 1993 DAILY WEATHER

1-6 Northwesterly winds aloft continued to keep tropical moisture from reaching the Colorado mountains. A Canadian cold front dropped down across Colorado on the 1st bringing an abrupt end to the heatwave of late July. Scattered showers developed east of the mountains on the 1st and became more numerous on the 2nd. Dense clouds and high humidities helped hold daytime temperatures east of the mountains down in the 60s (some 50s in the foothills) on the 3rd, while the mountains and Western Slope were dry and 10 to 30 degrees warmer. Temperature rebounded a bit on the 4th, but more warmth resulted in more active convective storms. Limon got 1.13" of rain on the 4th. Then an upper disturbance crossed Colorado on the 5th, cooling temperatures again and setting off widespread thundershowers. Briggsdale was deluged with 2.63" of rain. The 6th was warmer again with more sunshine, but a few storms erupted over northeastern Colorado.

7-11 For the first time all summer, southwesterly winds developed and pumped tropical moisture into southwestern Colorado. Mountain thundershowers developed each day, while the Eastern Plains became hot and mostly dry 7-9th. Mountain showers became heavier on the 9th and continued into the morning of the 10th in some areas. Great Sand Dunes National Monument measured 1.17" of rain. Later on the 10th, heavier storms organized east of the mountains and dropped locally heavy rains. Parker reported 1.70" and Stratton added 1.97". Storms were widely scattered on the 11th but put on spectacular lightning displays for much of the region late into the night.

12-14 A cold front snuck into eastern Colorado on the 12th and helped trigger more strong storms. Flagler received 2.27" of rain, and the Arapahoe 14N station south of Burlington got 3.10". Showers decreased over eastern Colorado on the 13th but increased in western Colorado. Clouds, rain, and cool temperatures covered much of western Colorado on the 14th.

15-17 Much drier air moved into Colorado for a few days. Some light thundershowers occurred on the 15th, but most of the State was sunny and dry 16-17th. Daytime temperatures shot up into the 90s at lower elevations, but nights were cool especially in the mountains. Fraser reported a low of 26° on the 16th.

18-22 Cooler air returned to northern Colorado, while moisture increased from the south. Early morning thunderstorms east of Burlington dropped very heavy rains near Goodland, KS. Then scattered but locally heavy storms developed later on the 18th depositing 1.54" at the Pueblo airport and more than 2" near Ordway. Clouds were plentiful 19-20th, and scattered thunderstorms were most numerous over southern Colorado. As an upper-air disturbance traversed the region on the 21st, storms became widespread and locally heavy. Eastonville (northeast of Colorado Springs) reported 2.33" of rain. Showers diminished on the 22nd, but temperatures remained cooler than normal, especially across the western half of the State.

23-25 Colorado enjoyed a few days of dry weather. Nights were chilly in the mountains with some reports below freezing. Days were warm, however. Uravan hit 98° on the 24th and Las Animas's 103°F reading on the 25th was the hottest in Colorado in August. A few sprinkles dripped on northern Colorado late in the day as a cold front approached.

26-29 Very moist tropical air moved northward into southwest Colorado while cooler Canadian air penetrated into northern portions of the State. Showers turned into steady soaking rains across southern Colorado lasting until midday on the 29th. Storms also spread into eastern and southeastern counties. Unseasonably cool daytime temperatures accompanied the rains. The high temperature for Durango on the 27th was only 58°F, 25 degrees cooler than usual. Heavy 24-hour rain reports including 1.31" at Alamosa on the 27th and 1.90" at Pagosa Springs on the 28th. Impressive multi-day storm totals included 2.86" in two days at Haswell and a 3-day total of 5.42" at Wolf Creek Pass 1E.

30-31 A stronger surge of cold autumn-like air dropped down from the north. Denver's high temperature on the 30th was only 62°F, and some places in the foothills stayed in the 40s. Most of the State began to dry out, but rain continued over portions of southern Colorado. Durango measured an additional 2.58" 30-31st. As skies cleared on the 31st, temperatures dropped to their lowest levels of the month. The morning low at Akron 4E dipped to a near-record 36°F. Hohnholz Ranch on the Larimee River was the State's cold spot with a low of 24°F.

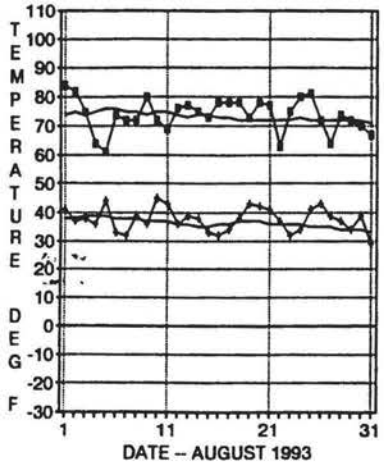
Weather Extremes

Highest Temperature	103°F	August 25	Las Animas
Lowest Temperature	24°F	August 31	Hohnholz Ranch
Greatest Total Precipitation	8.11"		Arapahoe 14N
Least Total Precipitation	0.15"		Maybell
Greatest Total Snowfall	0.00"		No snow reported
Greatest Snow Depth	0.00"		None reported

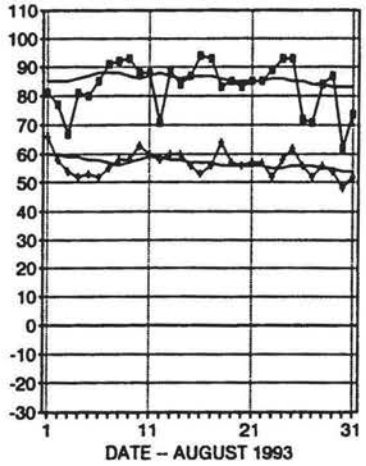
AUGUST 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

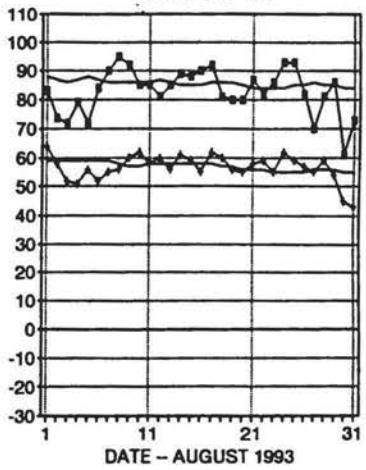
GRAND LAKE 1NW



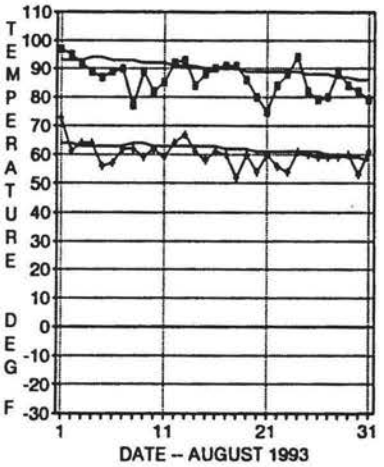
DENVER



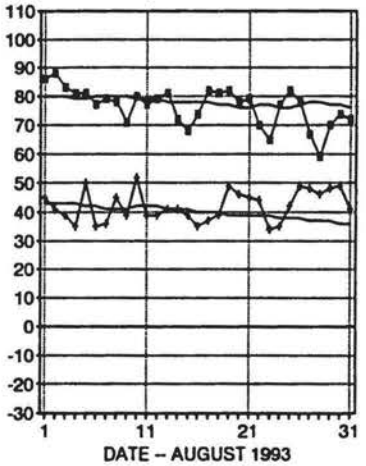
AKRON 1N



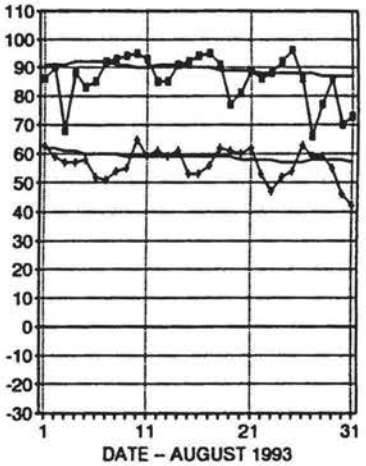
GRAND JUNCTION



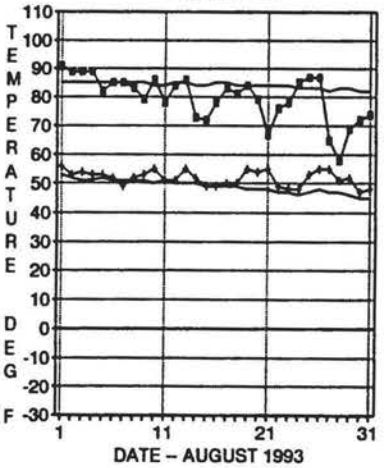
GUNNISON (COCHETOPA CRK.)



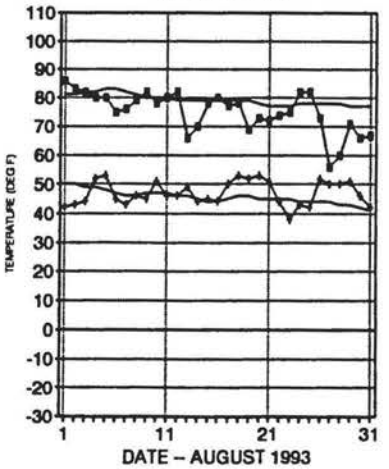
PUEBLO WSO



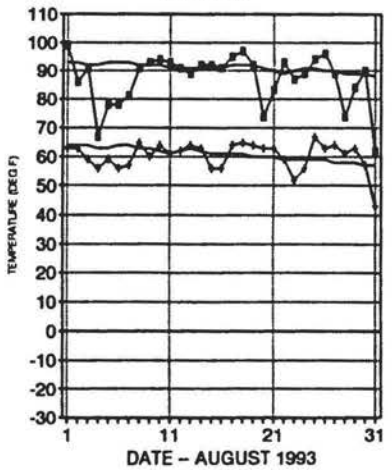
DURANGO



ALAMOSA



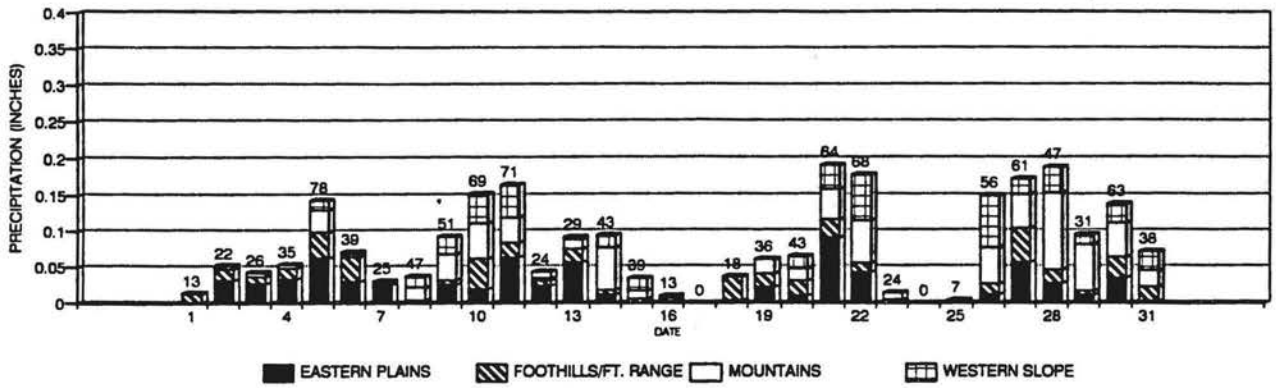
LAMAR



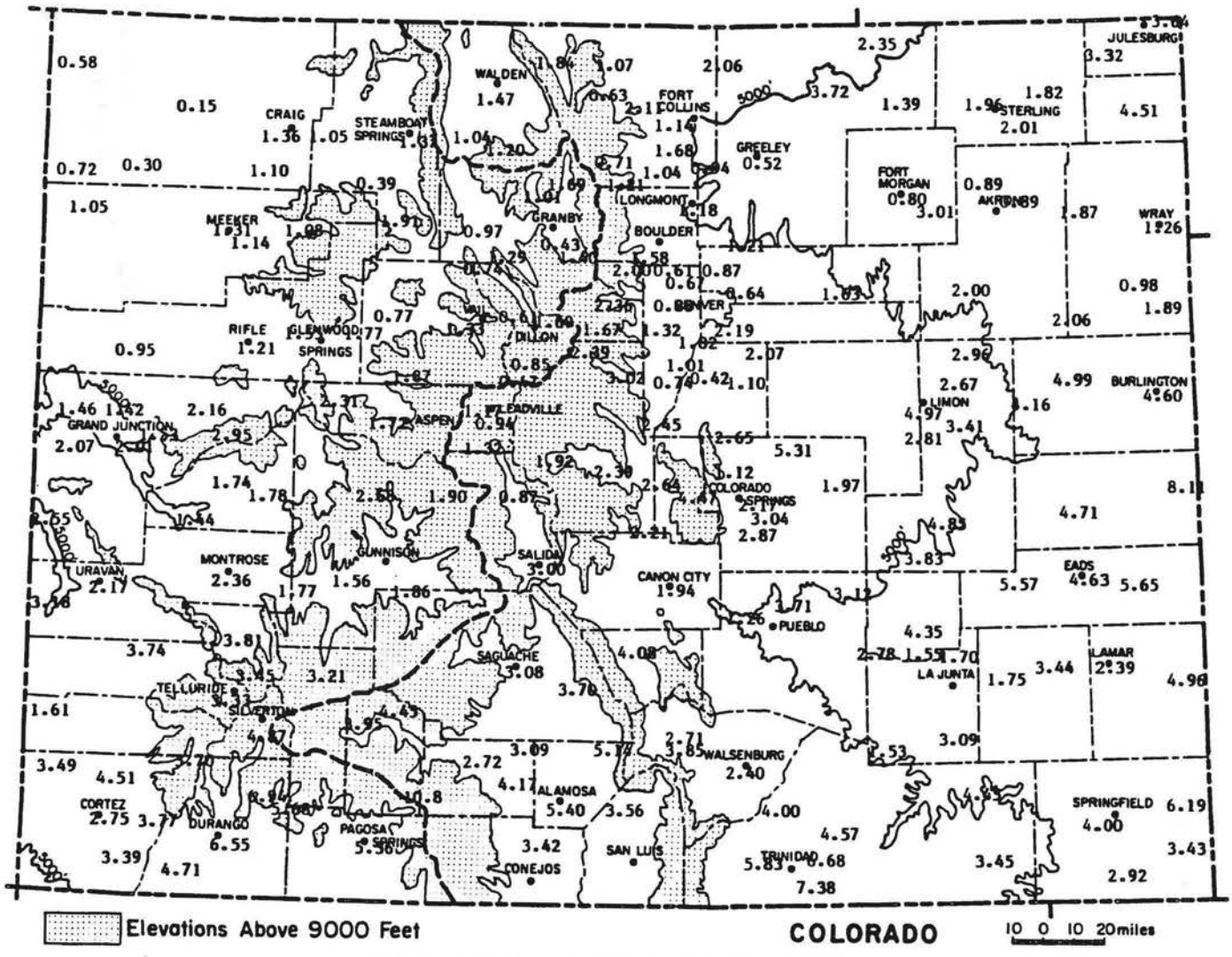
AUGUST 1993 PRECIPITATION

Precipitation fell somewhere in Colorado on most of the days in August. There were two dry periods with little or no rain, 16-17th and 23-25th. There were four periods when precipitation damped the majority of Colorado: 5th, 10-11, 21-22 and 26-30th. Statewide, August precipitation totalled nearly 2.45", considerably above average. No single day, however, averaged more than 0.20". By comparison, August 1992 received a comparable amount of precipitation when averaged across the State. Most of it was concentrated in a single storm August 23-25th.

COLORADO DAILY PRECIPITATION - AUG 1993

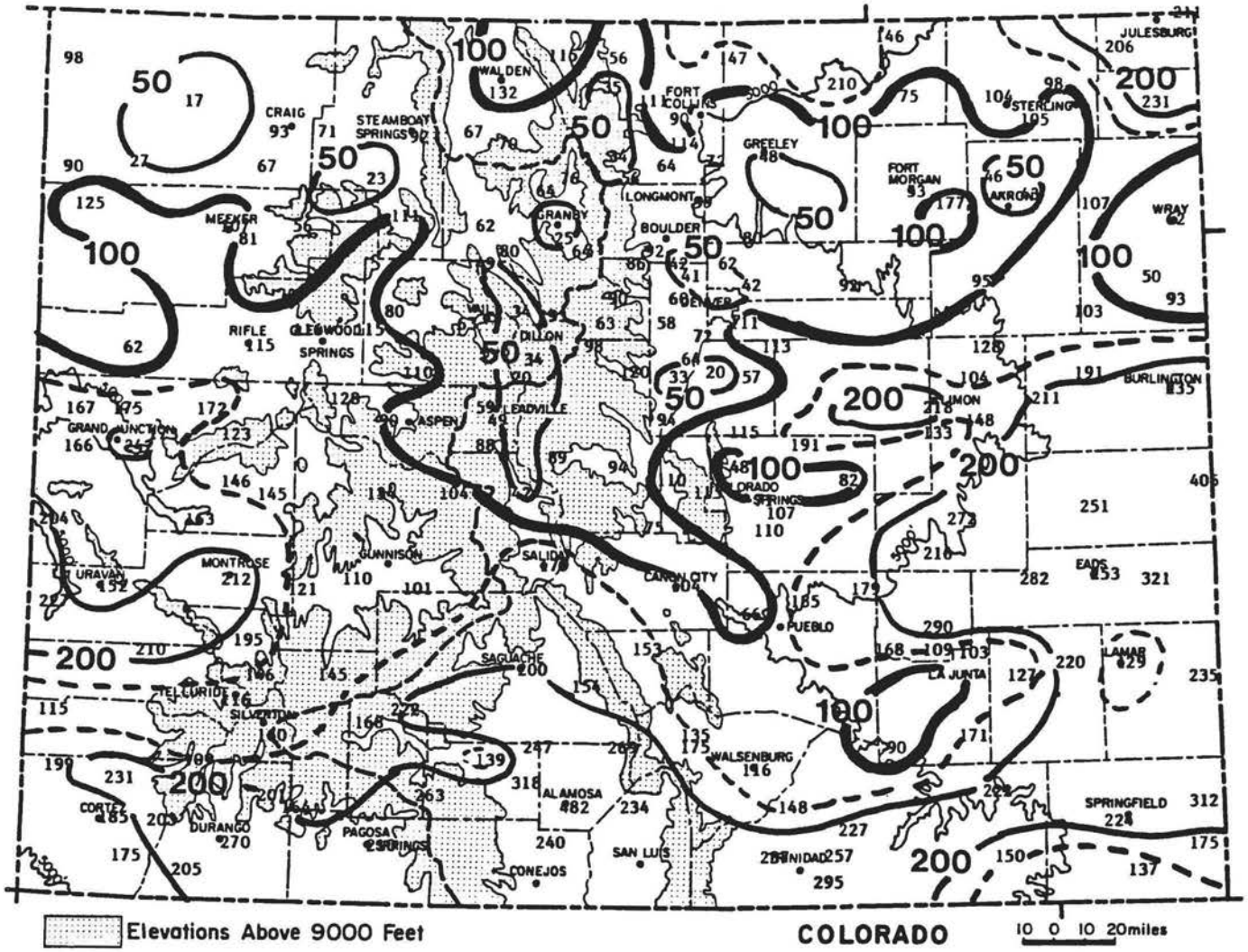


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

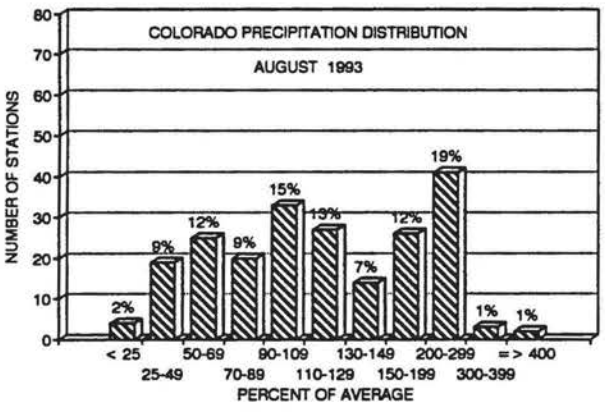


Precipitation Amounts (in inches) for August 1993.

AUGUST 1993 PRECIPITATION COMPARISON



August 1993 Precipitation as a Percent of the 1961–90 average.



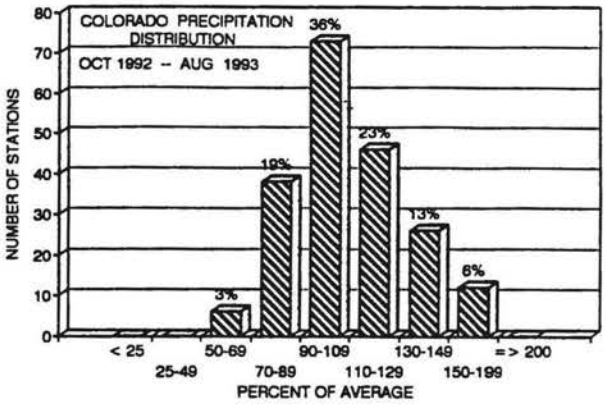
Colorado experienced a broad distribution of precipitation in August. Totals ranged from 17% of average at Maybell to 482% of average at Alamosa. Overall, the wet areas outnumbered the dry area about 3 to 2. Alamosa's 5.40" total shattered the previous August record there by more than one inch.

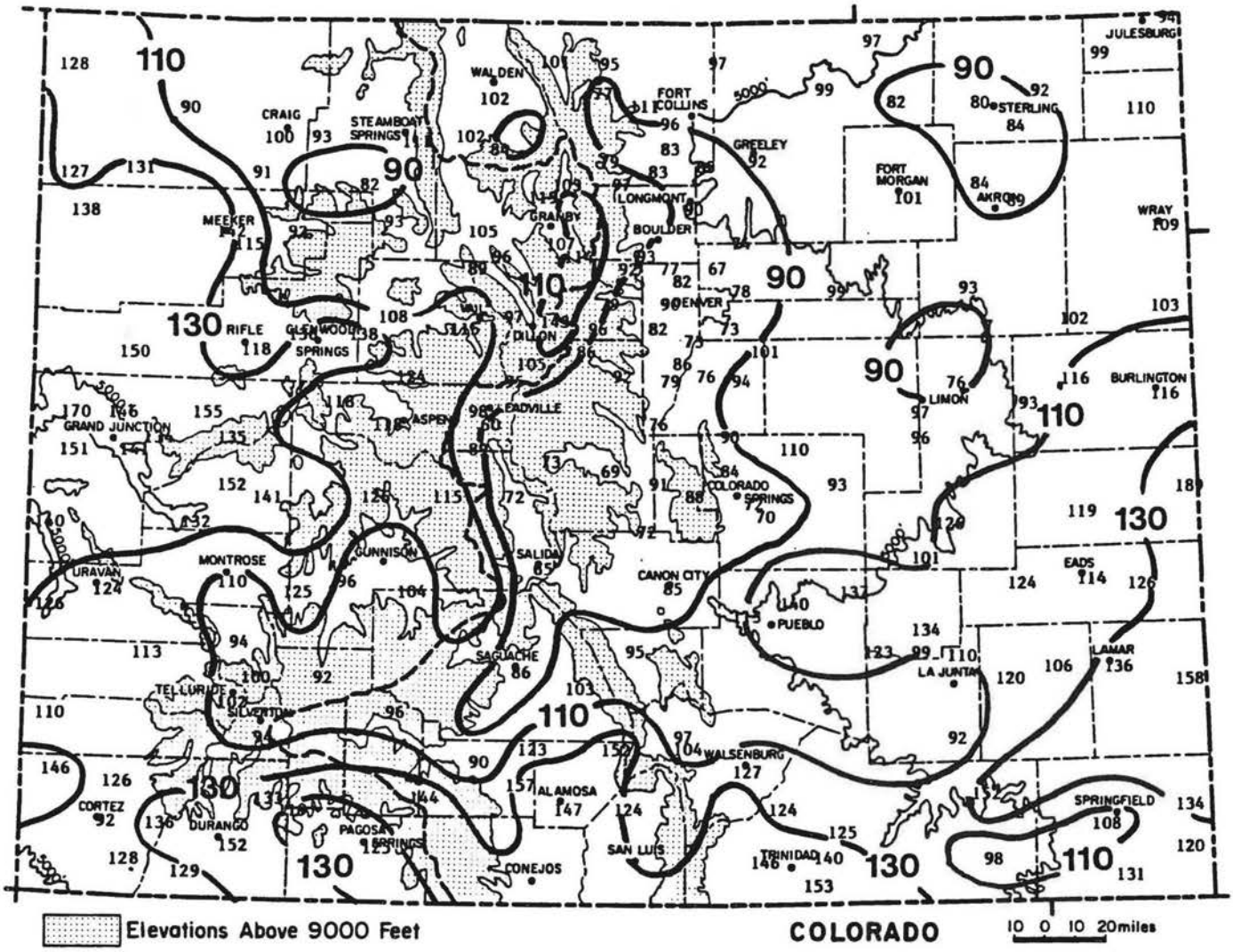
AUGUST 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	0.64"	26th driest in 122 years of record (driest = 0.02" in 1924)
Durango	6.55"	**Wettest** in 99 years of record (previous wettest 5.97" in 1947)
Grand Junction	1.42"	23rd wettest in 102 years of record (wettest = 3.65" in 1921)
Las Animas	1.75"	50th wettest in 128 years of record (wettest 5.98" in 1916)
Pueblo	3.71"	10th wettest in 124 years of record (wettest = 5.85" in 1955)
Steamboat Springs	1.37"	39th driest in 87 years of record (driest 0.17" in 1944)

1993 WATER YEAR PRECIPITATION

Weather patterns continued their fickle ways in August. After the wet winter that much of Colorado experienced, a fairly dry spring and a very dry early summer were pressing the precipitation totals back below normal in expanding areas of the State. August reversed that trend and we are nearly assured that the water year will end up wetter than average for the majority of the State. Wet areas (110% of average or greater) now cover most of the Western Slope, much of the Central and Southern mountains, the San Luis Valley and most of the southeastern Colorado plains and plateaus. Dry areas (less than 90% of average) are scattered across northeastern Colorado and lie in a band east of the Continental Divide from Sagauche and Salida north to Longmont and Estes Park. Northglenn is one of the driest stations with respect to average – just 67% of average so far. The remainder of the State can be classified as near normal. A thorough analysis and review of the 1993 water year will be published in the September issue of "Colorado Climate".





October 1992–August 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR AUGUST 1993

HEATING DEGREE DATA — COLORADO CLIMATE CENTER (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	92-93	97	131	295	607	1281	1796	1637	1280	958	692	435	185	9394
	93-94	51	118											169
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	92-93	249	228	361	583	1272	1458	1325	1197	1039	901	557	363	9533
	93-94	232	221											453
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	92-93	20	55	71	337	921	1093	1130	958	697	514	233	91	6120
	93-94	5	M											M
BUENA VISTA	AVE	50	111	318	620	980	1243	1259	1047	992	729	477	197	8003
	92-93	107	148	306	536	1119	1302	1211	1093	907	735	448	232	8141
	93-94	83	144											227
BURLINGTON	AVE	0	9	138	432	822	1132	1175	948	859	519	254	34	6320
	92-93	5	39	74	372	928	1301	1331	1103	773	531	219	68	6744
	93-94	0	25											25
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4967
	92-93	2	29	73	305	862	976	1064	885	668	482	199	55	5620
	93-94	0	22											22
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	92-93	21	53	91	383	990	1101	1179	991	776	558	286	84	6513
	93-94	0	40											40
CORTEZ	AVE *	0	11	146	474	826	1163	1237	958	853	594	322	81	6667
	92-93	18	42	122	373	965	1276	1051	880	780	578	282	106	6453
	93-94	10	14											24
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8378
	92-93	67	64	234	496	1139	1453	1408	1270	976	765	364	203	8441
	93-94	87	60											147
DELTA	AVE	0	10	125	403	774	1126	1221	888	719	435	186	36	5927
	92-93	6	10	71	301	919	1192	967	783	649	469	181	52	5800
	93-94	13	33											46
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	92-93	10	35	58	346	926	1219	1162	992	686	489	195	71	6189
	93-94	1	20											21
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1008	747	459	11218
	92-93	364	361	525	744	1346	1480	1435	1273	1220	1011	693	480	10952
	93-94	327	350											677
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	92-93	34	49	139	371	988	1319	1152	966	766	569	302	136	6793
	93-94	6	43											49
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	92-93	47	73	209	503	1140	1389	1387	1118	894	641	352	169	7922
	93-94	53	52											105
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	92-93	103	167	238	540	1074	1200	1177	1083	879	722	479	226	7888
	93-94	85	140											225
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	92-93	22	55	87	377	940	1222	1239	1031	706	519	209	83	6490
	93-94	5	22											27
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6480
	92-93	12	40	36	352	937	1472	1494	1202	789	509	156	64	7065
	93-94	0	19											19
GRAND JUNCTION	AVE	0	0	55	332	736	1125	1240	854	670	389	132	13	5548
	92-93	0	6	25	222	868	1245	1018	799	597	446	144	33	5403
	93-94	4	0											4

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

HEATING DEGREE DATA — COLORADO CLIMATE CENTER (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE 6SSW	AVE	214	260	468	781	1113	1478	1600	1361	1283	945	660	381	10542
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949	648	360	10676
	93-94	297	274											571
GREELEY	AVE	0	7	158	446	831	1153	1206	924	808	492	231	52	6308
	92-93	14	43	59	374	948	1334	1348	1073	705	502	182	82	6664
	93-94	4	15											19
GUNNISON	AVE	130	204	435	763	1143	1609	1786	1456	1237	867	580	306	10516
	92-93	208	M	M	617	1278	M	M	M	M	M	M	M	M
	93-94	M	M											M
LAS ANIMAS	AVE	0	0	69	338	750	1068	1141	862	707	370	121	9	5455
	92-93	0	11	33	304	937	1267	1242	956	648	360	128	9	5895
	93-94	0	12											12
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10670
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033	736	489	11276
	93-94	354	390											744
LIMON	AVE	6	21	189	521	879	1189	1218	991	924	603	344	96	8981
	92-93	16	54	133	442	1018	1278	1339	1118	850	615	335	113	7311
	93-94	7	48											55
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	92-93	20	61	77	388	982	1299	1347	1063	721	534	228	105	6825
	93-94	12	30											42
MEEKER	AVE	28	56	261	564	927	1240	1345	1066	998	651	394	184	7714
	92-93	23	44	152	426	1123	1306	1253	1117	859	644	335	183	7465
	93-94	54	42											96
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	92-93	15	43	87	332	1000	1247	1023	873	687	571	241	104	6223
	93-94	14	15											29
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	92-93	120	126	317	536	1123	1442	1291	1096	915	714	422	261	8365
	93-94	94	143											237
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	398	152	10	5413
	92-93	0	15	58	390	1009	1132	1186	959	703	428	195	30	6105
	93-94	0	18											18
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	92-93	12	31	113	375	976	1241	1114	900	711	536	244	94	6347
	93-94	13	7											20
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1806	1316	1169	801	543	297	9779
	92-93	180	119	316	570	1247	1583	1452	1240	1063	812	458	275	9295
	93-94	166	144											310
STERLING	AVE	0	9	149	482	852	1200	1265	983	843	504	238	56	6541
	92-93	14	36	70	400	949	1473	1401	1188	739	501	182	86	6999
	93-94	0	14											14
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1126	1101	819	574	310	8986
	92-93	180	189	313	529	1194	1268	1193	1046	961	743	550	380	8566
	93-94	228	249											477
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	92-93	0	18	61	321	991	1137	1013	904	699	450	205	39	5838
	93-94	0	27											27
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	92-93	270	263	433	709	1310	1471	1428	1313	1153	899	592	384	10245
	93-94	286	282											568
WALSENBURG	AVE	0	8	105	371	693	955	992	820	744	477	229	44	5438
	92-93	5	29	54	271	894	951	947	875	684	461	210	42	5423
	93-94	0	17											17

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

AUGUST 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	79.7	51.9	65.8	-1.4	96	39	52	84	501	2.35	0.75	146.9	8
STERLING	86.4	57.7	72.0	-0.1	103	39	14	241	652	1.96	0.08	104.3	7
FORT MORGAN	82.2	58.2	70.2	-2.3	94	40	19	187	623	0.80	-0.69	53.7	2
AKRON FAA AP	83.0	56.6	69.8	-1.6	95	43	24	181	604	0.89	-1.04	46.1	7
AKRON 4E	83.7	53.8	68.7	-2.8	95	36	35	158	573	0.89	-1.15	43.6	7
HOLYOKE	80.5	58.2	69.3	-3.2	94	42	24	168	599	4.51	2.56	231.3	9
JOES	82.3	55.6	69.0	-3.9	96	38	35	164	580	2.06	0.06	103.0	9
BURLINGTON	83.3	58.3	70.8	-2.3	96	42	25	214	624	4.60	2.65	235.9	9
LIMON WSMO	78.5	52.9	65.7	-2.8	88	37	48	79	504	4.97	2.70	218.9	12
CHEYENNE WELLS	86.0	56.9	71.4	-1.7	96	41	21	229	623	5.71	3.71	285.5	13
EADS	85.7	59.1	72.4	-1.5	102	44	19	258	653	4.63	2.80	253.0	10
ORDWAY 21N	87.0	57.1	72.0	-1.1	101	41	22	246	634	3.83	2.06	216.4	10
ROCKY FORD 2SE	90.4	56.0	73.2	-0.9	99	39	8	269	653	1.55	0.13	109.2	13
LAMAR	87.3	60.3	73.8	-1.3	99	43	15	296	682	2.39	0.54	129.2	14
LAS ANIMAS	90.0	59.8	74.9	-1.4	103	41	12	327	692	1.75	0.38	127.7	14
HOLLY	88.4	61.6	75.0	-0.5	99	44	7	326	713	4.96	2.85	235.1	19
SPRINGFIELD 7WSW	91.5	59.6	75.5	2.0	99	44	6	343	707	4.00	2.22	224.7	14
TIMPAS 13SW	87.9	58.6	73.2	-0.9	101	45	20	284	656	1.53	-0.17	90.0	6

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	80.3	54.4	67.3	-1.9	91	43	22	101	544	1.14	-0.12	90.5	7
GREELEY UNC	83.3	55.8	69.5	-1.7	95	45	15	163	591	0.52	-0.55	48.6	3
ESTES PARK	75.5	46.5	61.0	0.5	83	38	128	12	416	0.71	-1.33	34.8	10
LONGMONT 2ESE	84.7	50.8	67.7	-2.3	99	44	30	124	546	1.18	-0.01	99.2	4
DENVER WSFO AP	83.5	56.5	70.0	-1.4	94	48	20	185	598	0.64	-0.88	42.1	9
EVERGREEN	75.4	45.4	60.4	-1.5	89	39	140	7	401	1.32	-0.94	58.4	15
CHEESMAN	79.1	38.9	59.0	-4.5	92	31	185	7	451	2.35	-0.23	91.1	15
LAKE GEORGE 8SW	71.2	43.4	57.3	-1.7	80	36	231	0	337	2.39	-0.15	94.1	18
ANTERO RESERVOIR	71.6	40.5	56.0	0.2	79	31	268	0	343	1.92	-0.23	89.3	15
RUXTON PARK	61.5	40.0	50.7	-3.2	72	32	433	0	191	4.47	0.59	115.2	19
COLORADO SPRINGS	79.2	55.4	67.3	-1.3	92	45	40	117	540	2.17	-0.86	71.6	17
CANON CITY 2SE	82.3	56.8	69.5	-1.6	95	47	22	168	592	1.94	0.08	104.3	17
PUEBLO WSO AP	86.0	56.4	71.2	-3.1	96	42	18	221	626	3.71	1.71	185.5	10
WESTCLIFFE	73.2	45.2	59.2	-1.8	83	33	172	0	372	4.08	1.42	153.4	16
WALSENBURG	82.5	55.8	69.2	-0.6	91	44	17	156	598	2.40	0.34	116.5	14
TRINIDAD FAA AP	83.2	54.9	69.0	-2.6	93	46	27	161	577	4.57	2.56	227.4	15

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	74.1	37.1	55.6	-0.9	83	26	282	0	381	1.47	0.36	132.4	15
LEADVILLE 2SW	67.7	36.5	52.1	-0.5	77	29	390	0	283	0.94	-0.96	49.5	11
SALIDA	78.3	48.7	63.5	-0.2	88	38	78	37	457	3.00	1.33	179.6	13
BUENA VISTA	76.3	44.7	60.5	-1.8	88	35	144	12	416	0.87	-1.18	42.4	16
SAGUACHE	73.7	46.0	59.8	-1.7	84	40	156	2	377	3.08	1.54	200.0	17
HERMIT 7ESE	70.3	37.4	53.8	-0.5	82	30	338	0	323	3.95	1.61	168.8	13
ALAMOSA WSO AP	75.2	46.9	61.1	-1.3	86	38	118	4	406	5.40	4.28	482.1	17
STEAMBOAT SPRINGS	79.8	40.3	60.1	-0.1	89	33	144	1	465	1.37	-0.11	92.6	10
YAMPA	75.0	45.7	60.3	0.9	82	38	137	0	397	1.91	0.19	111.0	9
GRAND LAKE 1NW	73.7	37.6	55.7	0.8	84	29	283	0	374	1.69	-0.51	76.8	14
GRAND LAKE 6SSW	72.3	39.5	55.9	-0.7	81	31	274	0	353	1.01	-0.56	64.3	9
DILLON 1E	69.5	37.4	53.5	-1.3	78	32	350	0	310	0.61	-1.14	34.9	11
CLIMAX	63.7	35.0	49.4	-0.4	73	29	477	0	220	0.47	-1.84	20.3	7
ASPEN 1SW	72.5	42.6	57.6	-2.9	83	38	221	0	357	1.72	-0.18	90.5	14
CRESTED BUTTE	70.0	38.0	54.0	-1.7	82	31	332	0	320	2.68	0.68	134.0	16
TAYLOR PARK	65.7	38.2	51.9	-2.2	76	32	396	0	250	1.90	0.09	105.0	12
TELLURIDE	71.7	41.7	56.7	-1.8	85	32	249	0	347	3.33	0.48	116.8	16
PAGOSA SPRINGS	77.9	42.5	60.2	-2.2	90	34	143	2	438	5.36	2.81	210.2	15
SILVERTON	68.5	38.6	53.6	-0.1	81	32	347	0	293	4.87	1.83	160.2	18
WOLF CREEK PASS 1	60.5	39.7	50.1	-1.2	71	32	457	0	173	10.89	6.76	263.7	22

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	80.0	47.2	63.6	-1.8	91	37	60	26	477	1.36	-0.09	93.8	6
HAYDEN	80.0	45.9	63.0	-1.8	89	37	73	18	477	1.05	-0.41	71.9	8
MEEKER NO. 2	82.7	46.2	64.5	-0.8	95	41	42	33	510	1.31	0.09	107.4	10
RANGELY 1E	85.5	52.8	69.1	-1.6	96	48	3	137	584	1.05	0.21	125.0	11
EAGLE FAA AP	82.4	45.4	63.9	-0.3	90	39	52	27	514	0.77	-0.19	80.2	9
GLENWOOD SPRINGS	84.2	49.1	66.6	-1.4	94	43	14	73	529	1.55	0.22	116.5	9
RIFLE	86.3	47.9	67.1	-1.6	97	40	7	78	551	1.21	0.16	115.2	8
GRAND JUNCTION WS	86.5	59.9	73.2	-3.0	97	52	0	260	686	1.42	0.61	175.3	11
CEDAREDGE	83.9	49.2	66.6	-3.2	94	44	20	76	531	1.74	0.55	146.2	10
PAONIA 1SW	84.9	54.2	69.6	-1.1	100	51	6	154	586	1.78	0.56	145.9	10
DELTA	80.6	49.6	65.1	-6.0	92	42	33	43	490	1.44	0.56	163.6	7
COCHETOPA CREEK	76.5	42.0	59.3	-0.3	88	34	174	4	418	1.86	0.02	101.1	13
MONTROSE NO. 2	81.8	53.3	67.5	-2.5	93	46	15	101	546	2.36	1.25	212.6	9
URAVAN	90.1	56.7	73.4	-1.5	105	45	0	268	660	2.17	0.75	152.8	12
NORWOOD	78.5	49.3	63.9	-0.5	89	42	52	24	467	3.74	1.96	210.1	10
YELLOW JACKET 2W	82.5	52.4	67.4	-0.8	93	47	13	95	540	3.49	1.74	199.4	14
CORTEZ	82.9	51.9	67.4	0.4	95	47	14	98	537	2.75	1.27	185.8	13
DURANGO	79.8	51.7	65.8	-0.7	91	47	43	77	497	6.55	4.13	270.7	14

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

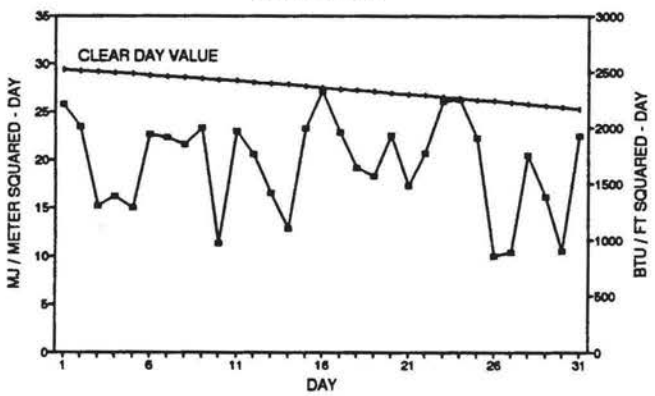
AUGUST 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	NA	NA	NA	--	--
Denver	6	11	14	55%	72%
Fort Collins	5	17	9	--	--
Grand Junction	8	13	10	86%	77%
Limon	6	8	16	--	--
Pueblo	NA	NA	NA	52%	78%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

August brought the normal amount of sunshine to northwestern Colorado. The rest of the State, however, was considerably cloudier than normal. This is the second consecutive cloudy August for the Front Range and Eastern Plains. At Pueblo with 52% of their possible August sunshine, this appears to have been one of their cloudiest summer months on record.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
AUGUST 1993

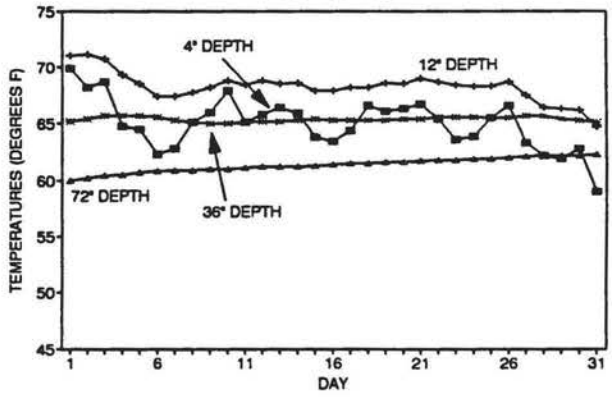


AUGUST 1993 SOIL TEMPERATURES

August soil temperatures at all depths were cooler than average. Near-surface soil temperatures varied considerably day to day in response to the large fluctuations in air temperatures.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
AUGUST 1993



HATS OFF TO: *William Roe of Cedaredge*

William Roe retired last month after 14 years of dedicated service as the Cedaredge weather observer. During his time of observing, the highest temperature in Cedaredge reached 103° and lowest was -20°F. The largest snowstorm observed by Mr Roe was 23 inches in March 1985. Ken Harton will be the new Cedaredge observer. Many thanks for your service.

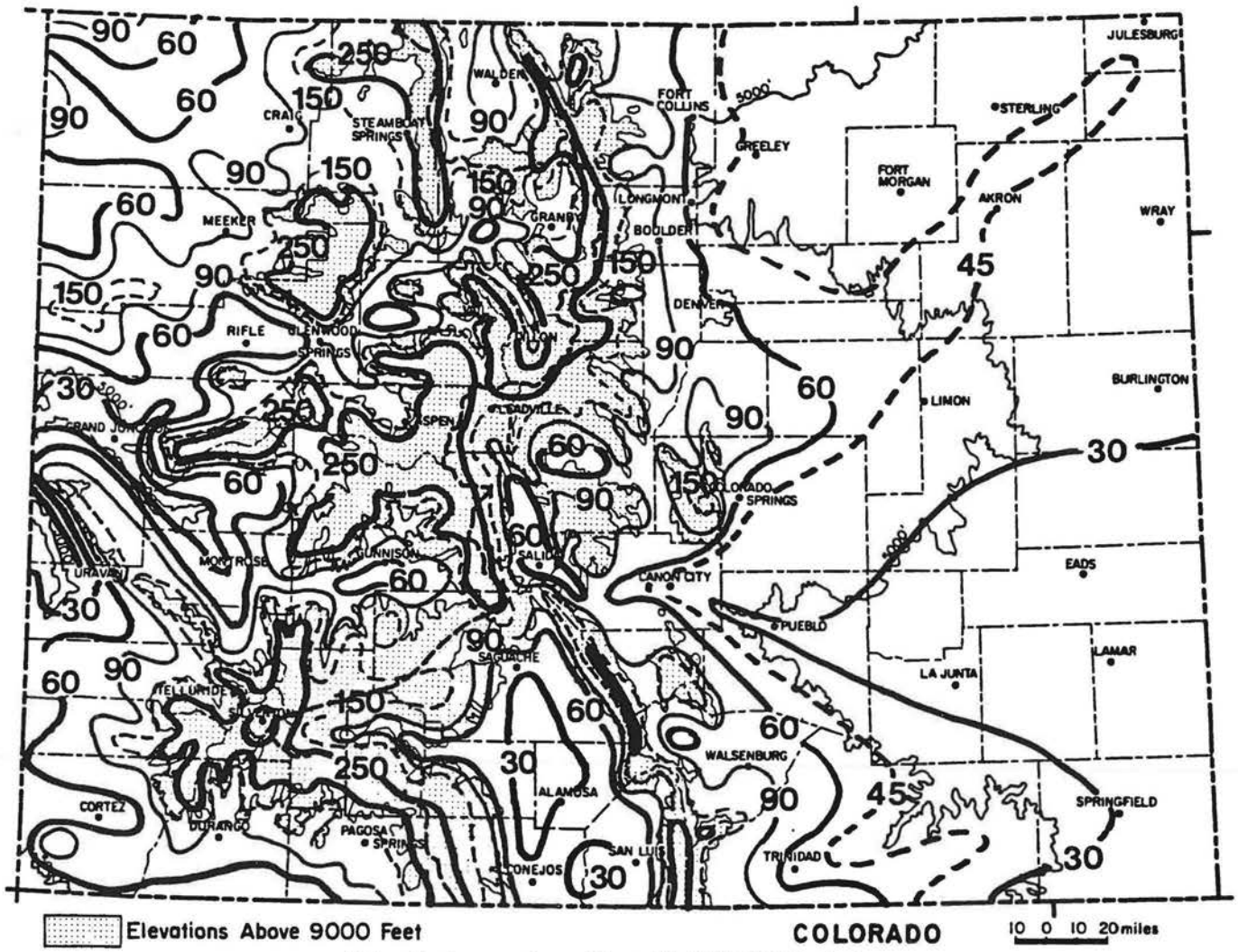
PLANNING FOR SNOW

Amazing changes have occurred over the past two decades as we have swiftly become an information-hungry society. Interests in weather and climate information have always been high here in Colorado, but the types of interests have been changing. Instead of a casual curiosity about the climate and how it affects us, we have seen increasingly specific and detailed information requirements from many and varied fields.

Snow has emerged as one of our State's great natural resources. We have seen a huge increase in requests for snow-related information. People want to know how much snow will fall – where and when – and they want to know months or even years in advance. Why are they asking? Mostly they are asking for economic reasons. Some questions pertain to future ski area expansions. Some questions are related to management strategies for public lands. But most of the questions are coming from small businesses and banks. Snow-related small businesses like shuttle-bus services to ski areas are both positively and negatively affected by snow. Heavy snow brings more skiers, but it also makes it harder to safely and swiftly transport them. Numerous small seasonal businesses have appeared in recent years that do lawn care and landscaping in the summer and snow removal in the winter. If it doesn't snow, they don't go. That's where the banks come in. They want to know how much risk there is that it may not snow. If it doesn't snow, their small business loans won't get paid back.

I could give you many more examples of how information gets used. The myriad of important uses is just amazing. What we really need to do, however, is provide information. During the past year we have been working to improve the types of snow information that we can provide to help plan for the future. We still aren't very good at giving precise long-range forecasts. The best substitute for an accurate forecast, is a good climatic description that shows what range of conditions to expect and how likely are certain events and conditions.

Much of what I am about to show you is the result of the efforts of a high school student. Natalie Tourville, who is now a senior at Rocky Mountain High School here in Fort Collins, worked with us as a student intern as a part of the Professional and Community Experience (PaCE) program in the Poudre R-1 School District. We were able to attack a problem for which resources had otherwise not been available.



Colorado Average Annual Snowfall (1961-1990) in inches.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

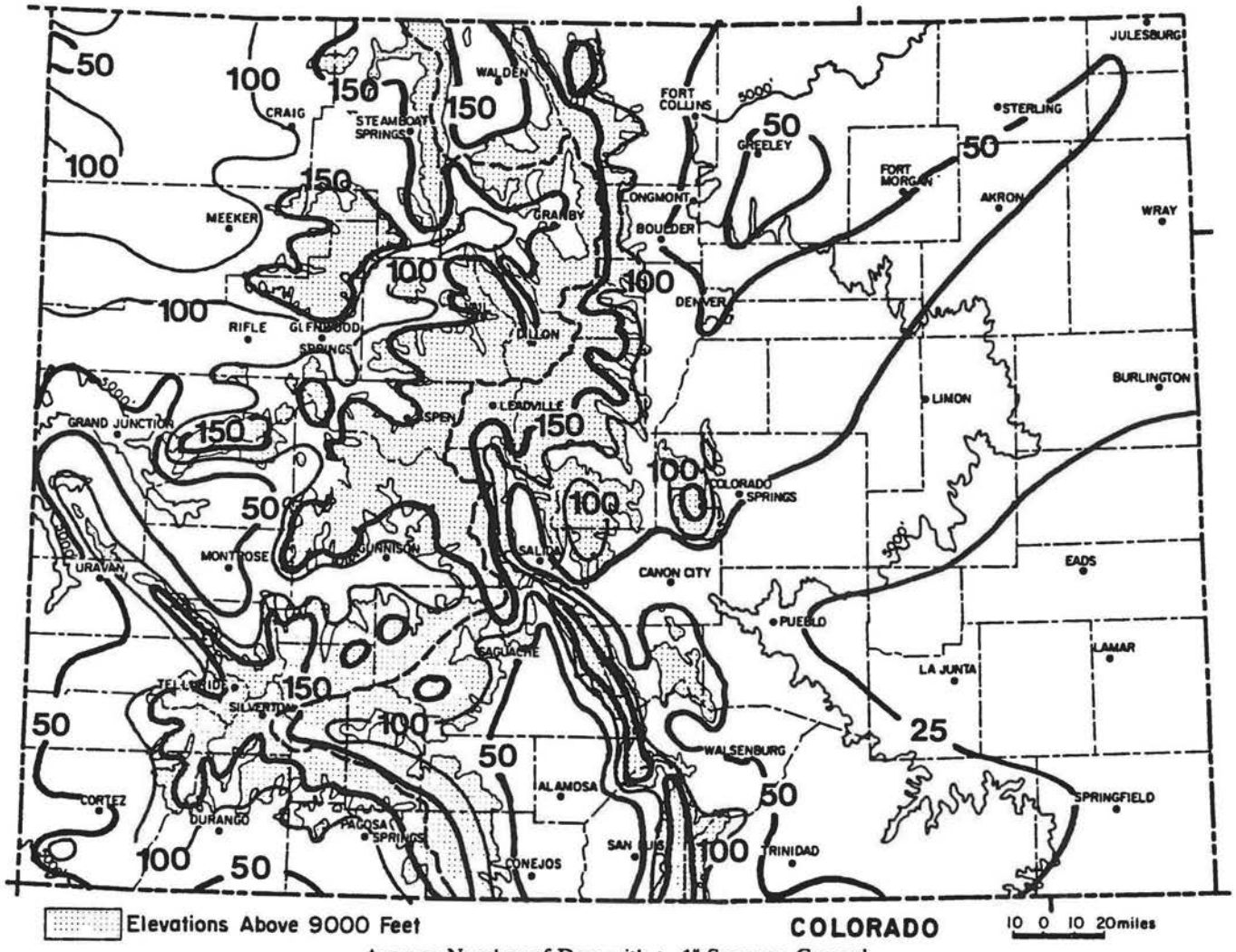
New Colorado Snowfall Maps

The best available precipitation and snowfall data for the 1961-1990 period were analyzed from across Colorado. From this information we have produced two new maps. The first is a map of average annual snowfall in inches. Variations are so extreme across the State that precise mapping is difficult on such a small map. Annual average snowfall varies from about 20 inches near Grand Junction and in extreme southeastern Colorado to more than 600 inches east of Steamboat Springs. There are many areas of Colorado where average snowfall varies dramatically over very short distances. The greatest changes (gradients) are typically found just east of the Continental Divide. There are several locations where annual snowfall drops off by 200 to 300 inches in a matter of less than five miles as one travels toward the east. There are even some interesting snowfall patterns out on the Eastern Plains. For example, more snow falls on the higher ground south of the South Platte River than in or north of the valley.

The second map shows the average number of days per year with at least one inch of snow on the ground. The duration of snowcover is significant for many applications ranging from street maintenance and forest management to hiking and hydrology. On average, less than 25 days per year are snow covered in southeastern Colorado and in the Palisade area just east of Grand Junction. By comparison, Aspen, Breckenridge, Silverton and most of Colorado's ski towns can expect about 150 days with snowcover. This increases to close to 250 days at elevations above 11,000 feet in the Northern and Central Mountains. The number of snowcover days is highly variable from year to year at lower elevations but is more consistent higher in the mountains. As a rough approximation, snowcover duration (days) is similar to observed snowfall, in inches, across much of Colorado.

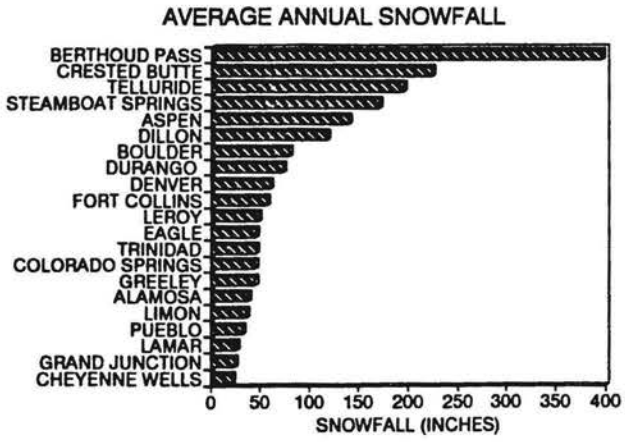
Annual snowfall averages are interesting, but if you are thinking about starting a local snow-removal company or a transportation-related business, what you would really need to know is "How often does it snow, and how often do we expect big snows?" To help answer these questions, we investigated daily snowfall characteristics at selected locations in Colorado.

The average number of days with snowfall equal to or greater than several specified thresholds are shown here for Denver, Durango and Steamboat Springs. Steamboat Springs receives an inch or more of snow more than three times as often as Denver. But interestingly, Denver has nearly the same frequency of really large snowstorms (10" and greater).

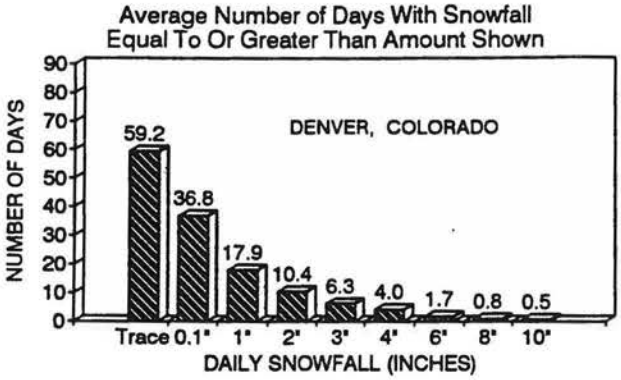


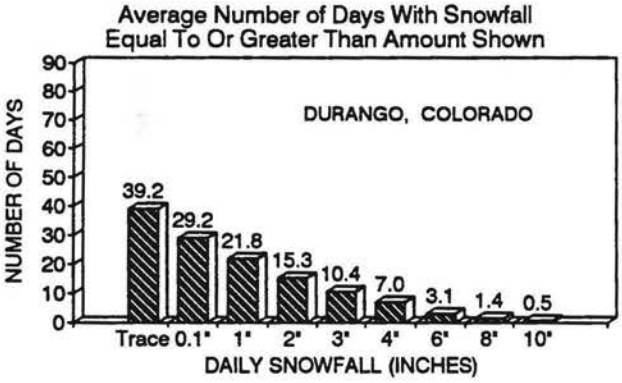
Average Number of Days with ≥ 1" Snow on Ground.

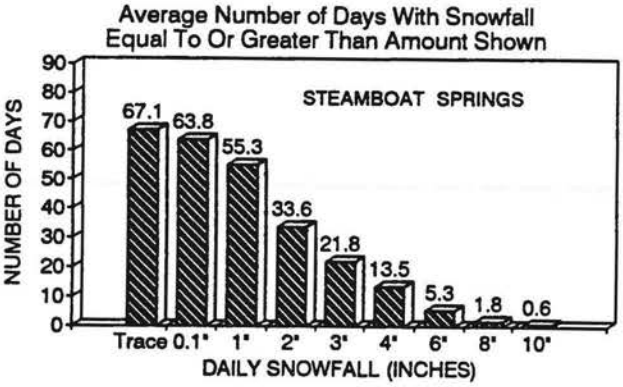
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

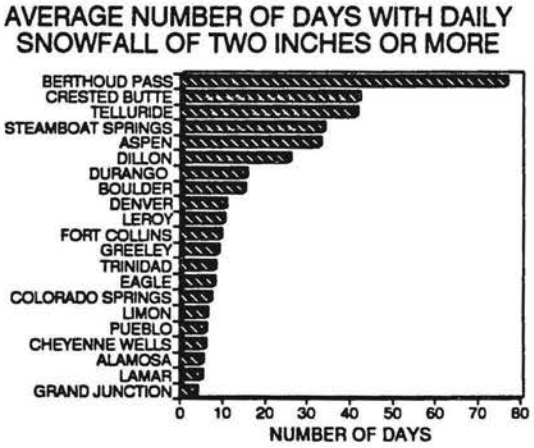


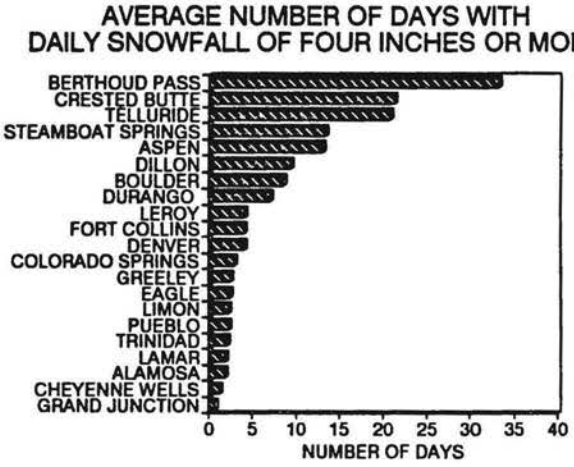
Even a trace of snow can make roads and sidewalks slippery if temperatures are at or below the freezing point. But major plowing and shovelling operations often aren't required until at least two inches of snow accumulate. The average number of days per year on which at least two inches of snow falls ranges from only about four days at Grand Junction to more than 75 days up on Berthoud Pass (and in other high-mountain locations which we did not analyze). Eight inches of snow in one day is surprisingly infrequent throughout Colorado. At any given point on the Eastern Plains these heavy snows occur an average of less than once per year. Eight-inch snows increase in frequency to about one a year at Denver and Colorado Springs, two at Steamboat Springs, six at Crested Butte and nine on Berthoud Pass.

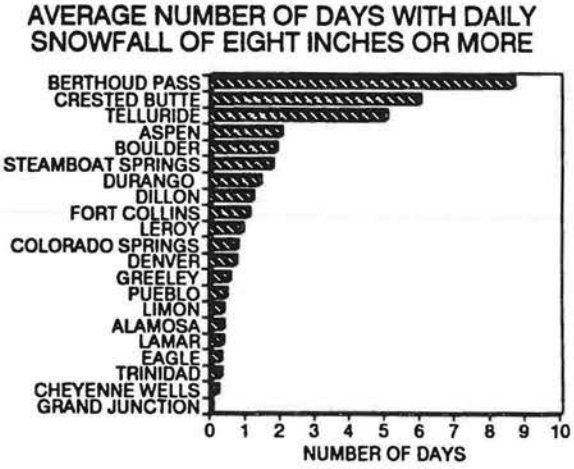










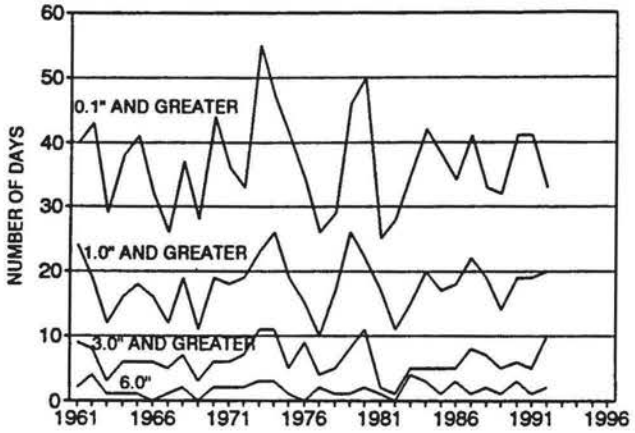


Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

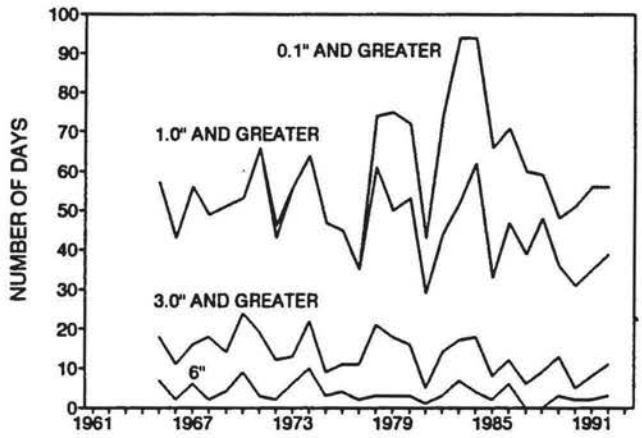
If we always received the average snowfall on the average number of days and it stayed on the ground for the average duration, we would always be well prepared for snow. Reality, however, shows us large year to year variations. Last winter, for example, provided much greater snowcover duration than usual across much of the Eastern Plains – triple the average at Lamar. To understand variability, it is helpful to look at time series and probability distributions. During the past 30 years for example, Boulder has averaged 9 days per season with 4" or more of snowfall. However, the number of days have varied from as few as 3 to as many as 15. That variation would make a huge difference to a beginning snow removal business.

Example time series are shown here for Denver, Dillon and Telluride. Large interannual variations are common. At Telluride, for example, only 9 storms dropped 3 inches or more of snowfall during the drought winter of 1976-77. The following winter there was a near-record high of 47 three-inch snows.

ANNUAL VARIATION IN NUMBER OF SNOW DAYS
DENVER, COLORADO

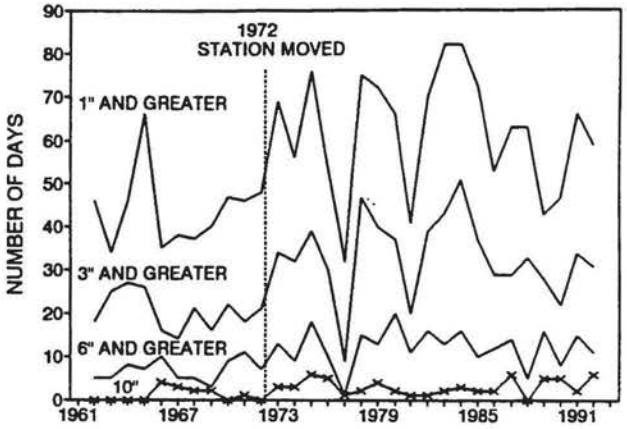


ANNUAL VARIATION IN NUMBER OF SNOW DAYS
DILLON, COLORADO



Time series graphs also point out other interesting information. For example, at Telluride the station was moved a few blocks closer to the mountains that tower over the town. That small station move had a large impact on observed snowfall frequencies. At Dillon, an apparent long-term downward trend in the number of 1", 3" and 6" snows has been observed. You

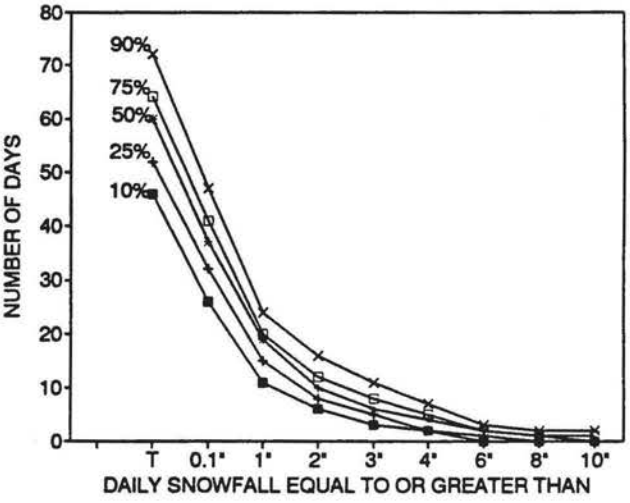
ANNUAL VARIATION IN NUMBER OF SNOW DAYS
TELLURIDE, COLORADO



can also see a sharp increase beginning in 1978 in the number of days with at least 0.1" of snowfall. This sudden increase in small events and decrease in larger events coincided precisely with a change in the weather observer at the Dillon station.

The final figure here shows nonexceedance probability curves for Denver. This may be the best planning information of all, once you get used to looking as this type of graph. For example, it shows that 80% of all winters will have between 6 and 16 days with 2" or more of snowfall. The median (50% probability) is 10 days. In 10% of the years more than 16 two-inch events can be expected, and in 10% of the years less than 6 days with 2" or more of snow can be expected. The same information is shown for each of the daily snowfall thresholds.

NONEXCEEDANCE PROBABILITY CURVES
DENVER, COLORADO



We don't have room to present the probability information for all stations. We are currently in the process of completing a comprehensive publication on Colorado snowfall characteristics that will contain both averages, variations and probabilities for representative locations throughout the State. Please contact us if you would like to receive more information.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.

COLORADO CLIMATE

SEPTEMBER 1993

Volume 16 Number 12

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

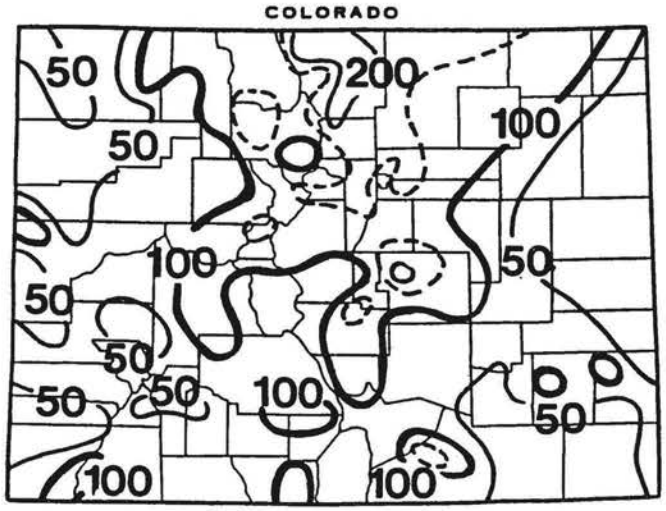
This report has been prepared each month since January 1977 with the support of the Colorado Agricultural Experiment Station and the College of Engineering

September Climate in Perspective – Early Snow and Cold

September brought such a broad assortment of changeable weather to Colorado that it nearly seemed like springtime. Thunderstorms with hail and damaging winds, heavy snows, heatwaves, early freezes, fogs and strong winds were all a part of the September story. But there were also lots of lovely autumn days. The changing autumn colors were beautiful and were not severely affected by the storms. Overall, temperatures were cooler than average statewide and precipitation totals varied greatly.

Precipitation

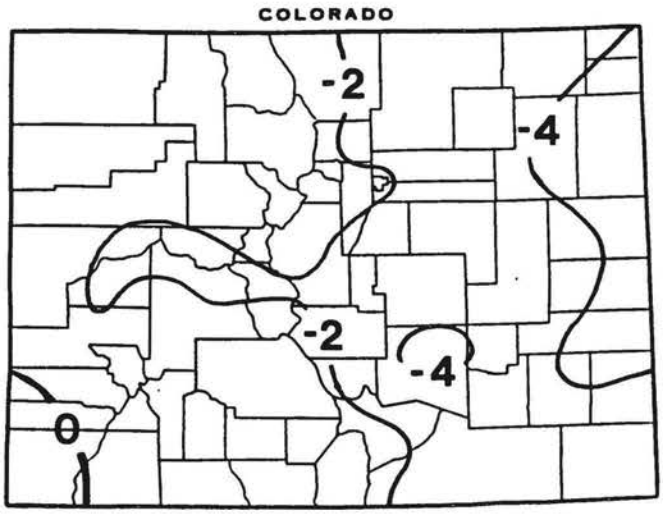
Several cold fronts and storm systems crossed Colorado in September providing opportunities for precipitation. Most of the storms moved in from the west and northwest and had limited moisture supplies. As a result, much of Colorado ended up drier than average for the month. Portions of both eastern and western Colorado reported considerably less than 50% of average. Meanwhile, the Front Range and much of the Northern and Central Mountains were wetter than average. Most of Larimer County, in north central Colorado, received more than 200% of average.



September 1993 precipitation as a percent of the 1961-1990 average.

Temperatures

September temperatures zipped up and down like yoyos, especially east of the mountains. For example, temperatures were close to record high values on the 11th and 12th. The 13th and 14th were close to record low values. Overall, the cold days outnumbered the warm days, and nearly all of Colorado ended up cooler than average for the month. Some areas east of the mountains were four to five degrees Fahrenheit below the 1961-1990 average. Colorado is now in a lengthy cool period which began in late May 1992. Since then, most months have been cooler than average.



Departure of September 1993 temperatures from the 1961-90 averages.

Inside This Issue

SEPTEMBER 1993 DAILY WEATHER

1-3 September began with seasonal temperatures on the 1st. Thundershowers developed over western Colorado as a low pressure trough approached from the northwest. Most showers were light, but Norwood reported 0.67". Scattered thundershowers pushed eastward out of the mountains early on the 2nd, and temperatures were much cooler over eastern Colorado. After a chilly morning on the 3rd (21° at Fraser), daytime temperatures rebounded quickly.

4-7 Winds aloft blew from the northwest 4-7th. Some light showers developed near the mountains on the 4th but became more widespread on the 5th as a chilly, damp airmass slipped southward into eastern Colorado. Parts of eastern Colorado awoke to dense fog on the 6th. Later in the day, thundershowers developed. Fountain reported 1.12". Temperatures were unseasonably cold east of the mountains. Limon only reached 58°F on the 6th. An upper air disturbance crossed Colorado on the 7th and set off widespread showers. Most precipitation was light, but some places in the mountains got close to 0.50 inches. Heavier storms erupted east of the mountains. Lamar reported 1.35" of rain. Aguilar measured 2.34" of rain and melted hail.

8-12 Rain ended and skies cleared on the 8th, but temperatures remained below normal. Dry and warmer weather moved in on the 9th. A weak upper disturbance set off a few convective showers on the 10th, mostly across southern Colorado. The 11-12th brought the warmest weather of the month to most of Colorado along with gusty, dry southwesterly winds. Low elevation temperatures climbed to near 90° each day with 70s well up into the mountains. Las Animas hit 101° on the 12th, the hottest in Colorado for the month. Clouds increased on the 12th, and showers and thundershowers moved into western and extreme northern Colorado very late in the day as a strong cold front approached.

13-15 Cold air from the north combined with a developing storm system over the Central Rockies to cause a very dramatic and rapid change in the weather. The 90 degree weather was over. By sunrise on the 13th cold winds were blowing and pouring rains were changing to snow in the mountains, along the Front Range and across the northeast plains. A foot of snow accumulated in some foothill locations. An inch or two accumulated on the Front Range cities – one of the earlier snowfalls this century at low elevations. Precipitation continued for much of the day on the 13th with some impressive totals. Mesa Verde National Park received 1.51" of rain. Grand Lake 1NW recorded 1.76" of rain and melting snow. The storm rushed eastward, and by early on the 14th skies were clear. This allowed temperatures to drop to near-record lows. The first freeze of the year struck many agricultural areas and caused significant crop losses. This freeze for northeast Colorado was at least 2 weeks earlier than average. The Arkansas Valley and the Grand Junction area barely escaped a killing freeze. Up in the mountains, Climax dipped to 10°F, the coldest reading in the State. A warmup began on the 15th with mostly sunny skies.

16-19 Another cold front moved into Colorado on the 16th setting off a few evening thundershowers along the Front Range. The 17th was partly cloudy and seasonal on the Western Slope but cool, cloudy and unsettled east of the mountains. On the 18th, a strong low pressure area aloft moved across Colorado setting off surprisingly strong thunderstorms for this late in the season along the Front Range and across the northeast plains. An inch or more of rain fell in some areas. Small hail was common. An apartment was badly damaged by strong winds near Denver. Morning fog on the 19th was followed by clearing skies and slightly moderating temperatures. Some clouds and snow showers lingered over the higher mountains.

20-24 A lovely day on the 20th was followed by increasing winds and warmer temperatures on the 21st. Pueblo hit 90°F. Mild, dry weather continued in western Colorado 22-23rd, but moist easterly breezes brought low clouds, drizzle and chilly temperatures east of the mountains. Lamar only reached a high of 54° on the 23rd. On the 24th, an upper air disturbance quickly crossed the State accompanied by clouds, some brisk winds and a few showers.

25-30 Northwesterly winds aloft brought predominantly dry and mild weather to Colorado for the remainder of September. Fast moving cold fronts zipped across northern and eastern portions of Colorado late on the 25th, early on the 28th and late on the 30th. Little moisture accompanied these systems, but temperatures dropped each time east of the mountains. With very dry air in place over the Western Slope, huge day-night temperature changes were noted. At Eagle, for example, daytime temperatures near 80° were followed by nighttime temperatures in the 20s.

Highest Temperature	101°F
Lowest Temperature	10°F
Greatest Total Precipitation	3.51"
Least Total Precipitation	0.05"
Greatest Total Snowfall	11"
Greatest Snow Depth	9"

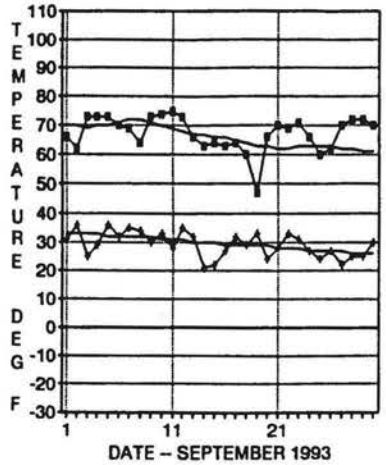
Weather Extremes

September 12	Las Animas
September 14	Climax
	Allenspark, Buckhorn Mountain
	Arapahoe, Hermit 7ESE
	Cabin Creek
	Mt. Evans Research Center

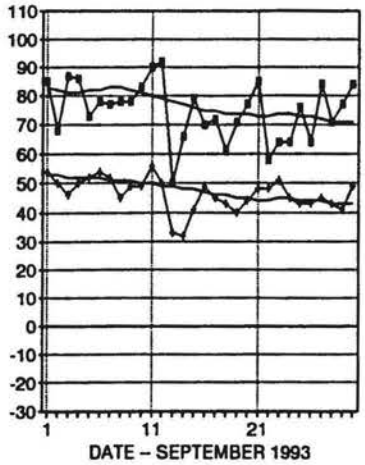
SEPTEMBER 1993 TEMPERATURE COMPARISON

Observed daily high and low temperatures are shown along with smoothed daily averages for the 1961-1990 period for nine selected locations. (Note: The time of observation effects the recorded high and low temperatures. Durango, Gunnison (Cochetopa Creek) and Lamar each take their observations at 8 a.m. Grand Lake takes their daily measurement at 5 p.m. The remaining stations shown below report at midnight.)

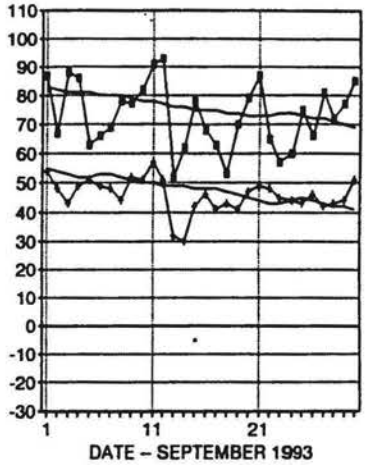
GRAND LAKE 1NW



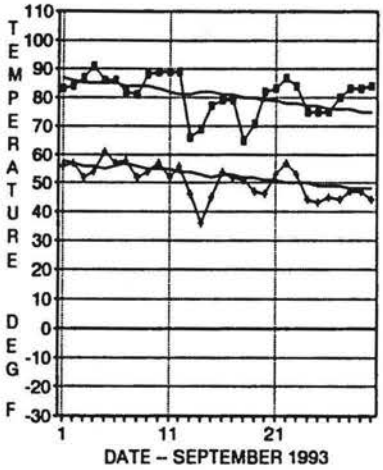
DENVER



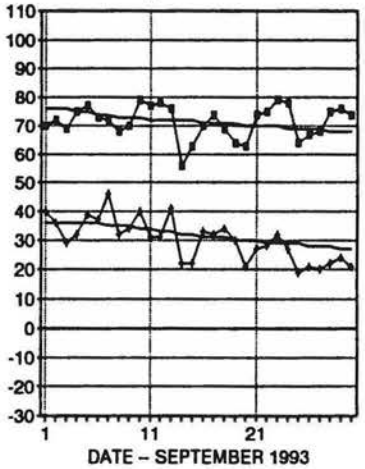
AKRON 1N



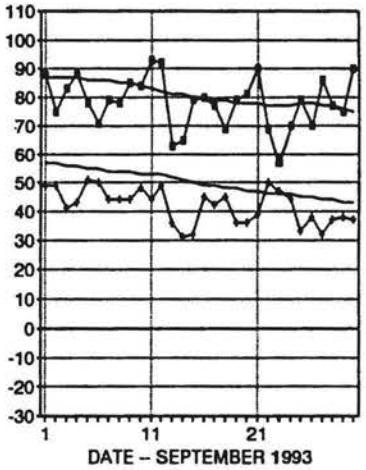
GRAND JUNCTION



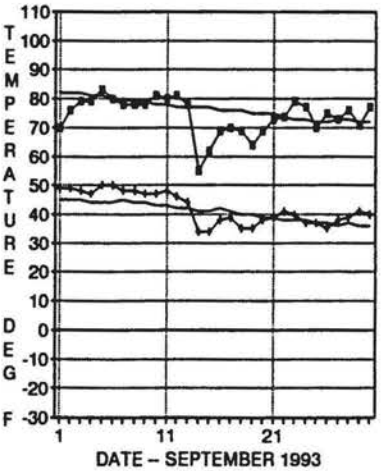
GUNNISON (COCHETOPA CRK.)



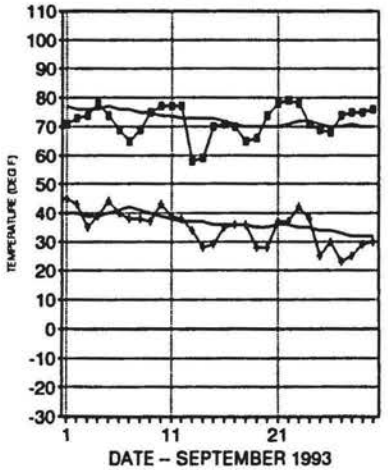
PUEBLO WSO



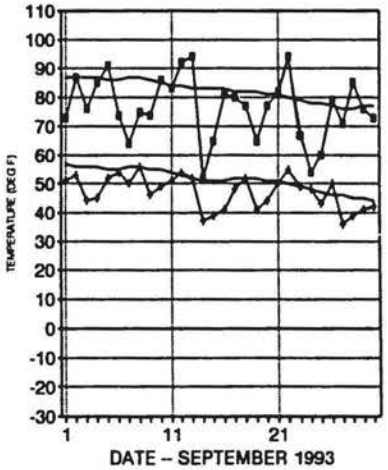
DURANGO



ALAMOSA



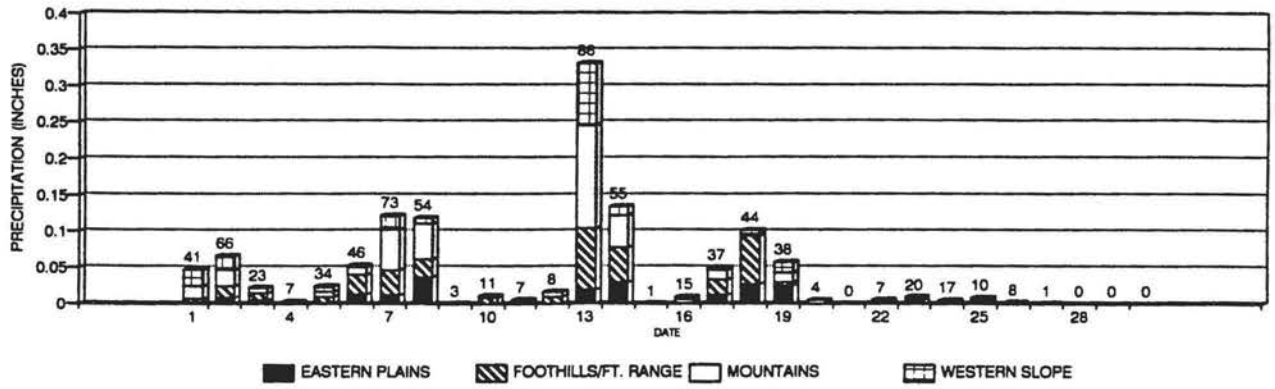
LAMAR



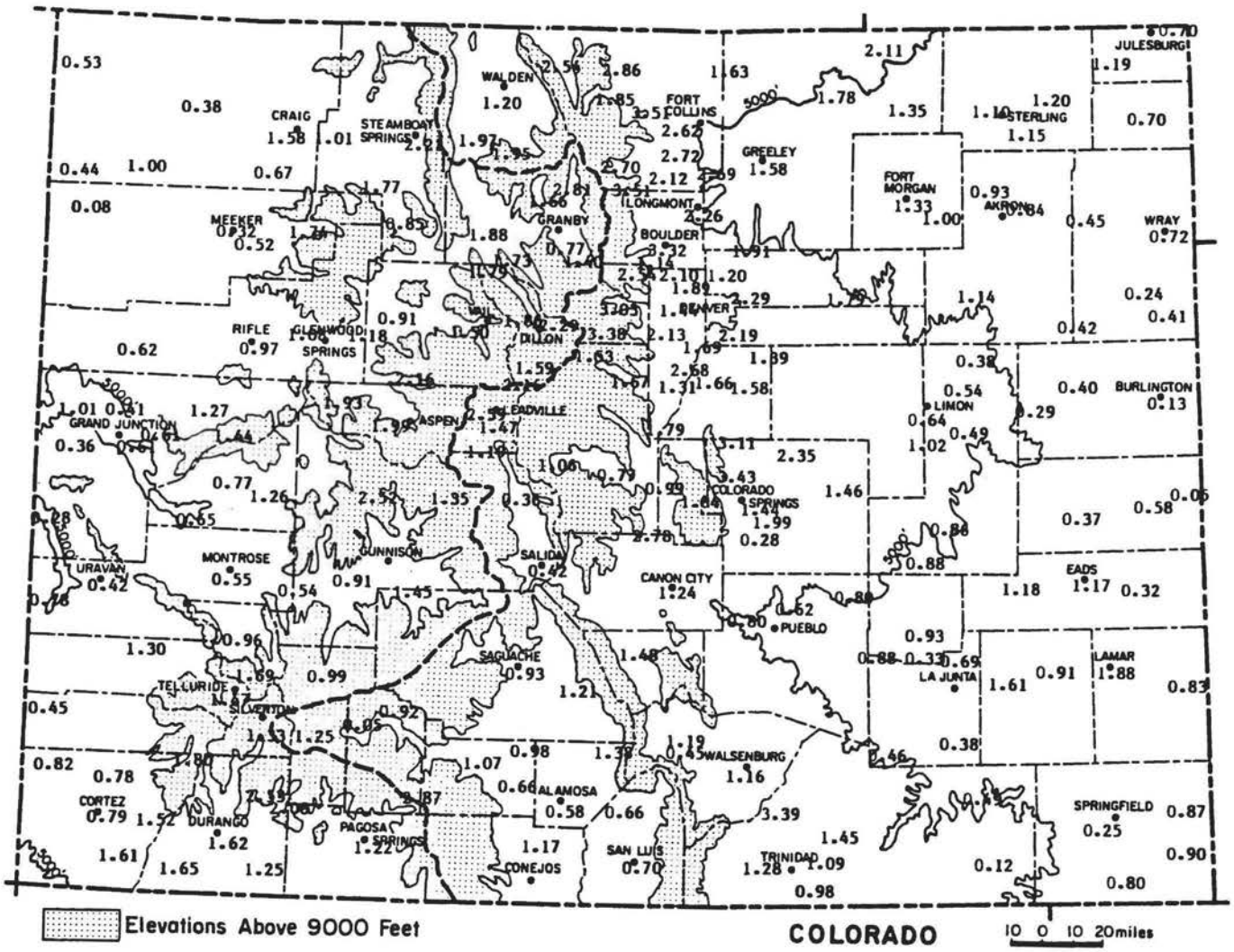
SEPTEMBER 1993 PRECIPITATION

September was composed of several wet periods separated by days that were dry statewide. Most locations on the Eastern Plains and Western Slope experienced 4 to 8 days with precipitation. The Mountains and Front Range areas had between 8 and 14 days with precipitation. Most of September's precipitation fell on the 1-2nd, 6-8th, 13th and 17-18th. Precipitation on the 13th (some observing stations report this on their morning observations on the 14th) averaged more than 0.45" statewide, the heaviest event for the State as a whole since late March.

COLORADO DAILY PRECIPITATION - SEP 1993

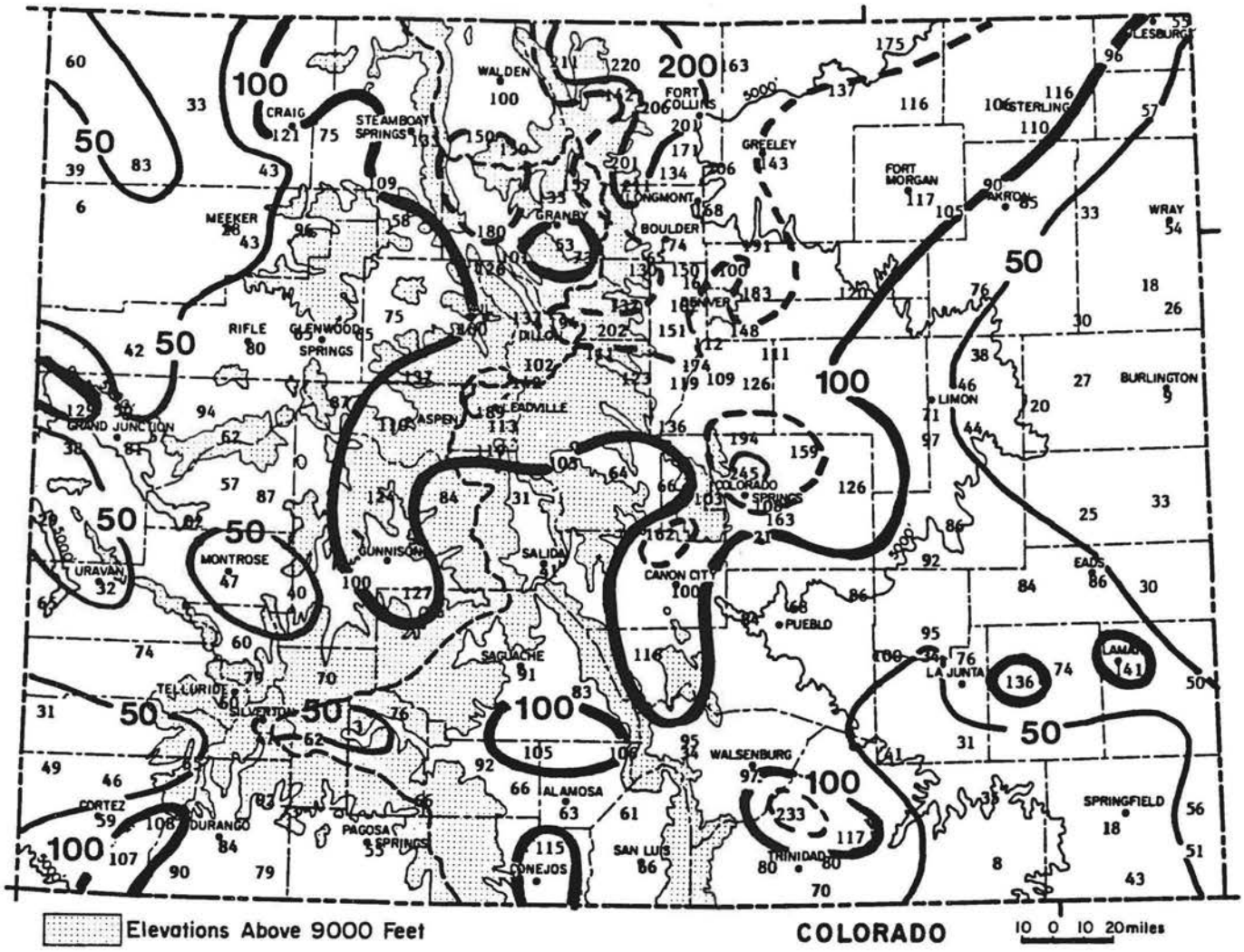


(due to differences in time of observation at official weather stations, precipitation may appear on more days than it actually fell)

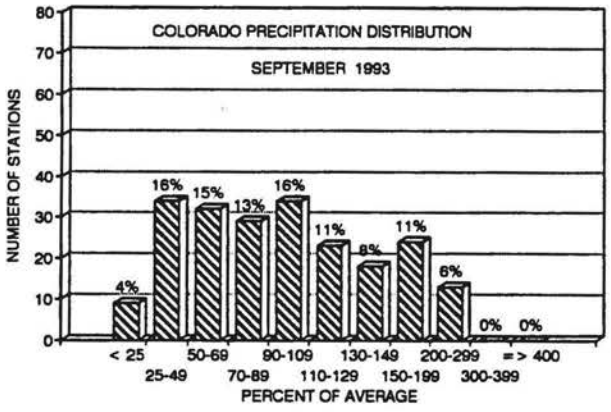


Precipitation Amounts (in inches) for September 1993.

SEPTEMBER 1993 PRECIPITATION COMPARISON



September 1993 Precipitation as a Percent of the 1961–90 average.



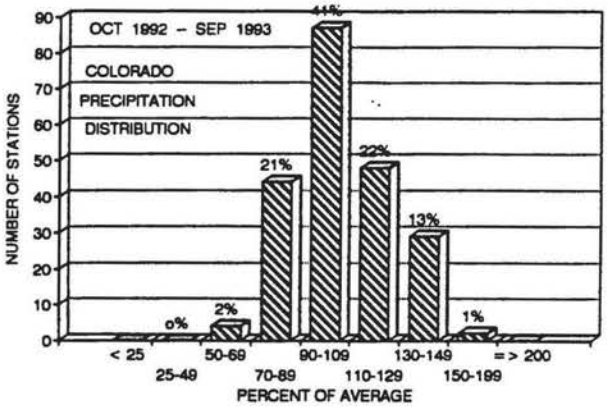
Once again, Colorado experienced a broad distribution of precipitation from less than 10% of average at a handful of sites to more than 200% of average in north central Colorado. Overall, the dry areas outnumbered the wet areas about 3 to 2. At Colorado Springs this was the first wetter than average month since January.

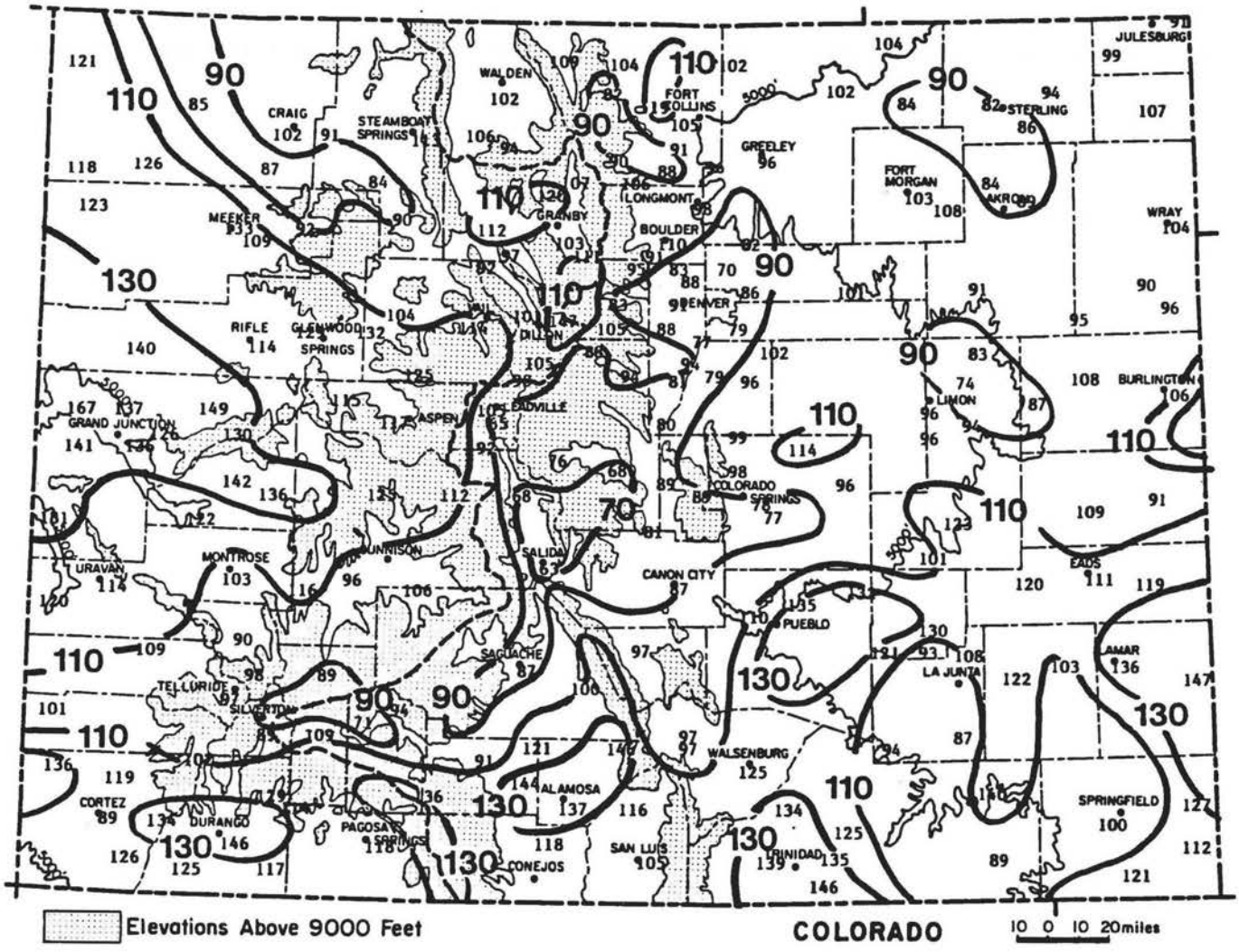
SEPTEMBER 1993 PRECIPITATION RANKING FOR SELECTED COLORADO CITIES

Station	Precip.	Rank
Denver	2.29"	17th wettest in 122 years of record (wettest = 4.67" in 1961)
Durango	1.62"	45th driest in 100 years of record (driest < 0.01" in 1953)
Grand Junction	0.41"	34th driest in 102 years of record (driest < 0.01" in 1892, 1901, 1944 and 1953)
Las Animas	0.61"	48th driest in 128 years of record (driest < 0.01" in 1983 and 8 previous years)
Pueblo	0.62"	62nd driest in 125 years of record (driest < 0.01" in 1882, 1892, 1916 and 1956)
Steamboat Springs	2.21"	22nd wettest in 89 years of record (wettest 8.15" in 1961)

1993 WATER YEAR PRECIPITATION

Our special feature this month (pages 10-13) will summarize the 1993 Water Year in detail. Overall, statewide precipitation ended up slightly above average. 41% of Colorado's official weather station were close to average (90-109% of average). 23% of the State was dry (less than 90% of average), and 36% of the State was wet (110% or more of average). The wettest areas, with respect to average, were observed in west central Colorado and across the southern tier of counties. Durango accumulated 28.22" of moisture for the year, 146% of average. This was their 4th wettest year in the past 100 years. Holly, in extreme southeastern Colorado was also wet with a total of 22.85" for the year – 147% of average. This was their 6th wettest year this century and their wettest since 1965. Dry areas developed early in the year east of the Continental Divide. Some of these dry spots persisted throughout the year. A handful of sites, including Salida and Buena Vista, received less than 70% of average. Below average precipitation was also measured in parts of northwest Colorado, parts of the Front Range and scattered locations on the northeastern plains.





October 1992–September 1993 Precipitation as a Percent of the 1961-90 averages.

COMPARATIVE HEATING DEGREE DAY DATA FOR SEPTEMBER 1993

HEATING DEGREE DATA — COLORADO CLIMATE CENTER (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
ALAMOSA	AVE	42	98	306	667	1053	1473	1559	1193	1014	717	453	174	8749
	92-93	97	131	295	607	1281	1796	1637	1280	958	692	435	185	9394
	93-94	51	118	342										511
ASPEN	AVE	95	150	348	651	1029	1339	1376	1162	1116	798	524	262	8850
	92-93	249	228	361	583	1272	1458	1325	1197	1039	901	557	363	9533
	93-94	232	221	425										878
BOULDER	AVE	0	7	136	387	726	973	1004	815	744	474	235	53	5554
	92-93	20	55	71	337	921	1093	1130	958	697	514	233	91	6120
	93-94	5	26	202										233
BUENA VISTA	AVE	50	111	318	620	980	1243	1259	1047	992	729	477	197	8003
	92-93	107	148	306	536	1119	1302	1211	1093	907	735	446	232	8141
	93-94	83	144	357										584
BURLINGTON	AVE	0	9	138	432	822	1132	1175	946	859	519	254	34	6320
	92-93	5	39	74	372	928	1301	1331	1103	773	531	219	68	6744
	93-94	0	25	189										214
CANON CITY	AVE *	0	11	91	325	645	896	933	756	688	408	193	41	4987
	92-93	2	29	73	305	882	976	1064	885	668	482	199	55	5620
	93-94	0	22	153										175
COLORADO SPRINGS	AVE	6	18	164	468	816	1091	1122	924	859	558	302	87	6415
	92-93	21	53	91	383	990	1101	1179	991	776	558	286	84	6513
	93-94	0	40	212										252
CORTEZ	AVE *	0	11	146	474	826	1163	1237	958	853	594	322	81	6667
	92-93	18	42	122	373	985	1276	1051	880	760	578	282	106	6453
	93-94	10	14	165										189
CRAIG	AVE	32	58	275	608	996	1342	1479	1193	1094	687	419	193	8376
	92-93	67	64	234	498	1139	1453	1408	1270	976	765	364	203	8441
	93-94	87	60	286										433
DELTA	AVE	0	10	125	403	774	1128	1221	888	719	435	186	36	5927
	92-93	8	10	71	301	919	1192	967	783	649	469	181	52	5800
	93-94	13	33	232										278
DENVER	AVE	0	0	144	429	780	1054	1094	885	806	504	253	71	6020
	92-93	10	35	58	346	926	1219	1162	992	686	489	195	71	6189
	93-94	1	20	152										173
DILLON	AVE	282	341	555	856	1203	1504	1587	1355	1321	1006	747	459	11218
	92-93	364	381	525	744	1346	1480	1435	1273	1220	1011	693	480	10952
	93-94	327	350	579										1256
DURANGO	AVE	6	37	203	512	846	1172	1246	952	853	594	363	127	6911
	92-93	34	49	139	371	968	1319	1152	966	768	569	302	136	6793
	93-94	6	43	201										250
EAGLE	AVE	25	72	275	617	981	1376	1435	1106	958	675	422	164	8106
	92-93	47	73	209	503	1140	1389	1387	1118	894	641	352	169	7922
	93-94	53	52	277										362
EVERGREEN	AVE	78	122	349	651	945	1194	1218	1039	1011	741	512	234	8094
	92-93	103	167	236	540	1074	1200	1177	1083	879	722	479	226	7888
	93-94	85	140	347										572
FORT COLLINS	AVE	0	12	176	471	825	1113	1156	913	828	525	272	77	6368
	92-93	22	55	87	377	940	1222	1239	1031	706	519	209	83	6490
	93-94	5	22	207										234
FORT MORGAN	AVE	0	8	144	445	840	1197	1277	963	831	492	222	41	6460
	92-93	12	40	36	352	937	1472	1494	1202	789	509	156	64	7065
	93-94	0	19	168										187
GRAND JUNCTION	AVE	0	0	55	332	738	1125	1240	854	670	389	132	13	5548
	92-93	0	6	25	222	868	1245	1018	799	597	446	144	33	5403
	93-94	4	0	59										63

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

HEATING DEGREE DATA — COLORADO CLIMATE CENTER (303) 491-8545

STATION		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	ANN
GRAND LAKE	AVE	214	260	468	781	1113	1476	1600	1361	1283	945	660	381	10542
	92-93	277	311	442	685	1301	1563	1583	1340	1197	949	648	380	10876
	93-94	297	274	496										1067
GREELEY	AVE	0	7	158	446	831	1153	1206	924	806	492	231	52	6308
	92-93	14	43	59	374	948	1334	1348	1073	705	502	182	82	6664
	93-94	4	15	178										197
GUNNISON	AVE	130	204	436	763	1143	1609	1786	1456	1237	867	580	308	10516
	92-93	208	M	M	617	1278	M	M	M	M	M	M	M	M
	93-94	M	M	M										M
LAS ANIMAS	AVE	0	0	69	338	750	1088	1141	862	707	370	121	9	5455
	92-93	0	11	33	304	937	1267	1242	956	648	360	128	9	5895
	93-94	0	12	90										102
LEADVILLE	AVE	272	337	522	817	1173	1435	1473	1318	1320	1038	726	439	10870
	92-93	383	435	536	785	1401	1502	1462	1305	1209	1033	736	489	11276
	93-94	354	390	591										1335
LIMON	AVE	6	21	189	521	879	1169	1218	991	924	603	344	96	8961
	92-93	16	54	133	442	1018	1278	1339	1118	850	615	335	113	7311
	93-94	7	48	237										292
LONGMONT	AVE	0	10	171	468	834	1141	1190	941	840	525	253	70	6443
	92-93	20	61	77	386	982	1299	1347	1063	721	534	228	105	6825
	93-94	12	30	246										288
MEEKER	AVE	28	56	261	564	927	1240	1345	1086	998	651	394	164	7714
	92-93	23	44	152	426	1123	1308	1253	1117	859	644	335	183	7465
	93-94	54	42	253										349
MONTROSE	AVE	0	11	143	453	819	1159	1246	935	791	510	248	68	6383
	92-93	15	43	87	332	1000	1247	1023	873	687	571	241	104	6223
	93-94	14	15	161										190
PAGOSA SPRINGS	AVE	64	115	324	636	984	1330	1423	1131	1029	756	512	244	8548
	92-93	120	126	317	538	1123	1442	1291	1096	915	714	422	261	8365
	93-94	94	143	357										594
PUEBLO	AVE	0	0	62	357	735	1051	1091	837	722	396	152	10	5413
	92-93	0	15	58	390	1009	1132	1186	959	703	428	195	30	6105
	93-94	0	18	155										173
RIFLE	AVE	0	23	184	502	858	1237	1330	980	825	549	298	95	6881
	92-93	12	31	113	375	976	1241	1114	900	711	536	244	94	6347
	93-94 E	13	7	199										219
STEAMBOAT SPRINGS	AVE *	113	166	396	725	1122	1525	1606	1316	1169	801	543	297	9779
	92-93	160	119	316	570	1247	1583	1452	1240	1063	812	458	275	9295
	93-94	166	144	395										705
STERLING	AVE	0	9	149	462	852	1200	1265	963	843	504	238	56	6541
	92-93	14	36	70	400	949	1473	1401	1188	739	501	162	66	6999
	93-94	0	14	193										207
TELLURIDE	AVE	152	204	390	679	1005	1290	1336	1128	1101	819	574	310	8968
	92-93	180	189	313	529	1194	1268	1193	1048	981	743	550	380	8566
	93-94	228	249	455										932
TRINIDAD	AVE	0	7	87	364	690	955	995	815	722	444	218	42	5339
	92-93	0	18	61	321	991	1137	1013	904	699	450	205	39	5838
	93-94	0	27	123										150
WALDEN	AVE	189	273	498	825	1161	1457	1528	1296	1237	909	657	348	10378
	92-93	270	283	433	709	1310	1471	1428	1313	1153	899	592	384	10245
	93-94	286	282	510										1078
WALSENBURG	AVE	0	8	105	371	893	955	992	820	744	477	229	44	5438
	92-93	5	29	54	271	894	951	947	875	684	461	210	42	5423
	93-94	0	17	110										127

* = AVES ADJUSTED FOR STATION MOVES M = MISSING E = ESTIMATED

SEPTEMBER 1993 CLIMATE DATA

EASTERN PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
NEW RAYMER 21N	68.0	40.7	54.4	-3.6	89	25	318	8	289	2.11	0.91	175.8	9
STERLING	74.2	44.1	59.2	-2.6	98	30	193	26	364	1.10	0.07	106.8	6
FORT MORGAN	74.0	47.5	60.8	-1.8	95	33	168	47	377	1.33	0.20	117.7	3
AKRON FAA AP	73.2	45.8	59.5	-2.4	93	30	192	34	356	0.93	-0.10	90.3	3
AKRON 4E	72.3	42.8	57.5	-4.8	95	28	232	16	337	0.84	-0.14	85.7	5
HOLYOKE	70.7	46.0	58.3	-4.3	96	31	218	27	324	0.70	-0.51	57.9	7
JOES	73.4	43.9	58.7	-4.6	98	31	204	23	355	0.42	-0.98	30.0	4
BURLINGTON	73.3	45.2	59.2	-4.3	95	32	189	24	357	0.13	-1.20	9.8	1
LIMON WSMO	71.4	43.0	57.2	-2.7	88	29	237	11	327	0.64	-0.26	71.1	8
CHEYENNE WELLS	78.3	45.9	62.1	-2.2	97	32	116	36	428	0.58	-1.17	33.1	8
EADS	74.6	45.1	59.8	-5.4	94	33	176	28	371	1.17	-0.19	86.0	6
ORDWAY 21N	76.0	44.3	60.1	-3.4	93	33	168	29	395	0.88	-0.07	92.6	8
ROCKY FORD 2SE	83.5	43.1	63.3	-2.7	96	31	88	44	478	0.33	-0.64	34.0	7
LAMAR	76.4	47.1	61.7	-4.8	94	36	137	45	404	1.88	0.55	141.4	6
LAS ANIMAS	80.8	46.6	63.7	-3.8	101	36	90	58	449	0.61	-0.57	51.7	4
HOLLY	80.1	47.1	63.6	-2.2	97	34	103	65	455	0.83	-0.81	50.6	8
SPRINGFIELD 7WSW	81.8	47.7	64.8	-1.0	95	33	72	73	477	0.25	-1.12	18.2	4

FOOTHILLS/ADJACENT PLAINS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
FORT COLLINS	72.7	43.6	58.1	-2.1	89	29	207	9	349	2.62	1.32	201.5	9
GREELEY UNC	73.9	44.8	59.3	-2.9	93	30	178	17	366	1.58	0.48	143.6	8
ESTES PARK	69.5	39.7	54.6	1.1	78	21	307	3	306	2.70	1.36	201.5	13
LONGMONT 2ESE	74.5	39.4	56.9	-3.8	93	27	246	12	370	2.26	0.92	168.7	12
BOULDER	73.6	43.9	58.7	-2.3	90	28	202	22	366	3.32	1.42	174.7	12
DENVER WSFO AP	74.9	46.3	60.6	-1.7	92	32	152	30	384	2.29	1.04	183.2	9
EVERGREEN	70.4	36.0	53.2	-0.9	86	22	347	0	312	2.13	0.72	151.1	12
CHEESMAN	71.8	28.6	50.2	-6.3	84	21	437	0	340	1.79	0.48	136.6	7
LAKE GEORGE 8SW	65.6	32.4	49.0	-2.8	75	23	473	0	249	0.77	-0.42	64.7	6
ANTERO RESERVOIR	64.9	29.7	47.3	-1.4	74	20	524	0	236	1.06	0.04	103.9	8
COLORADO SPRINGS	72.4	43.8	58.1	-2.5	85	28	212	11	346	1.44	0.11	108.3	9
CANON CITY 2SE	74.7	45.7	60.2	-2.5	88	32	153	18	387	1.24	-0.00	100.0	9
PUEBLO WSO AP	78.3	41.8	60.1	-5.5	93	31	155	16	422	0.62	-0.28	68.9	6
WESTCLIFFE	70.2	32.2	51.2	-2.9	77	17	410	0	309	1.48	0.21	116.5	8
WALSENBURG	78.9	44.9	61.9	-0.9	88	30	110	24	452	1.16	-0.03	97.5	10
TRINIDAD FAA AP	78.1	44.7	61.4	-2.5	89	30	123	23	438	1.45	0.22	117.9	9

MOUNTAINS/INTERIOR VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
WALDEN	65.5	30.1	47.8	-0.8	78	16	510	0	241	1.20	0.01	100.8	7
LEADVILLE 2SW	61.9	28.5	45.2	-1.2	69	19	591	0	184	1.47	0.17	113.1	7
SALIDA	73.2	37.2	55.2	-1.4	83	26	288	0	355	0.42	-0.60	41.2	7
BUENA VISTA	71.4	34.2	52.8	-2.3	80	23	357	0	330	0.36	-0.77	31.9	4
SAGUACHE	69.7	36.3	53.0	-1.2	79	30	354	0	303	0.93	-0.09	91.2	8
HERMIT 7ESE	67.6	26.4	47.0	-0.7	76	17	534	0	271	0.05	-1.56	3.1	1
ALAMOSA WSO AP	71.8	35.0	53.4	-1.3	79	23	342	0	336	0.58	-0.33	63.7	4
STEAMBOAT SPRINGS	71.6	31.7	51.6	-0.5	82	23	395	0	332	2.21	0.56	133.9	12
YAMPA	69.2	38.9	54.1	2.3	78	27	323	0	297	0.85	-0.61	58.2	9
GRAND LAKE 1NW	67.3	29.0	48.2	0.1	75	21	500	0	267	2.81	1.03	157.9	14
GRAND LAKE 6SSW	65.5	31.0	48.2	-1.2	73	23	496	0	241	1.66	0.42	133.9	10
DILLON 1E	62.5	28.4	45.4	-2.4	71	21	579	0	198	1.86	0.51	137.8	7
CLIMAX	55.8	25.3	40.6	-2.7	64	10	725	0	106	2.16	0.64	142.1	9
ASPEN 1SW	66.6	34.7	50.6	-2.4	75	26	425	0	253	1.98	0.18	110.0	10
CRESTED BUTTE	64.0	28.5	46.2	-2.1	73	19	554	0	219	2.52	0.49	124.1	11
TAYLOR PARK	60.6	29.2	44.9	-2.1	68	22	598	0	165	1.35	-0.24	84.9	6
TELLURIDE	66.5	32.5	49.5	-2.5	74	21	455	0	254	1.47	-0.95	60.7	8
PAGOSA SPRINGS	73.5	32.3	52.9	-2.0	84	13	357	0	360	1.22	-0.97	55.7	7
SILVERTON	63.4	29.0	46.2	-1.0	72	22	559	0	212	1.33	-1.46	47.7	11
WOLF CREEK PASS 1	55.1	31.7	43.4	-1.7	65	16	639	0	99	2.87	-1.45	66.4	12

WESTERN VALLEYS

	Temperature						Degree Days			Precipitation			
Name	Max	Min	Mean	Dep	High	Low	Heat	Cool	Grow	Total	Dep	%Norm	# days
CRAIG 4SW	72.8	37.7	55.2	-1.5	83	25	286	0	349	1.58	0.28	121.5	9
HAYDEN	73.7	37.6	55.6	-0.4	82	25	271	0	361	1.01	-0.33	75.4	8
MEEKER NO. 2	76.0	36.8	56.4	-0.8	87	24	253	4	398	0.32	-0.80	28.6	7
RANGELY 1E	78.1	43.1	60.6	-0.5	90	33	140	17	430	0.08	-1.13	6.6	3
EAGLE FAA AP	76.3	34.8	55.6	-0.2	84	24	277	1	402	0.91	-0.30	75.2	7
GLENWOOD SPRINGS	76.2	39.3	57.8	-1.5	87	29	211	0	401	1.08	-0.58	65.1	7
RIFLE	78.8	37.5	58.2	-1.9	88	29	199	0	437	0.97	-0.23	80.8	8
GRAND JUNCTION WS	81.1	50.7	65.9	-0.9	91	36	59	92	509	0.41	-0.40	50.6	4
CEDAREDGE	78.7	39.8	59.2	-2.4	88	28	171	5	437	0.77	-0.58	57.0	4
PAONIA 1SW	78.7	44.9	61.8	-0.5	89	34	112	24	438	1.26	-0.18	87.5	9
DELTA	75.5	38.6	57.1	-5.6	84	30	232	0	390	0.65	-0.39	62.5	5
COCHETOPA CREEK	71.5	30.1	50.8	-0.8	79	19	419	0	329	1.45	0.31	127.2	7
MONTROSE NO. 2	76.2	43.0	59.6	-1.9	86	34	161	8	401	0.55	-0.62	47.0	4
URAVAN	84.2	46.0	65.1	-0.7	95	37	64	73	505	0.42	-0.88	32.3	6
NORWOOD	73.2	40.3	56.7	-0.1	81	28	241	0	356	1.30	-0.45	74.3	4
YELLOW JACKET 2W	76.9	44.9	60.9	0.3	85	33	129	14	417	0.82	-0.85	49.1	3
CORTEZ	77.6	41.8	59.7	0.2	85	32	165	13	427	0.79	-0.54	59.4	2
DURANGO	74.1	42.0	58.1	-0.8	83	34	201	2	370	1.62	-0.29	84.8	4

Data are received by the Colorado Climate Center for more locations than appear in these tables.
Please contact the Colorado Climate Center if additional information is needed.

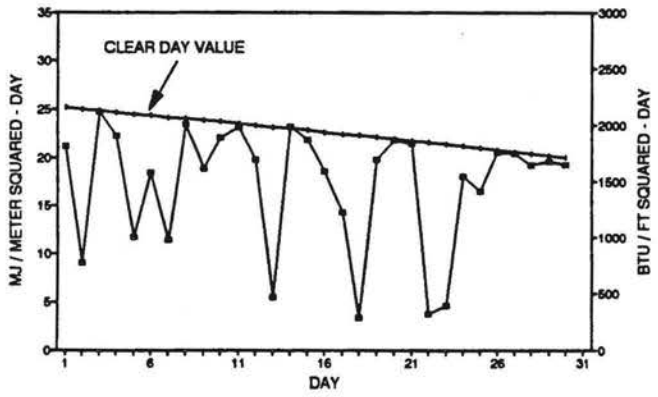
SEPTEMBER 1993 SUNSHINE AND SOLAR RADIATION

	Number of Days			Percent Possible	Average % of
	CLR	PC	CLDY	Sunshine	Possible
Colorado Springs	15	9	6	--	--
Denver	14	9	7	69%	74%
Fort Collins	11	11	8	--	--
Grand Junction	19	10	1	92%	79%
Limon	19	4	7	--	--
Pueblo	NA	NA	NA	84%	80%

CLR = Clear PC = Partly Cloudy CLDY= Cloudy

September brought a combination of many sunny days interspersed with a few very cloudy ones. Cloudiness was most prevalent over the Northern Mountains and northeast plains. Overall, incoming solar energy for the month was equal to or greater than average over most of Colorado.

FT. COLLINS TOTAL HEMISPHERIC RADIATION
SEPTEMBER 1993

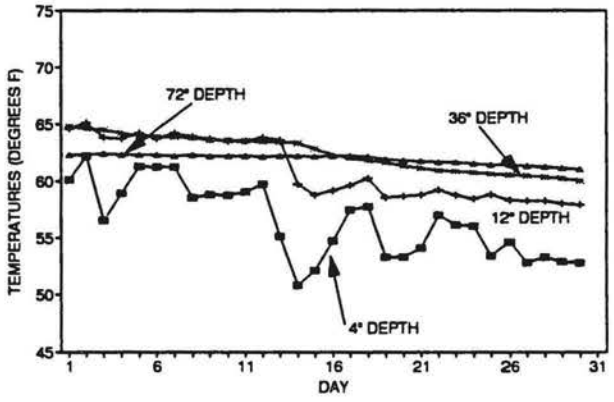


SEPTEMBER 1993 SOIL TEMPERATURES

September soil temperatures dropped sharply in mid September following the first snow and freezing temperatures. The typical cold-season temperature profile then emerged with near-surface temperatures cooler than the deep soils.

These soil temperature measurements were taken at Colorado State University beneath sparse unirrigated sod with a flat, open exposure. These data are not representative of all Colorado locations.

FORT COLLINS 7 AM SOIL TEMPERATURES
SEPTEMBER 1993



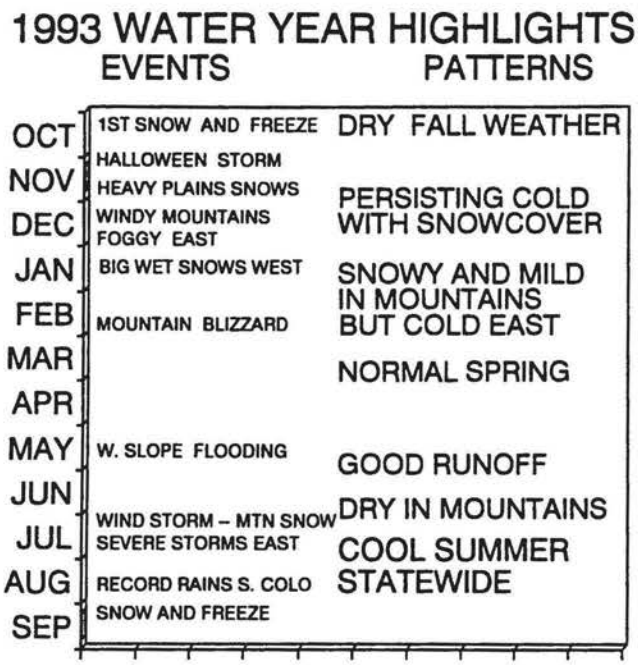
HATS OFF TO: *Carl Bolt* of Pagosa Springs, Colorado.

Several excellent weather observers have chosen 1993 as their year to call it quits. This month, Carl Bolt turned in his raingage and thermometers after 12 years of diligent and enthusiastic observing in Pagosa Springs. He plans to do a little travelling and enjoying the weather (instead of reporting it). Carl, have fun. We sure will miss your reports.

A REVIEW OF THE 1993 WATER YEAR

Significant Features

1993 will go down as a year that brought most of Colorado cool temperatures and adequate moisture. There were a variety of storm systems and temperature changes that kept Coloradans on their toes. The figure below outlines some of the most significant features of the year.



1993 Winter Season

The 1993 Water Year began with a mild October. Then, just in time for Halloween, a blast of wet and snowy weather hit the mountains and Western Slope. This set the tone for most of the rest of the winter as a progression of storms steadily covered the Rockies in a blanket of deep snow. November was snowy and very cold statewide. November ended up as the snowiest month of the winter for most areas east of the mountains. Denver received 20.1" out of their 1992-93 total of 65.8". December snows came in light doses (except for a big Pacific storm that reached southwestern Colorado late in the month), but cold temperatures were very persistent. Because of the consistently cold temperatures, November snows remained on the ground, even at low elevations.

During January and February, the Rocky Mountains provided a distinct barrier between cold but dry air over the Great Plains and mild but very moist air that episodically pushed eastward from the Pacific. A major sub-zero coldwave chilled eastern Colorado in mid-February. Snowcovered ground continued to be the rule across the northern Front Range and much of the Eastern Plains. Winter precipitation totals were not large east of the mountains, but snowcover helped greatly to preserve soil moisture. Meanwhile, western Colorado saw its snowiest winter since the mid 1980s. An unusually large number of avalanches resulted from the combination of heavy snows, winds and temperature changes. Avalanches claimed 12 lives in the Colorado mountains. In southwest Colorado, including the city of Durango, a series of midwinter storms produced near record snow accumulations. Wet snow several feet deep contributed to several major roof failures. Durango received a record-breaking 14.62" of precipitation from December through February. This coincided with the end of the 6-year drought that had plagued California and other western states.

March and April were fairly typical late-winter months in Colorado bringing changeable temperatures, lots of mountain snow, some low-elevation rains and the first thunderstorms of the season. High elevation snowpack remained well above average through March and April, especially across central and southern Colorado. Prospects for plentiful water supplies from snowmelt were excellent. As usual, there were plenty of strong spring winds. Spring storms fortunately skipped past southwestern Colorado. Moderate temperatures helped the awesome low-elevation snowpack melt in an orderly fashion with a minimum of flooding. There was also a lack of major spring snowstorms along the Front Range and across the Eastern Plains.

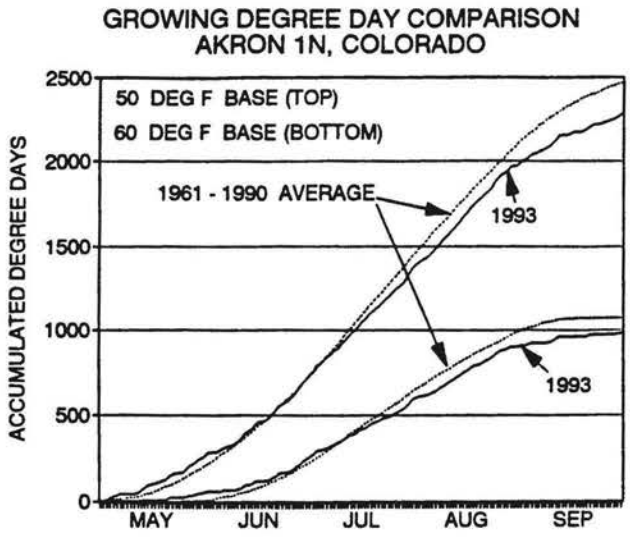
The 1993 Growing Season

Cold, stormy weather in early May raised flood concerns in western Colorado. Episodes of warm, sunny weather interspersed with numerous early-summer thunderstorms did indeed produce some flooding later in the month. Mud and rock slides also disrupted transportation on a few highways. Overall, the benefits of having the first greater than average runoff season since the mid 1980s outweighed the liabilities. Reservoirs filled and cities and farmers gave thanks.

For the second year in a row, summer temperatures were considerably below average. Growing degree day totals lagged behind the average across most agricultural areas resulting in slow crop development and maturation. There were more hot days than in 1992, but again there were no prolonged heatwaves. Several very chilly periods were noted east of the mountains with daytime temperatures only in the 60s and 70s. Growing degree day accumulations are shown here for Akron 1N. Other areas of eastern Colorado were even cooler. Growing degree day totals ended up about 10% below average and were especially deficient during late summer.

Precipitation patterns and thunderstorm distributions were also quite unusual. A stronger summer jet stream kept moist air out of western Colorado throughout June and July. Instead, storms were concentrated across the Midwestern States where incredible rains and flooding lasted for several weeks. Eastern Colorado was the source region for many of

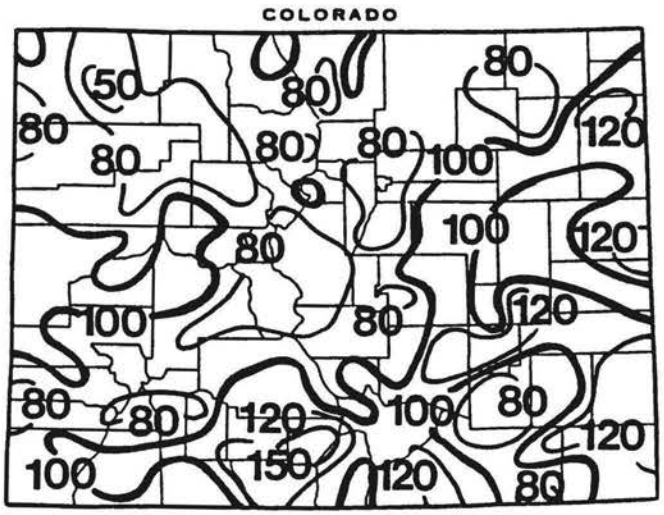
Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.



the Midwestern storm complexes. Some areas of extreme eastern Colorado experienced heavy rains and local flooding in July and August.

Highlights of the summer in Colorado included a record-breaking winter-like downslope windstorm on July 3rd along the Front Range, a mountain snowstorm on the 4th of July and a series of extremely intense tornado-producing thunderstorms later in July across east-central Colorado. There were more windy days than normal for the summer, and the traditional afternoon thundershowers that are so common most summers in the mountains were almost nonexistent. That all changed, however, during the 2nd week of August when tropical moisture finally made its way northward. Thunderstorms and all-day rains became common across southern Colorado for the last three weeks of August. Some extremely large monthly totals were reported, some exceeding six inches. Alamosa had their wettest August on record with 5.40". The wet weather effectively ended the threat of wild fires that had been increasing throughout the summer.

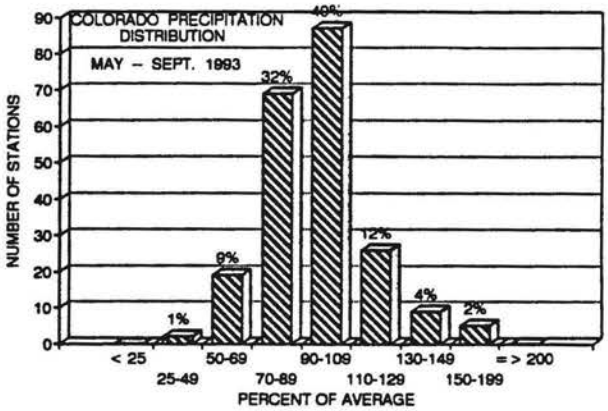
September brought the 1993 water year to a close with more cooler than average weather and one of the more dramatic



Precipitation for May-September 1993 as a percent of 1961-90 average.

weather changes in recent years. An unusually early snowstorm on the 13th came just a few hours after record high temperatures soared into the 90s on the 12th. A hard freeze on the 14th brought an early end to the growing season for many farmers in northeast Colorado.

Each month of the 1993 growing season brought contrasting rainfall patterns to Colorado. May was unusually wet on the Western Slope (where it is usually dry) and unusually dry in northeast Colorado (where it is usually wet at that time of year). In June, most of Colorado was very dry, but north central sections were wet. It was one of the driest Julys statewide in several years, but northeast Colorado was very wet. August was dry in northwest and north central Colorado, but southern areas were extremely wet. September reversed this pattern with wet weather in north central Colorado and quite dry across most of the remainder of the State.



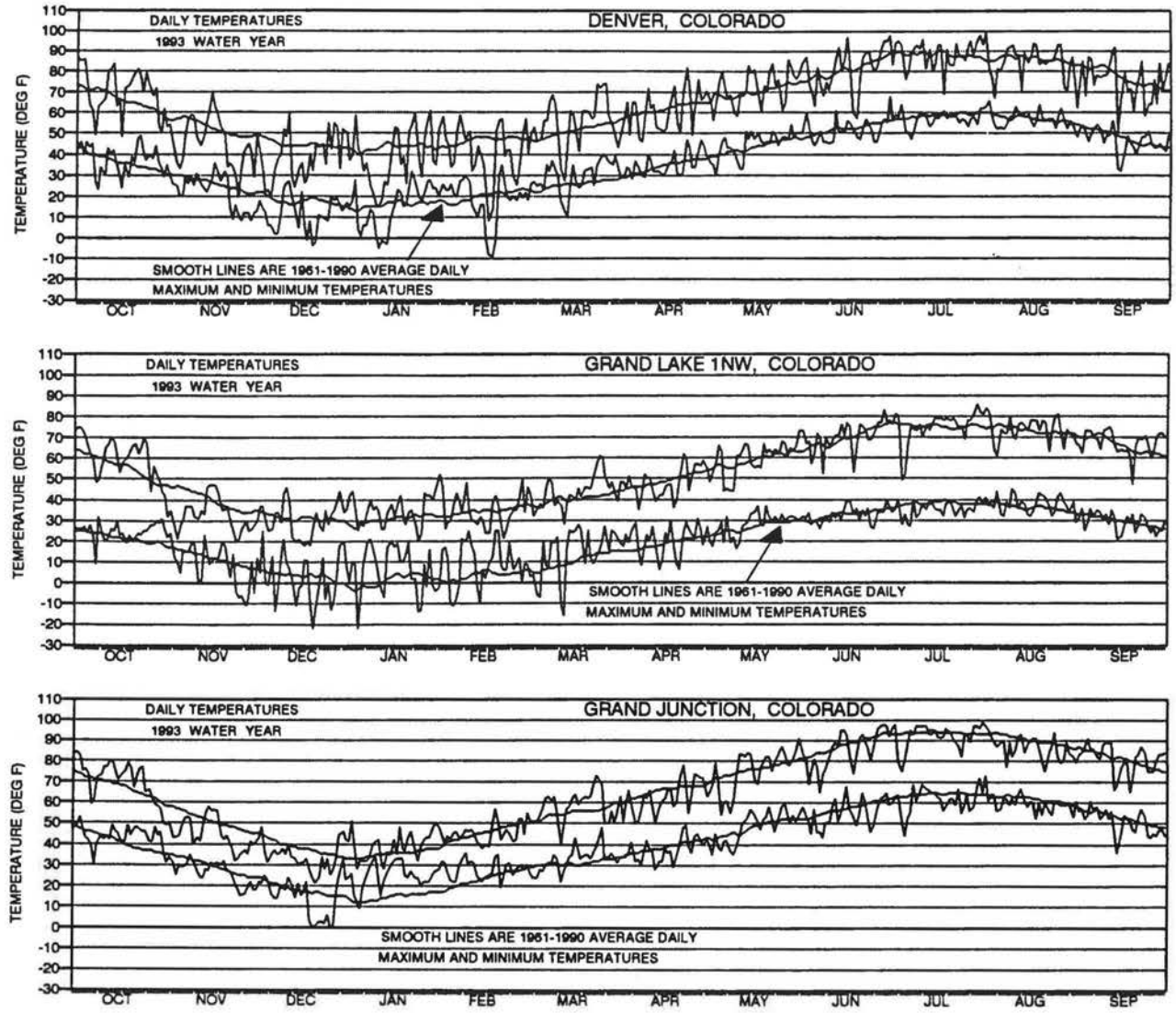
Overall, 1993 growing season (May-Sept) precipitation was a little drier than average. More than 70% of Colorado's weather stations received between 70% and 110% of the average growing season precipitation. The driest areas were observed in northwest Colorado (Maybell reported just 2.39", 48% of average), in central Colorado (Buena Vista totalled 3.32", 49% of average) and over portions of the Front Range and Eastern Plains. Wetter than average conditions were observed over much of the east central and southeastern plains of Colorado, the San Luis Valley and west central counties. The most May-September rainfall at an official weather station was 21.49" (192% of average) at Arapahoe 14N.

Temperature Summary

Temperatures combined over the entire 1993 Water Year ended up below average over most of Colorado and considerably cooler than usual across the Eastern Plains and San Luis Valley. The only exceptions were found in parts of southwest Colorado where several winter episodes of mild and moist Pacific air helped keep temperatures for the year a little above average. Most of the State ended up with 8 or 9 cooler than average months. In parts of eastern Colorado, this was the coolest year in two decades.

1993 brought the second consecutive cooler than average summer to Colorado. Unlike last year when the cool

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.



summer was concentrated east of the mountains, this year temperatures were uniformly below average from June through September across the entire State. These have been the coolest back-to-back summers in Colorado since 1950-51.

The graphs above show daily maximum and minimum temperatures throughout the year at selected sites. There were plenty of daily variations, as always, but not many extremes. One of the most unusual events of the year was the cold temperatures of July 4-5th. Grand Junction reported their coldest July temperature in recorded history, 44°F on the 5th. Over the entire State, the highest temperature for the year was 107°F on July 8 at three stations in southeast Colorado. The coldest temperature was -38°F on December 24th at Taylor Park Reservoir. Neither of these extremes is unusual for Colorado.

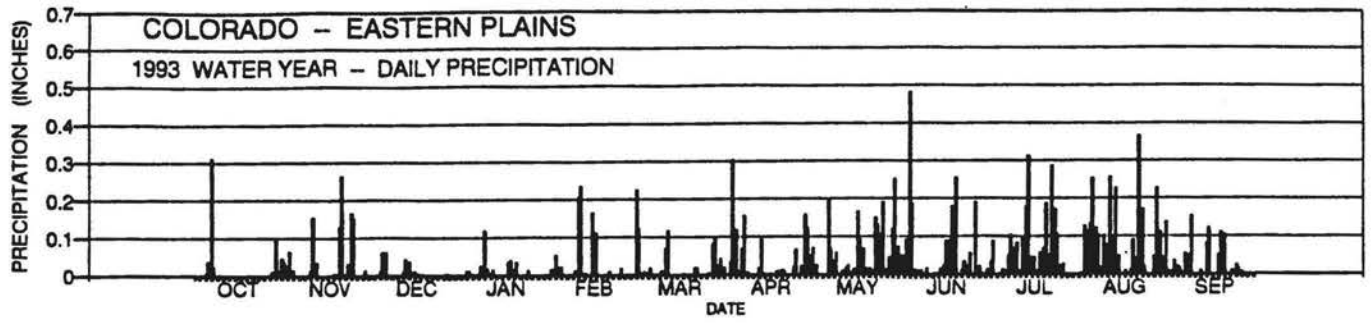
Precipitation Summary

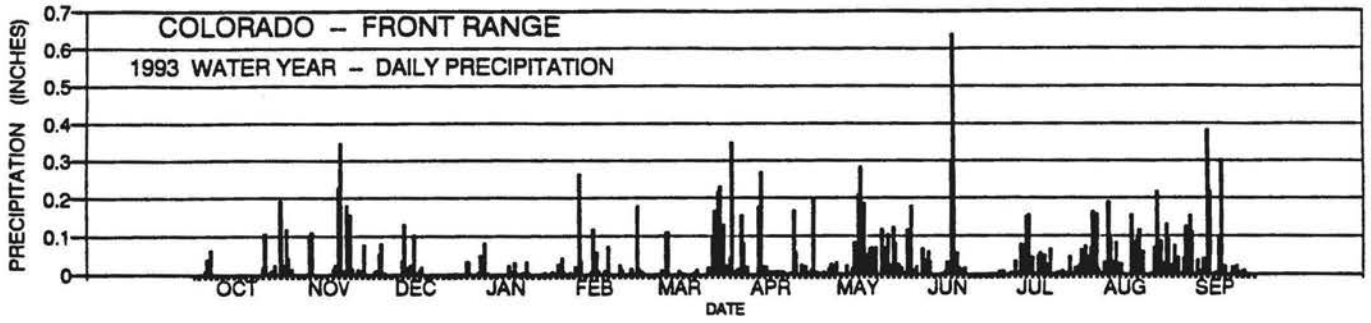
The majority of Colorado finished the 1993 Water Year with near to above average precipitation totals. The wettest areas were found in west central, south and southeast Colorado. Drier than average regions were concentrated in central Colorado east of the Continental Divide with smaller dry areas in northwest and northeastern counties. Each month brought highly variable precipitation patterns. In 10 out of the 12 months, precipitation totals in Colorado varied from less then 25% to more than 200% of average. Overall, statewide precipitation for the year was 106% of average. The long-term statewide average is just over 17 inches per year.

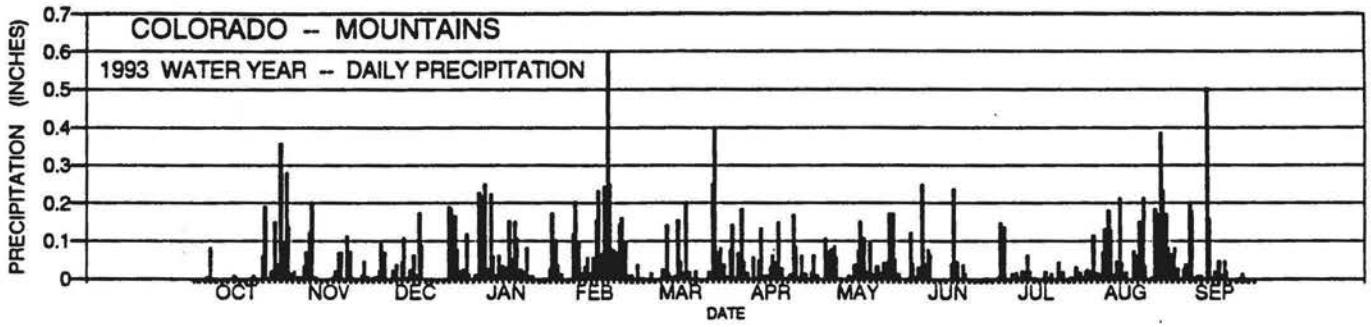
The year's precipitation was composed of many days with light precipitation along with a few days with moderate to heavy totals. The following graphs show the daily distribution of precipitation during the year. October 31 was the wettest day of the year on the Western Slope. Up in the mountains, the biggest storm was February 19-20. On the Front Range, June 17 was the wettest day, while out on the plains, June 2-3 was the soggiest period.

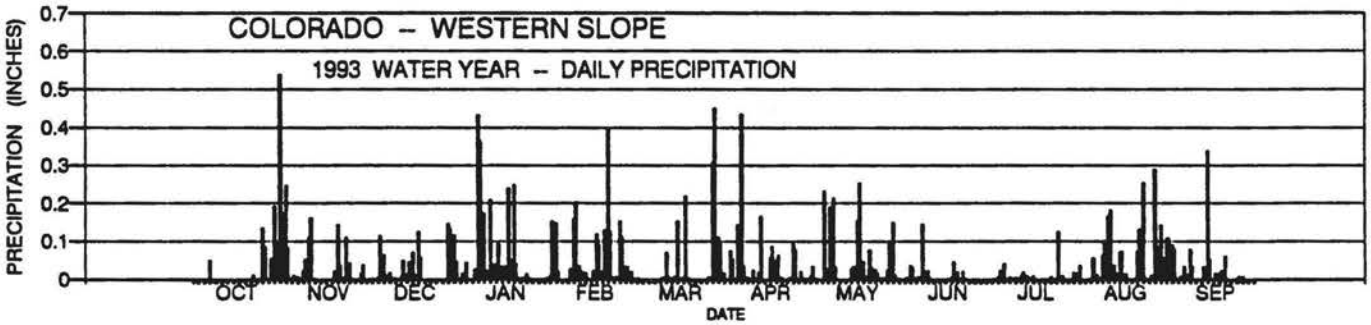
Precipitation totals, statewide, while greater than average, were a little less than in 1992. However, streamflow and surface water supplies were much greater than last year with many of Colorado's rivers and streams flowing 10% to 40% above average. The reason for this contrast was the seasonal distribution of precipitation. This year, much more precipitation fell during the winter months and accumulated as snow. By comparison, 1992 had a dry winter followed by a wet summer.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.









JCEM WTHRNET Problems

Note: Due to equipment problems, considerable amounts of data have been missing from the Joint Center for Energy Management WTHRNET during recent months. We expect data to begin appearing again in October 1993.

For those of you who utilize these data, solar radiation readings from Montrose and Durango have been inaccurate for more than one year due to calibration problems. JCEM is aware of these problems and should have them taken care of in November.

Unless noted otherwise, the special features contained in **Colorado Climate** are prepared and edited by Nolan Doesken, Assistant State Climatologist, at the Colorado Climate Center. Comments and questions are always welcome.