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**BIENNIAL CATALOG OF  
RESEARCH REPORTS, PAPERS, BULLETINS  
AND THESES**

For the period ending December 1965



ENGINEERING RESEARCH

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COLLEGE OF ENGINEERING

Colorado State University  
Fort Collins, Colorado

December, 1965

CER65DKS-RDD52

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### COLLEGE OF ENGINEERING ADMINISTRATIVE OFFICERS

Lionel V. Baldwin, Dean, College of Engineering

Daryl B. Simons, Associate Dean for Research

Richard D. Dirmeyer, Administrative Engineer

John E. Dean, Head, Department of Electrical Engineering

Norman A. Evans, Head, Department of Agricultural Engineering

J. W. N. Fead, Head, Department of Civil Engineering

Bernard W. Marschner, Head, Department of Mechanical Engineering

Herbert Riehl, Head, Department of Atmospheric Science

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J. W. N. Fead, Head, Department of Civil Engineering  
Bernard W. Marschner, Head, Department of Mechanical Engineering  
Herbert Riehl, Head, Department of Atmospheric Science



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## INTRODUCTION

This catalog presents a list of Colorado State University publications prepared by the faculty, research staff and students of the College of Engineering. Included are publications of U. S. Government staff affiliated with the College of Engineering.

A listing of publications prior to 1964 may be found in the catalog "Research Reports, Papers, Bulletins and Theses, 1948 through 1963, Civil Engineering Section, December 1963, CER63RAS71".

Publications prior to 1963 which are not in the 1948-1963 catalog have been included here for completeness.

The publications by members of various departments are listed alphabetically by senior

author. Papers co-authored by members of different departments are cross-referenced with appropriate notes.

Theses and dissertations may be obtained on an interlibrary loan by writing to the Director of Libraries, Colorado State University.

Copies of publications, when available, may be obtained, either free or for a nominal charge, upon communication to the senior author. In the event that the senior author is not listed under faculty and research staff, communications should be addressed to one of the co-authors or as a last resort to the Department Head.

## ABBREVIATIONS USED IN THIS CATALOG

AGU	American Geophysical Union
AIAA	American Institute of Aeronautics and Astronautics
AMS	American Meteorological Society
ARS	Agricultural Research Service
ASAE	American Society of Architectural Engineers
ASCE	American Society of Civil Engineers
ASEE	American Society of Electrical Engineers
ASME	American Society of Mechanical Engineers
ATC	Air Traffic Control
AWWA	American Water Works Association
CAT	Clear-Air Turbulence
IASH	International Association of Scientific Hydrology
ICID	International Commission on Irrigation and Drainage
IEEE	Institute of Electrical and Electronics Engineers
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NSF	National Science Foundation
SCAT	Supersonic Commercial Air Transport
SEATO	South East Asia Treaty Organization
SEPM	Society of Economic Paleontologists and Mineralogists
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USWB	United States Weather Bureau
WMO	World Meteorological Association

ACADEMIC AND RESEARCH FACULTY  
DEPARTMENT OF AGRICULTURAL ENGINEERING

N. A. Evans, Head

1965-66

BARMINGTON, R. D., Associate Agricultural Engineer: (power machinery).

CLARK, S. J., Assistant Professor and Assistant Agricultural Engineer: (power machinery).

COREY, A. T., Professor and Agricultural Engineer: (flow through porous media).

EVANS, N. A., Professor and Head of Department: (irrigation and drainage).

HANSEN, R. W., Associate Professor and Associate Agricultural Engineer: (farm structures and power machinery).

HEERMANN, D. F., Junior Agricultural Engineer: (irrigation).

PUBLICATIONS

Agricultural Engineering Department

Anat, A., H. R. Duke and A. T. Corey, Steady upward flow from water tables, Colorado State University, Hydrology Paper No. 7, June 1965.

Barmington, R. D., Weed problems and the ability of sugar beets to recover from hail damage, Colorado Agricultural Experiment Station Bulletin, 1952.

\_\_\_\_\_, The relation of seed, cell size and speed to beet planter performance, Scientific Journal Series Paper No. 268, January 1948.

\_\_\_\_\_, Forced ventilation of stored sugar beets, Scientific Journal Series Paper No. 290, 1948.

\_\_\_\_\_, The extent of sugar beet emergence studies at Colorado A and M College, Scientific Journal Series No. 318, February 1950.

\_\_\_\_\_, Physical factors of the soil affecting beet seedling emergence, Scientific Journal Series No. 319, February 1950.

\_\_\_\_\_, 1951 mechanical thinning of sugar beets at Colorado A and M gives encouraging results, Scientific Journal Series No. 380, Colorado Agricultural Experiment Station, February 1952.

\_\_\_\_\_, Leaves stripped from sugar beet plants with new type machine, reprint from Colorado Farm and Research, Vol. 1, No. 4, November-December 1950.

\_\_\_\_\_, Mechanical sugar beet weeder, reprint from Colorado Farm and Home Research, January-February 1951.

\_\_\_\_\_, Sugar beet top food value saved by mechanical methods, reprint from Colorado A and M News, July 1951.

\_\_\_\_\_, and S. W. McBirney, Mechanizing the production of sugar beets, Colorado Agricultural Experiment Station Bulletin No. 420-A, April 1952.

\_\_\_\_\_, P. N. David and H. S. Wilgus, Conservation of sugar beet tops by dehydration, Colorado Agricultural Experiment Station Bulletin, 1952.

\_\_\_\_\_, Sugar beets succeed under adverse conditions, Miscellaneous Series No. 524. (Approved 1-6-53 for publication in U and I Cultivator, Holly Sugar Corporation Magazine and British World Crops).

\_\_\_\_\_, Metering devices and test results of some foreign and domestic sugar beet planters, Scientific Journal Series No. 473, Colorado Agricultural Experiment Station. (Approved for publication in Proceedings of the American Society of Sugar Beet Technologists, January 1956).

\_\_\_\_\_, Planting equipment for monogerm seed, Scientific Journal Series No. 554, Colorado Agricultural Experiment Station and Journal of the American Society of Sugar Beet Technologists, January 1958.

Agricultural Engineering Department - continued

- Barmington, R. D., Conservation and utilization of sugar beet tops, Scientific Journal Series No. SS554, Colorado Agricultural Experiment Station, April 1958.
- \_\_\_\_\_, Planter tests and seed preparation using monogerm sugar beet seed, Scientific Journal Series 648, Colorado Agricultural Experiment Station and Journal of the American Society of Sugar Beet Technologists, April 1960.
- \_\_\_\_\_, Sugar beet planting progress with monogerm seed, Crops and Soils, Vol. 13, No. 6, March 1961.
- \_\_\_\_\_, Trends in sugar beet planter design in Colorado, Scientific Journal Series No. 762, Colorado Agricultural Experiment Station and the Journal of American Society of Sugar Beet Technologists, January 1962.
- Bloomsburg, G. L. and A. T. Corey, Diffusion of entrapped air from porous media, Colorado State University, Hydrology Paper No. 5, August 1964.
- Brooks, R. H. and A. T. Corey, Hydraulic properties of porous media and their relation to drainage design, American Society of Agricultural Engineers Transactions, Vol. 7, No. 1, 1964.
- Clark, S. J., J. B. Liljedahl and D. L. Apple, Performance of dual and tandem traction tires--a model study, Society of Automotive Engineers, September 1965.
- Corey, A. T., The interrelation between gas and oil relative permeabilities, Producer's Monthly, Vol. XIX, No. 1, November 1954.
- \_\_\_\_\_, Measurement of water and air permeability in unsaturated soil, Soil Science Society of America Proceedings, Vol. 21, No. 1, January-February 1957.
- \_\_\_\_\_, and C. H. Rathjens, Effect of stratification on relative permeability, Technical Note No. 393, Journal of Petroleum Technology, December 1956.
- \_\_\_\_\_, Concept of total potential in water and its limitations, Soil Science, Vol. 92, No. 5, May 1961.
- \_\_\_\_\_, and H. R. Duke, Evaporation from fallow soil surfaces, presented at the ASAE Rocky Mountain Section Meeting, University Park, New Mexico, April 1964.
- \_\_\_\_\_, and R. H. Brooks, Hydraulic properties of porous media, Colorado State University, Hydrology Paper No. 3, March 1964.
- Corey, G. L., A. T. Corey and R. H. Brooks, Similitude for non-steady drainage of partially saturated soils, Colorado State University, Hydrology Paper No. 9, August 1965.
- Evans, N. A., Stratum survey techniques for drainage investigation on irrigated lands, Technical Bulletin 67, Colorado State University Experiment Station, December 1958.
- \_\_\_\_\_, Water table control investigations in arid and semi-arid regions, Proceedings, International Commission on Irrigation and Drainage, April 1959.
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- \_\_\_\_\_, S. A. Taylor and G. H. Cannell, Water requirements of crops, Monograph No. SP-SW-1062, American Society of Agricultural Engineers, January 1962.
- \_\_\_\_\_, Drainage, reclamation, and **management** practices--research on Western Colorado soils, General Series No. 762, Colorado Agricultural Experiment Station, July 1961.
- \_\_\_\_\_, Movement of water as affected by free energy and pressure gradients, III: Restriction of solutes by membranes, Colorado Agricultural Experiment Station Scientific Journal Series No. 780, March 1962.
- \_\_\_\_\_, Water measurement with U.S. Steel irrigation gates, (contract report) October 1963.
- \_\_\_\_\_, Weed seed and trash screens for irrigation water, Popular Bulletin 522-S, Colorado State University Agricultural Experiment Station, November 1964.
- Hansen, R. W., Performance of feed pelleting machine, (contract research project) January 1961.
- \_\_\_\_\_, Potato storage investigations in the San Luis Valley of Colorado, General Series No. 793, Colorado State University Agricultural Experiment Station, September 1963.
- Pugh, W. J., Inexpensive land preparation for leaching, Journal of Soil Conservation, Vol. 18, No. 6, November-December 1963.

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Scott, V. H., and A. T. Corey, Pressure distribution during steady flow in unsaturated sands,

Soil Science Society of America Proceedings, Vol. 25, No. 4, July-August 1961.

ACADEMIC AND RESEARCH FACULTY  
DEPARTMENT OF ATMOSPHERIC SCIENCE

Herbert Riehl, Head

1962-66

- BAER, F., Associate Professor: (theoretical and numerical problems of atmospheric flow).
- GRANT, L.O., Associate Professor: (precipitation physics, weather modification, mountain weather).
- GRAY, W., Assistant Professor: (tropical meteorology, turbulence, weather forecasting).
- MARLATT, W.E., Associate Professor: (radiation physics related to satellite observations. Agricultural and forest climates).
- RASMUSSEN, J.L., Instructor: (synoptic meteorology, hydrometeorology).
- REITER, E.R., Professor: (high altitude winds, aerospace science, turbulence and air pollution).
- RIEHL, H., Professor and Head: (atmospheric dynamics, jet streams, hurricanes).
- SINCLAIR, P.C., Assistant Professor: (severe storms).
- SMITH, E.K., Affiliate Professor: (upper atmosphere physics).
- SQUIRES, P., Affiliate Professor: (cloud physics).

PUBLICATIONS

Atmospheric Science Department

- Baer, F. and W. Kamm, Numerical analysis of TIROS radiation observations, At. Sci. Tech. Paper 67, 1965.
- Grant, L.O., Indications of residual effects from silver iodide released into the atmosphere, Proceedings West. Snow Conf., At. Sci. Tech. Paper 49, 1963.
- \_\_\_\_\_, and J. Marwitz, The application of radar to snow surveying, Proceedings West. Snow Conf., At. Sci. Paper, 1965.
- \_\_\_\_\_, Guy Goyer and T. J. Henderson, The laboratory and field evaluation of Weathercord, A new high efficiency cloud seeding device, to be published in J. Appl. Meteor.
- Gray, W.M., On the balance of forces and radial accelerations in hurricanes. Quart. J. Royal Meteor. Soc., 88, 378, 1962.
- Gray, W.M., Calculation of cumulus vertical draft velocities in hurricanes from aircraft observations, J. Appl. Meteor., 4, 4, 1965.
- Marlatt, W.E. and H. Riehl, Precipitation regimes over the upper Colorado River, J. Geoph. Res. 68, 6447, 1963.
- \_\_\_\_\_, R.M. Moxham, D.R. Crandell, Thermal features at Mount Rainier, Washington, as revealed by infrared surveys, USGS Prof. Paper 525-D, pps. D-93-D100, 1965.
- Rasmussen, J.L., Some aspects of the monthly atmospheric circulation affecting monthly precipitation over the Colorado River basin, At. Sci. Tech. Paper 46, 1963.
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ACADEMIC AND RESEARCH FACULTY  
DEPARTMENT OF CIVIL ENGINEERING

J. W. N. FEAD, Head

1965-66

ALBERTSON, M. L., Professor: (hydraulics, fluid mechanics, water resources).

BALDWIN, L. V., Professor and Dean, College of Engineering: (fluid mechanics, thermosciences).

BARNES, A. H., Associate Professor: (hydrology, hydraulics).

BELL, J. M., Associate Professor: (soil mechanics).

BENDER, M. E., (on leave) Professor and Dean, SEATO Graduate School of Engineering: (highways, engineering economics).

BINDER, G. J., Assistant Professor: (fluid mechanics, hydrology).

BITTINGER, M. W., Associate Professor: (ground water, hydrology).

BRITTON, C. C., Associate Professor of Electrical Engineering: (instrumentation).

CERMAK, J. E., Professor: (fluid mechanics, mechanics, hydraulics).

CHAMBERLAIN, A. R., Professor and Vice President for Administration: (fluid mechanics).

CHUANG, H., Assistant Professor: (fluid mechanics).

DIRMEYER, R. D., Jr., Assistant Professor and Administrative Engineer: (soil mechanics).

DUKE, H., Junior Civil Engineer: (ground water).

FEAD, J. W. N., Professor and Head of Department of Civil Engineering: (structures, soil mechanics).

FINN, C. L., Assistant Electronics Engineer: (instrumentation).

GLOVER, R. E., Temporary Professor: (ground water, structures).

GOODMAN, J. R., Assistant Professor: (structures, mechanics).

GOROVE, A., Junior Civil Engineer: (instrumentation).

HAYMAN, R. W., (on leave) Assistant Professor: (highways, soil mechanics, photogrammetry).

KARAKI, S., (on leave) Associate Professor: (fluid mechanics, hydraulics).

KOLOSEUS, H. J., Associate Professor: (hydraulics, fluid mechanics).

KOMURA, S., Junior Civil Engineer: (hydraulics).

KUMMER, J. W., Junior Civil Engineer: (thermosciences).

LONGENBAUGH, R. A., Assistant Professor: (ground water, hydrology).

MARKOVIC, R. D., Junior Civil Engineer: (hydrology, hydraulics).

MERONEY, R. N., Assistant Professor: (fluid dynamics).

NATH, J. H., (on leave) Associate Professor: (hydraulics, structural designs, fluid mechanics).

PARSHALL, M., Associate Professor: (domestic water supply, sanitation).

PLATE, E. J., Associate Professor: (fluid mechanics).

REICH, B. M., Assistant Professor: (hydrology).

ROWLAND, W. F., Assistant Professor: (hydrology).

RUFF, J. F., Junior Civil Engineer: (hydraulics).

SANDBORN, V. A., Associate Professor: (fluid mechanics, aerodynamics).

SCHULZ, E. R., (on leave) Associate Professor: (hydrology).

Civil Engineering Department - continued

SCHWEIZER, H. H., Associate Professor:  
(mechanics, structures).

SHEN, H. W., Associate Professor: (fluid  
mechanics, hydraulics).

SHEN, R. T., (on leave) Assistant Professor:  
(structural design, hydrology, canal lining,  
technical writing, illustration).

SHOKOUH, H., Junior Civil Engineer:  
(fluid dynamics).

SIMONS, D. B., Professor and Associate Dean  
for Research: (hydraulics, fluid mechanics,  
water resources).

SKINNER, M. M., (on leave) Assistant Civil  
Engineer: (hydraulics, ground water).

SMITH, G. L., Assistant Professor:  
(hydraulics, fluid mechanics, hydrology).

SUNADA, D. K., Assistant Professor:  
(ground water).

VANDERBILT, M. D., Assistant Professor:  
(structures, mechanics).

WARD, J. C., Associate Professor:  
(environmental engineering).

YEVDJEVICH, V. M., Professor:  
(hydrology, hydraulics, water resources).

PUBLICATIONS

Civil Engineering Department

Abdullah, M. S. and D. B. Simons, Pipe insert  
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Colorado State University, prepared under  
project 303-105 flow measurement,  
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Albertson, M. L., The ASEE Information Center  
on International Affairs, presented at the  
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Engineering Education, June 1964.

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and the U. S. National Committee, ICID,  
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(CER65MLA36).

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Research Conference, Journal of the  
Irrigation and Drainage Division, ASCE,  
December 1964.

\_\_\_\_\_, Components of international development  
programs related to engineering education,  
presented at the World Congress on  
Engineering Education, ASEE, June 1965.

\_\_\_\_\_, and R. T. Shen, Report on Information  
Center for ASEE Committee on International  
Engineering Education, presented at Annual  
Meeting of ASEE, University of Maine,  
June 1964.

\_\_\_\_\_, see - Shen, R. T., Department of  
Civil Engineering.

Algert, J. H., A statistical study of bed forms in  
alluvial channels, U. S. Geological Survey  
Colorado State University, June 1965.  
(CER65JHA26)

\_\_\_\_\_, see - Nordin, Carl F., United  
States Geological Survey.

Baldwin, L. V. and N. H. C. Hwang, Decay of  
turbulence, axisymmetric wakes, ASME  
Transactions, Journal of Basic Engineering,  
1966. (CER64NH-LVB16).

\_\_\_\_\_, and Y. Kuo, Comments on "three-  
dimensional effects in viscous wakes,"  
AIAA Journal, Vol. 2, No. 6, June 1964.

\_\_\_\_\_, see:

1. Cermak, J. E., Department of Civil  
Engineering.
2. Kuo, Y., Department of Civil  
Engineering (2 coauthorships).
3. Sandborn, V. A., Department of  
Civil Engineering.

Binder, G. J., see - Cermak, J. E., Depart-  
ment of Civil Engineering (2 coauthorships).

Bittinger, M. W., The problem of integrating  
ground water and surface water use,  
Ground Water, Vol. 2, No. 3, July 1964.

\_\_\_\_\_, see:

1. Eshett, A., Department of Civil  
Engineering.
2. Maasland, D. E. L., Department of  
Civil Engineering (2 coauthorships).
3. Smith, S. C., Department of Civil  
Engineering.

Bodig, J., see - Troxell, H. E., Department  
of Civil Engineering.

- Caffey, J. E., Inter-station correlations in annual precipitation and in annual effective precipitation, Hydrology Paper No. 6, Colorado State University, June 1965.
- Cermak, J. E. and K. S. Davar, Characteristics of diffusion plumes from a point source within a turbulent boundary layer, International Journal of Air and Water Pollution, Vol. 8, pp. 339-354, 30 December 1963.
- \_\_\_\_\_, and G. J. Binder, Streaming potential fluctuations produced by turbulence, Physics of Fluids 6 (8) 1963.
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- \_\_\_\_\_, U. S. - Japan seminar on instrumentation in hydraulic research (7-16 April 1965, Tokyo, Japan), May 1965. Presented to the National Science Foundation.
- \_\_\_\_\_, and J. A. Peterka, Simulation of wind field over Point Arguello, California by wind tunnel flow over a topographic model, December 1965. Final report for Navy Department, USN123(61756) 34 361 A (PMR). (CER65JEC-JAP64).
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- \_\_\_\_\_, see:
1. Chuang, H., Department of Civil Engineering.
  2. Hsi, G., Department of Civil Engineering.
  3. Quraishi, A. A., Department of Civil Engineering.
- Chamberlain, A. R., see - Sayre, W. W., U. S. Geological Survey Section.
- Chang, S. C., Velocity distributions in the separated flow behind a wedged shaped model hill, M. S. Thesis prepared as a technical report, December 1965. (CER65SCC66).
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Civil Engineering Department - continued

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- Chuang, H. and J. E. Cermak, Turbulence measured by electrokinetic transducers, Journal of Hydraulics Division, Proceedings of ASCE, Vol. 91, No. HY 6, pp. 1-8, November 1965. (CER65HC-JEC5).
- \_\_\_\_\_, Uncertainties in the measurement of helium plasma temperature by a relative intensity method, Applied Optics No. 4, December 1965. (CER65HC61).
- \_\_\_\_\_, see - Cermak, J. E., Civil Engineering Department.
- Cox, W. L., Evaluation of a North Dakota hail suppression operation, August 1964. Sponsored by the National Science Foundation under Grant GF-2594. (CER64WLC26).
- \_\_\_\_\_, The establishment and operation of a close grid pibal network in Northeastern Colorado, August 1965. Prepared for Research Participation Program sponsored by NSF, assigned to Northeastern Colorado Hail Project, also sponsored by NSF Grant No. G23-706. (CER65WLC44).
- \_\_\_\_\_, see - Schleusener, R. A., Department of Civil Engineering.
- Crews, D. L., see - Troxell, H. E., Department of Civil Engineering.
- Dava, K. S., see - Cermak, J. E., Department of Civil Engineering.
- Dirmeyer, R. D. and M. M. Skinner, Evaluation of Colorado clays for sealing purposes, Colorado State University Experiment Station, Technical Bulletin 83, May 1964. Prepared for Colorado Water Conservation Board. (CER64RDD-MMS5).
- \_\_\_\_\_, Clays as a canal sealant, prepared for Review, Vol. II, Division of Engineering Geology, Geological Society of America (scheduled for publication, Fall 1964).
- \_\_\_\_\_, see - Sunada, D. K., Department of Civil Engineering.
- Duckstein, L., see - Cermak, J. E., Department of Civil Engineering.
- Duke, H. R., Maximum rate of upward flow from a water table, M. S. Thesis, Colorado State University, Agricultural Engineering, March 1965.
- \_\_\_\_\_, see:
1. Anat, A., Department of Agricultural Engineering.
  2. Corey, A. T., Department of Agricultural Engineering.
  3. Skinner, M. M., Department of Civil Engineering.
- Eshett, A. and M. W. Bittinger, Stream-aquifer system analysis for conjunctive-use operations, Journal of Hydraulics Division, ASCE, Vol. 91, HY 6, pp. 153-164, November 1965. (CER64AE-MWB29).
- \_\_\_\_\_, see - Longenbaugh, R. A., Department of Civil Engineering.
- Fead, J. W. N., and H. B. Seed, Apparatus for repeated load tests on soils, special technical publication No. 254 of American Society for Testing Materials.
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ACADEMIC AND RESEARCH FACULTY  
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ACADEMIC AND RESEARCH FACULTY  
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RENNAT, H. O., Associate Professor:  
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STEELE, R. L., Associate Professor: (thermo-  
dynamics and cloud physics, behavior of  
aerosols in atmospheric environments).

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