



ATMOSPHERIC SCIENCE

COLORADO STATE UNIVERSITY

2021 NEWSLETTER

Back toward normal

Fall semester brought a reinvigorated campus and return to something resembling normalcy a year and a half into the pandemic. Most classes and many events have been held in person, and our international students delayed by visa issues finally were able to join us in Fort Collins.

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Students gather in the community space Oct. 29, during the Young Scientist Symposium on Atmospheric Research.

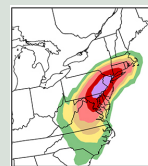
Steven Miller named new CIRA director, ATS professor

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Department members earn AGU, AMS honors

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ATS develops heavy rainfall forecast tool used nationwide

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The *Atmospheric Science Newsletter* is published annually for alumni, friends, and members of the department.

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Privileged to serve 11 years as department head

I hope this message finds you well and coping with the strange new reality of 2021. Our optimistic expectations of a return to “normal” have been met with the reality of a protracted pandemic, yet there is much to be grateful for and celebrate. I am pleased that we can bring you lots of good news in the pages of this newsletter.



Department Head
Jeff Collett

Let me start with the most recent news and perhaps our biggest announcement of the year. NASA recently selected its newest Earth Ventures Mission, INCUS (INvestigation of Convective UpdraftS). INCUS is a \$177 million mission led by our own Professor Sue van den Heever and will feature three small satellites flying in tight coordination. INCUS will be focused particularly on vertical motions through storms, with the goal of better representing these storms in weather and climate models. A short piece about the mission announcement is included on **Page 13**, but expect a bigger feature in next year’s newsletter.

Our cover story this year takes a look at the state of our educational and research operations in the department as the pandemic continues. We are pleased to have most faculty, students, and staff back on campus with nearly full resumption of in-person classes, seminars, and other research activities. One of these upcoming activities will be to honor our 2021 Outstanding Alum, Tristan L’Ecuyer of the University of Wisconsin. Please see more about (and from!) Tristan on **Page 9**.

Last year, we reported on changes to our graduate recruiting process, including elimination of the GRE requirement and implementation of a more holistic application review process. I am pleased to report that this

year’s entering class is both one of the largest in department history as well as the most diverse.

This year continued a string of honors earned by faculty, staff, students, and alumni. You can read more about these in the pages ahead. Among major recognitions are the selection of Associate Professor Libby Barnes

for the AGU Macelwane Medal, Professor Steve Rutledge for the 2022 AMS Suomi Technology Medal, Dr. Melissa Burt for the 2022 AMS Charles E. Anderson Award, Professor Emeritus Wayne Schubert for the AGU Charney Lecture, Associate Professor Emily Fischer for the Jon C. Graff Prize for Excellence in Science Communication, and Dr. Paul DeMott and Libby Barnes as AGU Fellows. Several alumni also received notable honors: Professor Gudrun Magnusdottir was recognized as an AMS Fellow, Dr. John Knaff was selected for the 2022 AMS Banner I. Miller Award, and Professor Xubin Zeng was elected as an AGU Fellow. I’d also like to remind all of you that Professor Emeritus Dick Johnson will be honored at the AMS meeting in January with the Richard Johnson Symposium, following a pandemic delay from 2021.

This will be my last newsletter column. It has been my privilege to serve for 11 years as department head and play some small role in the growth and success of the department during that time. I am looking forward to a return to full-time faculty status next July. Meanwhile, I wish you a happy and healthy 2022. We look forward to seeing you in person, here in Fort Collins or elsewhere.

Sincerely,

Jeffrey L. Collett Jr.
collett@colostate.edu

FACULTY NEWS

Steven Miller named new CIRA director, ATS professor

Research scientist and Colorado State University alumnus Steven Miller has been named director of the Cooperative Institute for Research in the Atmosphere. Miller holds a joint appointment as professor in the CSU Department of Atmospheric Science.



Founded in 1980 under the direction of University Distinguished Professor Emeritus Tom Vonder Haar, CIRA's research into satellite meteorology quickly spread to other topics, including hurricane forecasting and weather forecast models. CIRA works with NOAA,

NASA, and the U.S. Departments of Defense, Energy, and Interior to advance our understanding of weather, water, and air quality.

CIRA products help visualize tropical storms, air quality, and fire or dust events. If you've seen stunning color imagery of weather over the United States posted by NOAA, odds are you're looking at a product developed at CIRA.

CIRA has branch offices across the country – in Maryland, the Aviation Weather Center in Kansas City, the National Hurricane Center in Miami, and the Earth System Research Laboratory in Boulder – where nearly 200 scientists, engineers, and researchers work on myriad topics. Miller is responsible for

managing the strategic planning and oversight of these scientists. He brought to the position a deep understanding of what makes relevant science, significant management and interpersonal skills, and a strategic vision to keep the vibrant research institute thriving.

Kummerow served as director since 2010, following University Distinguished Professor Emeritus Graeme Stephens, who succeeded Vonder Haar in 2008.

Under Kummerow's tenure, CIRA significantly grew its research volume – to \$26 million annually from \$17 million in 2010 – and added a new wing to the CIRA building on the Foothills Campus at CSU. Partnerships with the Aviation Weather Center, the National Hurricane Center, and NOAA offices have flourished, along with programs in education and social science.

Miller is now a professor at his alma mater (M.S., '97; Ph.D., '00). After completing his doctorate, Miller worked at the Naval Research Laboratory in Monterey, California, before coming back to CSU in 2007 as CIRA deputy director.

Jeff Pierce selected Professor of the Year

Professor Jeff Pierce was named Professor of the Year for the 2020-2021 academic year, based on evaluations by students administered by the department's graduate representatives. Students fill out surveys for each course throughout the year, and grad reps then determine which professor received the most feedback for teaching excellence.

Grad rep Kimberley Corwin presented Pierce with the award Sept. 1 at the New Student Welcome Picnic. Corwin shared

highlights from the evaluations, praising Pierce's "hands-on, engaging teaching style that easily facilitates learning" and adaptability and innovation around teaching during COVID-19.

"He promotes a healthy learning environment that inspires students to participate and ask questions," Corwin said.

Students noted that Pierce conveys both his interest in the subject and in student success.



FACULTY NEWS

AGU honors Elizabeth Barnes, Paul DeMott, Wayne Schubert

Three CSU atmospheric scientists have been recognized by the American Geophysical Union. Associate Professor Elizabeth Barnes was selected for the James B. Macelwane Medal, Senior Research Scientist Paul DeMott has been elected a Fellow, and Professor Emeritus Wayne Schubert was chosen to deliver the Jule Gregory Charney Lecture. They will be honored Dec. 15 at the AGU Fall Meeting in New Orleans, Louisiana.

Barnes will receive the Macelwane Medal for “significant contributions to the geophysical sciences by an outstanding early-career scientist.” Along with the medal, the AGU also will confer fellowship to Barnes.

Clara Deser, a senior scientist and head of the Climate Analysis Section at the National Center for Atmospheric Research, nominated Barnes for the medal.

“Dr. Elizabeth Barnes is an exceptionally gifted atmospheric dynamicist, who is innovating the application of emerging tools in data science to uncover new insights into the physics of the climate system,” Deser wrote for the award citation.

DeMott, an international leader in the study of ice nucleation and aerosol-cloud interactions, was elected an AGU Fellow for his research achievements and outstanding contributions to the field. Since 1962, the AGU has elected fewer than 0.1% of its membership to join this prestigious group.

“Paul’s work has been truly groundbreaking and influential,” said University Distinguished Professor Sonia Kreidenweis, who has been a close collaborator of DeMott’s for many years. “His work has helped define both the sources of ice-nucleating particles and their roles in regional and global climate, especially in how



they affect cloud microphysics and precipitation.”

In addition to his significant scientific contributions, DeMott has innovated measurement technologies and mentored many early-career scientists.

The Charney Lecture is presented to a prominent scientist who has made exceptional contributions to the understanding of weather and climate. Schubert, now retired from teaching but not research after 47 years with the department, has made pioneering discoveries in his research of tropical cyclones, moist convection, and the dynamics of mesoscale and synoptic-scale phenomena.

NOAA scientist George Kiladis nominated Schubert for the Charney Lecture.

“The investigations led by Wayne into [hurricane] features transformed CSU into a leading center in the theory and modeling of tropical storms,” Kiladis wrote in his nomination letter. “Wayne has an ability to take any topic, no matter how complex, and make it first understandable in words before solving it analytically, which is yet another reason that he has contributed so much to our field.”

Paul DeMott, Elizabeth Barnes receive college awards

Senior Research Scientist Paul DeMott received the Outstanding Researcher Award and Associate Professor Elizabeth Barnes received the Faculty Excellence Award during the Walter Scott, Jr. College of Engineering All-College Meeting on March 22. Nominations were submitted by colleagues and staff of the college’s eight departments and programs.

DeMott was recognized for “sustained,

exceptional research achievements leading to fundamental advances in understanding and measurement of ice-nucleating particles and for raising international recognition of the profound impacts of ice nuclei on clouds and climate.” He acknowledged his many colleagues deserving of the award and thanked collaborator University Distinguished Professor Sonia Kreidenweis and his wife, Charlotte.

Barnes was recognized for “her contributions of astonishing quality and quantity to climate dynamics research.” The award citation noted, “She is a sought-after collaborator, an award-winning mentor and teacher, and a leader in service to CSU and her research field.” Barnes credited her students and postdocs as the foundation of the great research and science done by her group.

FACULTY NEWS

AMS honors Steven Rutledge, Melissa Burt, Richard Johnson

Three department members will be honored Jan. 23-27 at the 102nd American Meteorological Society Annual Meeting in Houston. Professor Steven Rutledge will receive the Verner E. Suomi Technology Medal and Melissa Burt, Walter Scott, Jr. College of Engineering assistant dean for diversity and inclusion, will receive the Charles E. Anderson Award. The meeting also will feature a symposium named for Professor Emeritus Richard Johnson.



Rutledge was selected for the Verner E. Suomi Technology Medal based on his “exceptional contributions to the development, innovation, and application of radar meteorology and atmospheric electricity technologies,” according to the AMS citation. The late Verner Suomi is considered the father of satellite meteorology, and the medal named for him acknowledges significant technological achievement.

Rutledge leads the Radar Meteorology Group at CSU, which operates the CSU-CHILL National Radar Facility and led the development of SEA-POL, the world’s most advanced shipborne weather radar. Rutledge has studied cloud properties using Doppler, spaceborne, and polarimetric radar technology. He has been principal investigator on many field campaigns around the world. Rutledge joined the department in 1988 and served as department head from July 1999 through December 2006.

Burt was recognized for outstanding contributions to the promotion of diversity in the atmospheric or related sciences and broader communities through education and community service. Charles Anderson was the first African American to

receive a Ph.D. in meteorology. “To follow in his footsteps is quite an honor,” Burt said.

Burt serves in numerous leadership positions with national professional organizations in the earth sciences, fields with the lowest diversity across all STEM fields. She leads initiatives to empower young scientists and facilitates difficult discussions on equity. In the department, Burt leads the NSF Research Experiences for Undergraduates program.

The Richard H. Johnson Symposium will celebrate Professor Emeritus Johnson for his distinguished career as a researcher and educator. Johnson’s career has led to important discoveries on tropical and midlatitude convection, and his contributions to many international field campaigns set a new standard for collecting and analyzing unique observations.

The symposium originally was scheduled for 2021 but was postponed due to the global pandemic. Only two or three named symposia are included in each year’s program, reserving this recognition for the most outstanding individuals who have significant achievements in their field.

Emily Fischer recognized by University, Society for Science

Associate Professor Emily Fischer was named a Monfort Professor, one of CSU’s highest honors, during this year’s *Celebrate! Colorado State Awards*. Monfort Professorships are awarded to faculty who are rising stars in their fields. The two-year awards provide \$50,000 each year for recipients to work on specific research projects and are made possible by the



Monfort Family Foundation.

Fischer’s Monfort action plan will take advantage of improving low-cost sensor technology to identify impacts of air pollution on economically disadvantaged and minority communities.

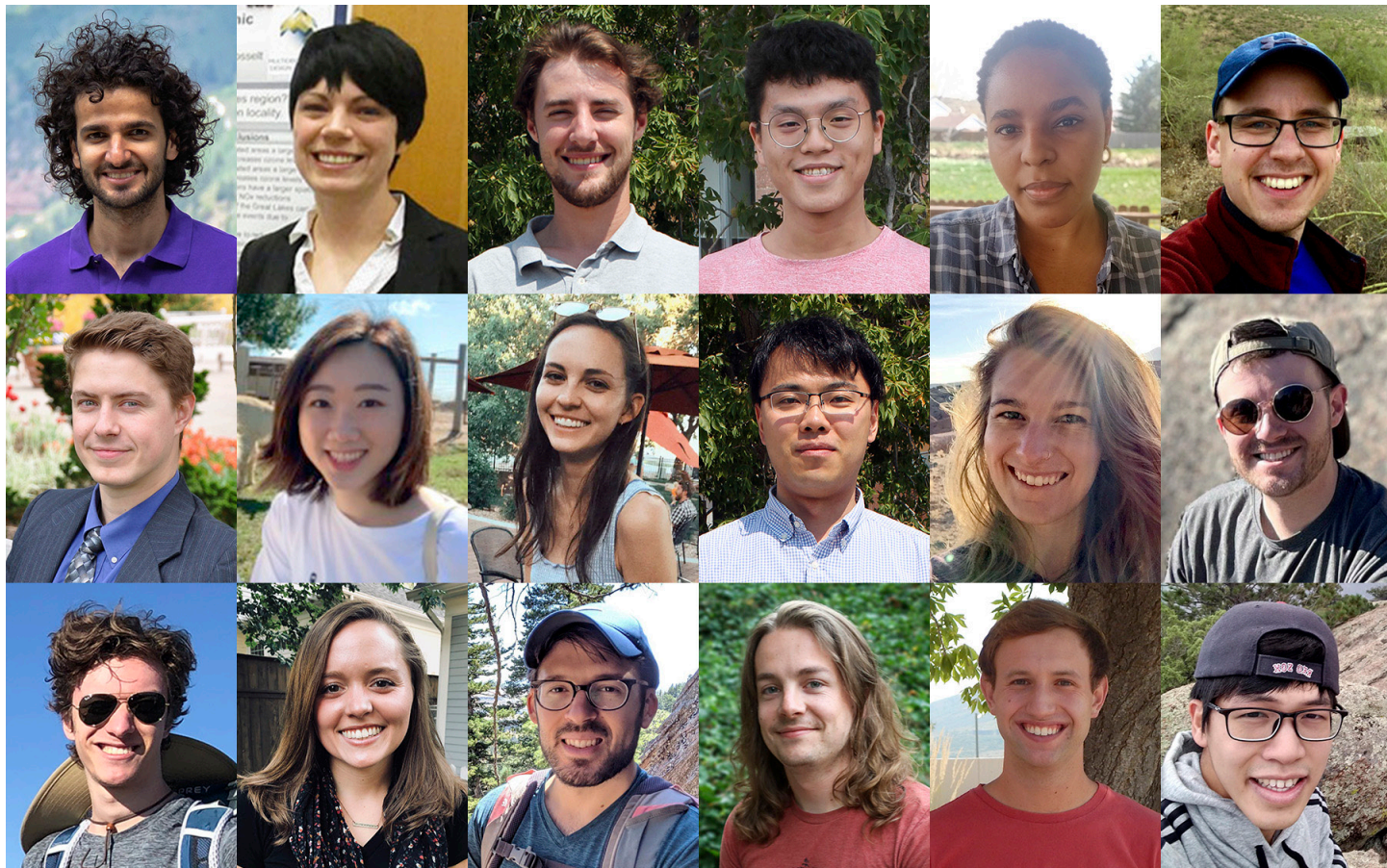
Fischer also was selected for the Jon C. Graff, Ph.D. Prize for Excellence in

Science Communication from the Society for Science. The Society for Science is a nonprofit organization that promotes the understanding and appreciation of science and the vital role it plays in human advancement.

Now in its third year, the award is given to one scientist included in the *Science News* SN 10, a list spotlighting 10 early- and mid-career scientists on their way to widespread acclaim.

STUDENT AND STAFF NEWS

Congratulations, graduates!



2021 graduates, from left to right, top to bottom row: Ali Akherati, Jennie Bukowski, Adam Clayton, Wei-Ting Hsiao, Jhordanne Jones, Drew Koeritzer, Matthew Lang, Yoonjin Lee, Allie Mazurek, Yasutaka Murakami, Alex Naegele, Michael Needham, Lance Niño, Kate O'Dell, Casey Patrizio, Jamin Rader, Justin Whitaker, and Kevin Yang.

2021 Graduates

Student – degree – research group

Ali Akherati – Ph.D. – Jathar/Pierce
Jennie Bukowski – Ph.D. – van den Heever
Adam Clayton – M.S. – Rutledge
Wei-Ting Hsiao – M.S. – Maloney/Barnes
Jhordanne Jones – Ph.D. – Bell
Drew Koeritzer – M.S. – Kummerow
Matthew Lang – M.S. – Chiu
Yoonjin Lee – Ph.D. – Kummerow/Zupanski
Allie Mazurek – M.S. – Schumacher

Student – degree – research group

Yasutaka Murakami – Ph.D. – Kummerow/van den Heever
Alex Naegele – Ph.D. – Randall
Michael Needham – M.S. – Randall
Lance Niño – M.S. – Kreidenweis
Kate O'Dell – Ph.D. – Pierce/Fischer
Casey Patrizio – Ph.D. – Randall/Thompson
Jamin Rader – M.S. – Barnes
Justin Whitaker – Ph.D. – Maloney
Kevin Yang – M.S. – Chiu

STUDENT AND STAFF NEWS

Welcome, new students!



Fall 2021 incoming class. Front row, left to right: Tyler Barbero, Jack Cahill, Christine Neumaier, Yiyu Zheng, Zaibeth Carlo-Frontera, En Li, and Nico Gordillo. Middle row, left to right: Casey Zoellick, Anindita Chakraborty, Weixin Zhang, Zoe Douglas, Olivia Sablan, Erin (Lexi) Sherman, and Amanda Bowden. Back row, left to right: Brian Heffernan, Dhyey Solanki, James Larson, Andrey Marsavin, Jon Thielen, Ben Ascher, Joe Kelly, Spencer Jones, Emily Lill, and Ivy Glade. Not pictured: Kyle Hilburn and Ayesha Wilkinson.

Melissa Burt receives President's Council on Culture Award

Melissa Burt, assistant dean for diversity and inclusion in the Walter Scott, Jr. College of Engineering, received the President's Council on Culture Award as part of the *Celebrate!* Colorado State Awards.



Burt received several nominations, including one co-signed by Dean David McLean and atmospheric science Associate Professor Emily Fischer:

"Dr. Burt serves in numerous leadership positions with

Burt was recognized for her individual effort to be a change agent – promoting diversity, equity, and inclusion within her department, her college, and across campus. The award acknowledges significant and positive contributions to creating a University culture.

national professional organizations in the earth sciences, fields with the lowest diversity across all STEM fields," they wrote. "She leads initiatives to empower younger scientists and also facilitates difficult discussions on equity. At the same time, she is quietly but fiercely

supporting individual students who reach out in need of a mentor or a role model. In the last year, she co-founded a national campaign to educate mothers about climate change and became an IAspire Leadership Academy Fellow. In every arena, her leadership is creative, humble, brave, and undeniably effective."

Burt said she is deeply honored to be nominated and humbled to receive the award, and that she is extremely grateful for members of her college and the CSU community who are working to co-create a culture that is inclusive and equitable for all members.

STUDENT AND STAFF NEWS

Student and Postdoc Awards, Fellowships, and Recognition

AGU Outstanding Student Poster Award	Allie Mazurek
Air & Waste Management Association Scholarship	Julieta Juncosa Calahorrano, Lilly Naimie
Alpha Lambda Delta Betty Jo Hudson Fellowship	Zoe Douglas
Alumni Award	Jennie Bukowski
American Association of State Climatologists New Scientist Award in Applied Climatology	Sam Childs
AMS Best Student Oral Presentation	Chih-Chi Hu
AMS Max Eaton Prize	Jon Martinez
AMS Outstanding Student Conference Poster	Zoe Douglas
AMS fourth-place Outstanding Student Oral Presentation	Julieta Juncosa Calahorrano
AMS first-place Outstanding Student Poster Presentation	Sam O'Donnell
AMS first-place Student Poster	Naufal Razin
AMS second-place Student Poster	Jon Martinez
Colorado Science & Engineering Policy Fellowship	Lee Brent
David L. Dietrich Award	Kathryn Moore
EGU Outstanding Student Presentation Award	Kirsten Mayer
Future Investigators in NASA Earth and Space Science and Technology (FINESST)	Marqi Rocque
Herbert Riehl Memorial Award	Kevin Barry
International Conference on Mesoscale Convective Systems and High-Impact Weather in East Asia (ICMCS-XIV) Best Student Oral Presentation	Chelsea Nam
International Institute for Applied Systems Analysis Young Scientists Summer Program	Sagar Rathod
NASA Postdoctoral Fellowship Program	Justin Whitaker
NSF Graduate Research Fellowship	Jon Thielen
Program of Research and Scholarly Excellence Scholarship	Ivy Glade, En Li, Christine Neumaier
Scott Inclusive Excellence Graduate Assistantship	Olivia Sablan
Shrake-Culler Scholarship	Ting-Yu Cha
Third-place Peter B. Wagner Memorial Award for Women in Atmospheric Sciences	Ting-Yu Cha
UCAR Next Generation Earth Science Fellowship	Julieta Juncosa Calahorrano
Walter Scott, Jr. Fellowship plus Dean's GRA	Zaibeth Carlo-Frontera, Erin (Lexi) Sherman

Tristan L'Ecuyer chosen as 2021 Outstanding Alum

University of Wisconsin professor and director of the Cooperative Institute for Meteorological Satellite Studies Tristan L'Ecuyer was selected as the 2021 recipient of the department's Outstanding Alum Award. He will receive the award and present a seminar on his work Dec. 9 at ATS.

L'Ecuyer earned his Ph.D. from the department in 2001, under the supervision of Graeme Stephens, who is now a professor emeritus. His dissertation was "Uncertainties in Space-Based Estimates of Clouds and Precipitation: Implications for Deriving Global Diabatic Heating."

Following his Ph.D., L'Ecuyer spent a decade at CSU as a postdoc and research scientist, working extensively on the CloudSat mission. He then joined the faculty of the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin.

Since 2018, L'Ecuyer has served as director of Wisconsin's Cooperative Institute for Meteorological Satellite Studies (CIMSS). In 2020, he led the successful re-competition of CIMSS, ensuring the continuation of this crucial partnership with NOAA in satellite meteorology.

L'Ecuyer's research lies at the intersection of satellite remote sensing and climate science. He has published more than 150 papers, and his work is widely cited.

L'Ecuyer runs an active research program, including current leadership of the NASA Earth Venture-Instrument PREFIRE (Polar Radiant Energy in the Far Infrared Experiment).

He has graduated nine Ph.D. students in his first decade at Wisconsin and continues to advise a large research group. In 2020, he was honored with the American Geophysical Union Ascent Award.

Note from Tristan L'Ecuyer:

I want to express my genuine appreciation to everyone in the Department of Atmospheric Science for recognizing me with the Outstanding Alum Award. It is an honor to be counted among the long list of very accomplished scientists that graduated from our department. I am and always will be proud to be a CSU Ram!

I owe my interest in atmospheric science and my enthusiasm for pushing the envelope of what global observations can tell us about our environment to my time at CSU and my



adviser Graeme Stephens. Coming from a theoretical physics background, ATS gave me my first true taste of the atmospheric and climate science fields.

I still remember discussing elements of Earth's energy budget in my first meeting with Graeme. Little did I know, I'd still be trying to refine estimates of those quantities more than two decades later! From being able to independently explore ideas to opportunities to interact with leaders in the field, my experience at CSU has been fundamental to shaping my career.

I am also indebted to the many great students and long list of collaborators I've been fortunate to work with since leaving the Foothills Campus. I'm especially grateful for my students. This award is really recognition of their hard work, and they, in turn, benefit from ATS as I pass on the lessons I learned during my time at CSU.

It is especially rewarding to now be able to highly recommend the ATS graduate program to our best undergraduate students here at Wisconsin. I hope I've prepared them for graduate school as well as CSU prepared me for my career!

Sincerely,
Tristan L'Ecuyer

Alumni Updates

Chris Collimore (M.S., '89) earned his Ph.D. in atmospheric science from UCLA in 2018. He served as the Doherty Visiting Professor at Florida Tech in 2019 and is currently a postdoc at NOAA CESSRST (at City College in New York), where he uses satellite data to investigate tropical cyclone formation and the inner-core dynamics of mature tropical cyclones. As part of his postdoc, he has a six-month residency at GFDL at Princeton. After that, he would like to work on interannual variations of convection in the tropics and conduct more work on tropical cyclones.

Jim Fleming (M.S., '73) has just begun a "permanent sabbatical" as the Charles A. Dana Professor of Science, Technology, and Society Emeritus at Colby College.

Tom Guinn (M.S., '89; Ph.D., '92) recently was selected as chair of the Applied Aviation Sciences Department at Embry-Riddle Aeronautical University (ERAU) in Daytona Beach, Florida. He oversees 28 personnel and four B.S. programs, including meteorology, air traffic management, aerospace and occupational safety, and spaceflight operations. Prior to his selection as chair, Tom served as the program coordinator for the B.S. meteorology program. Tom came to ERAU in 2008 after a 22-year career as a weather officer in the Air Force.

Edward Hindman (M.S., '67) has been a researcher since 1961 and an educator since 1978. Since his retirement from teaching in 2007, he has been a professor emeritus of the Earth and Atmospheric Sciences Department at the City College of New York. In November 2021, he celebrated the 40th anniversary of the Storm Peak Laboratory in Steamboat Springs, which he co-founded and named in 1981 while he was a research associate with Professor Lewis Grant.

Stacey Hitchcock (Ph.D., '18) is a postdoctoral research fellow with the Australian Research Council's Centre of Excellence for Climate Extremes and the School of Earth Sciences at the University of Melbourne in Melbourne, Australia. Her research aims to improve understanding of the processes that support extreme rainfall in organized deep convection, with a specific emphasis on linear systems that frequently impact Melbourne and the surrounding region.

John Knaff (M.S., '92; Ph.D., '97), a CIRA colleague and NOAA scientist, received the 2022 Banner I. Miller Award from the American Meteorological Society for "groundbreaking work in developing a new application to significantly improve the prediction of rapid intensification of tropical cyclones in the Western North Pacific." John will receive the award at the 35th Conference on Hurricanes and Tropical Meteorology.

Jason Knievel (M.S., '96; Ph.D., '01) works at the Research Applications Laboratory of the National Center for Atmospheric Research in Boulder, where he is deputy director for science in the National Security Applications Program. His research foci include weather in complex terrain, deterministic and probabilistic numerical weather prediction, and wildfires.

Yoonjin Lee (M.S., '17; Ph.D., '21) defended last year and officially graduated in May. She is currently working as a postdoc at CIRA.

Jakob Lindaas (M.S., '18; Ph.D., '20) is now working on the professional policy staff of the House Select Committee on the Climate Crisis after a yearlong AAAS Congressional Science Fellowship in the Office of U.S. Sen. Martin Heinrich.

Alumni Updates

Annareli Morales (M.S., '14) completed her Advanced Study Program postdoc fellowship at NCAR, having researched science communication styles and their impact on engagement, learning, and inclusion of Hispanic and Latino adults. She is currently working as a research scientist at NOAA/CIRES in Boulder, in the Hydrometeorology Modeling and Applications team. She'll be getting back to mountain meteorology and cloud microphysics research, testing NOAA operational models and using observations from the SPLASH campaign.

Joe Munchak (Ph.D., '10) received the IEEE Geoscience and Remote Sensing Society 2021 Transactions Prize Paper Award for "An Active-Passive Microwave Land Surface Database from GPM." In August, Joe left NASA's Goddard Space Flight Center, where he had been for 10 years, to join Tomorrow IO, a weather intelligence company that is preparing to launch a constellation of precipitation radar satellites.

Rob Nelson (M.S., '15; Ph.D., '19) recently accepted an algorithm scientist position at the NASA Jet Propulsion Laboratory after finishing his postdoc. He works on retrieval algorithm development for the OCO-2, OCO-3, and MISR projects.

Minnie Park (Ph.D., '20) is a postdoctoral research associate at the Brookhaven National Laboratory. She works on the regime-focused analysis of aerosol-cloud interactions and long-term variability of surface solar radiation and boundary layer clouds over the Western North Atlantic Ocean as a part of the NASA ACTIVATE (Aerosol Cloud meTeorology Interactions oVer the western ATLantic Experiment) campaign.

Walt Petersen (M.S., '92; Ph.D., '97) was named science research and projects division chief within the Science and Technology Office at NASA's Marshall Space Flight Center in May. Walt manages MSFC's Earth, Astrophysics, Heliophysics, and Planetary Science portfolio, partnerships, workforce, and a world-class test facility, the X-ray and Cryogenic Facility.

Zitely Tzompa Sosa (Ph.D., '18) is a postdoctoral researcher at the Laboratoire des Sciences du Climat et de l'Environnement (Paris, France) and the Cyprus Institute (Nicosia, Cyprus). Her research focuses on the analysis and modeling of methane emissions from oil and gas sources with special focus in the Eastern Mediterranean and Middle East regions.

Darren Van Cleave (M.S., '09) was promoted in September 2021 to meteorologist-in-charge of the National Weather Service weather forecast office in Salt Lake City, Utah. In this role, he oversees all aspects of the daily operations to provide weather forecasts and decision support services to the western two-thirds of Utah and the southwest corner of Wyoming. Van Cleave previously served as the science and operations officer at the same office since 2016. His NWS career has included stops at weather forecast offices in Rapid City, Sacramento, and Missoula.

Xubin Zeng (Ph.D., '92), a University of Arizona professor, was elected a fellow of the American Geophysical Union in 2021 for his contributions to atmospheric science and hydrology.

Climate Center focused on monitoring, research, service

Update from Colorado Climate Center
Director Russ Schumacher.

After a seemingly endless year of weather and climate extremes in Colorado in 2020, including intense drought and the worst wildfires on record, 2021 was tame in comparison. Yet, there was still plenty to keep track of for the Colorado Climate Center.

It was another warm and dry year across Colorado: the 11th warmest and 36th driest water year (October 2020-September 2021). Although drought conditions improved somewhat with an active summer monsoon in the mountains, serious water concerns persist across the Western U.S., as summarized by Assistant State Climatologist Becky Bolinger in the *Washington Post*.

The burn scars from the 2020 wildfires were also the sites of flash floods and debris flows in Summer 2021, including

a tragic flash flood in the Poudre Canyon and a long-lasting closure of Interstate 70 in Glenwood Canyon in July.

CCC staff analyzed these and other weather and climate events and provided expertise to a broad range of audiences, including government agencies, water and agriculture groups, the media, and the public. We published peer-reviewed papers on a **destructive windstorm** and **crop-specific drought indicators**, and wrote articles for broad audiences on the “**new climate normals**,” 2020 drought, and the huge snowstorm that hit the Front Range in March 2021. We also collaborated on projects to provide improved **climate information to ski areas** and Colorado’s wine industry.

Our two observing networks continue to grow as well. CoCoRaHS continues to attract new volunteer observers of all ages across the U.S., Canada, and the Bahamas. In 2021, the milestone of 4

million daily reports was reached faster than ever before, on Sept. 28, 16 days earlier than the previous record set last year. Useful new interactive maps (**maps.cocorahs.org**) were rolled out last year, and new water year summaries were introduced in 2021 that allow observers to analyze their data (and those across the whole network) much more easily.

The Colorado Agricultural Meteorological (CoAgMET) network, also known as Colorado’s Mesonet, has seen many enhancements, including a new **web data portal** and real-time maps. The observations from both of these networks continue to gain wider use by meteorologists, water utilities, farmers and ranchers, and weather enthusiasts.

All together, we keep a strong focus on fulfilling our mission of serving Colorado with climate monitoring, research, and services.



The Fort Collins weather station on the CSU campus recorded a storm total of 19.5 inches of snow for March 13-15, which is tied for the 11th biggest snowstorm on record. (Some locations on the west side of Fort Collins recorded substantially more snow than was measured on campus.) March 15 photo by Zach Schwalbe

Susan van den Heever to lead \$177M NASA mission INCUS

NASA has announced a \$177 million earth science mission led by Colorado State University that will study the behavior of tropical thunderstorms, with the goal of better representing these storms in weather and climate models. The mission will be a collection of three small satellites, flying in tight coordination, and is called Investigation of Convective Updrafts (INCUS). It is expected to launch in 2027 as part of NASA's Earth Venture Program.

INCUS's principal investigator is Susan van den Heever, professor in the Department of Atmospheric Science, whose expertise is in cloud physics, cloud dynamics, and mesoscale meteorology and modeling. The team includes Kristen Rasmussen, assistant professor in atmospheric science, and Steven Reising, professor in the Department of Electrical and Computer Engineering. CSU's

Cooperative Institute for Research in the Atmosphere will perform data processing for the mission, overseen by Phil Partain.

The project will directly address why convective storms, heavy precipitation, and clouds occur exactly when and where they form. The investigation stems from the 2017 Earth Science Decadal Survey by the National Academies of Sciences, Engineering, and Medicine, which lays out ambitious, but critically necessary, research and observation guidance.

The INCUS mission will be focused particularly on the vertical motions through storms, explained van den Heever, who has led several cutting-edge field campaigns focused on severe weather. These vertical motions play critical roles in storm intensity, in formation of high clouds – and hence

climate change – and in large-scale atmospheric circulations. Despite their critical importance, these vertical motions are often poorly represented in weather forecasting and climate models, van den Heever said. That's where the INCUS observations will come in, filling gaps in scientists' understanding of these motions.

"I am extremely excited to work with the very talented INCUS team to make these groundbreaking observations, which will better prepare us for predictions of extreme weather in current and future climates," van den Heever said.

CSU has a rich history of NASA satellite development. It includes CloudSat, led by University Distinguished Professor Emeritus Graeme Stephens, and TEMPEST-D, led by Reising. Both will serve on the INCUS team.

ATS researchers co-lead \$12.5M NSF aerobiome project

University Distinguished Professor Sonia Kreidenweis, Senior Research Scientist Paul DeMott, and their research group will study microbes in the air, or the aerobiome, as part of a new \$12.5 million National Science Foundation project.

The Biology Integration Institutes: Regional OneHealth Aerobiome Discovery Network (BROADN) – including atmospheric scientists, agricultural biologists, microbiologists, and sociologists from across Colorado State University – aims to improve our fundamental understanding of the aerobiome during this five-year project.

The aerobiome plays an important role in human, animal, plant, and overall ecosystem health. Bacteria in clouds can even influence precipitation, but we don't yet understand how weather, seasons,



The Central Plains Experimental Range is one of the NSF NEON sites that will be used for the BROADN project.

and environmental stresses such as drought, agriculture, and fire affect these microorganisms in the air.

BROADN plans to gather enough data

through their joint effort to inform predictive models and mitigation strategies for problems as critical as the airborne transport of pathogens.

"There's process-level understanding that still is not there," said Kreidenweis, deputy director of the project. "We hope to help push forward the global effort in understanding the processes controlling the biology of the atmosphere."

Kreidenweis said now is the time for this ambitious undertaking. She is encouraged by the new and improved tools that will be employed in this study.

"Now we're able to characterize airborne microbes in more detail, and to understand the aerobiome as a bigger system with impacts on plant, animal, and human health," she said.

ATS develops heavy rainfall forecast tool used nationwide

Researchers in the department have developed a tool for predicting heavy rainfall that is now used daily by the Weather Prediction Center, part of the National Weather Service. By working with the Weather Prediction Center over the past several years, Associate Professor Russ Schumacher and his group were able to tailor the tool to suit forecasters' needs.

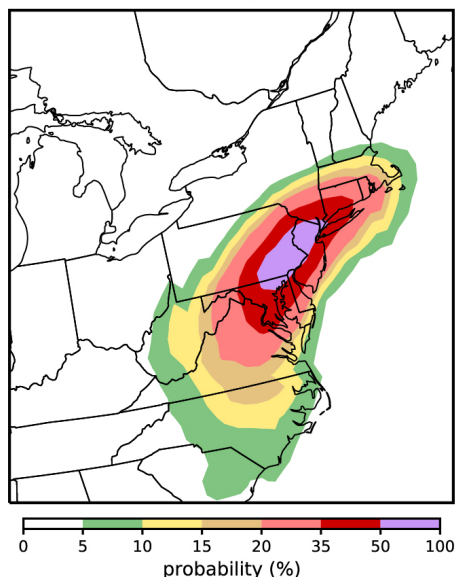
Excessive rainfall is difficult to forecast, and Weather Prediction Center forecasters needed a tool to help them generate Excessive Rainfall Outlooks, which are issued for the contiguous United States one to three days in advance. These outlooks predict the probability for rainfall that may lead to flash flooding, so they are important for alerting people in harm's way.

WPC forecasters examine many different data sources in creating Excessive Rainfall Outlooks, and the number of data sources have multiplied in recent decades. Given the tight turnaround, WPC meteorologists were interested in a tool that could synthesize at least some of the data and give them a reasonable starting point.

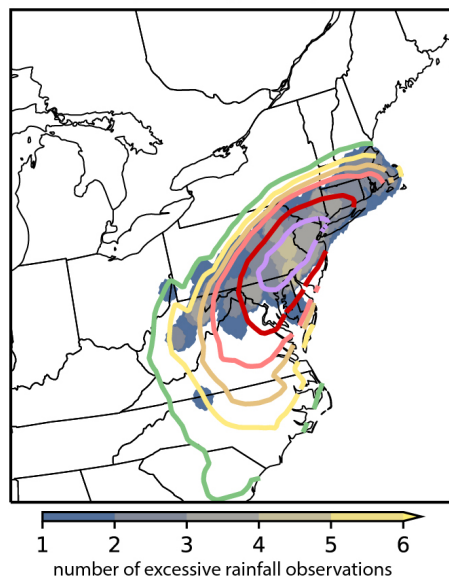
Enter machine learning plus atmospheric science Ph.D. student Greg Herman, whose undergraduate background included computer science and meteorology. Computers are good at quickly filtering huge datasets into a comprehensible output, and Herman and Schumacher harnessed that strength for the Colorado State University Machine Learning Probabilities system.

"The CSU-MLP prediction system provided the first such forecast, and represents the first machine-learning tool incorporated into WPC's operations,"

CSU-MLP day-2 probability of excessive rainfall forecast issued morning of 31 August 2021



Observations of excessive rainfall in 24 hours ending morning of 2 Sept 2021



Example CSU-MLP forecast for the extreme rainfall associated with Hurricane Ida. The left panel shows the forecast probability of excessive rainfall, including a "high risk" (probability exceeding 50%) for an area from Maryland through Pennsylvania, New Jersey, and New York. The right panel shows the resulting observations of excessive rainfall. The CSU-MLP correctly highlighted the corridor where widespread heavy rain and flooding would occur.

said Mark Klein, the Weather Prediction Center's science and operations officer. "Its forecasts have proven very skillful when compared to observations, and thus it has become a critical tool for our meteorologists."

NOAA's reforecasts, retrospective forecasts run with today's improved numerical models, made it possible for Herman and Schumacher to train their machine-learning model using a consistent dataset. The CSU-MLP algorithm searches historical data from the reforecasts and rainfall record for conditions similar to the current weather forecast. It is able to quickly determine whether those conditions led to heavy rain.

The machine-learning model calculates

the probability for heavy rain across the entire U.S., and it has adapted over time based on regional differences.

Herman and Schumacher first presented the tool to a testbed, the annual Flash Flood and Intense Rainfall experiment, in 2017. Based on user feedback from the testbed and WPC forecasters, they fine-tuned the model until it was ready for operations in late 2019. Schumacher's group continued to work with forecasters to make improvements and released an update in 2020.

"Transitioning research work to operations at NWS is difficult; this project is one of few success stories," Klein said. "Russ' group has proven to be one of the best collaborators in academia that WPC has worked with."

DEPARTMENT NEWS

Moms urge action on climate change in national campaign

Melissa Burt and Emily Fischer are accomplished climate researchers – familiar faces at scientific meetings, and around the halls of Colorado State University’s Department of Atmospheric Science. But to millions of Americans meeting Burt and Fischer for the first time, they are moms – and that’s what they hope will be the difference.

Burt, Fischer, and their adorable families are stars of a national media campaign called **Science Moms** that launched in January. The campaign’s urgent message about the realities of climate change tugs at the fierce protective instincts of its target demographic: mothers.

“Science Moms is a different kind of messaging,” said Burt, a research scientist in atmospheric science and assistant dean for diversity and inclusion in the Walter Scott, Jr. College of Engineering. “This is a group who we know will do anything for their kids.”

A driving force behind Science Moms is the Potential Energy Coalition, a nonpartisan, nonprofit group that wants to shift the narrative on climate change by bringing together leading creative and media agencies. A former colleague recruited Fischer to be a part of Science Moms, which includes the national ad buy and a website with information on how to take action on climate change.

An associate professor in atmospheric science and a mother to two daughters, Fischer studies ozone and wildfire smoke and their consequences for health. She recruited her CSU colleague, Burt, who studies Arctic clouds, radiation, and sea ice, to join Science Moms.

“I am frustrated by climate change, by the communication that has been happening



Left: Emily Fischer with her daughters, Freida (left) and Joan, enjoying lunch at Rocky Mountain National Park. Right: Melissa Burt with her daughter, Mia, at Horsetooth Reservoir in Fort Collins.

around it, and the lack of action,” Fischer said. “There is a lot of consensus on the science. There are clear solutions. There is just a lack of political will.”

For the campaign, Fischer and Burt are joined by four other climate scientist-moms at other universities: Katherine Hayhoe, Ruth DeFries, Tracey Holloway, and Joellen Russell.

The campaign, now airing in major television markets across the nation, features Burt and Fischer narrating slideshows with pictures of themselves, their partners, and their children – and how those relationships spur them to action in their day jobs as climate scientists.

“From the second you have a child, you want to do everything you can to protect them,” says Fischer’s voice, as images flash of a smiling, hot chocolate-stained face, an unsteady toddler on tiny skis, and a newborn getting a first kiss from mom. “I think our action on climate change is no different. It’s just an



extension of being a mom.”

Fischer thinks about climate change every day, and not just in terms of its consequences for her kids’ future. In 2018, Fischer was the lead scientist on a national field campaign to study wildfire smoke, in which she and colleagues flew a National Science Foundation instrument-laden airplane into smoke plumes across Idaho and other states.

The intersection between Fischer’s professional and personal life hit even closer to home in August 2020. She and her husband, Peter, and two daughters, Freida, 8, and Joan, 5, were camping in the Rawah Wilderness when the Cameron Peak Fire, which would continue burning into winter, ignited. The family ran six miles to safety, Fischer clutching her two daughters’ hands, unsure if they would make it out in time. The connections between longer, more intense fire seasons, and the creeping up of average temperatures due to greenhouse gas emissions, are undeniable, say both Burt and Fischer.

DEPARTMENT NEWS



Students gather in the outdoor community space Sept. 30, before the weekly colloquium.

Back toward normal, continued from cover

This fall, the department welcomed 25 new students, one of our largest incoming classes ever. The cohort is also the most diverse group of incoming students in department history.

The past year-plus, though challenging, forced us to adapt and grow, and some of the lessons learned have led to lasting improvements. Defenses and the weekly colloquium are now offered in a hybrid traditional-and-virtual format, allowing for more participation.

Faculty, who had only days to move their courses online in 2020 and then had to figure out how to hold students' attention in the virtual environment, continue to utilize new student engagement skills, even in face-to-face classes.

Some improvements weren't motivated by the pandemic, but the resulting distance and hardships sharpened the department's focus

on ensuring students have the tools they need to succeed. Several new initiatives have sprung up to connect students with resources and support: the CIRA/Atmospheric Science Mentoring Program (CAMP), a lunch-and-learn series for first-year students, and the Atmospheric Science International Student and Scholar Association, founded by students.

These new practices join some old favorites that are back, such as the New Student Welcome Picnic, where we meet and greet our incoming class. This year, we also welcomed those who could not join us in person for the last academic year.

The indoor and outdoor community space, finished in February 2020 shortly before the pandemic began, regularly draws groups eager to socialize and enjoy lunch together. Smiling, albeit often masked, faces animate our classrooms and common areas once again.

Faculty & Staff Milestones (Years of Service)

5 years

Jayne DeLoss
Kristen Rasmussen

10 years

Becky Bolinger
Peter Goble
Leah Grant

15 years

Amy Sullivan

20 years

David Thompson

30 years

Sonia Kreidenweis