



AI helping to unravel complexity of climate, weather

Imagine that we could predict not only severe storms more than a week out but also what the climate will be like in 50 years and how intervention strategies might lessen the impacts of climate change. Department researchers are developing ways to do all these things using a powerful tool: artificial intelligence. Here's a flavor of what we have been doing in the machine learning sphere.

Professor Elizabeth Barnes uses machine learning, a subset of AI, to disentangle the complexity of climate science. Professor Russ Schumacher, also Colorado state climatologist and director of the Colorado Climate Center, led development of a machine learning model that can accurately predict severe weather four to eight days in advance and is now used daily in National Weather Service operations.

Machine learning: The perfect tool for climate science

Barnes's research group uses machine learning to detect the impacts of climate change, predict weather and climate a few weeks to decades into the future, and explore the potential outcomes of hypothetical climate intervention strategies such as geoengineering. The climate system is incredibly complex, and those who study it rely on massive amounts of data. Barnes said machine learning is the perfect tool for climate scientists.

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Senior research scientist Paul DeMott retires



Page 5

Maria Silva Dias and William Gray awards, two new student awards

Pages 6-7



CoCoRaHS turns 25, and other Climate Center updates

Page 14



Happy New Year from Fort Collins

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Your support of the Department of Atmospheric Science enhances recruitment and retention of world-class faculty and students, while ensuring critical contributions to weather, climate, and air quality research. Thank you for considering how you can make a contribution for our shared success.

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Contact Us

Department of Atmospheric Science
1371 Campus Delivery
Colorado State University
Fort Collins, CO 80523-1371
Phone: (970) 491-8682
atmos.colostate.edu

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Editors: Sarah Tisdale,
Eric Maloney

Please send alumni news, comments, questions, corrections, and address updates to: info@atmos.colostate.edu, or call (970) 491-8682.

Best wishes from the Colorado State University Department of Atmospheric Science as we enter 2024. We have had another extremely successful year as a department. Our largest incoming cohort ever of outstanding graduate students joined us. Welcome, and we look forward to working with you over the next several years!

Our research expenditures also hit a record level. It truly is a pleasure and honor to be leading such a thriving and collegial department of world-class graduate students, research scientists, staff, and faculty.

We have much else to celebrate this year. I'm excited that Melissa Burt was promoted to associate professor in July, and Emily Fischer was promoted to the rank of professor. We also had a bittersweet milestone this year in that senior research scientist and ATS Distinguished Alum Dr. Paul DeMott retired from our department. Paul first joined our department as an M.S. student in 1979, and a retrospective on Paul's legendary career is contained below ([Page 5](#)). Our department has also launched a search for an assistant professor in surface-atmosphere interactions, and we look forward to a new colleague starting in fall of 2024. This year also saw a transition in Walter Scott, Jr. College of Engineering leadership, with Dr. David McLean stepping down and the start of the term of Dr. Allen Robinson, who specializes in impact of emissions from energy systems and other sources on air quality, climate, and human health. We thank Dave for his service and look forward to working with Allen in the coming years to grow our department's leadership.

Our department continues to lead the atmospheric science field in studies of climate, weather, air quality, and atmospheric science education. A research highlight from the year is the new partnership between Professor Michael Bell,



**Department Head
Eric Maloney**

University Distinguished Professor V. Chandrasekar in the Department of Electrical and Computer Engineering, and external partners, including NCAR, to develop the next generation Airborne Phased Array Radar ([Page 15](#)).

Our graduate students continue to be honored with prestigious awards and fellowships from professional societies and funding agencies ([Page 10](#)). We also bestowed two

new student awards this year, the Dr. William Gray award for an outstanding research paper in tropical meteorology ([Page 6](#)) and the Dr. Maria Silva Dias award for outstanding research by a Ph.D. student ([Page 7](#)). Our scientists and educators also continue to be honored with prestigious awards from our major professional societies, including AMS and AGU, as well as with University, college, and department honors ([Pages 4-5](#)). Congratulations also to our distinguished alumni who have been honored, including John Henz, CCM, who was named the 2023 ATS Outstanding Alum and received his award at a ceremony on Oct. 31 ([Page 11](#)).

Our facilities are also a focus of our attention, and we initiated a major remodel of the third floor of the main ATS building to bring it in line with 21st-century standards. This will include opening up hallways and interior spaces with glass walls to allow more light into the interior. As part of the process, we have moved the department library to the ground floor of the building. The Riehl Room remodel was also completed, and the room successfully hosted a visit to ATS in October from CSU President Amy Parsons.

I wish you a happy and healthy 2024 and look forward to seeing you in the near future here in Fort Collins, out and about in the field, or virtually.

Best wishes,

Eric D. Maloney, Department Head,
eric.maloney@colostate.edu

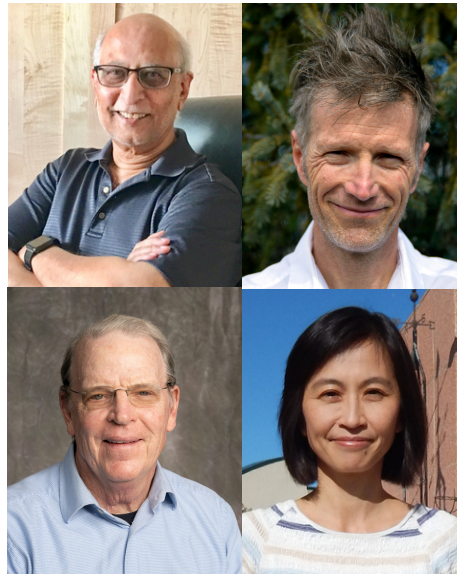
FACULTY NEWS

Faculty, research staff, alumnus honored by AMS

The American Meteorological Society gave awards to several faculty members, research staff, and a department alumnus.

Professors A.R. Ravishankara and David Thompson were named as Fellows of the AMS. The nomination is open to all 13,000 or so AMS members, and a select few are elected as new Fellows each year by the society's governing body. AMS Fellows have made outstanding contributions to the atmospheric or related oceanic or hydrologic sciences or their applications during a substantial period of years.

Professor Christine Chiu was awarded the David and Lucille Atlas Remote Sensing Prize. This prize is given biennially in recognition of advances in the science and technology of remote sensing and its application to knowledge of the earth, oceans, and atmosphere.



Clockwise from top: A.R. Ravishankara, Dave Thompson, Christine Chiu, Dave Randall

Professor Dave Randall was selected for the Warren Washington Research and Leadership Medal. The medal honors the recipient's outstanding research and leadership in the

science of modeling weather and climate, with an emphasis on the role of clouds.

Randy Chase, research scientist with CIRA and Professor Sue van den Heever's group, and Aaron Hill, recent research scientist with Professor Russ Schumacher's group, were named AMS editor's award winners. Hill recently began an assistant professor position with the University of Oklahoma.

Alumnus Mark DeMaria (M.S., '79; Ph.D., '83;), a CIRA Fellow and senior research scientist, received the Banner I. Miller award for contributions related to understanding rapid TC intensifications. DeMaria was named an AMS Fellow last year.

This year's recipients will be recognized at the **104th AMS Annual Meeting** in Baltimore in January 2024.



Current ATS faculty left to right, top to bottom: Christine Chiu, Pat Keys, Sue van den Heever, Michael Bell, Melissa Burt, Libby Barnes, Kristen Rasmussen, Russ Schumacher, Dave Randall, Sonia Kreidenweis, Peter Jan van Leeuwen, Chris Kummerow, Maria Rugenstein, Steve Miller, A.R. Ravishankara, Emily Fischer, Scott Denning, Dave Thompson, Jeff Pierce, Eric Maloney.

Not pictured: Jeff Collett, Jim Hurrell.

FACULTY NEWS

Sonia Kreidenweis receives AGU recognition

The American Geophysical Union Atmospheric Sciences section honored University Distinguished Professor Sonia Kreidenweis with the Yoram J. Kaufman Outstanding Research and Unselfish Cooperation Award.



Yoram J. Kaufman, a researcher who served as a mentor and devoted his career to international collaborations on atmospheric aerosols that influence the climate.

Kreidenweis was recognized at the atmospheric science section dinner at the **AGU meeting** in December in San Francisco.

This award recognizes a senior scientist's broad influence in atmospheric science in honor of

Maria Rugenstein wins EGU Early Career Award



Professor Maria Rugenstein has been awarded the 2024 Outstanding Early Career Scientist Award by the Climate: Past, Present & Future

Division of the European Geosciences Union. This award recognizes Rugenstein for her important contributions to the Earth

sciences in the area of climate. Rugenstein has contributed fundamental and widely recognized research on understanding climate sensitivity and feedbacks, including the role of SST pattern changes for understanding the future climate response to greenhouse gas forcing. This award will be celebrated during the 2024 EGU General Assembly, which will be held from April 14–19 in Vienna, Austria.

Chris Kummerow named Professor of the Year

The department's graduate representatives selected Professor Chris Kummerow as the Professor of the Year, an award announced during the New Student Welcome Picnic on Sept. 5.



Graduate representative Angelie Nieves Jiménez presented the honor. The awardee is selected based on the strongest feedback for teaching excellence on student course evaluations.

Students commented on Kummerow's incredible teaching ability and how, despite having a busy schedule, he "always takes time with his students and is happy to give a listening ear."

Students also commented on Kummerow's efforts to instill the importance of work-life balance in their careers.

Department staff, faculty honored with awards

Research scientist Dr. Leah Grant received an AMS MESO/WAF/NWP Very Early Career Award in July.

Six faculty members, researchers, and administrative staff from the Department of Atmospheric Science were recognized during the Walter Scott, Jr. College of Engineering All-College Meeting on April 18. Nominations were

submitted by colleagues and staff of the department.

- Outstanding Service to Students: **Sarah Tisdale**
- Outstanding Researcher Award – Rising Star: **Aaron Hill**
- Diversity, Equity, and Inclusion: **Melissa Burt**

- Art Corey Award for Outstanding International Contributions: **Michael Bell**
- Faculty Excellence Award: **Emily Fischer**
- Outstanding Researcher Award: **Amy Sullivan**

RETIREMENT NEWS

Senior research scientist Paul DeMott retires

The department hosted a celebration on Sept. 8 to mark the retirement of senior research scientist and ATS Distinguished Alum Dr. Paul DeMott. The large classroom was filled to overflowing with well-wishers from the Atmos Hill, as well as those traveling from Boulder and beyond, to hear DeMott present "Perspectives from a career in ice nucleation research at Colorado State University." Department Head Eric Maloney's introductory remarks praised DeMott's remarkable career.

DeMott joined the department's Ph.D. program in Fall 1979, after graduating from the State University of New York at Albany with a degree in atmospheric science. While admitting that the proximity of Colorado ski resorts may have been a persuasive factor in his choice of graduate programs, DeMott noted that he had become interested in cloud microphysics while an undergraduate and was intrigued by the ongoing work in the department on Colorado snowfall. He joined Professor Lewis Grant's research team to work on orographic cloud seeding experiments, completing his M.S. in 1982 and Ph.D. in 1990. DeMott then moved into a research scientist position in the department, with promotion to senior research scientist in 2002.

DeMott was interested in understanding how atmospheric aerosols nucleate ice in clouds, one of very few scientists worldwide focusing on this problem. He tested the effectiveness of cloud seeding agents



and other particle types, such as soot, in the department's Cloud Simulation facilities, publishing some of the first work discussing the potential for an "ice indirect effect" on cirrus clouds through competing heterogeneous and homogeneous nucleation processes. In what was to become a transformative part of DeMott's research portfolio, he collaborated with Dr. David Rogers, then at CSU and later at the NCAR Research Aviation Facility, to develop the prototype Continuous-Flow Diffusion Counter, the first instrument to measure atmospheric ice nucleating particles in real time. By 1996, DeMott and Rogers had built a version of the CFDC that could be flown on a research aircraft, and that year they successfully participated in the NASA SUCCESS (SUBsonic aircraft: Contrail & Clouds Effects Special Study) mission. This milestone initiated a series of productive decades for DeMott, who served as a member of NASA, DOE, and NSF science teams conducting research around the globe, pushing the frontiers of understanding of airborne ice nucleating particles. Observational data were obtained by

DeMott and his team in numerous laboratory-, ground-, and aircraft-based studies. Modeling collaborators applied his findings to investigate aerosol-cloud interactions in mixed-phase and ice clouds, leading to a number of seminal high-profile papers and sparking renewed international interest in ice nucleation research that continues to the present day.

In addition to constantly refining the CFDC,

DeMott co-organized several international instrument intercomparison workshops aimed at improving and standardizing methods for the measurement of ice nucleating particles.

DeMott has published more than 260 peer-reviewed articles (H-index 76) and has been recognized multiple times as a Clarivate Highly Cited Researcher. DeMott's excellence in mentoring is also well known, and he has served as co-adviser and committee member for more than 35 ATS and international students and postdocs. The many honors Paul has received for his scientific and professional contributions include Fellow of the American Geophysical Union, Fellow of the American Meteorological Society, and Honorary (Lifetime) Member of the IAMAS International Committee on Nucleation and Atmospheric Aerosols, an honor bestowed on fewer than 10 individuals worldwide.

Congratulations to DeMott on an outstanding career with lasting impact, and best wishes for a well-deserved retirement.

STUDENT NEWS

New student scholarship award honors Bill Gray's contribution to atmospheric science

The department recently honored graduate student Alex DesRosiers as the first recipient of the William M. Gray Award, a newly established honor that recognizes outstanding published research into fundamental tropical meteorology and climate.

DesRosiers, who received the award at a special event on Nov. 3, is a Ph.D. candidate entering the final year of his research, which involves the vertical structure of tropical cyclones and how that relates to their intensity as well as their intensification rate.

The award celebrates the lasting academic contributions of the late CSU Professor Bill Gray, a renowned hurricane researcher. The award includes scholarship funding through an endowment started by Gray's family after his death in 2016.

DesRosiers was nominated by Professor Michael Bell in the Department of Atmospheric Science for work on a paper in **Geophysical Research Letters** that uses data from hurricane hunter aircraft to understand how a hurricane's height relates to its strength.



Sarah Gray, Bill Gray's daughter, talks about her father.

The paper is particularly relevant to the award as Pat Fitzpatrick, a Ph.D. candidate in 1995, studied the same types of questions under Gray, but the data was crude and the relationships were never explored further or published in peer-reviewed literature. DesRosiers was able to use modern techniques and technology to finish the work and help advance understanding of hurricane structure and intensity change.

"Bill Gray is a household name in the field of tropical cyclone research. To even be considered for an award bearing his name is an incredible honor for me," he said. "I am thankful for this recognition and the opportunity to follow in his footsteps here while striving to make a fraction of the contributions he's made over his career. I am also thankful for the many people around me who have always supported me and made this possible."

As part of the November event, DesRosiers presented his paper's findings to faculty, staff, and students. Additionally, Gray's children were in attendance and offered remembrances of their father and his time at the University.

Gray was a faculty member in the department from 1961 until his retirement in 2005. His research made enormous contributions to the understanding of tropical cyclone structure, intensification, and climatology. He is best known for developing the **seasonal hurricane forecasts**, which have



Alex DesRosiers and Eric Maloney

now been offered for 40 years at CSU and have led to improved understanding of how large-scale climate features, such as El Niño, impact Atlantic hurricanes. Department Head Eric Maloney said that during his time at CSU, Gray advised 70 M.S. and Ph.D. students – many of whom have become prominent leaders in the field.

"This award honors not only his legacy in hurricane research, but also his broader research in tropical meteorology and the legacy it has produced in the department that still resonates today," he said.

The Bill Gray Award will now be presented annually by the department each fall to the graduate student who submits the best technical manuscript for publication in referred literature during the previous 18-month period on research advancing understanding of the physics and dynamics of the tropical atmosphere and ocean, including hurricanes.

Story by Josh Rhoten

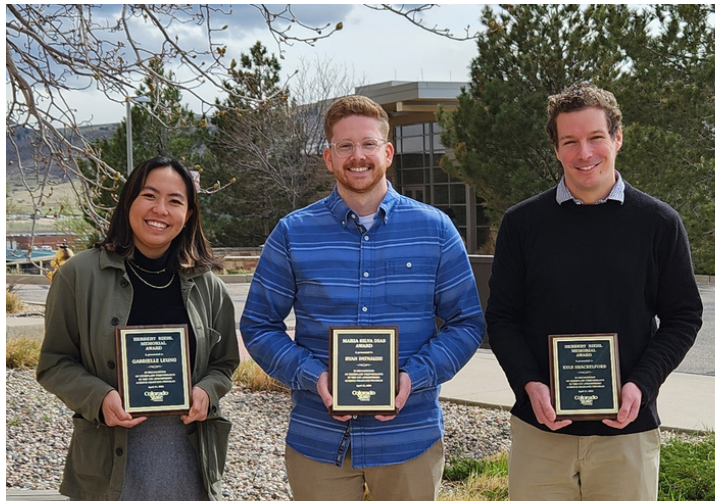
STUDENT NEWS

Inaugural Silva Dias Award and Riehl Award winners

The Silva Dias Award is given annually to a senior Ph.D. student for outstanding research. Ph.D student Ryan Patnaude was honored with the inaugural award this year at a ceremony on April 21. At the award ceremony, Patnaude presented his research on sea spray chemistry and cirrus cloud formation. Graduate students Gabrielle “Bee” Leung and Kyle Shackelford were honored with the department’s Riehl Award, given for an outstanding paper by an M.S. student, on that same day. Leung was

nominated for a paper describing a simple mechanism for strong aerosol gradients to drive sea breeze-like circulations and support cloud formation. Shackelford was nominated for work on the role of rain layers in modifying the ocean surface layer and generating convection in the context of the Madden Julian Oscillation.

The former Alumni Award was renamed in honor of 2017 ATS Outstanding Alum winner Professor Maria Silva Dias through the initiative of our students, and this honor was bestowed for the first time this year. Silva Dias received her Ph.D. from our department in 1979, where she studied the response of tropical mesoscale convective systems to environmental wind and temperature variations. She was a founder of the atmospheric science department at the University of São Paulo, where she has been a professor for most of her career. Silva Dias also served as director of the



Riehl Award recipient Gabrielle Leung, Silva Dias Award recipient Ryan Patnaude, and Riehl Award recipient Kyle Shackelford

Center for Weather Forecasting and Climate Studies of the Brazilian National Institute for Space Research. Over her career, Silva Dias has conducted seminal research in numerous areas of atmospheric and climate science, including tropical convection, South American precipitation and climate, and biosphere-atmosphere interactions. She has employed a range of approaches to address her research goals. For example, she has led numerous major South American field campaigns in addition to employing novel numerical modeling approaches. Silva Dias won the CSU ATS Outstanding Alum Award in 2017, and has been recognized nationally and internationally with numerous positions and accolades, including as president of the Brazilian

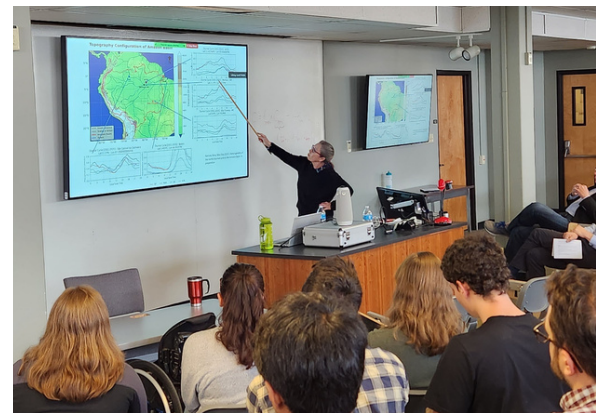
Maria Silva Dias gives a seminar on April 21; a department award has been renamed in her honor.

Meteorological Society, a member of the Brazilian Academy of Sciences, and Fellow of the AMS.

Silva Dias was able to join the department for the inaugural award ceremony. She was touched and excited to have this award named after her, noting “I am truly honored to have my name chosen for the named award for Ph.D. students. The Department of Atmospheric Science at CSU is what gave me the

initial velocity as a scientist and as a professor, and this recognition means a lot to me.” Silva Dias also gave a department seminar on April 21, describing exciting ongoing research in a talk titled “Heterogeneity of the rainfall diurnal cycle in the Amazon Basin.”

The department is honored that Silva Dias is one of its distinguished alumni. Congratulations to Patnaude for winning the inaugural Silva Dias award, and congratulations to Riehl Award winners, Leung and Shackelford!



STUDENT NEWS

Congratulations, graduates!



Spring and Summer 2023 graduates from left to right, top to bottom: Tyler Barbero, Ting-Yu Cha, Anindita Chakraborty, Charlotte Connolly, Luke Davis, Ivy Glade, Chih-Chi Hu, Daniel Hueholt, Joe Kelly, Nathan Kelly, Nicolas Leitmann-Niimi, Gabrielle Leung, Kirsten Mayer, Chandra Pasillas, Marqi Rocque, Kyle Shackelford, Madison Shogrin, Alex Sokolowsky, Dhyey Solanki, Shim Yook

2023 Graduates

Student - degree - research group

Tyler Barbero - M.S. - Bell
Amanda Bowden - M.S. - Maloney
Jack Cahill - M.S. - Barnes/Maloney
Ting-Yu Cha - Ph.D. - Bell
Anindita Chakraborty - M.S. - Hurrell
Charlotte Connolly - M.S. - Barnes
Luke Davis - Ph.D. - Thompson
Ivy Glade - M.S. - Hurrell
Emily Gordon - Ph.D. - Barnes
Kyle Hilburn - Ph.D. - Miller
Chih-Chi Hu - Ph.D. - van Leeuwen
Ann Casey Hughes - M.S. - Randall
Eric James - Ph.D. - Schumacher
Joe Kelly - M.S. - Chiu
Nathan Kelly - Ph.D. - Schumacher

Student - degree - research group

Nicolas Leitmann-Niimi - M.S. - Kummerow
Gabrielle Leung - M.S. - van den Heever
En Li - M.S. - Pierce/Fischer
Andrey Marsavin - M.S. - Collett
Kathryn Moore - Ph.D. - Kreidenweis/DeMott, P.
Christine Neumaier - M.S. - van den Heever
Chandra Pasillas - Ph.D. - Bell/Kummerow
Ryan Patnaude - Ph.D. - Kreidenweis/DeMott, P.
Marqi Rocque - Ph.D. - Rasmussen
Olivia Sablan - M.S. - Fischer/Pierce
Kyle Shackelford - M.S. - van Leeuwen/DeMott, C.
Lexi Sherman - M.S. - Rasmussen
Madison Shogrin - M.S. - Fischer
Dhyey Solanki - M.S. - Chiu
Shim Yook - Ph.D. - Thompson

STUDENT NEWS

Welcome, new students!



2023 incoming students, from left to right: Sabrina Cohen, Kelsey Ennis, Nari Im, Isaac Schluesche, Daniela Guevara, Nick Mesa, Devin McAfee, Lena Low, Tom Juliano, Delían Colón-Burgos, Ty Johnson, Jennifer McGinnis, Olivia Lee, Rachael Auth, Bali Summers, Ashley Dwyer, Killian McSweeney, Jacob Landsberg.
Not pictured: Chelsea Bekemeier, Yu-An Chen, Samantha Greeney, Kat Humphreys, Yu-Cian Tsai, Hao-Lun Yeh.

Student-led mentoring program a smashing success

The CIRA and Atmospheric science Mentoring Program is celebrating its third successful year. CAMP was established to create mentoring relationships within the ATS and CIRA communities by placing incoming first-year students in a mentoring pod consisting of a senior graduate student and a faculty or staff member.

Pod-based mentoring fosters connections between individuals with diverse backgrounds and professional experiences, which complements traditional mentoring structures that students may have access to through their group and cohort. These pods meet throughout the year to build connections and discover how these relationships can be used as support, mentoring, or networking opportunities. Since its beginning, CAMP has created

51 mentoring pods, facilitating more than 150 mentoring opportunities.

CAMP also builds community by strengthening networks with our alumni community around the world. The CAMP website hosts the **Alumni Network**, a directory of ATS alumni who have actively opted in to communicate with members of the ATS and CIRA communities, including networking and interacting with first-year students. While CAMP has been around for only a few years, it has had an enormous impact on the CSU ATS and CIRA communities. A member of the leadership team says, "I think the best part about CAMP is seeing people who aren't in the same cohort or research group, but in a pod together, having lively conversations at lunch. It's nice to see CAMP actively strengthening the CSU atmospheric science

community. It makes me very excited for what is to come in the following years."

With continued support from CIRA and the Department of Atmospheric Science, CAMP is looking forward to many more exciting years of its mentoring program. Your support and enthusiastic participation is what makes this program successful!

Story by Charlotte Connolly

Attention, Alumni!

If you are interested in having a profile on the **Alumni Network page**, visit the page and complete the linked form to create your profile. In the future, CAMP plans to host virtual events that will allow current students to meet members of CAMP's Alumni Network.

STUDENT NEWS

Student and Postdoc Awards, Fellowships, and Scholarships

AAAR Student Presentation Award	Olivia Sablan
ACCESS XVII Early Career Award	Marina Nieto-Caballero
AGU Outstanding Student Presentation Award	Emily Gordon, Olivia Sablan
AMS Conference on Mesoscale Processes Outstanding Student Oral Presentation Award	Ben Ascher, Nick Falk
AMS Conference on Weather Analysis and Forecasting Outstanding Student Oral Presentation Award	Allie Mazurek
AMS first-place Best Student Poster Presentation Award	Kimberley Corwin
AMS Graduate Fellowship	Nick Mesa
AMS honorable mention Student Poster Presentation Award	Kyle Shackelford
AMS Outstanding Student Presentation Award	Christine Neumaier
AMS second-place Student Poster Presentation Award	Eric Goldenstern
AMS third-place Poster Presentation Award	Jingxuan Cui
David L. Dietrich Award	Sam O'Donnell
DOE Computational Science Graduate Fellowship	Amanda Bowden
Fulbright Scholar	Daniela Guevara
Graduate Student Showcase Scholarship Award	Justin Hudson
Herbert Riehl Memorial Award	Gabrielle Leung
International Global Atmospheric Chemistry Early Career Researchers Online Conference Poster Presentation Prize	Olivia Sablan
Maria Silva Dias Award	Ryan Patnaude
MIT CEE Rising Star 2023-24 Cohort	Julieta Juncosa Calahorrano
National Atmospheric Deposition Program Scientific Symposium Best PhD Student Oral Presentation Award	Lilly Naimie
NASA FINESST (Future Investigators in NASA Earth and Space Science and Technology)	Leif Fredericks, Daniel Hueholt
NASA Intern	Olivia Sablan

Continued on next page

ALUMNI NEWS

Student and Postdoc Awards, Fellowships, and Scholarships

NSF Graduate Research Fellowship Program	Delían Colón-Burgos, Killian McSweeney, Nick Mesa, Angelie Nieves Jiménez
Rocky Mountain States Section of the Air and Waste Management Association Scholarship	En Li, Olivia Sablan
Shrake-Culler Scholarship	Allie Mazurek
SoGES Sustainability Leadership Fellow	Alyssa Stansfield
VPR 2023-24 Graduate Fellow	Marc Alessi
William Gray Award	Alex DesRosiers

John Henz selected as 2023 Outstanding Alum

John F. Henz, CCM, received the Outstanding Alum award for 2023. He was honored in a ceremony at the department on Oct. 31, where he presented his work and provided a perspective on his career. Henz was nominated for the ATS Outstanding Alum award by fellow alum Gerald Mulvey (Ph.D., '77.) Henz received his M.S. from the department in 1974, studying with Professor Lewis Grant. His dissertation was titled "Colorado High Plains Thunderstorm Systems."

Subsequent to leaving CSU, he served in various roles in industry, including as president of the Geophysical Research & Development Corporation and Weather Center (1976-1982), partner for Henz, Kelly, & Associates (1983-1989), president for Henz Meteorological Services (1989-2000), atmospheric science practice leader for HDR Engineering (2001-2010), and senior meteorologist for Dewberry Engineering (2010-2015). Most recently, he served in a more limited role as a consulting meteorologist for the Hydro-Meteorological and Forensic Service. Henz earned designation as an AMS Certified Consulting Meteorologist in 1980.

Throughout his career, Henz has made substantial contributions to the field of flood warnings through design of flood forecast observing systems, forensic meteorology, flood forecast tools, and countless contributions to training and service to AMS. Notably, he provided the first public alerts by radio during the Big Thompson Flood event of 1976, likely saving multiple lives, for which he received a special award from the AMS in 1977. He also developed a flood climatology for South Boulder Creek in Boulder County, Colorado, and an early warning system for floods in Fairfax, Virginia, among numerous other projects and duties. Henz was elected Fellow of the AMS in 2013, and awarded the 2018 AMS Henry T. Harrison Award for Outstanding Contributions by a Consulting Meteorologist. He served on the AMS Board of Certified Consulting Meteorologists from 2007-2012, including as chair in 2010. Henz also served as member of the board on Economic Enterprise Development from 2008-2010, among many other examples of AMS engagement.

Congratulations to Henz; the department is proud that you are an alum!



John Henz and Eric Maloney

A note from John Henz

Humbled best describes how I felt upon learning I had been awarded the 2023 Outstanding Alum Award. Further humbled and impressed best describes how I felt upon visiting the department and reflecting on how deeply my three years at CSU impacted my career for the next five decades. When I entered the department as a master's student in January 1972, Department Head Elmer Reiter acted as both a mentor and friend.

Continued on Page 17

ALUMNI NEWS

Alumni Updates

Steve Ackerman (M.S., '79; Ph.D., '87) retired in October 2023. He has served as the vice chancellor for research and graduate education at University of Wisconsin-Madison since August 2019. He served in a number of additional leadership roles, including director of the Cooperative Institute for Meteorological Satellite Studies. Ackerman is an elected Fellow of the American Meteorological Society and received the CSU ATS Outstanding Alum award in 2014.

Melissa Burt (M.S., '08; Ph.D., '16) was promoted to associate professor and associate dean for diversity, equity, and inclusion in the Walter Scott, Jr. College of Engineering at Colorado State University. Burt also received the WSCOE Diversity, Equity, and Inclusion award in April 2023.

Thomas Guinn (M.S., '89; Ph.D., '92) is now chair of the Applied Aviation Sciences Department at Embry-Riddle Aeronautical University in Daytona Beach, Florida, where he oversees four B.S. programs: Meteorology, Air Traffic Management, Space Operations, and Aerospace & Occupational Safety. He retired from the Air Force in 2008 prior to joining ERAU the same year.

Ken Harding (M.S., '91) was selected as the National Weather Service chief operations officer. Harding manages the day-to-day mission execution units responsible for delivering NWS weather, water, climate, and space weather products, services, information, and budgetary planning for 11 National Service Programs. He also oversees all nine national centers in the National Centers for Environmental Prediction. Harding is responsible for coordinating and integrating all aspects of mission execution to ensure consistency of NWS products and services.

Stacey Hitchcock (Ph.D., '18) completed a postdoc at the University of Melbourne, Australia, and made the move back to the U.S. in July to start as an assistant professor at the University of Oklahoma in August 2023.

Steve LaDochy (M.S., '69) retired after 52 years of teaching at California State University, Los Angeles (1987-2022), University of Winnipeg (1970-1987), and University of Kansas (1979-80). He also was a summer research faculty at the Jet Propulsion Laboratory, NASA, for 13 years. He recently gave a paper with Michael Witiw at the ninth International Fog, Fog Collection & Dew Conference, titled "Aviation Accidents with Fog Involved: Kobe Bryant." He has also co-authored a book with Mike Witiw called *Fire and Rain: California's Changing Weather and Climate*, released in November 2023.

Landan MacDonald (M.S., '15) is finishing his urology residency in Halifax, Nova Scotia. He will be starting a urologic oncology fellowship at MD Anderson in Houston, Texas, next year. His research will focus on focal therapy for prostate cancer and MRI fusion biopsies.

ALUMNI NEWS

Alumni Updates

Kirsten Mayer (M.S., '19; Ph.D., '22) is a project scientist at the National Center for Atmospheric Research, where she focuses on applying machine learning techniques to explore sources of subseasonal to seasonal predictability and correct biases in subseasonal to decadal initialized hindcasts.

Annareli Morales (M.S., '14) is now an environmental health specialist with the Weld County Department of Public Health and Environment in Greeley, Colorado. Her job includes air quality policy analysis, stakeholder engagement and outreach, explaining complex science in plain language to decision-makers, and relationship building.

James Purdom (Ph.D., '86) received the 2023 Chinese government's Friendship Award, their highest award given to foreign experts. He was head of the NOAA NESDIS RAMM Branch at CIRA (1980-1997). After retiring from NESDIS as its director of Research and Applications in 2001, he came back to CIRA where he was a senior research scientist until the end of 2006.

Sagar Rathod (Ph.D., '22) is a postdoctoral research associate at the La Follette School of Public Affairs at the University of Wisconsin-Madison, working on methane mitigation policies in the oil and gas sector and future fuels for the shipping industry. Switching domains, he will join an Indian air-quality/climate-tech startup in December 2023.

Louis Rivoire (Ph.D., '20) continues to assist Caltech's Jet Propulsion Laboratory with the development of a satellite mission aimed at quantifying long-term changes in stratospheric circulation. In early 2024, he will transition from Harvard University to MIT, where he will study the long-range transport of atmospheric pollutants as a postdoctoral Fellow.

Sarah Tessendorf (M.S., '03; Ph.D., '06) has been a project scientist at the National Center for Atmospheric Research in the Research Applications Laboratory since 2007. She was recently the first Scientific and Engineering Leadership Fellow in the University Corporation for Atmospheric Research President's Office in 2019-2020. During this fellowship, she piloted a mentoring program for staff at UCAR, and won the UCAR Outstanding Accomplishment Award for Mentoring in 2020. She also serves on the WMO Expert Team for Weather Modification and co-chairs the AMS STAC committee on Planned and Inadvertent Weather Modification. She also co-leads a newly initiated GEWEX Regional Hydroclimate Project in the United States with fellow alum Tim Schneider (M.S., '94).

Paul Wolyn (Ph.D., '92) will retire at the end of 2023 with more than 31 years at the National Weather Service. He has been the science and operations officer at the NWS in Pueblo, Colorado, since March 1995, and he is the original SOO at the office. After retirement, Wolyn will be involved with Diaconate formation for the Catholic Diocese of Pueblo. He is also looking forward to not having to drive to work in snowstorms!

CLIMATE CENTER UPDATE

A year of milestones for the Climate Center

Update from Colorado Climate Center Director Russ Schumacher

2023 has been a year of achieving major milestones for the Colorado Climate Center. Perhaps the biggest was the celebration of the 25th anniversary of the Community Collaborative Rain, Hail, and Snow Network. CoCoRaHS started in 1998, a year after the Fort Collins flash flood in 1997, and continues to grow. In fact, the number of observations by volunteer precipitation observers has increased by 19% over the last four years, and another record was set for the earliest date of the 5 millionth observation of the year. June 17, which was the 25th anniversary of the first observation in the database, was declared “CoCoRaHS Day” by the governor of Colorado. The CoCoRaHS team, led by Julian Turner and Noah Newman, released the **Data Explorer**, which gives observers new ways to look at their data. This project was sponsored by NOAA’s Office of Education. CoCoRaHS also helped to characterize the extreme rainfall across eastern Colorado in Spring and Summer 2023, including the deluge in Fort Collins on July 31, which was the most intense

rainstorm locally since the 1997 flood.

Another major effort over the last year has been the preparation of the Climate Change in Colorado report, updated for the first time since 2014. The report includes observations since the previous update, robust online content that includes interactive figures, and a focus on observed and projected trends in water supply and hazards. The report update was led by assistant state climatologist and alum (Ph.D., '14) Becky Bolinger and is available in both PDF form and on an **interactive website**.

The CCC also hosted the inaugural **Colorado Climate Services Summit** in August at the new CSU Spur campus in Denver. This two-day event brought together a wide range of providers and users of climate information for discussion on needs for weather and climate data and ways to better coordinate the information available to those who need it. Attendees were enthusiastic about making it an annual event, possibly next time in western Colorado.

The Colorado Agricultural Meteorological network – also known as Colorado’s Mesonet – welcomed a new manager in 2023. Lane Simmons managed the lysimeter project at CSU’s Arkansas Valley Research Campus for nearly 20 years, and was also the CoAgMET station technician for southeastern Colorado, so he brings a wealth of experience to the job. Simmons has spearheaded station improvements, including the addition of 10-meter meteorological towers and all-weather precipitation gauges at select stations, and the addition of a new station at the CSU Spur campus in Denver. CoAgMET also plays a key role in research to better understand the parts of Colorado that may have suitable climate conditions for growing wine grapes. **This research, led by CCC climatologist Peter Goble**, was published in 2023, and will continue into the future with the addition of weather stations in southwestern Colorado.

The CCC also continues to fulfill one of its core missions of climate monitoring in Colorado.

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RESEARCH

CSU partners in NSF-funded next-gen airborne radar designed by National Center for Atmospheric Research

Adapted from a **National Center for Atmospheric Research news release**.

Colorado State University researchers are partners in a project that could revolutionize our ability to observe, understand, and ultimately predict high-impact weather events. The **National Science Foundation has awarded \$91.8 million** in funding for a next-generation airborne radar designed by the National Center for Atmospheric Research, and CSU will contribute to the radar's research and development.

The Airborne Phased Array Radar will improve on existing radar by allowing scientists to sample the atmosphere at higher spatial

resolution and probe more deeply into storms, ultimately painting a more detailed picture of storm dynamics and microphysics. APAR will also be an extremely flexible platform. Its agile scanning capability can switch radar beam directions almost instantaneously, allowing scientists to scan the atmosphere in any direction, a contrast to traditional fixed-direction airborne scanning radars.

The rich data generated from APAR will give forecasters critical information for better predicting a range of high-impact weather events, including hurricanes, atmospheric rivers, tornadoes, derechos, and blizzards.

V. Chandrasekar, a University

Distinguished Professor in the Department of Electrical and Computer Engineering and Fellow of the Cooperative Institute for Research in the Atmosphere, will lead CSU's team. Chandrasekar is an expert in weather radar and radar signal processing who holds numerous patents in radar system design, radar network development, and radio frequency communications.

Atmospheric science Professor Michael Bell, a co-investigator on APAR, and Chandrasekar also lead the NSF-supported community research radar, **SEA-POL**, a precipitation radar designed and built by CSU engineers. The scientific community can request to use NSF-supported assets such as SEA-POL and APAR for research anywhere in the world.

Airborne radar is one of the only observing platforms available to obtain the highest resolution measurements of wind and precipitation structure of weather systems. Advancements in phased array technology will enable scientists to better measure the characteristics of heavy rain, snow, and hail in remote weather systems in areas that aren't in range of ground-based systems.

"With most ground-based radars, you have to wait for the weather to come to you, but with an aircraft you can take the radar to the storm anywhere in the world," Bell said.



The NSF/NCAR C-130 sits in its hangar at the Research Aviation Facility in Broomfield, Colorado. NCAR's new Airborne Phased Array Radar will be mounted on this C-130 and made available to the University research community. Credit: UCAR

Continued on Page 17

RESEARCH

Impoverished, underserved school populations more exposed to air pollutants, study finds

U.S. schools located in impoverished areas or districts that represent historically underserved students are more likely to suffer from poor air quality, a team at Colorado State University's Department of Atmospheric Science has found.

This research appeared in the fall in *GeoHealth*, the American Geophysical Union's research journal that marries human and planetary health for a sustainable future.

Led by Professor Jeff Pierce, scientists studying K-12 public school databases found major socioeconomic disparities related to healthy air around the schools. The team studied two kinds of pollutants: fine particulate matter and nitrogen dioxide, or NO₂, that largely originates from dirty combustion such as wildfire smoke and cars.

Fine particulate matter that can easily sneak into lungs is the leading cause of premature death worldwide, according to the World Health Organization.

The team reviewed 2019 demographic and financial information for 98,537 public schools in the contiguous United States through the National Center for Education Statistics. NASA also



Lead author and alum Michael Cheeseman (M.S., '18; Ph.D., '22) inspects devices built by John Volckens's group that measure PM_{2.5} particulate pollution.

contributed satellite data with estimates of pollutant concentrations across the country.

Among the findings were that white students attend schools with the lowest concentrations of NO₂, followed closely by American Indian/Alaska Native students. Conversely, students from other marginalized groups, including Black or African Americans, Asian or Asian/Pacific Islanders, and Hispanics, attend schools with relatively higher concentrations of NO₂.

This data can help communities think about school placement

going forward, Pierce said. "Giving schools a focus can help people think about how schools are built," he said. "Choices can be made so These kind of complex issues are going to increasingly require a team in key disciplines such as social sciences, health, and engineering working together," he added.

"At CSU, we have a critical mass of people thinking about air pollution, from people who have a physical, chemical understanding to those thinking about environmental justice and different ways to slice the data."

From story by Emily Wilmsen

Henz, continued from Page 11

Professor Lewis O. Grant offered me a GRA in his cloud physics and weather modification program. He recognized that my interests in mountain and Plains thunderstorm development and his existing orographic and winter cloud/snow enhancement programs were not an ideal fit. He found creative ways for me to research the orographic relationships of Colorado thunderstorm formation and upslope precipitation production within his program's goals.

Thanks to insight gained through work with one of Grant's teams, we were able to make an early flash flooding prediction on local radio starting the day before the Big Thompson flash flood on July 31, 1976. The broadcasts saved many lives and served as a foundation for my career work in the development of operational flash flood prediction programs in Colorado, Arizona, Virginia, and Texas. This example is just one of myriad interactions I've had with department faculty and

students that led to positive impacts on my career and our profession. When I returned to CSU to accept the award, the impressive growth of the physical additions to the ATS campus and current research contributions being made by the faculty on many of society's most pressing environmental issues were apparent. The vibrant pulse of the campus and students has only grown stronger through the years.

Thank you for making me a part of it.

Climate Center, continued from Page 14

Water year 2023 saw substantial drought relief, with a much above-average snowpack in the mountains. But flooding became a concern, with the wettest four-month period on record in parts of the Front Range and Eastern Plains during May-August. Spring and Summer 2023 were also extremely active for hail

and tornadoes, with a **new state record for hailstone diameter** established in Yuma County in August. Water year 2023 was tied for the 60th warmest (the coolest since 2010), and the 33rd wettest (wettest since 2017) in the statewide average. With water year 2024 underway, the CCC will continue its work providing

climate monitoring, climate research, and climate services for Colorado from our home here in the Department of Atmospheric Science.

If you're interested in receiving our monthly Colorado climate updates, please **subscribe** on our website.

Airborne radar, continued from Page 15

Bell leads the **CSU Tropical Weather and Climate Research Team**, the group responsible for CSU's **Atlantic hurricane forecast**. His research group will develop next-generation radar data quality control and wind and precipitation analysis techniques and tools for APAR.

Airborne radar is a key technology aboard NOAA's Hurricane Hunter aircraft that sends information about hurricanes back to the

ground for forecaster analysis. APAR technology will eventually replace NOAA's current airborne radars.

"We are working to design products that can take advantage of APAR capabilities in the future and continue to improve weather forecasts," Bell said.

"It is exciting to now have this opportunity to help build the next-generation system in collaboration

with NCAR and look forward to new discoveries that APAR will enable."

NCAR is sponsored by the National Science Foundation. Other APAR partners include NOAA, Ball Aerospace, State University of New York Stony Brook, University of Massachusetts Amherst, and the University of Oklahoma. NCAR expects to have the radar up and running in 2028.

From story compiled by Jayme DeLoss

DEPARTMENT NEWS

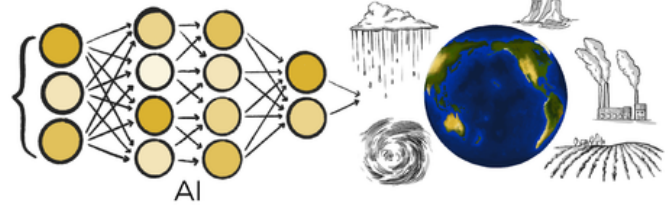
AI, from cover

Given enough data, a complex enough machine learning model can find patterns among the noise and potentially produce accurate predictions, but Barnes is interested in explainable AI – that is, figuring out how a machine learning model reached the conclusion it did. She likens deciphering the model's process to solving a maze by starting at the end and working backward. "We've always been using data and trying to pull out all the complexity of the climate system and make it understandable to a human, and now, machine learning is allowing us to go in even deeper and find even more complicated relationships. The place we're at right now is still trying to make their predictions understandable to humans," Barnes said. "If it does a good job and we can learn why it was able to do it, we then actually learn new climate science."

Her group is also focused on interpretable AI – sometimes called transparent AI. They are starting from scratch, building machine learning models from the ground up, so the models are understandable to people every step of the way. "That's a much slower process and, honestly, way harder," Barnes said, "but the result is when it makes a prediction, you don't have to ask, 'Why did it make that prediction?' You already know why." Explainability and interpretability are two pieces that can help people trust AI, but a lot of other factors come into play. Barnes, Imme Ebert-Uphoff, a scientist with the Cooperative Institute for Research in the Atmosphere and professor in the Department of Electrical and Computer Engineering, and computer science Professor Chuck Anderson are exploring what it will take to create trustworthy AI for studying weather and climate. They are partners in the National Science Foundation-funded **Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography**, led by the University of Oklahoma.



CSU Ph.D. student Allie Mazurek discusses the CSU-MLP with forecaster Andrew Moore.



CSU weather model used in storm prediction

A machine learning model created in the department has improved forecasters' confidence in storm predictions and is now used daily by the National Weather Service's Storm Prediction Center and Weather Prediction Center. The model, developed by a team led by Russ Schumacher, is capable of accurately predicting excessive rainfall, hail, and tornadoes four to eight days in advance. The model is called CSU-MLP for **Colorado State University-Machine Learning Probabilities**. Schumacher's team worked with NWS forecasters over six years to test and refine the model for their purposes.

The CSU code is now running on the Storm Prediction Center's and Weather Prediction Center's operational computer systems, helping forecasters predict hazardous weather, so people in harm's way have enough lead time to prepare. The atmospheric scientists trained the model on historical records of severe weather and NOAA reforecasts, retrospective forecasts run with today's improved numerical models.

Team member Allie Mazurek, a Ph.D. student, is working on explainable AI for the CSU-MLP forecasts. She's trying to figure out which atmospheric data inputs are most important to the model's predictions, so the model will be more transparent for forecasters. "These new tools that use AI for weather prediction are developing quickly and showing some really promising and exciting results," Schumacher said. "But they also have limitations, just like traditional weather prediction models and human forecasters have strengths and limitations. The best way to advance the field and improve forecasts will be to take advantage of each of their strengths: the AI for what it's good at, which is identifying patterns in massive datasets; numerical weather prediction models for being grounded in the physics; and humans for synthesizing, understanding, and communicating."

Schumacher discusses the promise and limitations of AI for weather prediction in more detail in **this piece in *The Conversation***, co-authored by Aaron Hill, a former ATS research scientist who is now a faculty member at the University of Oklahoma.

Story by Jayme DeLoss; contributions from Eric Maloney