

Atmospheric Circulation

Atmospheric Sciences Department at the University of Washington

Photo from the rooftop of our building courtesy of Steven Domonkos and David Warren

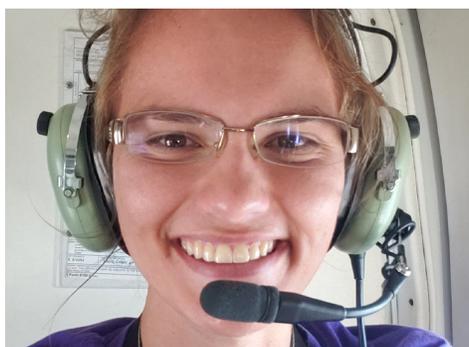
Atmospheric Sciences Participation in the Fire Influence on Regional to Global Environments and Air Quality (FI-REX-AQ) Campaign

Part 1: Shining a New Light on the Chemical Composition and Evolution of Nighttime Wildfire Smoke Through the FIREX-AQ Aircraft Campaign

By Carley Fredrickson, Graduate Student in Atmospheric Sciences

In the western United States, wildfire frequency, severity, and season length have been increasing. Although fire is important for many ecosystems to thrive, wildfires pose major risks to populations residing in wildland-urban interfaces as well as to smoke-laden communities downwind of these fires. Exposure to particulate matter from wildfire smoke is detrimental to human health, leading to both respiratory and cardiovascular diseases. In addition to particulate matter, wildfires emit an assortment of gases whose composition depends on a variety of factors including fuel conditions, fire intensity, and fire weather conditions. Researchers have contemplated what differences exist between daytime and nighttime smoke. At night, smoke stays closer to the ground and fires burn with less intensity. Additionally, different

nighttime oxidants affect the chemistry and composition of the smoke. While previous field campaigns sampled daytime wildfire smoke, there had yet to be a study dedicated specifically to the sampling and characterization of wildfires from the point of emission during daytime and nighttime.



Graduate student Carley Fredrickson on the NOAA-Chem Twin Otter gaining leadership experience and learning about aircraft campaign operations. Photo courtesy of Carley Fredrickson



Graduate student Carley Fredrickson displaying the campaign t-shirt in front of the NOAA-Chem Twin Otter used in the aircraft campaign. Photo courtesy of Mark Stone, University of Washington

To address this knowledge gap, from July to September 2019, an intensive interagency study of North American wildfires led by NASA and NOAA called Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) was conducted. This campaign operated primarily out of Boise, ID, a central

location for northwestern United States fires. There were multiple measurement platforms involved in this project, from satellites, mobile labs, and ground sites to NASA's ER-2, NASA's DC-8, and NOAA's Met and Chem Twin Otters. During this campaign, I worked with NOAA researchers on the NOAA-Chem Twin Otter, a small twin engine plane that allowed low altitude sampling of wildfire smoke, reaching as low as 1000 feet above the terrain.

With postdoctoral researcher Dr. Brett Palm and myself representing Professor Joel Thornton's research group, we brought our High Resolution Time of Flight Chemical Ionization Mass Spectrometer (HR-ToF-CIMS) up to speed for aircraft installation and operation. This instrument can measure hundreds of oxygenated, halogenated, and nitrogen-containing compounds, including those observed in wildfire smoke. Participating in FIREX-AQ with the NOAA-Chem Twin Otter gave us the opportunity to sample low altitude nighttime smoke.

Our days often started at 9 AM, turning on and warming up our instruments for the flights ahead of us. This included pumping down our instrument to low pressures, warming up our power supply, and installing a new cylinder of nitrogen. With takeoff around 1 PM, we would have time to process and interpret data measured on previous days. This was critical to ensure our instrument was operating at 100%. After roughly ten hours since the initial takeoff, the plane would arrive back in Boise. All of our instruments would then need to be shut down and operations would conclude around midnight with the process repeating the next day.

The size and extensive instrument payload of the NOAA-Chem Twin Otter presented many limitations to our operations. Our maximum flight time of two and a half hours promoted frequent refueling at airports in McCall, ID and Baker City, OR. To support the refueling away from our Boise base, we needed a support truck to both continue powering the instruments and provide cool air to the plane's interior. There were many roles that were rotated amongst the PIs and graduate students. From signaling to the pilots and flying

in the aircraft, to operating the support truck and processing the previous day's data, I got to be involved in most of the planning, support, and operation of the field campaign. This was something I did not expect to be a part of, but I appreciated the opportunity to learn these skills. Perhaps I could plan my own aircraft campaign in the future, not unlike department alumna Dr. Emily Fischer (now an Associate Professor at Colorado State)! Additionally, I learned how to fix our instrument away from our resources

at the UW laboratory. It's always important to keep a cool head, ask for help, and improvise as best you can.

We have preliminarily processed our data and are gearing up to finalize our dataset in February 2020. Looking further ahead, all researchers involved with the FIREX-AQ campaign will meet at the NASA Langley Research Center in March 2020 for our first post-campaign science meeting.

Part 2: Analyzing Wildfire Smoke Organic Aerosol Chemistry with the Mount Bachelor Field Program

By Phil Rund, Graduate Student in Atmospheric Sciences



Claire Buysse working on observatory rooftop. Photo by Mark Stone

In late July, four research teams came together at Mount Bachelor Observatory in central Oregon to study western US wildfire smoke. This effort was part of the Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) campaign, a joint venture by NASA and NOAA aimed to gather comprehensive of smoke from biomass burning and wildfires. These observations were collected at ground sites, like Mount Bachelor, as well as several research aircraft and mobile laboratories. Mount Bachelor Observatory has been operated by professor Dan Jaffe since 2004

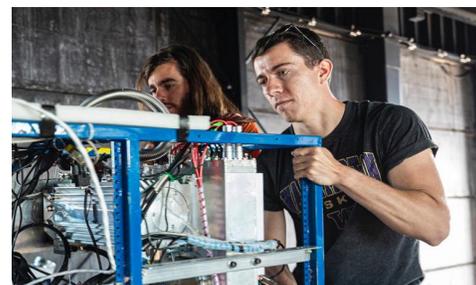
During the Summer and early Autumn of this year, Phil Rund participated in the field campaign at Mount Bachelor Observatory (MBO). The observatory is positioned at an altitude of ~2740m, providing potential

for both free tropospheric and boundary layer influence, depending on time of day and ambient conditions. The campaign was a collaborative effort between four universities to conduct extensive measurements of the composition of biomass burning plumes during peak fire season. Despite a relatively inactive start to fire season for this region, multiple periods of light to moderate smoke were identified by PM measurements throughout the month of August. Phil deployed a Chemical Ionization Mass Spectrometer (CIMS) equipped with a custom Filter Inlet for Gases and AEROSols (FIGAERO) from the Thornton group. The FIGAERO-CIMS is capable of measuring both gas phase and particle phase compounds with particular strength in measuring organics. Gas compounds are analyzed in real-time while particulates are collected onto a filter to then be thermally desorbed by heated ultra-high purity nitrogen. Essentially this instrument takes in the ambient air at the site and produces mass spectra from which the chemical composition of air masses can be deduced. A total of 20 large compressed nitrogen cylinders were also deployed for month-long instrument operation.

After driving up a bumpy dirt road (what would be a ski run in Winter), the only modes of transportation to the observatory at the peak of the mountain were to either take a scheduled ski lift ride or hike the trail (consisting of a 1700 ft elevation gain over ~ 2 miles). The ski lift was only scheduled to run Monday and Wednesday mornings,

while the instrument/cylinders required maintenance about every other day. A typical day looked like an 8am drive to the site from Bend for a morning summertime hike up the mountain. Once at the summit and inside the ski lift building, gas cylinders would be changed and the instrument would be checked on with small adjustments for signal strength, or occasionally some more major fixes. After collecting the real-time data from days prior to be processed, Phil began the hike back down to the car, often passing friendly leisure hikers. On a clear day at the summit, there were great views of the Three Sisters in Oregon and well as a hazy glimpse of Mt. Hood in the distance.

Work is continuing with this dataset, Phil is finishing up data processing and plans to analyze particulate measurements of smoke events as well as general organic aerosol properties with the end goal being particulate source apportionment for the area. The MBO team will be meeting in 2020 to discuss ongoing analysis/results.



Graduate student Phil Rund and lab technician Noah Bernays unloading measurement instruments. Photo courtesy of Mark Stone, University of Washington

An Industry Seminar Series to Explore Career Paths

By Fiona Lo, graduate student

While a graduate degree in atmospheric sciences has traditionally aimed to prepare a student for a research career in academics, there are many alternative ways to put a graduate degree to use in society. The physics knowledge, data science, programming and communication skills acquired in the UW atmospheric sciences program are easily marketed to many sectors of industry that require employees able to engage in independent work using analytical techniques and critical thinking. Though employment opportunities for atmospheric scientists are wide-ranging, many students don't realize the breadth of jobs available to someone with their skill set.

In light of this, graduate students Fiona Lo and Lauren Schmeisser created the Industry Speaker Seminar Series in 2017 as part of a departmental initiative to spread knowledge about job prospects available outside of academia as well as to create opportunities for alumni to share their career paths with current students and postdocs.

Once per quarter, the Industry Speaker Series hosts a speaker with a background in atmospheric science, who is now applying their skillset in a non-academic field. Speakers share their career experiences, describe skills that they use in their job, and offer advice for those also looking to find employment in industry.

In the past year, the following alumni of UW Atmospheric Sciences have shared their career experiences and advice at the Industry Seminar Series: Mario Zatzko (Rambol, Ph.D. 2015), Bart Brashers

(Rambol, Ph.D. 1998), Kristin Larson (S&P Global, Ph.D. 2002) and Kelly McCusker (Rhodium Group, Ph.D. 2013).

We are looking to build a department alumni career network to keep track of present and past jobs held by alumni. The network will be a way for students to identify career paths available for them both within and outside of academia. If you are interested in being part of this network, please fill out the Alumni Career Network form located in the alumni section of our website. In addition, if you are willing to come speak at the Industry Seminar Series and/or participate in informational interviews with students, please indicate so on the form. Please contact Erica Coleman (ecoleman@uw.edu) with questions.

DIGging into Diversity, Equity, and Inclusion in the Department of Atmospheric Sciences

By graduate student Katie Brennan and recent PhD Graduate Jeremy McGibbon

Since 2016, the Diversity and Inclusion Group (DIG) has held regular meetings to discuss concerns of members of our department and initiatives to address them. This group began as a grassroots initiative among graduate students and has expanded to include faculty, staff, and postdocs with an interest in working on these issues.

As emphasized in a recent Nature paper entitled 'No progress on diversity in 40 years' [Bernard & Cooperdock 2018], the geosciences have been slow to improve on issues regarding diversity, equity, and inclusion. Our group of volunteers helps spark direct action in our department, working in close collaboration with the Department Diversity, Equity and

Inclusion Committee appointed by the Chair. What kind of direct action, you might ask? Here are some highlights:

- Creating a Graduate & Undergraduate student mentoring program; pairs graduate students with an undergraduate to help them navigate the program and share career and academic advice.
- Inviting speakers to the Department colloquia and seminars, including speakers from the UW Center for Evaluation and Research for STEM Equity and Professor Sharona Gordon for a Below the Waterline training
- Holding workshops within the department, including a student led implicit bias training, student-led movie screenings and discussions, and a mental health workshops hosted by on-campus professionals.
- Revamping the graduate student admissions process in collaboration with the Department Diversity, Equity, and Inclusion Committee in hopes of attracting a broader range of students

to the department. The process now includes more specific questions that encourage students to convey their knowledge, skills and interest in the field that they may have gained in or outside of academia.

- Crafting a Diversity Statement for the Department, which is now published on our webpage.

Though DIG has gotten the ball rolling and helped start discussions and action in the department in the past few years, there remains much work to be done. Everyone deserves an environment that can bring out their full potential, and the success of our field is dependent on supporting and encouraging every member of our community. Diversity of our field is necessary for growth, and depends on removing structural barriers placed on many of its members. We hope that DIG will keep momentum going, so that our next 40 years can see real progress.

UW Climate Scientists Contribute to Multi-Institute Hackathon to Understand New Climate Model Data

By Robert Jnglin Wills, postdoctoral fellow

Modeling centers around the world are now releasing data from simulations with the next generation of climate models in a project known the Coupled Model Intercomparison Project Phase 6 (CMIP6). For three days in October, thirty UW climate science graduate students and postdocs got together in a CMIP6 “hackathon” to learn about future climate change from these new simulations. We combined efforts with hackathons at two other institutes, the National Center for Atmospheric Research (NCAR) in Boulder, Colorado and the Lamont-Doherty Earth Observatory in Palisades, New York. It was a test in working together remotely, which is increasingly a focus for climate scientists trying to limit their CO₂ emissions from travel.

Besides studying the new climate projections, an overarching goal was for all participants to use a common set of Python tools for accessing and analyzing the CMIP6 data. These tools allow users to quickly access and analyze CMIP6 data on cloud storage, without downloading all of the data themselves. This facilitates reuse of analysis code across projects and makes the resulting science more reproducible. In particular, we worked with state-of-the-art Python packages for efficient analysis of large multi-dimensional datasets.

Highlights from the UW group include a public-facing web tool for visualizing

local CMIP6 climate projections, an investigation areas of the Southern Ocean surface waters that are sinking into the deep ocean in different CMIP6 models and how this affects climate, an analysis of how well CMIP6 models can simulate observed Pacific Ocean temperature changes over the last 50 years, an investigation of projected changes in the position of the Gulf Stream, and an investigation of projected changes in Antarctic sea ice. While these projects, as expected, were not completed after just 3 days, there is now momentum amongst the participants to continue working on them, to continue learning Python, and to work towards making our science more open and reproducible.

Anyone interested in trying out these CMIP6 analysis tools for themselves can access the Pangeo hackathon template on which these projects are based on Github (<https://github.com/cmip6hack/project-template>) or contact Robert Jnglin Wills (rcwills@uw.edu) for more information.

The UW CMIP6 Hackathon was made possible by funding from the University of Washington Department of Atmospheric Sciences and Program on Climate Change, among other sources. A version of this article with hyperlinks, including links to the individual projects, can be found at: pcc.uw.edu/blog/2019/12/02/uw-hackathon/.



UW climate scientists analyzing climate model data in Python.

UW Atmospheric Sciences Weather Challenge Team WINS National Contest in 2019

By Lynn McMurdie



Faculty lead Lynn McMurdie, center, and some of the students from the winning UW team pose on the roof of the Atmospheric Sciences-Geophysics Building. Photo by Dennis Wise/University of Washington

Over thirty enthusiastic and talented forecasters joined the UW forecasting team for the National WxChallenge forecast contest 2018-2019. The team included undergraduate students (from freshmen to seniors), graduate students, faculty and staff and alumni. For 10 weeks in the Fall and again for 10 weeks in the Winter and Spring, the team entered forecasts for maximum temperature, minimum temperature, maximum sustained windspeed and quantitative precipitation for 10 different cities. Fourteen of the 30 team members competed for the full year and for the first time, the UW WxChallenge team brought home the first-place trophy, edging out past winners Colorado State University and Pennsylvania State University. Several individuals did extremely well. Graduate student Jonathan Weyn took first place overall, and graduate student Joe Zagrodnik, faculty advisor Lynn McMurdie and undergraduate Jamin Rader all placed in the top 10 out of over 1000 contestants. Virginia Rux (class of 2016) placed 2nd overall in the alumni category and Lynn McMurdie placed 2nd overall in the faculty/staff category. Jamin Rader, Mason Freidman and Calen Randall all placed in the top 10 in the undergraduate categories. Several team members brought home trophies for being the top forecaster either overall or in their category at individual cities, including: Jonathan Weyn (top category 2 Portland, OR), Calen Randall (top

category 4 forecaster, Boise, ID), Kevin Tu (top category 0, Phoenix, AZ), Peter Brechner (overall winner, Phoenix, AZ), and Magdelana Szabo (overall winner, Nashville, TN). The team benefits from custom software originally designed by former graduate student Luke Madaus and updated and modified by current team members, Weyn and Zagrodnik. This software is a dashboard that brings together information from more than a dozen forecast models in one place making it easy for forecasters to assess any model biases for particular cities or in particular weather situations. In addition, Weyn developed a machine-learning tool that compares historical forecasts for a given city with the actual weather to learn the models' biases in different scenarios and correct for them. This machine-learning tool also entered the contest in the "model" category along with many other models from operational centers. Over the two weeks of forecasts for Pueblo, CO, one of the most challenging cities for the 2018-2019 contest, this model delivered the best forecasts and beat all the human forecasters for that city, earning Weyn a special category trophy. If you would like to learn more about the winning team, please see the UW Today article at: www.washington.edu/news/2019/04/04/april-weather-madness-uw-wins-top-team-individual-prizes-in-national-forecasting-contest-now-enters-tournament-round/

The 2019-2020 forecast contest is currently underway, and the UW team is looking forward to another challenging forecast year. If you're interested in joining the team, please email us at: lynnm@uw.edu, jweyn@uw.edu and lloveras@uw.edu.



Celebratory cake made by Lynn. Eventually we received the real trophy too.

A message from Chair Cecilia Bitz



Professor Cecilia Bitz

At the end of June 2019 Dale Durran completed his term as department chair. As the first chair who is also an alumnus (Ph.D. 1997), I am honored to take over as the eleventh chair since the department was founded.

I am grateful to Dale for teaching me the ropes over the past two years while I was the Associate Chair. Together, with the rest of the faculty, I thank Dale for his distinguished leadership. He has accomplished many things including the hiring of a new faculty member, Assistant Professor Alexandra Anderson-Frey. In addition, he, together with our undergraduate program coordinator Professor Becky Alexander, initiated a new undergraduate class in broadcast meteorology that will be taught for the

first time this Winter by local KOMO-TV Chief Meteorologist Shannon O'Donnell.

Dale passes on the department in good health. Our research program is stronger than ever. Under his watch, our undergraduate program grew, nearly doubling in size in the last decade, and our graduate student population has held steady. Fortunately, Dale has left me with a team of outstanding and highly capable staff. I thank Shannon Millican, Assistant to the Chair, for her role in creating this issue.

I am excited to lead this department of impressive people. I am proud of the accomplishments listed in this issue; especially in highlighting the role of our postdoctoral fellows. In the last few years, we've had an especially strong group of postdocs, who have created an active network to promote career advancement and are having a positive impact on the culture of our department. I was impressed when they asked if they could be called on to substitute teach when faculty must be away. Along with our Graduate students they are key participants in our public outreach program.

As I look ahead, I plan to work on expanding our curriculum in data science and solutions to environmental problems. I also want to work on improving our early-career mentorship of students, postdocs and faculty and further our efforts to build diversity, equity and inclusion in the department.

There have been many pleasant surprises upon becoming Chair; I've had the privilege of communicating with many friends of the department, including emeritus professors and their family and alumni. I urge all alumni and friends to send us news about their activities. We'd be happy to share your messages in the next edition of the Atmospheric Circulation.

I want to thank all who have made donations to the department. State support for our department is not keeping up with the times, and we are increasingly reliant upon the generosity of our alumni and friends. Your donations help the department in recruiting the best students, postdocs, and faculty along with allowing us to be able to host high-profile invited lecturers -enriching our department, and in communicating atmospheric sciences to the broader community.



Cecilia officially accepts the chair from Professor Dale Durran (look closely at her hand to see a relic passed down since Professor Norbert Untersteiner's time, the sixth chair of the department).

New Faculty

Assistant Professor Alexandra Anderson-Frey

Photo by University Photography

We are excited to welcome Alexandra Anderson-Frey who joins our faculty as an Assistant Professor. Alex received her doctorate from Penn State University and prior to joining us, was a postdoc at the NOAA/University of Oklahoma Cooperative Institute for Mesoscale Meteorological Studies in Norman, Oklahoma. Her research interests include mesoscale meteorology, thunderstorms, tornadoes, synoptic meteorology, statistical applications, and machine learning.



Congratulations to our Faculty

Professor Christopher Bretherton

was elected to the National Academy of Sciences. Chris studies how clouds form and change over time and how to better represent these processes in global climate and weather-forecasting models. He also researches the role that clouds may play in climate change.

Professor Qiang Fu

will be awarded the Jule G. Charney medal, a career research award from the American Meteorological Society. The citation of his award reads, "For pioneering contributions to the theory and practice of atmospheric radiative transfer and its critical linkages to climate and climate change". The formal presentation of the award will take place as part of the 100th AMS Annual Meeting in January 2020 at Boston, Massachusetts.

Associate Professor Abby Swann was recognized with four major honors this year! Science News had her on their list of 10 promising early- and mid-career scientists. She was also awarded the 2019 Global Environmental Change Early Career Award of the American Geophysical Union, an Early Career Fellow of the Ecological Society of America, and she was named the inaugural winner Jon C. Graff, Ph.D. Prize for Excellence in Science Communications. Abby studies how plants influence the climate at global and geologic timescales and how larger climate shifts influence vegetation.

Professor Cecilia Bitz gave the Jacob Bjerknes lecture at the 2019 annual meeting of the American Geophysical Union, one of two named lectures of the Atmospheric Sciences section at AGU this year. Her talk was titled "Declining Sea Ice as an Early Indicator of Global Climate Change".

Professor Becky Alexander was promoted to full professor this Autumn 2019. Becky received her Ph.D. in 2002 in Atmospheric Chemistry from the University of California, San Diego and was a postdoc at Harvard before joining our Department in 2005. She was promoted to the rank of Associate Professor in 2013. Becky has developed an exciting research program to illuminate the life cycle of sulfate and nitrate aerosols on various time scales, from modern times to the Ice Ages. She and her students are also working to understand the oxidation capacity of the atmosphere in past climates (Ice Ages; pre-industrial to present), with the goal of better constraining the projections of greenhouse gases produced by human activity (e.g., methane). The tools she uses are a blend of observations obtained from ice cores in Greenland and Antarctica, and global scale modelling using the GEOS-Chem model.

Department News

Our heartfelt thanks to Dr. Harry Edmonds for his many years of service. Harry retired this year after most recently serving as Director of Computing.

On the occasion of his retirement, we acknowledge our gratitude to KOMO-TV Meteorologist Steven Pool for supporting many of our undergraduates in broadcast meteorology internships over the years.

Earlier this year the department welcomed senior staff members Shannon Millican, Assistant to the Chair, and Elin Martin, Grants Manager.



New graduate student welcome event

Alumni News

Kathryn (Katie) Boyd (2007, B.S.) started a new position last year as an Education and Outreach Associate at the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado in Boulder.

Issac Chamberlain (2015 B.S.) an Outreach Coordinator with 3Degrees, a clean energy consulting company that makes it possible for businesses and their customers to take urgent action on climate change. Issac manages a team of outreachers who educate and sell customers on utility renewable energy programs designed to help reduce their carbon footprint.

Jennifer Francis (1994, Ph.D.) is now a Senior Scientist at the Woods Hole Research Center in Falmouth, MA (as of Oct. 2018) after 24 years as a research professor in the Department of Marine and Coastal Sciences at Rutgers University.

Aaron Hill (2012, B.S.) will finish his Ph.D. from Texas Tech University in 2019. Aaron will then join the Department of Atmospheric Science at Colorado State University as a Postdoctoral Fellow in the Precipitation Systems Research Group. Over the last year, he participated in multiple field programs (e.g., VORTEX-SE, TORUS) aimed at improving our understanding of deep-convective storms, and spent time at NCAR as a graduate student visitor in MMM. Aaron and his wife also welcomed their first child in March 2019.

Thomas J. Kleespies (1974, B.S.) is happily ensconced with his wife Laura in Loveland CO, where he retired after 33 years of federal service (15 with DoD and 18 with NOAA/NESDIS). He is working on

brushing off his notes so he can teach his tangent linear/ adjoint coding class at CSU. These skills are a requisite for anyone wanting to get involved with variational data assimilation.

Marysa Laguë (2019, Ph.D.) received the James S. McDonnell Foundation Postdoctoral Fellowship for research in Dynamic and Multiscale Systems. She started her postdoc at the University of California, Berkeley, in Fall 2019 to work with Prof. Bill Boos, studying the effects of land surface processes on terrestrial cloud cover.

Philip Mote (1994, Ph.D.) accepted the position of Vice Provost and Dean of the Oregon State University Grad School where he also serves as Professor in the College of Earth, Ocean, and Atmospheric Sciences. He joins Lisa Graumlich on the AGU Board.

Gretchen Mullendore (2003, Ph.D.) was promoted to Full Professor at the University of North Dakota.

Louisa Nance (1995, Ph.D.) was appointed the Director of the Developmental Testbed Center (DTC) in June 2019 after serving as the acting director for approximately 14 months. The DTC is a distributed facility with staff from NCAR and NOAA/ESRL that focuses on improving the transition of research into operations directed at improving the forecast skill of US numerical weather prediction models. Louisa joined this effort in 2003 as the first full time hire.

Kristen Rasmussen (2014 Ph.D.) is currently an Assistant Professor in the Department of Atmospheric Science at Colorado State University and recently received the 2019 Graduate Advising and Mentorship Award from CSU.

Anthony (Benjamin) Schott (2002, Ph.D.) was recently selected as the new Meteorologist in Charge of the National Weather Service Forecast Office in New Orleans, LA. He previously held the same position in Milwaukee, WI. The NWS New Orleans office holds a high responsibility to ensure watches, warnings, and advisories are timely issued to a very vulnerable population. He has 17 years with the NWS, and an additional 5+ years forecasting weather and oceanographic conditions with the US Navy previous to his time at the University of Washington.

Xiaoming Shi (2015, Ph.D.) joined the Hong Kong University of Science and Technology (HKUST) in September 2018 as an Assistant Professor and works in the Division of Environment and Sustainability (ENVR). Besides teaching courses related to atmospheric sciences, Xiaoming teaches courses on climate policy and sustainability.

Hansi Singh (2015, Ph.D.) became an Assistant Professor in the School of Earth and Ocean Sciences at the University of Victoria in British Columbia, CA. She researches the physical climate system, with a special interest in the polar regions as well as the large-scale transport of atmospheric water from equator to pole.

Ryan Torn (2007, Ph.D.) became the chair of the Department of Atmospheric and Environmental Sciences at University of New York at Albany. Ryan studies weather forecasting models, tropical cyclones and atmospheric predictability.

Joe Zagrodnik (2019, Ph.D.) began a postdoctoral research appointment with the Washington State University AgWeatherNet in May 2019. He is developing hyper-localized weather forecasts and decision-making tools for agricultural interests in the state of Washington.

Alumni Event at AMS 2020, Boston, MA

We will be hosting an Alumni Reception for our department at the 2020 Annual Meeting of the American Meteorological Society in Boston on Tuesday, January 14th from 6:30pm-8:30pm at the Westin Hotel (Hancock Room). To ensure you receive an email invitation and reminder, please update your contact information by going to atmos.uw.edu/alumni or contacting atmos@uw.edu.



Faculty and family at the 2019 Holiday Party

Students, Scholarships & Fellowships

Undergraduate Research

The following undergraduate students (among those who were advised, faculty mentor noted after student's name) did research projects this year;

David Bonan/ Ed Blanchard- Wrigglesworth: Investigating Climate Teleconnection Patterns Relevant for Arctic Sea Ice across CMIP5 Models and Observations*

Jonathan Chriest: Midnight Sun, 25 Degrees below Zero, and other Experiences as a NWS Pathways Student in Interior Alaska*

Joshua Driscoll/ Dennis Hartmann: Machine-Learning for Long-Term Weather Forecasting*

Mason Friedman/Lynn McMurdie: Tropical Precipitation and Cross-Equatorial Heat Transport Responses to Localized Heating in a Fully- Coupled Climate Model*

Jane Harrell: Predicting Streamflow and Snowpack Sensitivities to Climate

Change in the Pacific Northwest's Green River Basin*

Joel Jacobson: Anthropogenic Influence on Reactive Chlorine in the Troposphere*

Jinhyuk Kim/Abby Swann: Evaporative Resistance Equally Important to Albedo in High Latitudes Due to Cloud Feedbacks*

Rikki Parent/ Dargan Frierson: How Mountain Ranges Influence Tropical Rainfall*

Jamin Rader/ Lynn McMurdie: Illuminating the Rain Shadow: Characteristics of Clouds and Precipitation on the Lee Side of the Olympic Mountains*

Elisa Zamora: Exploring Weather Broadcasting with KOMO4 News*

Surabhi Biyani /TJ Fudge: Estimating the Upper Bound of Crustal Heat Flow under Antarctica

Haley Staudmyer, Surabhi Biyani and Rikki Parent/Dargan Frierson: Analysis of high sensitivity models in the CMIP6 archive

Jesus Gallegos, Shane Peterson, Sara Salimi, John Song/Laura Hinkelman, Nick Bond: Solar Irradiance Monitoring: Measurements and Applications

Calen Randall, Peter Brechner/Cliff Mass: High-resolution regional climate

modeling over the Pacific Northwest. Calen has also worked on examining the relationship of the "Blob" with temperatures over the northwest.

Sean O'Neil/Knut Christianson: Inland Progression of Firn Aquifers in Southeast Greenland

Jane Harrell/ Bart Nijssen: Predicting Streamflow, Snowpack and Stream Temperature Sensitivities to Climate Change in the Pacific Northwest's Green River Basin.

Tatum Hennig/Mehmet Sarikaya: Molecular Dynamic Folding Propensities of Genetically Designed Dodecapeptides on Single Layer Atomic 2D Solids.

Joseph Paranzino: Hybrid Rocket design and construction, Society for Advance Rocket Propulsion (SARP)

Christine Neumaier/Joel Thornton: Evaluating anthropogenic enhancements to lighting.

** indicates projects that students presented in our undergraduate symposium*

Congratulations to our Graduates

Bachelor of Science

Alexander Arevalo
David Bonan
Peter Brechner
Jonathan Christi
Ian Despars
Jordan Doan
Joshua Driscoll
Andrew J. Duenas-Burns
Mason Friedman
Michael Gardner
Jane Harrell
Sean Hicks
Reiss Kauffman
Jin Kim
Kelsie Knowles
Yemas Ly
Nathan Nguyen
Sean O'Neil
Seth Peterson
Jamin Rader
Hyeok 'John' Song
AJ Thaler
Alicia Wright
Elisa Zamora

Master of Science with Thesis Title and UW faculty advisor

Rachel Atlas, In-Situ Observations and Large Eddy Simulations of Southern Ocean Boundary Layer Clouds (Bretherton)

Mary Kathleen Brennan, Reconstructing Arctic Sea Ice in the Common Era (Hakim)

Robin Clancy, The effect of ENSO on Arctic sea ice as a source of predictability (Bitz)

Yue Dong, Attributing Historical and Future Evolution of Radiative Feedbacks to Regional Warming Patterns using a Green's Function Approach: The Preeminence of the Western Pacific (Armour/Battisti)

Brandon McClung, The Diablo Winds of Central and Northern California: Climatology and Synoptic Evolution (Mass)

Hamid Alizadeh Pahlavan, The Effect of Hydrometeors on MSU/AMSU Temperature Observations over the Tropical Ocean (Fu)

Qiaoyun Peng, Evaluating airborne fluxes of reactive nitrogen compounds over the marine boundary layer: from eddy covariance to wavelet transform (Thornton)

Lydia Tierney, Orographic Precipitation in an Idealized Midlatitude Cyclone (Durran)

Lucas Vargas Zeppetello, The Origin of Soil Moisture Evaporation 'Regimes' (Armour/Battisti)

Doctor of Philosophy with Thesis Title and UW faculty advisor

Jiayue Huang, Improving constraints on the sources and distribution of sea salt aerosols in polar regions (Alexander)

Marysa Laguë, Quantifying the role of individual surface properties on atmospheric feedbacks and land-atmosphere interactions (Swann)

Jeremy McGibbon, Improving a higher-order turbulence closure parameterization using LES-trained machine-learning (Bretherton)

Kuan-Ting 'Andy' O, Ultraclean layers and optically thin clouds in the stratocumulus transition: depletion of cloud droplets and cloud condensation nuclei through collision-coalescence (Wood)

Andre Perkins, Reconstructing Coupled Atmosphere–Ocean Variability Over the Last Millennium (Hakim)

Casey Wall, On the interactions between clouds and atmospheric circulation in the tropics and midlatitudes (Hartmann)

Joseph Zagrodnik, Modification of Precipitation in Mid-Latitude Cyclones Passing over a Coastal Mountain Range (McMurdie)

Awards and Scholarships

Undergraduate Scholarships

Rafael Bakin received the Genevieve and Drew Hamilton Departmental Scholarship and the College of the Environment Scholarship.

Surabhi Biyani received the NOAA Hollings Scholarship.

Dylan Logan received the Sally Schoenberg and Randy Potet Departmental Scholarship.

Rose Schoenfeld received the Mindlin-Reed-Caldwell Departmental Scholarship.

Graduate Fellowships and Awards

Ben Barr – NASA FINESST

Claire Zarakas – DOE Computational Science Graduate Fellowship

Yakelyn Ramos Jauregui – UCAR Next Generation Fellowship

Ursula Jongbloed – College of the Environment Top Scholar Award

Billy Henshaw – GSFEI Top Scholar and Warren Departmental Scholarship

Patrick Murphy – GSFEI Top Scholar and Hartmann Departmental Scholarship

Victoria McDonald – GSFEI Top Scholar

Travis Aerenson – GSFEI Top Scholar

Alyssa Poletti – Program on Climate Change Fellowship, Graduate Opportunities Program Top Scholar

Aodhan Sweeney – ARCS, Provost's Excellence Scholar

Molly Wieringa – Hobbs Departmental Scholarship

Welcome to New Graduate Students for 2019-2020

Prior institution is given and UW faculty advisor:

Pedro Angulo-Umana, University of Minnesota, Twin Cities (Kim)

Travis Aeronson, Colorado College (Marchand)

Anna Black, Williams College (Hakim)

Mu-Ting Chien, National Taiwan University (Kim)

Jeyun Chun, ETH Zurich, Switzerland (Chen)

Kaitlyn Confer, Florida State University (Jaegle)

William Henshaw, Allegheny College (Fu)

Zhanxiang Hua, Purdue University (Anderson-Frey)

Ursula Jongebloed, Dartmouth College (Alexander)

Victoria McDonald, University of Victoria, British Columbia, Canada (McMurdie)

Patrick Murphy, University of Colorado, Boulder (Mass)

Alyssa Poletti, California Institute of Technology (Frierson)

Joseph Robinson, Virginia Commonwealth University (Jaegle)

Aodhan Sweeney, Florida State University (Fu)

Molly Wieringa, Harvard (Bitz)

Welcome back to **Ryan Eastman**, who rejoins the department after earning his M.S. degree here in 2009. (Wood)

Our Gratitude to our Donors

We thank all who have generously supported us throughout the year. Your gifts strengthen the core of the UW through recruitment and retention of world-class students and faculty. Your support of undergraduate and graduate students helps to create the next generation of scientific leaders.

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- Atmospheric Sciences Graduate Education Fund
- Hobbs Atmospheric Sciences Quality Enhancement Fund
- James Holton Endowed Graduate Support Fund
- Jan and Conway Leovy Endowed Graduate Support Fund
- Joost A. Businger Endowed Fellowship in Atmospheric Sciences
- Richard and Joan Reed Atmospheric Sciences Endowed Undergraduate Scholarship Fund

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Contact Us

Department of Atmospheric Sciences
University of Washington
Box 351640
Seattle, Washington 98195-1640

Phone 206-543-4250
Fax 206-543-0308
www.atmos.uw.edu

Atmospheric circulation is published annually for alumni, friends and members of the University of Washington Department of Atmospheric Sciences. This is the eighteenth issue.

Please send alumni news, comments, questions, corrections, and address updates to atoms@uw.edu or call 206-543-4250.

Giving Questions can also be referred to:
David Iyall, Senior Director for Advancement
College of the Environment
iyall@uw.edu / 206-221-0906

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Atmospheric Circulation

Atmospheric Sciences Department at the University of Washington