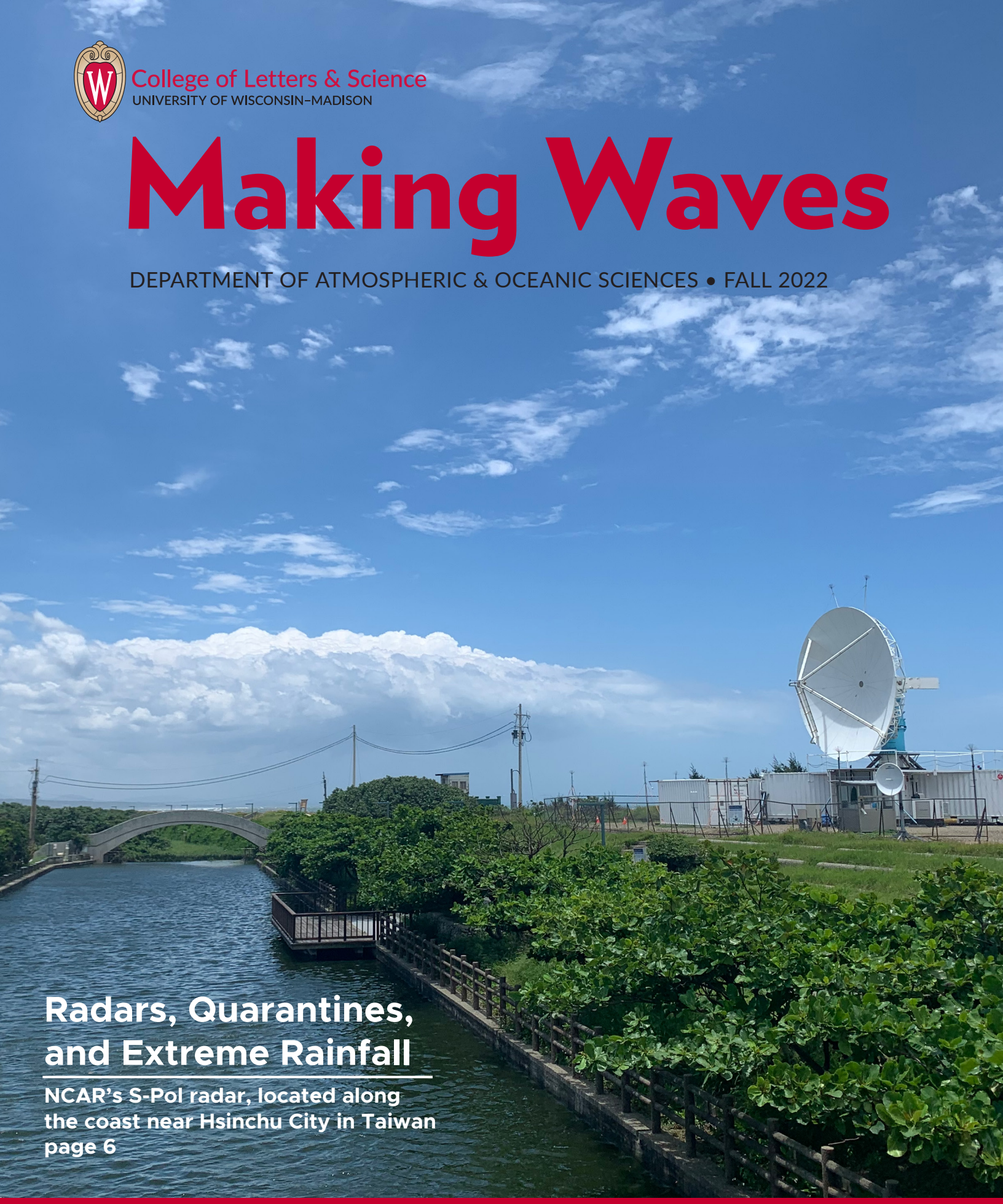
College of Letters & Science
UNIVERSITY OF WISCONSIN–MADISON

Making Waves

DEPARTMENT OF ATMOSPHERIC & OCEANIC SCIENCES • FALL 2022



Radars, Quarantines, and Extreme Rainfall

NCAR's S-Pol radar, located along the coast near Hsinchu City in Taiwan
page 6

A Letter from the Chair

Ankur Desai, Professor and Chair

Another fall semester is in full swing here in the AOSS building and it's great to see the building full of students, faculty, and staff. Usually, that buzz builds after the quiet of summer, but this summer was anything but!

Our building was filled with activity. A group of undergraduate researchers spent the summer engaged in research and professional development with our inaugural AOS summer research program conceived and led by our 1st year assistant professor Hannah Zanowski. Incoming director of the Center for Climatic Research (CCR), Dr. Mike Notaro, taught a new version of our introductory course AOS 100 to two dozen incoming freshman from the Summer Collegiate Experience program, which serves first-generation and underrepresented students looking to get a head start and discover potential majors. PhD student Alicia Hoffman led a new week-long "hidden curriculum" graduate student orientation, funded by the Inclusive Graduate Education Network (IGEN), to a large incoming cohort of graduate students (>20). Our 12 professional master's students were mostly off campus in internships, while our coordinator Kaitlyn Heinlein led a series of online summer professional development courses. Several K-12 summer programs also filled the classrooms. The AMS Collective Madison Meeting drew more than 700 folks to Madison in August, many of whom stopped by AOSS for a visit! Whew!

With the start of fall, we did mark a few transitions. In July, Prof. Greg Tripoli officially retired after 35 years on the faculty at AOS. Greg leaves an enormous legacy of foundational research and student training in our program. Earlier in the winter, long-serving academic staff member Dr. Ed Eloranta, developer of some of our field's most advanced ground-based LiDAR and remote sensing instrumentation, retired. We were also finally able to host our celebration for Prof. John Kutzbach's career and life.

This August, we were joined by our newest assistant professor (now up to 7!), Dr. Mayra Oyola-Merced, moving here from a scientist position at NASA Jet Propulsion Lab. Read more about her life and work in an article by her in this newsletter!

Our majors program continues to thrive, and it's been great to see the return of the Solstice party, rooftop party, t-shirt sales, and lots of camaraderie in the classroom, computer lab, and student lounge! And big news for our Ph.D. students, after a year of discussion and proposals, we have retired our old qualifying exams with a new "advancement process" and first-year advising committees that focus on evaluation through collection of multiple lines of evidence about progress. We also completed a new strategic 5-year plan, which outlines our vision moving into the future, which you can read here: www.aos.wisc.edu/resources/deptdocs

Some physical transformations are underway too in AOSS. Spaces have been updated and refreshed for students. The 3rd floor library is in process of redesign, and now with a new name: the AOSS library.

Our current exciting project is one we hope to unveil later this fall. Many of you are familiar and have spent time in the beloved "map room" on the 14th floor. But through the years, it has fallen into disuse and clutter. We are now renovating this space into the "UW Alumni Lounge", with gathering space for students, visitors, and alumni, with a coffee maker, mementos on the wall, and even a few maps. I'd love to show you around if you stop by!

Next year will be our department's 75th anniversary, our demisesquicentennial, coinciding with the University's 175th (a demisemiseptcentennial!). We are deep in planning stages for an event in fall 2023, and to which you will all be invited to attend. We will formally announce details at our reception at the AMS meeting in January! Please do reach out to the alumni engagement board if you would like to provide input or help with preparations!

Finally, I wouldn't be doing my job as chair if I didn't also tell you that none of these awesome events, room renovations, and student activities could happen if we didn't have your support. Alumni giving to our department funds also supports student scholarships, travel to conferences and the AMS student conference, participation of students in field projects and summer workshops, acquisition of instrumentation and supplies for classes, and visits by eminent scholars. The alumni lounge and the anniversary will both need substantial support. Any gift, $10, $100, $1,000, or $10,000 will help us reach out goals! Give at: www.aos.wisc.edu/alumni/giving

Please do reach out and tell us about your journey, your transitions, or exciting anniversaries! And come to AOSS and get a famous rooftop selfie with Pete!

-Dr. Ankur Desai

Design: Olivia Goins, AOS communications intern

On the Cover: NCAR's S-Pol radar, located along the coast near Hsinchu City in Taiwan, Angela Rowe

AOS Classroom Technology and Furniture Upgrades

Pete Pokrandt, Computer Systems Administrator (BS '88, MS '92)

I am sure that many of you remember the AOS classrooms on 8th floor. As an alum, I can recall taking Meteorology 321 in room 811 in the fall of 1986 where, in addition to using the chalk board, Prof. Houghton lectured with transparencies on an overhead projector. He would occasionally show 35 mm slides on the front screen using the slide projectors in the A/V booth in the back. Friday Weather Watch was conducted using a taped together "scroll" of paper DIFAX maps highlighted with colored pencil. These were fed through an opaque projector that gave off enough heat to seemingly cook a pizza! Down the hall is room 823, with its wide variety of chairs and hefty immovable tables that were getting old when I came through as an undergrad in the late 1980's. Many AOS 101 discussion sections have been taught in that room using those same tables in the years since.

The display technology in these rooms evolved over the years. Presenters originally used the legendary opaque projector, overhead transparency projectors, and ceiling mounted TVs which displayed the SSEC satellite looper. Next came the huge 3-gun color projector on a cart, followed by portable projectors and laptops that could be checked out and brought to a class or talk and used on a table at the front of the room. Most recently, we had been using a ceiling mounted projector and a side-wall mounted large screen TV connected to a computer at a repurposed office desk at the front of the room. Laptop users connected using a long video cable draped across the floor to the table up front.

Every year there is an Instructional Lab Modernization (ILM) funding exercise administered by L&S. This funding program is intended to provide comprehensive equipment upgrades in instructional laboratories, with remodeling allowed if necessary, to support the new equipment. During the past several years, the AOS department has taken advantage of this resource nearly every year, acquiring funds to replace computer hardware in the 14th floor computer classroom and build an instrumentation lab on the 9th floor that is outfitted with tools and workbenches so students can get hands-on experience with observational instruments.

Within the past few years, the department received ILM grant funding to upgrade the presentation technology and furniture in the 8th floor classrooms 811 (in 2019) and 823 (in 2020.) Room 811 was outfitted with new desk chairs, where the adjustable desks are large enough to hold a laptop and able to be positioned to accommodate left as well as right-handed people. A proper instructor podium was installed, with a document camera, power, and a variety of input connections right at the podium. A touch panel control allows for easy switching between the inputs. For improved sound, a gooseneck microphone at the podium, or a wireless lapel mic, can be mixed with the computer audio and run through new ceiling speakers so those in the back of the room can easily hear what is going on up front.

Room 823 was subsequently updated with a similar instructor podium, document camera, touch panel input selection, new projector screen, microphones and ceiling speakers. The large immovable tables and chairs were replaced with lighter weight tables and chairs. This gives more flexibility and ease for rearranging the furniture to accommodate different room layouts and varying teaching styles such as "flipped classrooms".

So the next time you come back to give a talk or just visit us for a future Alumni Open House or "Rooftop Selfie with Pete", you will find the seating and technology much more accommodating to both the speaker and the audience!

Welcome to our Newest Faculty Member

Mayra Oyola-Merced, Assistant Professor in AOS

I am Dr. Mayra Oyola-Merced, the new Assistant Professor at AOS.

I was born, raised, and educated in a small Island in the Caribbean (Puerto Rico), mostly known for its warm people, beautiful beaches and well, let's not sugar coat it, the world's finest rum! Sadly, that is not all Puerto Rico is known for. If you have been paying attention to the news, you probably remember some major headlines surrounding Puerto Rico's socio-economic struggles as a consequence of Hurricane María, and most recently, Fiona. As you can probably infer, I am no stranger to hurricanes and other forms of environmental disasters and that in part fueled my burning desire to become a scientist. Apparently, the love for science and exploration also runs in the family, as my grandfather used to be OBSSESED with weather. My mother, who was born a few years after ENIAC was used to run the first weather forecasts, used to hear constantly from my grandfather about how in the future, we will be using computers to forecast hurricanes instead of looking at the current year's avocado production (avocados are in Puerto Rico what Punxsutawney Phil is here in the US -- in Puerto Rico people used to think that numbers of avocados in a season were directly correlated with hurricane activity). The fact my grandfather knew that computers will eventually become the backbone of weather forecasting is very significant, given his humble background. Let me give you a picture of my grandfather's life– he was living in place undergoing political transition and turmoil, in a household with no TV nor electricity, where he had to provide for 11 children, two of which died due to lack of proper health services available in the Island. He never went to school, yet he managed to learn how to read and truly enjoyed it. My mom says his relatives and neighbors used to think he was a "little crazy" because he used to proclaim that one day humans will go to moon and other planets. Sadly, he didn't get to see his vision come to fruition when Neil Armstrong set foot on the moon, as he was hit by a car and died a few years before the Apollo Mission successfully accomplished this feat.

Like my grandfather, I am very inquisitive by nature and a lover of weather and space exploration. Unlike him, I am very privileged. Privileged to be the first person in my family to get a college degree and a PhD. Privileged to be able to travel the world doing what I love. Privileged to outlive my grandfather in age (I am now older than he was when he passed). I am privileged to see the rebirth of space exploration and privileged to have worked for the agency that is making it possible. And now, I am very privileged to be here, at one of the finest institutions on this planet and the birthplace of satellite meteorology, training the next generation of Atmospheric Scientists.

I join the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin-Madison, from one of the most amazing places on Earth (NASA Jet Propulsion Laboratory -the home of the Mars Rover!), where I specialized on satellite remote sensing for severe weather, climate monitoring and disaster risk reduction. I also served as the Deputy Director of the International GNSS Service (where GNSS stands for Global Navigation Satellite Systems), which is sponsored by the NASA Space Geodesy Program, where I managed a federation of over 250 international organizations advocating for GNSS satellite and ground-bases systems research and applications.

While I am passionate about researching severe weather, my one true love are aerosols (the "midichlorians" of the atmosphere!). I have worked on assessing and correcting the aerosol impact on operational sea surface temperature retrievals and on correcting the aerosol effect on hyperspectral infrared satellite

data assimilation for both NOAA (as a visiting scientist/PhD student) and the Naval Research Laboratory (as a Postdoc). I am also a strong believer that every Atmospheric Scientist should spend time in the field, and I have spent over 200 days at sea doing research (and looking forward to many more). Thus, my main interest is to improve space-borne observation capabilities and how these datasets are used in atmospheric modeling – particularly for severe weather and air quality applications. With that in mind, I have served and continue to serve in national and international board and committees national and international organizations to include AMS, AGU, EGU, the Associate Board of Directors of the Earth Women's Science Network and the International GNSS Service. Prior my start at UW-Madison, I was also member of the US delegation to the United Nations International Committee on GNSS. I must say that while I enjoyed my time at JPL and hiked, camped, ran and fished in every corner of California, I am grateful to be able to enjoy seasons and thunderstorms again, and I am looking forward to go ice-fishing and skating when the lakes freeze.

The primary driver in my life and my career is purpose, reason why I couldn't be happier to be in an institution whose core values are tied to the philosophy that "we will never be content until the beneficent influence of the university reaches every family in the state". Looking at our students and you, the alumni, I can confidently say the AOS influence goes far beyond Wisconsin to reach every family in the country. My goal as a Professor is to continue to support and train the next generation of professionals that will lead efforts to protect this nation's life and property. Of course, in order to do that, we need to step away from homogeneous thinking –we need to tap on a broader spectrum of people with different backgrounds, experiences and different ways to see the world (and the Universe!). I am looking forward to work with colleagues and students of all backgrounds, as well with you, alumni! Feel free to reach out to me via email or on social media if you have any questions, comments or suggestions.

-Dr. Mayra Oyola-Merced

Record Coldest Mornings Across Wisconsin

Ed Hopkins, Emeritus

How low the air temperature drops overnight depends upon several factors that include the weather and environmental conditions and the geographic setting. Overnight low temperatures in a Wisconsin winter can be extremely dependent upon these factors. Of the approximately 267 weather stations in the state that have provided weather observations beginning in the 1870s, 14 have reported overnight low temperatures falling to 50°F or lower. Nearly all these stations are found north of line running from Hudson along the St. Croix River eastward to Green Bay. Furthermore, essentially all these reports were from years prior to 1950, with at least two notable exceptions.

According to NOAA's National Centers for Environmental Information, the official lowest temperature that has ever been recorded anywhere in Wisconsin in the last 150 years of record-keeping is 55°F, set at a cooperative observer station 7 miles west of Couderay in Sawyer County on Friday, 2 February 1996 and tied again at that station two days later. This record had broken the previous all-time state record low of 54°F set on 24 January1922 at Danbury (Burnett County), nearly 50 miles to the west-northwest.

An exceptionally cold arctic air mass spread into the Upper Midwest from the Canadian Prairie Provinces at the start of February 1996. In addition to Wisconsin's all-time record low temperature, state record lows were also set in Minnesota (60°F) and Iowa (47°F) on the 2nd and 3rd, respectively. Within Wisconsin, 34 stations set all-time record low temperatures. On Friday, the morning when the new Wisconsin record was initially set, the center of the high pressure ridge associated with this arctic air mass was located over South Dakota. The maximum central pressure was slightly more than 1040 mb (30.7 in Hg). By Sunday, this high pressure ridge had drifted to the south-southeast to eastern Oklahoma. With high pressure, skies ranged from clear to scattered clouds and light near-surface winds, radiative cooling was enhanced. Furthermore, the Couderay station is situated in a low-lying marshy area subject to frequent cold-air drainage. On those record cold mornings, atmospheric conditions favored cold-air drainage. Snow depth was 25 inches during early February, with 6 inches having fallen as recently as 29 January. Consequently, this thick snow cover had a sufficiently fresh surface to allow for enhanced outgoing radiational cooling. Consequently, this thick snow cover had a sufficiently fresh surface to allow for enhanced outgoing radiational cooling.

Since these record temperatures are for point locations, one can wonder how these morning lows would rank in terms of the lowest statewide average minimum temperature over the last several decades. Spatially averaged minimum temperatures for the state were generated using a gridding technique for each of these days from approximately 125 stations. The statewide average minimum temperature was 33.2°F on Friday, 35.1°F on Saturday and 31.9°F on Sunday.

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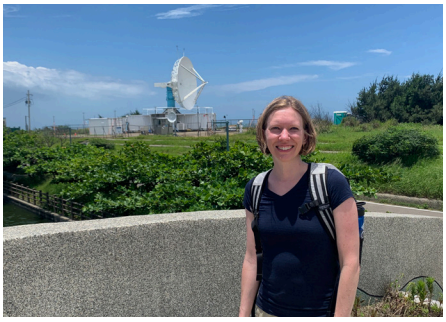
Radars, quarantines, and extreme rainfall: An overview of PRECIP 2022

Angela Rowe, Assistant Professor in AOS

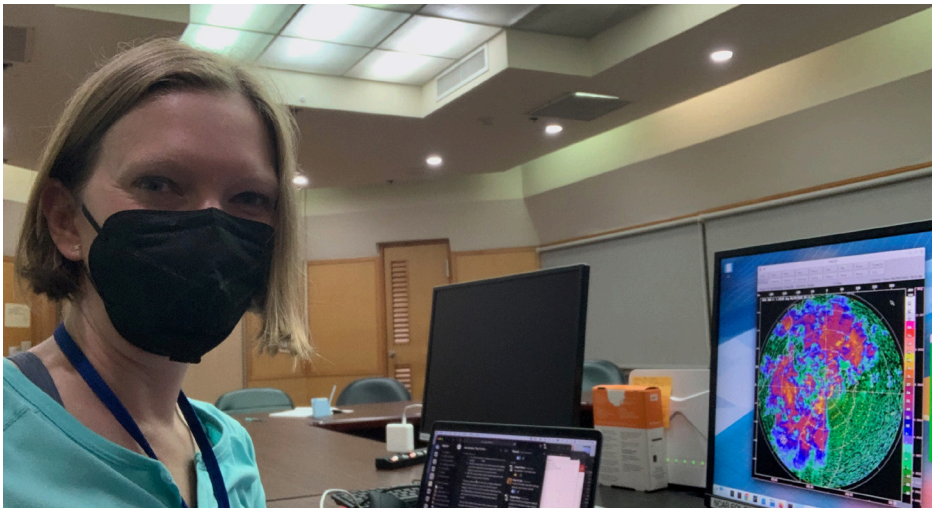


Extreme rainfall is global high-impact weather that remains a challenge to forecast, whether from land-falling hurricanes, seasonal monsoon rains, or stationary isolated storms in the summertime. Adding steep terrain to the equation can further exacerbate the impacts through devastating landslides and further complicates our understanding of the factors controlling intensity, duration, and location of extreme rainfall events. The NSF-funded Prediction of Rainfall Extremes Campaign in the Pacific (PRECIP) in Taiwan and Japan aims to improve our understanding of the multi-scale processes producing extreme rainfall through collecting measurements of a wide spectrum of rain events near complex terrain and in an oceanic environment.

The western North Pacific is a moisture-rich environment supporting frequent heavy rain events, including those produced from afternoon thunderstorms over the steep terrain of Taiwan, from the quasi-stationary Mei-Yu front migrating over Taiwan and adjacent oceanic regions during the spring, and from late summer tropical cyclones. The primary objective of PRECIP is to simplify the complexity of nonlinear combinations of available ingredients by identifying the key ingredients distinguishing heavy rainfall events that lead to strong vertical forcing and high rainfall intensity from those leading to long duration events with more sustained precipitation. The PRECIP research focus for our team at UW-Madison is the role of steep terrain in modifying the magnitude and availability of key ingredients for extreme rainfall, hypothesizing that the terrain enhances both the intensity and duration of rain. This interest is motivated in part by my participation in a 6-week field campaign in southwest Taiwan in 2008, using research weather radar data to investigate precipitation processes near the steep terrain for my 2011 Ph.D. dissertation.

PRECIP builds off that knowledge through an extension of observations over a longer period (25 May - 10 August) and with a continuous measurement strategy that not only captures the most intense events, but also the weaker ones as a necessary comparison. By focusing PRECIP observations in northern Taiwan and nearby Yonaguni Island (Japan) to the east, observations of these rainfall events and their ingredients encompass regions of steep topography and the adjacent ocean. NCAR's S-Pol dual-polarization radar served as the primary platform for continuous 3-D measurements of precipitating systems over northwest Taiwan, with Colorado State University's SEA-POL radar providing similar measurements on Yonaguni Island. To capture the environmental conditions, 6-h soundings were launched in both locations throughout the entire campaign, with UW-Madison AOS graduate student Ian Cornejo working to ensure the successful operation of a newly built hydrogen-based automatic sonde launcher from Taiwan's Central Weather Bureau. When the autolauncher worked reliably, he spent time at the S-Pol radar, monitoring radar operations. A network of Micropulse Differential Absorption Lidars deployed across northern Taiwan provided continuous high-resolution measurements of water vapor, which varied considerably throughout the campaign. Our NSF-funded instrument platforms were strategically placed within the context of Taiwan's extensivel radar, surface-station, and upper-air operational network.

Coordination and collaboration with our international partners in Taiwan and Japan was crucial for the success of this campaign, from developing the science focus in meetings going back to 2015 to navigating logistical complications from COVID-19 as the campaign was delayed for several years-



originally planned for May-August 2020, PRECIP was delayed twice. We made the most out of the delay with virtual dry runs to test communication and coordination with our international partners, an educational workshop to better prepare students and staff for the field operations and decision-making procedures, and through a semi-virtual campaign set along the Colorado Front Range testing radar scanning strategies and providing a comparison dataset for what we collected the following year in Taiwan and Japan. Both Ian Cornejo and I were part of the first shift of scientists for PRECIP, arriving in Taiwan mid May 2022 for a mandatory 7-day quarantine before the campaign began. I spent most of the campaign at the project operations center at the Central Weather Bureau in Taipei serving as PRECIP's first science director for > 3 weeks, coordinating with our team in other locations primarily via Slack. The Ops Center was quieter than most campaigns owing to the ongoing pandemic, although in-person interactions with local forecasters was a highlight of our co-location in Taipei. There were also a couple of days when I could visit my advisee Cornejo and other team members at the S-Pol radar site, which felt like a full circle moment.

PRECIP captured a wide range of precipitating systems, from backbuilding mesoscale systems along the coastline to afternoon thunderstorms over the mountains and oceanic systems associated with moisture transport from nearby tropical cyclones. We are collectively working on quality control of the datasets, expecting to present preliminary results early next year at upcoming meetings and workshops. This project was a success scientifically, and also in showcasing resilience and collaboration under exceptionally challenging circumstances. It was one of the best teams I've ever worked with in the field and we are excited about the ongoing international collaborations and new scientific insights resulting from PRECIP 2022.

UW-AOS Jupyterhub server simplifies remote teaching in a COVID world – and beyond!

Elizabeth Maroon, Assistant Professor in AOS
Pete Pokrandt, Computer Systems Administrator

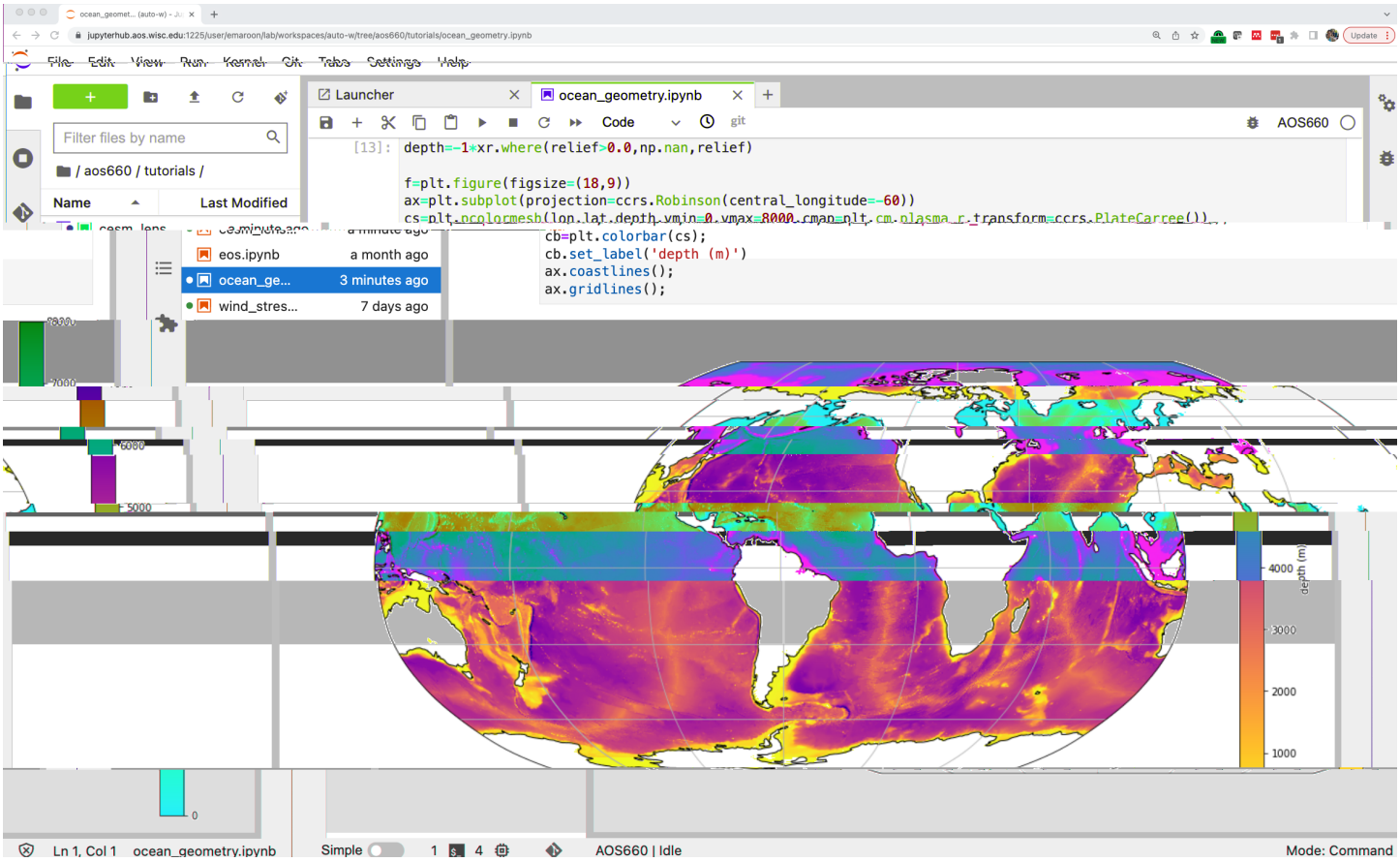
2020 was a challenging year for all of us. As part of the chaos, many UW-AOS professors and TAs were tasked with teaching normally in-person classes via remote online methods. A JupyterHub server that was acquired as part of an instructional lab modernization grant in 2018 became a vital tool for our instructors to be able to do so more easily.

Several UW-AOS classes have been using the Python programming language for examples and coding assignments. The language is fairly easy to learn, the code is quite readable, and Python is free! There are hundreds of modules written that already do much of what you might need to do, whether that's reading in data from a netCDF file or solving a complicated matrix algebra problem or calculating seawater density using the full 75-term thermodynamic equation of state. And unlike many of the other languages that we use, such as MATLAB, NCL, or IDL, it's useful for programming tasks far outside of the Earth Science realm.

Jupyter Notebooks allow you to write and execute Python and other languages in a web browser window and then save the code and output in a shareable file, called a notebook. Instructors can prepare assignments with instructions and code snippets in a notebook and send the file to the students via email or post them on Canvas. The students can then open the file in the Jupyter notebook environment, complete the assignment, save the notebook, and send it back to the instructor for grading.

For this to work, however, the students needed to install a Python environment that has the correct modules, and sometimes the correct versions of modules on their computer, and often the first class period or two was spent working through the bugs until all of the students had a functional Jupyter Notebook environment in which to run the notebooks.

Enter JupyterHub - a server that allows one to remotely log in and run notebooks in a Python environment that is already set up and tested. Instructors are able to develop



2022 Award Recipients

Faculty Awards

Ankur Desai: 2022 AGU Joanne Simpson Medal for Mid-Career Scientists

Tracey Holloway: National Academy of Medicine

Alumni Awards

Jordan Gerth: NOAA Bronze Medal

Shane Mayor: Outstanding Research Mentor Award Chico State University, California

Alan Robock: 2022 Future of Life Award

Tim Schmit: NOAA Bronze Medal

Kevin Schrab: NOAA Bronze Medal

Chris Sisko: NOAA Administrator's Award

Louis Uccellin: NWS Professional Achievement Award

Walter Wolf: NOAA Bronze Medal

Staff Awards

Pete Pokrandt: Academic Staff Mid-Career Achievement Award

Dee Van Ruyven: L&S University Staff Excellence Award

Student Awards

Jerrold Acdan: Lettau Award – Excellent MS Thesis

James Anheuser: AMS Outstanding Student Presentation Award Oral in Transition of Research to Operations

Stephanie Ortland: Lettau Award – Excellent MS Thesis

Aaron Gosch: Ettenheim Scholarship

Evan Meeker: Schwerdtfeger Award

Bailey Murphy: Student Services Award

Kaylan Patel: Sunkel Award

Juliet Pilewskie: Wahl Award – Outstanding TA

Megan Schaaf: Lettau Wahl Scholarship

Connor Steinke: Horn Scholarship

Charles White: AMS Outstanding Student Presentation Award Oral in Operational Environmental Satellite Systems

and test assignments and have the students run them, all in the same environment. The students don't have to install anything, they just open a web browser on their own computer and open the JupyterHub web page to use the preset environment and run code.

The server was installed and configured in early 2019, but saw limited use the first year or so. That changed during the spring and summer of 2020 – when instructors were brainstorming on how best to teach in a virtual setting, and how to get the most out of their limited time with the students. For example in Spring 2020, Jupyter Notebook tutorials were used in AOS 660 (Introduction to Physical Oceanography) to complement lecture material and homework exercises. The last tutorial prepared the students for the class project: to analyze ocean model output from the Community Earth System Model version 1 Large Ensemble (CESM1-LE), a cutting-edge climate model ensemble with forty realizations of the historical and projected future climate (Kay et al. 2015). Logging on to the JupyterHub from their own homes, students did exploratory analysis on a subset of the CESM1-LE to address questions such as "How does Arctic salinity change in response to global warming?" and "What happens to the Atlantic meridional overturning circulation in response to anthropogenic emissions?" and "How much ocean acidification does the CESM1-LE project by 2100?". This project gave students a taste of big climate data and introduced them to ocean-flavored climate change research topics in a hands-on manner. It also trained students on the Pangeo ecosystem of python packages, which is fast becoming the preferred set of python tools for big data geoscientific analysis (https://pangeo.io/).

During Fall 2020, we really pushed the JupyterHub server. The remotely taught AOS 575 (Climatological Data Analysis) saw record enrollment: 40% higher than any other offering since 2006! AOS 575 is a hands-on data analysis course that introduces statistical methods from linear regression to principal component analysis to power spectrums, and needs a platform for students to try these methods for themselves. The JupyterHub was, again, ideal for this purpose and even withstood 24 users simultaneously training a neural network on example weather data.

Since returning to in-person classes starting in the Fall of 2021, the JupyterHub server has remained a popular resource in AOS being used this semester in AOS 330, 573, 575, 630, 660, and 745. There are enormous benefits to not having to waste time at the beginning of class getting everyone set up, and having everyone including the instructor running in the exact same environment. The server was also an integral part of the inaugural 2022 Summer Research Program, providing visiting undergraduate students a solid platform on which to conduct research given their short 8 weeks working in the department. Going forward, the JupyterHub will continue to be a part of many of our courses, fostering a more flexible classroom.

Record Coldest Mornings Across Wisconsin cont.

While the sting of record cold mornings during the first four days of February 1996 was impressive, another arctic outbreak that had spread across the state on 30 January 1951 resulted in a lower statewide average minimum temperature of 36.1°F, based upon 120 station reports. The fascinating feature about this earlier event was that the lowest temperature was set in southwestern Wisconsin. The station at the Tri-County Airport in southwestern Sauk County outside Lone Rock reported a record low temperature of 53°F. This reading was also the lowest temperature reading of any of the 120 stations that reported across the state on that day and was only 1 Fahrenheit degree above the 54°F Danbury state record at that time; 61 of these 120 reporting stations in Wisconsin established all-time temperature records. Since the eastern news media reported this temperature as the lowest of any weather station around the contiguous United States on that day, the notoriety led to a large roadside billboard along U.S.H. 14 that proclaims: "We are the . . . coldest in the nation . . . . with the warmest heart."

One of the reasons for Lone Rock's 53°F record was the influence of an arctic air mass accompanying a sprawling high pressure ridge that traveled eastward from South Dakota, to become centered over northeastern Iowa on the morning of 30 January, with a central pressure of 1044 mb (30.8 in Hg). By the following morning, this high pressure system had reached the lower St. Lawrence Valley in Quebec. Since the arctic high traveled rapidly across southern Wisconsin, relatively cloud-free skies and light winds enhanced the nocturnal radiative cooling, across this portion of the state.

Other contributing factors are environmental, as Lone Rock is situated on the north side of the lower Wisconsin River Valley and frequently is on the receiving end of cold air draining downward from nearby higher terrain. While sandy soil of the floodplain surrounding Lone Rock has thermal properties causing the immediate surface to respond rapidly to variations in air temperature with relatively poor heat penetration, the area had a relatively deep snow cover. More than six inches of snow had fallen at Lone Rock over a three-day span from the 26th to the 28th, leaving a 19-inch snow cover on the ground on the 30th, resulting in vigorous radiative cooling under relatively cloud-free skies.

On the same day that Lone Rock made notoriety, Madison established its all-time record low of 37°F at the U.S. Weather Bureau Office located at the Madison Municipal Airport's Terminal (also known as Truax Field) on North Stoughton Road. This temperature of 37°F, which remains the lowest of any temperature officially recorded at Madison since records began in 1869, was due in part to the airport location. Located roughly five miles to the northeast of downtown Madison, the airport was located near relatively undeveloped marshy land that often would experience cold air drainage from higher terrain surrounding the airport. On that same morning, the minimum temperature observed at the U.S. Weather Bureau's City Office located in North Hall on the UW-Madison campus was 26°F. The maximum-minimum recording thermometers were located on the roof of the heated North Hall, 70 feet above ground level or 123 feet higher than those at the airport office. The lowest temperature prior to the relocation of the weather office to the airport was 29°F set at nearby Washburn Observatory in January 1888, where thermometers were at elevation 45 feet lower than those at North Hall.

Relatively fresh snow also contributed to Madison's 37°F record. On that morning, 16 inches of snow were on the ground, courtesy of snowfalls totaling 7.2 inches several days before.

Professional Master's Update

Kaitlyn Heinlein, Program Manager

It has been an exciting experience lifting the Professional Master's program off the ground these past couple years. Not only has the department been very supportive, but so has our amazing alumni. Last year, we had alumni reach out with internship and job opportunities, which provided some wonderful prospects for our students. Curious to see where everyone landed? Feel free to check out our new Professional M.S. Alumni page (aos.wisc.edu/profms-profiles) to learn more about their experiences.

This year, our cohort's career interests are quite diverse. Students are looking for opportunities in operational forecasting (especially aviation weather), catastrophe modeling, air quality consulting, geographic information systems (GIS), and even climate-focused business start-up. If you know of any summer 2023 internships and/or jobs related to these fields, please reach out to us through profms@aos.wisc.edu

The AOS graduate program (both research and professional) will be recruiting at AGU and AMS this winter. If you are planning to attend either of these events, come find us – we would love to connect with you! Speaking of recruitment, please continue to spread the word about our program. Applications for Fall 2023 enrollment is open. The deadline for the research program is January 1, and the professional program is February 1. Looking forward to another great year!

American Meteorological Society Student Chapter

Bella Onsi, AMS Vice President

It's been a great year for the student chapter of the American Meteorological Society! We started off the year by sending 8 students to the AMS Student conference in Houstin, Texas in January. We got to hear a variety of professionals talk about different careers within the field of meteorology and learn about current research being down. One of our students even presented his research during the student poster session. If you go to the 2023 AMS student conference website, the main picture they use is of three UW-Madison students! We've already started organizing to fund students from our chapter to attend the next AMS Student Conference in Denver, Colorado this January. Then in February, our AMS Chapter brought back the department wide Solstice party which we spent months planning. Faculty, graduate, and undergraduate students all got together for a nice dinner, fun games, and even had a live band play which included two professors from the department! This event took a lot of hard work and months of planning by our AMS officers, but the end result was well worth it. It was great to see the department celebrate being back together in this way for the first time since the beginning of the pandemic.

The undergraduate student lounge in the AOSS building has also gotten some upgrades. We added more tables and chairs and two large whiteboards which has been a great place for students to study together and collaborate. One wall has a variety of corkboards that students love to fill with weather and class related jokes. The lounge is always bustling with students and has become a great place to hang out with our fellow AMS students.

Our chapter would love to interact more with alumni who have been in our shoes. If you would like to connect with our chapter and possibly speak (in person or over Zoom) with our undergraduates about your career or what you've done with your AOS degree, we'd love to hear from you! Please reach out to Bella Onsi, one of the AMS officers, at onsi@wisc.edu if you'd like to be involved or learn more about what the AMS student chapter is up to throughout the year.

Graduate Student Association (GSA)

Stephanie Ortland, GSA Facilitator

The Graduate Student Association of the University of Wisconsin-Madison Department of Atmospheric Science (GSA) is a student-led group representing and acting on behalf of the graduate students to facilitate dialogue between faculty, staff, the university, other organizations, and the graduate students in the Atmospheric and Oceanic Sciences (AOS) Department. GSA contributes to developing a sense of community among graduate students by hosting monthly meetings and frequent events including seminars, outreach, and social activities. At the start of this Fall 2022 semester, GSA has welcomed new Professional Masters, Research Masters, and Ph.D. students to GSA and the AOS Department. As a part of this, GSA organized an outing to Devil's Lake State Park for graduate students and the AOS Welcome Picnic. Check out the newly updated GSA website at www.aos.wisc.edu/~gsa/ for more information.

Department of Atmospheric and Oceanic Sciences
UNIVERSITY OF WISCONSIN–MADISON

Making Waves

JEFF MILLER

Atmospheric and Oceanic Sciences
1225 W Dayton Street
Room 849
Madison, WI 53706

Annual AMS Alumni Reception

Join us to hear what's going on in the department, meet up with old friends and meet new friends as we share memories and catch up on the news in each other's lives. We hope to see you there!

Save the Date
1/10/2023
7-9pm

Hyatt Regency Denver Convention Center
Centenial Ballroom D
Denver, CO