College of Letters & Science

UNIVERSITY OF WISCONSIN-MADISON

MAKING WAVES

News for Alumni and Friends of the Deparment of Atmospheric and Oceanic Sciences Fall 2017

So much data. So little time.

Ecometeorology research group swimming in data.

Page 4

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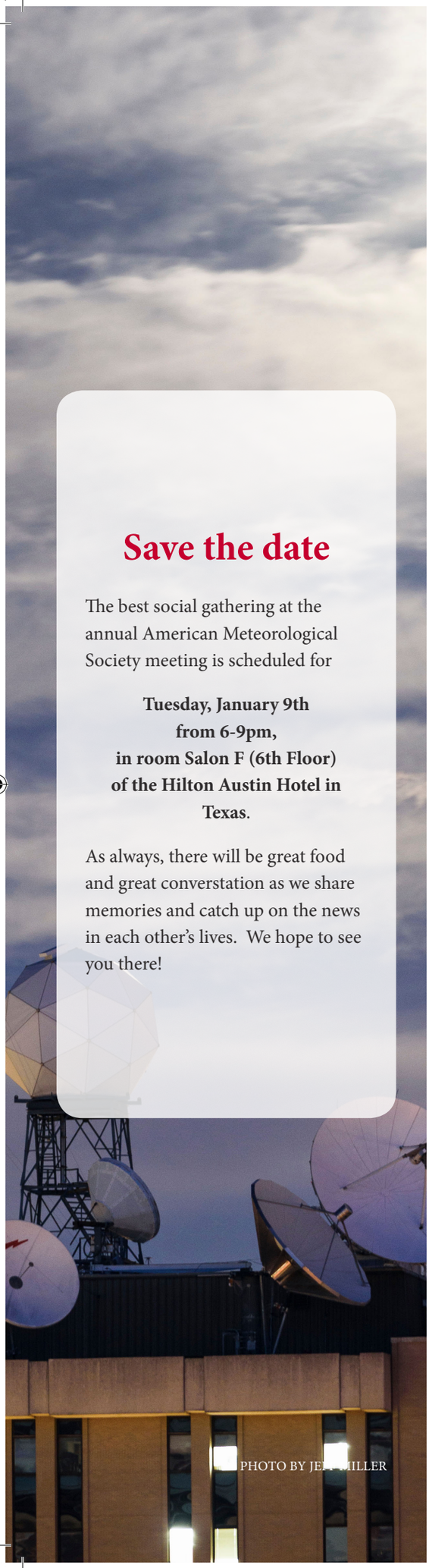

PHOTO BY JEFF MILLER

Save the date

The best social gathering at the annual American Meteorological Society meeting is scheduled for

Tuesday, January 9th from 6-9pm, in room Salon F (6th Floor) of the Hilton Austin Hotel in Texas.

As always, there will be great food and great converstation as we share memories and catch up on the news in each other's lives. We hope to see you there!

CHAIR'S LETTER

What a difference a year makes! The AOS Department is embarking on a path to renewal and growth with an attitude of rational exuberance over the future of our Department and the University of Wisconsin's College of Letters and Science. All this has emerged over the past year because of several important developments: First, we have received approval by L&S to recruit at least 2 and possibly 3 new tenure track faculty members this year as a result of room made in our budget due to retirements and outside opportunities that lead to faculty departures. Second, the Regents has given the UW permission to expand significantly over the next 5-6 years, by bringing in additional out-of state students. This will result in a 20% growth of the student body requiring the expansion of the University infrastructure and faculty. As a consequence, it is foreseen that new hiring opportunities will be forthcoming, particularly where shortages in staff can be demonstrated to exist. Third, AOS began offering a Natural Weather Hazards Freshman Interest Group (FIG) this Fall semester, which filled to its capacity of 20 students, all of which are potential undergraduate AOS majors. This FIG offering was one of several planned as we are planting the seeds for significant growth in our undergraduate program, coinciding with the University's overall growth plans. A fourth positive development is the appointment of a Visiting Assistant Professor, Dr. Ryan Sobash and an STS (Short Term Staff) instructor, Dr. Tim Wagner, who together are stepping in to cover the teaching of the Physical AOS core and the FIG. These hires were made possible under the new L&S rules of Department managed cost accounting and flexibility within our budget.

Beyond these developments, we have received support and encouragement from L&S to expand our faculty through cluster hires, many of which we are actively pursuing. At the same time, SSEC is planning to search for a new director who may have a tenure home in AOS, further expanding our numbers. Today, our tenured faculty number 12, but the new hires will bring our numbers up to 14-17 in the next 3 years and perhaps to the levels we once had over the next 5 years. Moreover we hope to expand the number of undergraduates that call our Department home. We also expect the number of our graduate students to rise significantly as we bring new world-class research projects into the university with our new hires.

In the next few years, we will rebuild our program for the 21st century, preserving who we are by maintaining a strong emphasis on quality of education while mentoring tomorrow's scientific leaders in Atmospheric and Oceanic Science.

On, Wisconsin!

Gregory Tripoli, Professor and Chair

Design: Sarah Morton, College of Letters & Science
ON THE COVER Limnology Research Bouy. Jeff Miller.

AOS/SSEC team test flies a new ultralight research airplane *by Grant Petty*

As we know, understanding and forecasting of weather and climate begin with measurements, and many of the important processes affecting weather and climate occur at significant distances above the Earth's surface. The traditionally high cost and logistical complexity of research flights by instrumented aircraft are beginning to be mitigated by the advent of less expensive unmanned aerial vehicles (UAVs), also commonly known as drones.

Yet UAVs have their own limitations: they are normally required to remain below 400 ft. altitude and within visual range of the ground-based pilot. And all but the largest and most expensive UAVs have extremely limited payload capacity – a few pounds at most – so that only a few small instruments can be carried aloft, and usually only for less than an hour at a time.

Last year, Professor Grant Petty, in partnership with Profs. Ankur Desai and Tristan L'Ecuyer and the Space Sciences and Engineering Center, embarked on an ambitious plan to acquire a manned ultralight aircraft that could bridge the gap between UAVs and conventional manned aircraft. It would carry a greater payload than UAVs and not be subject to altitude or line-of-sight restrictions. Yet it could be acquired, maintained, and operated at far lower cost than a conventional airplane, as well as being able to operate safely at extremely low altitudes, due to its light weight and very low speed.

The costs of launching this project were covered with flexible research funds available to Professors Desai and Petty through the Ned P. Smith Professorships awarded to them in 2015, with additional support from Prof. L'Ecuyer and SSEC.

In late June, the unassembled kit for a Zigolo ultralight arrived, and over the next three months, Prof. Petty's team, consisting of Chip Erwin from Aeromarine LSA, SSEC researcher Jonathan Thom, and AOS graduate student Craig Oswald, worked many long days building the airplane at the Physical Sciences Lab in Stoughton.

The culmination of the building phase came on a beautiful fall afternoon on

Continued on page 7

Professor Grant Petty pilots the newly built AOS/SSEC ultralight research aircraft on its first flight beyond the boundaries of the airport. Photo by Jonathan Thom.

Alumni Engagement Board

The Alumni Engagement Board of Atmospheric and Oceanic Sciences was established earlier this year through the support and efforts of AOS faculty, in particular Dr. Ankur Desai, and recent department alums. The mission of the board is to serve as a network for current students, our widespread and successful graduate and undergraduate alumni, and friends of the department, as well as facilitate educational web-based seminars that build undergraduate interest in the field, foster career development, and offer a resource for position openings and opportunities. Lastly, the Board will work to strengthen fundraising efforts across the department's extensive alumni network to support department initiatives and provide financial support for current and prospective students.

The inaugural board is led by six motivated former students who are dedicated to advancing the above objectives. Earlier this year, in close collaboration with Ethan Nelson and Pete Pokrandt, the Board spearheaded a redesign of the AOS department website which launched in June 2017. We encourage you to check out the revamped Alumni section and register (https://aos.wisc.edu/alumni/database/) with the AOS alumni database. This allows you to connect with fellow AOS Badgers as well as volunteer as a resource for current students to explore career opportunities that are possible with a UW AOS degree. Finally, you are invited to learn more about the Board and meet fellow alums at a kickoff event that will precede the alumni reception at the 2018 AMS Annual Meeting in Austin, Texas! From 4-6pm in room 614 of the Hilton Austin Hotel. Additional details will be announced on the website in the coming weeks.

- Co-Chairs: Dan Hartung (BS '07; MS '09) and Dr. Matt Sitkowski (PhD '12)

- Members: Dr. Tim Wagner (MS '06; PhD '11), Alex Kubicek (MS '13), Brian Miretzky (BS '06; MS '09), Tom Skilling

HAYLEY HUERD, PHOTO BY DAVID REED AND ANKUR DESAI

So Much Data, So Little Time *by Ankur Desai and David Reed*

Continuously running meteorological and aquatic sensors produce data, as much as 20 times every second. Sensors running continuously for over five years produce a lot of data. In the case of sensors observing carbon and energy fluxes over Lake Mendota, the most well studied lake in the world, a plethora of data is a good problem to have in the Ecometeorology research group (http://flux.aos.wisc.edu) run by Ankur Desai, AOS Professor, Associate Chair, and current holder of the Ned P Smith Professorship of Climatology. But when David Reed was awarded a postdoc fellowship from the National Science Foundation Atmospheric and Geospace Sciences division to add a second set of sensors to Lake Mendota, the group was swimming in data. Enter a team of summer students who spent 2017 carving out different aspects of the data to call their own.

Zachary Taebel is a current AOS senior, working on running lake physics models to compare with the five years of latent and sensible heat flux observations. This work is particularly interesting as these models are imbedded in weather and climate models, but have historically never been tested against this much observational data before. Zachary will be presenting his work at the AMS annual meeting this winter.

Angela Baldocchi is a student in the Gaylord Nelson Institute of Environmental Studies and the Department of Geography and she is continuing to work into the fall on joining our research group's data with a dataset collected by collaborators from the Center from Limnology. The Ecometeorology data is temporally expansive, but only monitors a small portion of Lake Mendota, while folks in Limnology measure spatially carbon dioxide concentrations from a speedboat once a week. She is currently matching the seasonal trends between the two atmospheric observations and the in-water observations. Interdisciplinary work takes extra time and effort, as Angela learned this summer, and she will present her results at the AGU annual meeting this winter.

Robyn Roberts is a Biology major who had the seemingly easy but quite tricky project of examining what was driving the carbon dioxide fluxes from the lake-atmosphere system. She developed a multiple linear regression model between carbon fluxes, solar radiation and air temperature, while quantifying the week-to-week variability in lake carbon fluxes. This project was a great fit for Robyn, combining her interests in small-scale biology and large-scale environmental issues.

Hayley Huerd was the only non-Madison undergraduate joining us from University of California-Merced

Environmental Engineering program for the summer. She joined the group as a part of a much larger international lake-atmosphere flux project and she was in charge of taking a boat out to the center of Mendota to collect data every four hours for a 24-hour period from a chamber she built and calibrated. During her time in Madison, she also collected chamber flux near the shoreline and was able to compare them all to the flux data from the entire lake, all while adopting to summer thunderstorms that were a very new experience for her.

Elizabeth Cartwright, a high school junior in Verona Area High School worked on a comparison of the lakeshore and the AOS building rooftop carbon dioxide data, calibrating the two data streams and then creating an algorithm to screen out the signal from the power plant next-door to AOS. At the end of the day, everyone in the lab is excited to see what is in store for this hard working and promising researcher!

Coordinating all of this student research took time, but David enjoys working with and mentoring undergraduates. While the fellowship has ended, David continues to collaborate with the Desai research group, now from his new position at Michigan State University.

DAVID REED, PHOTO BY ANKUR DESAI

Faculty Q&A Spot Light

Dan Vimont is a Professor in the Department of Atmospheric and Oceanic Sciences, the Director in the Nelson Institute Center for Climatic Research and also the Co-Director of the Wisconsin Initiative on Climate Change Impacts.

What current research projects are you involved in?
One of the fun things about this department is that there is an amazing diversity of different research projects going on, and some great folks with whom to collaborate. My primary research still focuses on coupled ocean / atmosphere interactions, especially those related to ENSO and the "Meridional Modes". I approach that work using observational analyses, model simulations, and development of theory. But I have also expanded my research to address questions about how climate change will affect Wisconsin, and the Midwest region as a whole. The latter has been very fun for me because it requires working with other researchers and stakeholders with very different research interests. That work is incredibly rewarding, and embodies the Wisconsin Idea.

How are different departments and centers at the UW collaborating on climate change research and policies?
There is a tremendous amount of climate change research underway here in AOS, at the Center for Climatic Research, and now around the whole UW campus. In 2007 we started a group called the Wisconsin Initiative on Climate Change Impacts (WICCI) to better understand the impacts of climate change in Wisconsin, and to develop information to help people adapt to expected changes. That effort took off, with partners in a wide range of fields and sectors of our economy, and across the state. A lot of WICCI's early success stemmed from research done here in AOS and at CCR, on understanding and describing local climatic changes here in Wisconsin. That work has catalyzed adaptation efforts in Wisconsin, and put UW on the map nationally as a leader in climate adaptation.

What is the future of climate change research locally and nationally?
There are a lot of really exciting directions in climate research that we're just starting to explore. I'm especially excited about the next generation of convection-permitting climate models that promise new advances in climate simulation, the explosion of satellite data that promises new ways of diagnosing climate processes (I'm continually checking out the high-resolution GOES-16 loops on our web page, and you should too!), new platforms for data analytics that enable analyses of regional and global climate processes, and new theoretical advancements that challenge us to view the climate system in new ways. We at AOS are embedded in all of this exciting research in various ways. I find that however discouraged I get about the politicization of science, it only takes a moment or two of talking with my colleagues to get excited about how we're moving forward to better understand the climate system, and ultimately carry out the mission of this Great State University of Wisconsin (queue up "Varsity" here…).

2017 Unidata Regional Workshop at UW-Madison *by Pete Pokrandt*

PHOTO BY MICHAEL JAMES/ UNIDATA

Unidata (www.unidata.ucar.edu) has been providing geoscience data, software tools and support to enhance Earth-system education and research for over 30 years. As part of this effort, Unidata hosts annual workshops at the Unidata Program Center in Boulder, CO where they train people to use Unidata developed and supported software. Recently, Unidata has also sponsored regional workshops, hosted by particular institutions in the Unidata community to provide easy access to software training for those who may not be able to travel to Boulder for training. In June, 2017, UW-Madison hosted a Unidata regional workshop focusing on Python tools and AWIPS.

The two-day Python session, with Unidata software engineers Ryan May and John Leeman, focused on the Unidata python modules 'metpy' and 'siphon'. Metpy has tools for reading, visualizing, and performing calculations with weather data, while Siphon contains utilities for retrieving atmospheric and oceanic data from remote sources. When Siphon is used to access data from a THREDDS server, the data can be time or spatially subsetted on the server end, allowing users to easily work with large data sets without the burden of having to download and store them locally.

AWIPS is the data visualization package currently in use at the NWS Centers and Forecast Offices. As they have previously done with GEMPAK, McIDAS and other utilities, Unidata is making this package available to the community, with modifications to make it more appropriate for an educational or research environment. Unidata software engineer Michael James led this one day session, focusing on the different data views available, and how to plot and overlay various types of data in AWIPS. In addition to UW-Madison students and staff, this regional workshop was attended by students and staff from UW-Milwaukee, the University of Minnesota, Iowa State University, and the University at Albany/SUNY.

Ed Hopkin's Historical Corner

The Origin of the Frozen Tundra

This New Year's Eve Day marks the 50th anniversary of the coldest game in National Football League (NFL) history as the Green Bay Packers hosted the Dallas Cowboys in the 1967 NFL Championship Game at Lambeau Field. The temperature at game time (1 PM) was 13 degrees below zero and the wind chill (according to the new method) was 36 degrees below zero as winds were 14 mph from the northwest. These conditions led some of the media to name the game the "Ice Bowl" and Lambeau Field as the "Frozen Tundra."

In the predawn hours of Sunday 31 December 1967, a cold front traveled southeastward across the Upper Midwest, ushering an arctic air mass into Wisconsin that replaced a relatively mild air mass. The high temperature at Green Bay on the previous day was 20 degrees. This arctic air mass accompanied a sprawling high pressure system that traveled rapidly to the southeast from the Canadian Prairie Provinces into the eastern Dakotas by Sunday. By Sunday morning, the temperature at Green Bay had dropped to 16 degrees below zero.

The subzero temperatures resulted in frostbite for many of the players and fans in attendance. An electric heating system that had been installed to keep the field's sod thawed was ineffective, as it created an icy surface that became treacherous to the players. However, most of the capacity crowd of 50,861 fans remained in the subzero weather to watch Packers quarterback Bart Starr sneak across the goal line closing seconds of the game as the Packers won the game 21-17.

Research Plane con't

October 8 at the Verona Air Park, when Prof. Petty flew the aircraft for the first time beyond the boundaries of the field and up to an altitude of 270 ft, averaging a mere 35 mph airspeed in level flight!

The next phase will entail acquiring and installing suitable instrumentation and avionics and conducting demonstration science flights in support of some research proposals already being developed. In particular, the team is talking to the engineers at Campbell Scientific regarding the possible adaptation of their IRGASON (infrared gas-analyzer + sonic anemometer) instrument to the ultralight airframe so as to be able to measure near-surface turbulent fluxes of momentum, sensible and latent heat, and carbon dioxide over wetlands, forests, lakes, and other inaccessible surface environments.

Professor Petty looks forward to hearing from students, faculty, and others who might be interested in research applications of this unique platform. His eventual goal is to help meet the airborne research needs of a broad range of users in the atmospheric and environmental sciences, from air sampling and turbulent flux measurements to remote sensing and imaging applications.

If you would like to know more about this project or to view photos and video of its first flights, visit Prof. Petty's blog at http://sleet.aos.wisc.edu/~gpetty/wp/

Dr. Donald R. Johnson Memorium *by Bart Adrian*

Professor Emeritus Donald R. Johnson died on April 13, 2017, at the age of 87. He was born and raised in central Kansas, served in the Air Force from 1952 until 1959, and began his association with the University of Wisconsin in 1959 as a meteorology graduate student. While completing his Ph.D. under Dr. Lyle Horn, in 1964 he was appointed professor in the Department of Meteorology. From 1977 until 1999 he also served as associate director of the Space Science and Engineering Center (SSEC).

Professor Johnson was a world-renowned researcher and a prolific writer. He was deeply involved in the world community of atmospheric scientists, in the community of the University of Wisconsin at large, in the community of his colleagues in AOS and SSEC, and with the community of his students. During his career, he directly mentored and guided 57 graduate students to Ph.D. and M.S. degrees.

It would be difficult to overstate what a profound personal impact Professor Johnson had on his graduate students, several of whom have gone on to leadership roles in the world community of educators and scientists, and in the U.S. National Weather Service and the Australian Bureau of Meteorology. He was a model of what it meant to be a great scientist and leader. But more than that, he was a model of kindness and what it meant to live fully and graciously. He read avidly, and conversations with him quickly revealed his broad knowledge of history and other subjects. The priority importance of his commitment to his family was always apparent. Many of us have fond recollections of gatherings at his family's farm just outside of Madison, where we had a window into the full life he led apart from his roles at the University. We are thankful for all he taught us about science and about life.The footprints he leaves behind are indelible.

YOU MAKE THE DIFFERENCE

To mail a donation to the Department of Atmomspheric and Oceanic Sciences, please make checks payable to the

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THANK YOU!

Department of Atmospheric and Oceanic Sciences
UNIVERSITY OF WISCONSIN–MADISON

Making Waves

PHOTO BY BRYCE RICHTER

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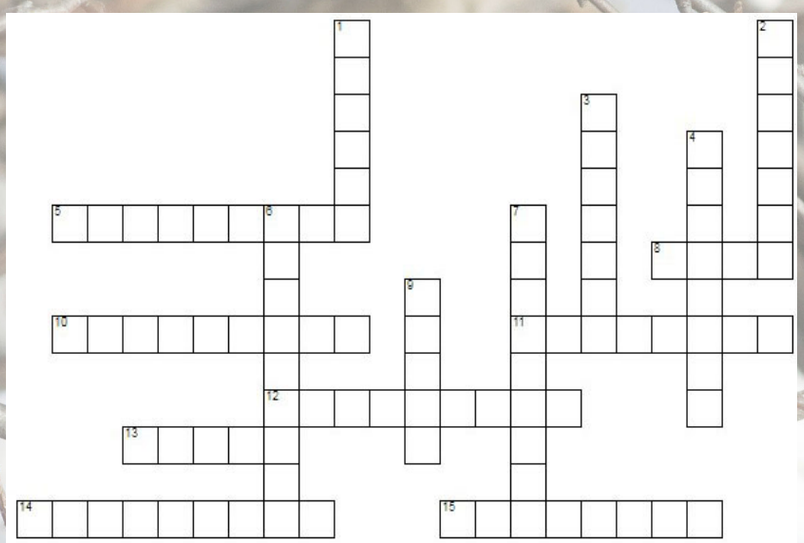

ACROSS

5. Energy transport through electomagnetic waves.
8. Reduces visability.
10. The region near the outer edge of the earth's outer atmosphere.
11. First professor on UW Campus to take meteorological observations in 1853.
12. Formed by chemical reactions.
13. Co-Founder of Department (1948) and "Father of Satellite Meteorology".
14. Current head of the National Weather Servie and UW Alum.
15. Describing the amount of water vapor contained in the air.

DOWN

1. Co-Founder of Department (1948) and firest director of the Institute for Environmental Studies (1970).
2. Prevailing weather conditions of a region, throughout the year, averaged over a series of years.
3. An atmospheric closed circulation rotating counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.
4. Forces that produce vertical motion in the atmosphere.
6. Warm air cover cold air.
7. Relatively strong winds concentrated narrowly in the atmosphere, normally referring to horizontal, high-altitude winds.
9. NOx & VOCs form this in sunlight.