UNIVERSITY of WYOMING

LARAMIE HIGH TIDINGS

Annual newsletter of the Department of Atmospheric Science, University of Wyoming

IN THIS ISSUE

One of the DOW radars was 'snowed-under' at its mountaintop location.

THE SNOWIE PROJECT

As some of you may recall, UW-DAS has its roots in weather modification. Well, we are back at it, although under different circumstances, and with different expectations. In an effort coordinated by UW-DAS Prof. Jeff French, scientists from NCAR, the University of Colorado, the University of Illinois, and UW conducted a major field campaign in January-March 2017 to investigate precipitation development in orographic clouds over the mountains of southwestern Idaho. The SNOWIE Project (Seeded and Natural Orographic Wintertime clouds – the Idaho Experiment), funded by the National Science Foundation, is designed to address long-standing questions about the effectiveness of glaciogenic cloud seeding. In order to accomplish this, project objectives focus around ice production in both natural and seeded clouds, just like much of the early work upon which the Department was built.

The UWKA trying to taxi on an icy tarmac in SNOWIE.

The 3-month field campaign included a unique partnership with Idaho Power Company (IPC). IPC has been conducting an operational cloud seeding program in the study region for more than a decade. The UW King Air (UWKA) along with the Wyoming Cloud Radar (WCR) and Lidar (WCL) were centerpiece instruments providing detailed observations of the microphysical and dynamical characteristics of the study clouds. The UWKA was joined by two 'Doppler on Wheels' (DOW) Radars and range of ground-based sensors placed throughout the study region.

UW scientists collaborated with scientists from NCAR and several other universities during the field phase and will continue to work with them through the data analyses and modeling phases of the project. Preliminary analyses from a handful of cases provide the first-ever unambiguous evidence of the initiation, growth, and fallout of ice crystals within a seeded region of cloud. In situ probes on the UWKA, the WCR and WCL, and the ground-based DOWs all captured spatial and temporal evolution of these signals. A large allocation for the NSF Wyoming/NCAR supercomputer (Cheyenne) was granted to the UW-DAS and initial modeling of these cases is underway.

Along with several news releases from UW and NSF, SNOWIE was also featured in the June 2017 issue of Popular Science.

THE SEAR-MAR PROJECT

The UWKA spent two weeks in Lancaster PA in November 2017 for a NSF-supported **S**tudent **E**xperience in **A**irborne **R**esearch in the **M**id-**A**tlantic **R**esearch (SEAR-MAR). Millersville University Meteorology professors Drs. Rich Clark (UW Atmospheric Science '87), Todd Sikora, and Brian Billings will lead a partnership with three other universities (Penn State, Rutgers, and University of Maryland-Baltimore County) for an educational experience using the aircraft. SEAR-MAR immersed some 100-150 students in the airborne study of the atmosphere. More on FaceBook under *Sear-Mar King Air* .

Millersville U. Meteorology majors in front of the UWKA during the SEAR-MAR project (photo courtesy of Dr. Clark).

"Students will use this valuable airborne observing system in SEAR-MAR to study the fine structure of fronts, atmospheric mountain waves, cold air damming events, and more across the mid-Atlantic region, Appalachian Mountains, piedmont, and the coastal plain".

Dr. Richard Clark, UW alumnus

MESSAGE FROM BART GEERTS, DEPARTMENT HEAD

Greetings. If this is the first time you have received the "*Laramie High Tidings*", that is because this is the first issue of what we hope will become an annual tradition, as a way communicating with our alumni and friends. In the last few decades, the Department steadily grew but saw relatively little change in its faculty, engineers, and scientists. Several faculty have retired in recent years, Prof. **Terry Deshler** in 2014, Prof. **Derek Montague** in 2015, and Prof. **Al Rodi** in 2016, although he continues to serve as PI of the UWKA Cooperative Agreement with NSF. And just a few months ago, former UW-DAS Head Prof. **Tom Parish** and Prof. **Bob Kelly** retired, together with **Perry Wechsler**, who ran the UW-DAS Engineering Support group since 1993. Tom, Bob and Perry together served almost 120 years in the Department!

The retirement of faculty is also a great opportunity for renewal and projection. We were fortunate to be joined by **Xiaohong Liu** as Wyoming Excellence Chair in 2013. Prof. Liu's group focuses on the representation of aerosol-cloud processes in climate models, and is by far the largest user of the Wyoming allocation of the NCAR Wyoming Supercomputer Center. Prof. **Shane Murphy** joined us in 2012; his group mostly studies trace gas emissions from wildfires and from oil and gas wells. He runs the School of Energy Resources Center of Excellence in Air Quality and his team operates a mobile air quality lab.

And in 2015 we were joined by **Zach Lebo** and **Jeff French**. Prof. Lebo's work focuses on improving our understanding of fundamental cloud microphysics, mesoscale dynamics, and microphysical-dynamical interactions. His numerical "bias" nicely complements the observational bias of most other UW-DAS' faculty. Finally, Jeff French started as a PhD student in the Department in the 1990s, as some of you may recall. He came back to Laramie in 2006 as King Air Project Scientist. His expertise with airborne cloud microphysical modelling is essential to the Department's key research enterprise, the UW King Air. With the retirement of two long-term faculty members this year, we are down from nine to just seven faculty, but we are hoping to be able to recruit at least one new faculty in airborne atmospheric observations soon.

In short, these are exciting times in the Department. With all the new faculty come new ideas, new initiatives, and also, the prospect of a new research aircraft, as you will read in the next story.

THE UW KING AIR AT 40 YEARS

This year the UW King Air "N2UW" celebrated its 40th anniversary with us. It has logged some 8000 flight hours in over 100 campaigns across the USA as well as abroad. NSF has supported the UWKA as a national facility since 1988, through a series of Cooperative Agreements. The UWKA is requested by by UW faculty and by external P/Is, although most campaigns involve participation of UW faculty. Commonly requested intruments include the Wyoming Cloud Radar (WCR) and Wyoming Cloud Lidar. Recently Dr. Wang's group also developed a temperature-humidity Raman lidar, MARLi, for use on the UWKA and other aircraft. An October 2017 article in Research Features nicely summarizes the UWKA's current capabilities.

Brand-new Beechcraft King Air research aircraft arrives at the UW Flight Center in summer 1977.

UWKA taking off in the Owens Valley CA for a mission in the 2006 T-REX campaign.

As N2UW is aging, we are examining limitations on its lifetime, and looking ahead towards the future with a new, more capable aircraft, probably another Beechcraft King Air, a type of aircraft that is ideally suited for the niche we occupy in the NSF Lower Atmosphere Observational Facility suite. This new aircraft is expected to have room for growth in measurement capabilities for at least the next two decades. Back in early 2016, we came close to the acquisition and modification contract of a King Air 350, but, unfortunately, a downturn in the Wyoming economy came at the wrong time for us. Hopefully a deal on a new aircraft will be reached by the time of the next issue of the *Laramie High Tidings*. Even then it will be a few years before basic modifications to the avionics, engines, power supply and key instrument ports will have been completed and we can retire N2UW.

In short, the journey that Don Veal started half a century ago, and that remains the core strength of the Department of Atmospheric Science, is not over by any means. While the Department has diversified healthily, we remain focused on supporting world-class airborne atmospheric research for the benefit of our faculty and our nation.

FACULTY NEWS

Dr. Zhien Wang co-authored an article titled "Tightening of tropical ascent and high clouds key to precipitation change in a warmer climate" in *Nature Communications* (doi:10.1038/ncomms15771). The paper argues that regional (especially tropical) precipitation changes in a changing global climate may exert profound impacts on ecosystems and human society.

Dr. Xiaohong Liu again made it on the Web of Science list of "Highly Cited Researchers" in 2017 by Clarivate Analytics. He has received this recognition every year since 2014. He gave an invited talk at the American Meteorological Society 97th Annual Meeting in Jan 2017 in Seattle, in the session "Grand Challenges in Observing Atmospheric Chemistry and Aerosols".

Dr. Shane Murphy's Air Quality Mobile Lab sampled emissions in several wildfires this past year, including the Napa and Sonoma County fires in October. The UWKA also flew there. We will be involved in more airborne wildfire studies in summer 2018, in particular in the WE-CAN (Western wildfire Experiment for Cloud chemistry, Aerosol absorption and Nitrogen) campaign, in which Dr. Murphy is one of the lead investigators.

Dr. Bart Geerts will give the 2018 Biennial Peter V. Hobbs Lecture at the University of Washington in Seattle, on 16 Feb 2018.

Finally, if you are in the area, join us in Laramie on Wed 29 November (6-10 pm) to celebrate the retirement of Tom Parish, Bob Kelly, and Perry Wechsler, at the Alice Harding Stevens center (603 E University Ave). And if you plan to attend the next AMS Annual Meeting in Austin TX, do not hesitate to visit our booth at the Career Fair held the weekend before (6-7 Jan 2018).

STUDENT NEWS

The following graduate students joined us this year:

- **Alex Butland**, from the Univ. North Dakota (Advisor: Jeff French)
- **Suqian Chu**, from Nanjing Univ. of Information Science and Technology (Advisor: Xiaohong Liu)
- **Melinda Hatt**, from Millersville Univ. (Advisor: Jeff French)
- **Thomas Mazzetti**, from Florida State Univ. (Advisor: Bart Geerts)
- **Kristie Smith**, from the Univ. of New Hampshire (Advisor: Zach Lebo)

Congratulations to the following PhD and MS graduates in the last two years:

- **Jason Sulskis, M.Sc.** (spring 2016) "A comparison and survey of the measured cloud liquid water content and an analysis of the bi-modal droplet spectra observed during the summer 2013 Convective Precipitation Experiment- Microphysics and Entrainment Dependencies (COPE-MED) Field Campaign" (Advisor: Jeff French).
- **Dana Mueller, M.Sc.** (summer 2016) "Vertical structure and evolution of bores observed during PECAN" (Advisor: Bart Geerts).
- **Adam Tripp, M.Sc.** (summer 2016) "The effects of terrain representation in WRF on modeling winds in complex terrain" (Advisor: Tom Parish and Bob Kelly).
- **Sharon Sullivan, M.Sc.** (fall 2016) " June 9-10, 2015: A case study of the great plains low-level jet during PECAN (Plains Elevated Convection at Night" (Advisor: Tom Parish)
- **Sara Lynn Fults, M.Sc.** (fall 2016) "Aerosol measurments during Central Chilean Orographic Precipitation Experiment" (Advisor: Jeff Snider)
- **Anna Robertson, M.Sc.** (fall 2016) "Methane emissions from production sites in dry vs. wet gas fields" (Advisor: Shane Murphy).
- **Jordan Christian, M.Sc** (spring 2017) "Radar kinematic information as surrogate for isentropes in stratiform precipitation systems" (Advisor: Bart Geerts)
- **Katerina Christian M.Sc.** (spring 2017) "A climatology of low-level jet dynamics over the Great Plains of the United States" (Advisor: Tom Parish)

- **Spencer Fabor, M.Sc.** (spring 2017) "Error characterization for airborne cloud probes using laboratory calibration and in-situ analysis" (Advisor: Jeff French)
- **Hunter Brown, M.Sc.** (summer 2017) "Implementation of a brown carbon parameterization in the Community Earth Systems Model (CESM): model validation, estimation of brown carbon radiative effect , and climate impact" (Advisor: Xiaohong Liu).
- **Meng Zhang, M.Sc.** (summer 2017) "Testing cloud microphysics parameterization and improving representation of Wegner-Bergeron-Findeisen process in mixed-phase-clouds in NCAR CAM5" (Advisor: Xiaohong Liu).
- **Kevin Kacan, M.Sc.** (summer 2017) "Microphysical and dynamical effects of mixed-phase hydrometeors in convective storms using a bin microphysics model" (Advisor: Zach Lebo)
- **Nicholas Zelasko, M.Sc** (summer 2017) "Orographic precipitation in Southeastern Wyoming" (Advisor: Jeff Snider)
- **Meng Zhang, M.Sc.** (summer 2017) "Testing cloud microphysics parameterization and improving representation of Wegner-Bergeron-Findeisen process in mixed-phase-clouds in NCAR CAM5" (Advisor: Xiaohong Liu).
- **Guo Lin, M.Sc.** (fall 2017) "Characterization of nocturnal environmental boundary layer conditions around convective storms with airborne Compact Raman Lidar during PECAN" (Advisor: Zhien Wang).
- **Xia Chu, Ph.D** (spring 2017) "Evaluation of the impact of turulence and overturning cells on mixed-phase clouds and precipitation using idealized WRF large eddy simulation" (Advisor: Bart Geerts)
- **Rudra Pokhrel, Ph.D** (summer 2017) "Qualification of absorption due to black and brown carbon from biomass and parameterizations for comparison to climate model results" (Advisor: Shane Murphy)

WELCOME TO ASSISTANT PROFESSOR DR. ZACHARY LEBO

Dr. Lebo joined the department at the beginning of the Fall 2015 semester after spending nearly 4 years combined at NCAR and CIRES/NOAA in Boulder, Colorado as a PostDoc and Research Scientist. UW-DAS provides a unique opportunity for a modeler like Dr. Lebo due to the NCAR-Wyoming Supercomputing Center being at our fingertips and the in-house observational capabilities of the King Air. The combination of these two capabilities is allowing him to further pursue research interests related to cloud microphysics and mesoscale dynamics. His second single-author paper was recently accepted for publication in the Journal of the Atmospheric Sciences.

Dr. Lebo and spouse alongside family after their wedding ceremony on the caldera of Santorini, Greece (August 13, 2017).

"*When I am not working on a new code or analyzing model simulations, I like to spend time outdoors running (the last day that I did not run was December 14, 2013), hiking, skiing, and snowshoeing or traveling the world with my wife; our love for travel led us to Santorini, Greece, for our wedding this past August, and it won't be too long before we are exploring yet another beautiful place. We both have a passion for craft beer and unique food (both twists on American classics or delicacies from other lands); my wife even has a blog in which she pairs craft beer with delicious foods). Recently, our family grew with the adoption of a puppy (we named him Tarragon to keep with the theme of herbs; our other dog's name is Cilantro). He is keeping us on our toes. We both look forward to many years as part of the DAS community!* "

ALUMNI NEWS

We 'd love to hear from you. If you have something new to share with the Department and other alumni, post it on our FaceBook page at https://www.facebook.com/atmosci/, or email Charlotte While at cfoster6@uwyo.edu,

HOW TO GIVE TO THE UW DEPARTMENT OF ATMOSPHERIC SCIENCE

Click here (https://securelb.imodules.com/s/1254/14/interior.aspx?SID=1254&GID=1&PGID=366&CID=985&bledit=1&dids=162.41). Choose your amount and, on the next page, make sure to check the Department of Atmospheric Science! Unless you check the "anonymous donation" box on the same box, you will be recognized in the next issue of the Laramie High Tidings. Please contact us (geerts@uwyo.edu) if you 'd like to further discuss donating to the Department. Thanks!