From the Program Coordinator, Dr. Bill Capehart:

On behalf of the Atmospheric and Environmental Sciences faculty, I send greetings and welcome you to our newsletter.

In our last letter to you, Dr. Detwiler briefed you on our situation at that time and now it is my turn. We are continuing our transition from an academic department into an academic program. Those who remember our history recall that we have been through major changes in brand and identity before. Our faculty continue to be engaged in research across campus and the nation with current and pending projects on severe storms, stream ecology, bio-inspired structures in the built environment, numerical weather prediction, fire meteorology, atmospheric electricity, and of course, our storm penetrating aircraft, the A10. Our faculty and students are still active in the research community and all three of our programs, Bachelor’s, Master’s and Doctoral Degrees are still here, and we continue to mentor our students’ transition into colleagues and active contributing members of the scientific community.

While it is with great sadness this year we have said farewell to our former colleagues, Pam Cox, Connie Crandall and P.V. Sundareshwar, our program has gained 6 undergraduates and 8 graduate students. We continue to mentor our student’s transition into colleagues and active contributing members of the scientific community, and we are receiving applications of all three programs.

Times are difficult for SDSM&T and all universities across the US with funding challenges from state to national levels. However, with our colleagues across campus we are dedicated holding our course and educating the next generation of scientists and professionals while pushing back the boundaries of knowledge during this challenging time. In this newsletter we hope to share with you our activities in these areas.

- Bill Capehart
### Research Notes

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<th>Dr. Andy Detwiler</th>
<th>Paul Smith, Donna Kliche and Andy Detwiler, along with students Connor Nelson and Jeff Wetter, continue to collaborate with the Naval Postgraduate School on a project to retrofit an A-10 “Warthog” aircraft for storm research. Nelson is working on software and analysis techniques to provide situational awareness during missions. These packages and procedures will support the mission scientist who will be coordinating with the A-10 pilot to achieve mission goals while maintaining high safety standards. Wetter is using numerical storm simulations to project flight conditions for a variety of storm types and over the range of flight altitudes the A-10 is expected to fly. This spring engineers at Zivco Aeronautics in Guthrie, OK, will submit detailed CAD drawings for airframe modification to engineers at the A-10 Special Program Office at Hill AFB for approval. We hope modifications will begin by late spring, with engineering test flights towards the end of 2015.</th>
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<td>Dr. Adam French</td>
<td>Dr. French, along with MS students Jacey Wipf and Kevin Wagner, is continuing work on an NSF-funded project investigating interactions between squall lines and isolated supercells, now in its second year. Thus far the project has been focused on using idealized numerical simulations to test how squall line-induced perturbations to the local environment can alter the structure and intensity of an isolated supercell storm. He presented some preliminary results from this study at the 27th AMS Conference on Severe Local Storms back in November. Dr. French also had a paper detailing numerical simulations of squall line-supercell mergers accepted to Monthly Weather Review this past fall. The paper, entitled “Numerical Simulations of Bow Echo Formation Following a Squall Line-Supercell Merger”, with co-author Matt Parker from NCSU, appeared in the December issue. Dr. French is also advising MS students Cody Moldan and Alex Schaefer, whose projects are focused on convective storms and pyrocumulus process, respectively.</td>
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<td>Dr. Bill Capehart</td>
<td>Along with coordinating the AES program, Dr. Bill Capehart is working on a number of projects in Numerical Weather and Climate Prediction and the Hydrologic Cycle. Dr. Capehart and graduate student Brianne Gerber are working on an ongoing validation study of the SDSM&amp;T’s Real-Time Weather Research and Forecasting (WRF) Modeling System over the Black Hills where it is run operationally to support regional operational and incident forecasting. With Dr. Mark Hjelmfelt, Bill is developing a means of assessing forecast confidence in operational model products. He is also working with graduate student Lucas Barrett along with colleagues in Civil and Environmental Engineering and the US Geological Survey to apply NCAR’s hydrologic extension of WRF (WRF-Hydro) to assess hydrologic impacts due to land cover change over the Black Hills. In Regional Climate Modeling Dr. Capehart is working with graduate students Parker Norton and Trisha Gabbert on downscaling future climate scenarios over the Northern Great Plains, and using contemporary simulations to assess the role of biomass burning on weather and water cycling over sub-Saharan Africa. He is also working on a project integrating urban and rural climates into structures that leverage biomimicry.</td>
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<td>Dr. Donna Kliche</td>
<td>Dr. Kliche has been busy with numerous projects ranging from mentoring youth to research on raindrop size distributions. Along with MS student, Jorel Torres (for whom she is major professor), she has been taking measurements of precipitation on top of the Mineral Industries building on campus with a Parsivel disdrometer. Snow measurements were made during the 2013-2014 winter seasons with the first measurements of snow particles in Rapid City made in 2013! Preliminary results were presented by Jorel Torres at the Western South Dakota Hydrology Conference in April 2014, and at the Northern Plains Convective Storms Symposium at the University of North Dakota in May 2014. Dr. Kliche is also involved in collaborative work with both the NASA-Goddard Space center and with the Las Alamos Research Laboratory. As a result of these collaborations, several students received internships and/or graduate assistantships. Dr. Kliche is currently advising three of our MS graduate students and one undergraduate for his senior project. Her research collaboration with Drs. Smith and Johnson (from the Math Department) resulted in a paper which was recently published in the Quarterly Journal of the Royal Meteorological Society, paper dealing with maximum likelihood estimation for gamma parameters (see list of articles below). In addition to her research, Dr. Kliche is mentoring Native American High School students and helping them develop science projects to be presented at the Regional Science Fair to be held this upcoming March.</td>
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<td>Dr. Lisa Kunza</td>
<td>Dr. Kunza’s aquatic ecology lab is conducting research on the ecological impacts caused by Didymosphaenia geminata (aka Didymo) mats. They are conducting monthly sampling in Rapid Creek to understand how these mats are impacting stream processes like nutrient cycling, metabolism, and food webs. One student is even looking at benthic macroinvertebrate gut contents to determine if these secondary producers have altered their diet due to the abundance of mat material readily available. They have also traveled to Grand Teton National Park to look at nutrient cycling in 3 streams with varying Didymo mat coverage. Dr. Kunza’s group presented at the Western SD Hydrology and SD Academy of Sciences conferences in 2014, and will be presenting this year at the Western SD Hydrology conference, Black Hills Area Botany &amp; Ecology workshop, and the annual meeting of the Society for Freshwater Science in Milwaukee, WI.</td>
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Faculty Emeriti

Dr. Paul Smith

Dr. Mark Hjelmfelt

Dr. John Helsdon

Dr. Smith has been busy in retirement traveling the world to see family and friends as well as staying active in the research community. He continues to work on statistical issues in relating disdrometer-measured rain drop data to radar measurements. Furthermore, Dr. Smith serves on the NEXRAD Technical Advisory Committee, and as a participant on the A-10 program Management Review. He would also like to note that he led “Team Smith” with three of his sons to defeat in the SDSM&T Community Golf Tournament on June 2. Dr. John Helsdon is continuing his work on the UPLIGHTS project while Dr. Mark Hjelmfelt is collaborating with colleague Darren Clabo on the impacts of thunderstorm downbursts to aviation assets on wildland fires.

A few photos from the AES Program

Dr. Kunza’s students get out for a little sampling in the reaches of Rapid Creek below the Pactola Dam. They even found enough “Rock Snot” (a.k.a Didymo) to create a nice SDSM&T tribute!
A few more photos from the AES Program in action!

AES 692 students launching a weather balloon. Photo: Tom Durkin

Donna Kliche’s Saturday morning student mentees. Photo: Donna Kliche

Section 2 Prescribed Fire, Wind Cave National Park. Photo: Darren Clabo

Parsivel Disdrometers. Photo: Jorel Torres
IAS Historical Note- Dr. Paul Smith, Faculty Emeritus

“Old Time Computing”
We bought the PDP-8 in 1967 and hooked it up to do real-time processing of radar data at our radar site out east on Radar Hill. The PDP-8 was one of the first (maybe the first) minicomputers, and we were the first to have real-time processing of weather radar data. There’s an article about the work in the 1974 Bulletin of the American Meteorological Society (April issue, if I recall correctly). Jim Boardman came out of McGill University to run the PDP-8, and did some amazing things with that 12-bit machine. He later moved on to greater things in the computer world...
- Dr. Paul Smith

From Jim Boardman, regarding the PDP-8:
For years I've wondered what happened to PDP-8 S/N 1175. It was September 1967 when I first came to Rapid City to work at the IAS for Paul. That good old computer was in the lab area just outside the inner offices. I lived and breathed with that computer from 1967 to 1971- loving every minute. Paul and IAS sent me to Maynard for two weeks to get to know it even better - what an amazing experience.

I notice from the photos that the Textronix RM503 is not there. It was in the center bay just at desk top level. I wrote programs to display reflectivity "slices" of storm clouds based on data gathered at our radar site during the summer. Since the RM503 was only controllable via (X,Y) dot position and a "Z-axis" beam on/off (using 6xxx IOT instructions), it was a lot of work to generate meaningful displays that had alpha numeric labels. I wrote all the subroutines to display the characters based on a 5x7 matrix as I recall.

Later, it was kept in the computer room along with George Gladfelter's IBM 1130 (this was pre-CDC 3600 days as I remember). One day after 5pm, Garth and I stayed up all night writing a program to play Conway's Game of Life. I've forgotten how we entered the initial positions - switch register settings or paper tape. What fun to see Conway's "life forms" creeping across the screen and interacting with each other.
Recent AES Publications and Presentations


Gerber, B.M., W.J. Capehart, 2015: Verification and Assessment of the SDSM&T Real-time WRF Forecasting System under Different Initialization and Data Assimilation Schemes, Eugenia Kalnay Symposium, AMS, 04-08 January 2015, Phoenix, AZ.


Meteorological Fascinations

January 15, 2015 Snow Cover Across SD

A “Blue Sky” day (15 January 2015) over South Dakota as seen by the MODIS imager aboard the Terra Polar Orbiting Satellite revealing snow cover across the state. Topographic features can be picked out such as the Black Hills, the Missouri River, the Niobrara River, and the Coteau des Prairie. Note the relationship of snow cover (white areas) with respect to those features. There is plenty of snow covering the northwestern Black Hills as compared to the southeastern Hills and the depressed areas along the Cheyenne, Moreau, and Grand Rivers have less snow than the higher elevations dividing them. A similar story can be seen near the Coteau in northeastern SD. Only the unique combination of terrain and meteorology can lead to such a beautiful wintertime image of the Rushmore State.

Have a safe and healthy Spring Semester!
From your Atmospheric and Environmental Sciences Faculty