AK CSC
Alaska Climate Science Center

Annual Report 2011-2012


John Wood, ARCUS

A Message from the Alaska Climate Science Center Directors:

For the Alaska Climate Science Center (AK CSC), 2012 was a year of continued growth and further development of our research capacity and outreach activities.

In this 2011-2012 annual highlights issue for the AK CSC, you will learn about new investments in research capacity to support high-performance simulation modeling activities, as well as providing state-of-the-art radar equipment to observe and document glacier dynamics. We also continued to place a high priority on training early career scientists. All of these early career scientists are addressing challenging issues related to climate variability and impacts on natural resource management, and once again you will meet one of the AK CSC funded graduate students.

In addition, this issue introduces the AK CSC outreach efforts at both the secondary and post-secondary levels—highlighting innovative programs to encourage the next generation of scientists and decision makers. We hope you enjoy learning about the AK CSC and we encourage you to visit our websites or email us to learn more about our research, education, and outreach activities. ◆

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2011-2012 Alaska Climate Science Center Highlights:

- Investment in high performance computing and ground penetrating radar
- Training and professional development activities for early career scientists
- New research collaborations with the USDA Forest Service and NOAA RISA Program
- Education, outreach, and communication program expansion
- Eight new research publications from 2011-2012

http://csc.alaska.edu
www.doi.gov/csc/alaska

FEATURED RESEARCH:

Updates from the Integrated Ecosystem Model for Alaska and Northwest Canada

The Integrated Ecosystem Model for Alaska and Northwest Canada (IEM) aims to link three individual ecosystem models—ALFRESCO, TEM, and GIPL—to better understand how vegetation, fire, and permafrost may interact under future climate scenarios. The project is designed to help resource managers understand the nature and expected rate of landscape change in Alaska and Northwest Canada. The IEM is a 5-year project that began with a pilot year in 2011.

2012 was the first full year of the project, and several key activities were completed:

- The data subgroup produced 1 km input datasets over the entire geographic domain using both historical data and the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 4 (AR4) scenarios
- The model coupling subgroup synchronously coupled the component models
- The tundra fire and treeline subgroup developed a new tundra succession version of ALFRESCO and completed initial calibration methods between ALFRESCO and TEM
- The wetland dynamics subgroup worked on developing a peatland version of TEM that could represent changes in water table and biogeochemistry in an open boreal fen
- The IEM project recognized the need to better engage management and stakeholders and added a science communicator to the team

For a full description of the accomplishments of 2012 and the tasks of the IEM project and subgroups going forward, the 2012 IEM Annual Progress Report is available online: http://tinyurl.com/iem-annual-report

The IEM is a collaborative project of the AK CSC and the Arctic, Western Alaska, and Northwest Boreal Landscape Conservation Cooperatives. Learn more about the IEM project at: http://csc.alaska.edu/projects/integrated-ecosystem-model ◆

Ground penetrating radar research at the AK CSC

Documenting the present state of snow, ice, and permafrost—collectively known as the cryosphere—in Alaska is crucial for understanding, predicting, and adapting to the dramatic cryospheric changes expected during the next 30 years. However, measurements of snow and ice are logistically challenging and time-consuming. To improve the efficiency of cryospheric research, the AK CSC invested in a new Ground Penetrating Radar (GPR) system in 2012. Since then, AK CSC-funded researchers have used the GPR system to help modelers constrain their simulations with high-resolution, spatially continuous data.

The system has been used extensively and collaboratively amongst individuals at the University of Alaska Fairbanks (UAF), the Alaska Division of Geological and Geophysical Survey (DGGS), and the United States Geological Survey (USGS). Campaigns and field expeditions used the GPR system to study the thermal properties of glaciers, winter fish habitats in arctic Alaska, permafrost conditions, and snow accumulation over tundra and glaciers. A recent innovation with the GPR was its airborne deployment over glaciers. This allows for spatially continuous estimates of snow-depth and snow-water equivalent over large areas that were previously very challenging and constrained by safety concerns to the researchers. ◆

Measuring snow properties and snow density using Ground Penetrating Radar on the Wolverine Glacier (L. Sass, USGS).

Alaska Climate Science Center New Researchers & Staff Members:

Katie Kennedy, K-12 Education and Outreach Coordinator

Wanda Tangermann, Program Coordinator

Dr. Nathan Kettle, Postdoctoral Fellow

Nathan is jointly funded by the NOAA funded Alaska Center for Climate Assessment and Policy (ACCAP) and the AK CSC.

Dr. James Powell, Postdoctoral Fellow

Jim is jointly funded by the USFS Pacific Northwest Research Station and the AK CSC.

Kristin Timm, Graduate Student (Science Communication)

Check out the list of new research publications from AK CSC researchers in 2011-2012: **http://tinyurl.com/akcsc-pubs**

Participants of the summer school hiked to the Canwell Glacier in the Alaska Range (T. Saito, UAF).

Climate modeling summer school attracts students from agencies and academia

The AK CSC and the International Arctic Research Center (IARC) came together to host a two-week summer school from July 16-27, 2012 at the University of Alaska Fairbanks. *"Climate system modeling: Downscaling techniques and practical applications"* brought together 20 graduate students and young scientists from Climate Science Centers across the United States with 25 academic specialists to explore the opportunities and challenges of applying downscaled climate models to climate-related research across numerous disciplines.

Each day of the summer school was packed with lectures, activities, and field trips to local attractions, including the Canwell Glacier and the Cold Regions Research and Engineering Laboratory (CRREL) permafrost tunnel. Lectures explored the use of models in studying permafrost, forest fires, ecosystems, glaciers, hydrologic, and marine systems. Students also completed group projects; one project used downscaled climate models to study potential shifts in park visitation in Alaska.

The summer school not only taught students how to apply available observations and global and regional model output to meet user needs at the local and regional scales, but it also discussed how to translate those results to stakeholders. The workshop included several sessions on integrating modeling with human dimensions research, translating models to stakeholders, and communicating about climate change.

In the evaluations, students expressed satisfaction with the summer school. Student comments were indicative of the summer school's success. One participant said, "this was a fabulous summer course!" and the "curriculum and logistics were well thought out…[and the] field trips were unforgettable!"

A full description, agenda, and some presentations are available at: http://www.iarc.uaf.edu/education_outreach/summer/2012/july ◆

"I had an amazing time here and the line-up of presenters was all-star…I'm leaving here with a much better understanding of arctic ecosystems and applications of downscaled data."

- Summer school participant comment

FEATURED STUDENT:

Carson Baughman

Alaska's Brooks Range makes for a difficult research environment, but Carson Baughman has embraced the challenge as part of his master's work studying soil processes in the region. He is studying the soil surface organic layer—the layer of accumulated dead plant material that builds up and decomposes, becoming a critical part of the soil.

Baughman is using field sampling and statistical methods to determine where the soil surface organic layer is accumulating within his 50-km^2 study area. He is also using topographic parameters, including exposure to sunlight, slope, and aspect, to predict the location of soil surface organic layers. Based on work at a series of sites with similar topographic parameters but different soil ages, Baughman can explore how long it takes for the soil surface organic layer to form, and how the accumulation of this layer affects the underlying mineral soils and permafrost layer.

Baughman's work is key for understanding the impacts of disturbance and climate change in these areas. When the soil surface organic layer is subject to disturbances, such as a tundra fire, they can release significant amounts of stored carbon, while also triggering a host of other landscape changes. He hopes that his research could be used to help understand linked climate, fire, and landscape change across the entire Arctic Foothills region. Baughman says that during his time in the field he developed first-hand knowledge of what is required to carry out a successful field research campaign.

Baughman's work was supported by the AK CSC and the Bureau of Land Management. He plans to defend his thesis in September of 2013. ◆

Carson documents soil characteristics at his field site in arctic Alaska (C. Baughman).

High school girls from Alaska and the Northwest participate in the inaugural Girls on Ice Alaska program by measuring stream flow on the surface of the Gulkana Glacier (M. Habermann).

AK CSC support enables Girls on Ice program growth

With support from the AK CSC, the popular Girls on Ice program that has been successfully operated in Washington state for the past 12 years was expanded to Alaska in 2012. In July of 2012, the inaugural Girls on Ice Alaska (GOI AK) team of 9 high school girls from Alaska and the Pacific Northwest joined 4 instructors for 8 days of exploration on the Gulkana Glacier in Interior Alaska. During this time, the girls hiked, camped and lived on the glacier, participating in daily science lessons, mountaineering excursions, and art activities. In small groups, the girls designed and implemented their own science experiments.

The Girls on Ice program is free for participants. The program enables young women who may not otherwise have such an opportunity—whether it is due to socioeconomic status or as a member of a group underrepresented in the sciences—to become engaged in research and the sciences.

Support from the AK CSC was leveraged to update mountaineering equipment and educational resources, cover some logistical costs, and provide training for the all female team of expedition leaders. Thanks to the AK CSC, Girls on Ice Alaska continues to inspire the next generation of self-confident, advocates for science and the environment. ◆

AK CSC invests in high performance computing

In early 2012, the Alaska Climate Science Center invested $100,000 on a new high performance computing system. With approximately forty times more power than a regular desktop computer, the new system enables programmers at UAF's Scenarios Network for Alaska and Arctic Planning (SNAP) to run significantly more model simulations in much less time. For model users and developers, the new system means rapid data analysis and faster turnaround times to address project needs.

The addition of the high performance computing system is particularly important for conducting the modeling work involved in the Integrated Ecosystem Model for Alaska and Northwest Canada (IEM) project which aims to link permafrost, fire, and tundra dynamics models. Using the new computing system, the amount of time needed to run one model simulation was reduced from days to just minutes. The IEM project requires a large number of simulations, and without this additional capacity it would not have been possible to conduct the IEM simulations. The increase in computing capacity allows modelers to perform a wide variety of simulations that previously were not possible, and will enable researchers to explore new methods more rapidly as our understanding of the drivers of ecosystem change increases. ◆

Students receive funding to attend the Alaska Water Resources Association Annual Meeting

The AK CSC and UAF's Water and Environmental Research Center (WERC) collaborated to provide 14 student travel grants to the Alaska Water Resources Association (AWRA) Annual Meeting in Juneau, Alaska from March 5-8, 2012. The AWRA meeting brings together professionals from all over the state of Alaska to discuss the latest research efforts and agency initiatives.

Travel grants were provided to undergraduate, masters, and PhD students conducting research on Alaska's hydrologic resources. All of the students who received grants presented their results, and were provided with the opportunity to discuss those results with the state's most qualified experts in the field. There were a total of 60 presentations given at the meeting, and these travel funds supported nearly 25% of them. The thoughtful research and energy that student travel grant awardees brought to the meeting was apparent to all in attendance. ◆

For more information, visit the AK CSC online at:
http://csc.alaska.edu or www.doi.gov/csc/alaska

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