



The Icebreaker

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Director's Message

I would like to congratulate Professor Richard Alley for receiving the European Geophysical Union's first-ever Louis Agassiz medal. I feel privileged to lead a center that includes outstanding scientists like Prof. Alley, Prof. Lonnie Thompson and many others.

It has been an exciting and busy summer so far. We recently completed measurements using a radar with digital beam forming capabilities as a part of the ongoing NASA program to measure surface elevation and thickness of a few fast flowing glaciers in Greenland. The preliminary results indicate we obtained

good ice thickness data over the Jakobshavn and a few other glaciers. Radar sounding of the Jakobshavn glacier channel has been a challenge. We are processing these data and will make these data available to the community as soon as possible.

Also I want to congratulate student Jilu Li for receiving a NASA Earth Science Fellowship to develop a complementary-coded pulse radar for mapping layers close to the bed of ice sheets. I hope that other center students will put together similar competitive proposals in the future.

I hope you enjoy reading the newsletter. Please send us any questions, comments or suggestions.

-Prasad Gogineni



The Center for Remote Sensing of Ice Sheets is made possible by a five-year award from the National Science Foundation (#0424589), which began in June, 2005.

Richard Alley receives first Louis Agassiz medal

Richard Alley, CReSIS scientist and a professor of geosciences at Pennsylvania State University, added to his long list of laurels with the presentation of the European Geophysical Union's first-ever Louis Agassiz medal.

Called "one of the genuinely catalytic scientists of the glaciological universe," Alley has played a key role in ice core paleoclimatology, dating ice cores from Greenland and Antarctica, and improving the reliability of data based on past temperature and snow and ice accumulation patterns. In his career, Alley has traveled three times to Antarctica and eight times

to Greenland.

Alley is a Fellow of the American Geophysical Union, a Geological Society of America Easterbrook winner, and a recipient of the Phi Beta Kappa Science Award for his book, "The Two-Mile Time Machine," along with a slew of other honors. He received his doctorate in geology from the University of Wisconsin, and has been a professor at Pennsylvania State University since 1988.

The medal is named in honor of Swiss scientist Louis Agassiz (1807-1873), considered one of the most influential thinkers of his time. Heralded as the "Father of Glaciology," Agassiz was the first to propose that the Earth had at one point undergone an ice age.

The EGU presented Alley with the honor

on April 4 at the General Assembly in Vienna, Austria, before he gave a speech on the changes occurring in ice sheets.



Professor Richard Alley on the Matanuska Glacier in Alaska. -Photo by Todd Johnston



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Feddema leads cumulative study on 21st-century global warming

CReSIS scientist Johannes Feddema led the first-ever study to incorporate a wider variety of human processes in the climate change debate.

The article, entitled "The Importance of Land-Cover Change in Simulating Future Climates," was featured in the Dec. 9 issue of *Science*. It marked the first time a simulation of 21st-century warming included not only interactive ocean and atmosphere components, but also changes in land cover caused by agriculture, deforestation and other human activities.

"Much of the climate change debate is centered on the atmosphere," said Feddema, a professor of geography at the University of Kansas. "We also showed more clearly that tropical deforestation has an impact."

The energy near the equator diffuses toward the earth's poles, Feddema said. Changing the land cover at the equator affects the entire energy dynamic.

"That disturbance propagates through the atmosphere or through the ocean to another place to affect the climate there," Feddema said.

During Feddema's time on sabbatical at the National Center for Atmospheric Research (NCAR), he and six NCAR scientists linked NCAR's Land Surface Model with the glob

al-scale Parallel Climate Model. The latter has been used in the past, but not with all the variables that Feddema and his group incorporated.

"It's rather expensive, and takes a really long time to do," he said.

The study examined two scenarios - whether greenhouse emissions will increase steadily or whether we will see rapid gains in energy efficiency and the increase will slow.

The first scenario shows that deforestation adds another 2 C or more to surface temperatures across the Amazon. Global warming alone leads to a 2 C temperature rise, Feddema said.

"You're doubling the effect of human impact on climate," he said.

Subsequent cooling of the Pacific Ocean results in weaker El Niño phenomena and stronger La Niñas, Feddema said.

His research will continue to cater to the need to improve representation of land cover in models of climate change. Feddema's next area of research will focus on the effects of urban areas on land mass.

CReSIS graduate student receives NASA Earth Science Fellowship

Jilu Li received a NASA Earth Science Fellowship based on his proposal to develop a system of complementary radar codes to map internal layers near the beds of ice sheets.

A CReSIS graduate student at the University of Kansas, Li wrote his proposal with the aim of filling a long-time hole in remote sensing technology. Weak signal strength limits the ability of current radars to detect deep internal ice layers. To improve the radars' capabilities of detecting internal layers near the bed, Li proposed to use complementary codes to cancel out the masking returns coming from the radars' side lobes. This allows for higher measurement sensitivity near the ice beds.

He plans to develop a prototype of the short-pulse radar system using Computer Aided Design (CAD), and eventually test the system through field work in Antarctica and Greenland. If the system reaches an optimal performance level, the previously unknown measurements of internal ice layers near the glacial beds will allow for a more accurate understanding of ice sheet flow in the past.

Li's was one of 55 out of more than 180 submitted proposals to be selected for the honor. He will receive financial support of \$24,000 per year for up to three years to pay for a stipend and tuition to enable his research efforts on this project.

Study on Greenland's glacier flow gains national attention

In the last decade, ice sheet mass loss in Greenland has more than doubled, with increased glacier flow causing two-thirds of the loss and dominating Greenland's contribution to sea-level rise, according to a recent study by two CReSIS scientists.

Dr. Pannir Kanagaratnam, the University of Kansas, and Dr. Eric Rignot, NASA Jet Propulsion Laboratory, published their study in the Feb. 17 issue of *Science*. The study has since received significant media and scientific attention. It is the first of its kind to incorporate recent changes in glacier velocity into estimates of the overall mass of ice being lost for nearly all of Greenland.

Glaciologist Gino Casassa, of Chile's Centro de Estudios Cientificos, called the study "a major finding" with the potential to provide a missing link to the understanding of shrinking glaciers around the world. Julian A. Dowdeswell, Cambridge glaciologist and director of the Scott Polar Research Institute, said that its observations were of "immediate concern."

Rignot and Kanagaratnam measured glacier velocities along the entire coast of Greenland, except the southwest, using satellite radar interferometry data as well as European remote sensing satellites.

The most pronounced changes unfold in the southeast, where "flow acceleration varies substantially among glaciers, but remains widespread and systematic." The study found that, on average, the 21 largest glaciers accelerated 57 percent between 1996 and 2005.

Warmer temperatures—Greenland has registered a 3 C increase in air temperatures during the last 25 years—are largely

to blame, because they increase the amount of melt water that penetrates to the ice bed, lubricating its motion toward the Atlantic Ocean.

Changes in glacier velocity were also observed in the north but had little impact on total mass balance. This may change, however, if temperatures continue to rise. According to the study, mass loss in Greenland could "continue to increase well above predictions."

Reports on the study, which was presented on Feb. 16 at the annual meeting of the American Association for the Advancement of Science in St. Louis, have been featured on CNN, BBC News, CBS News, MSNBC News and in *The Boston Globe* and *The Philadelphia Inquirer*, among others.



Jakobshavn Isfjord in May 2006 -Photo Courtesy of Thomas Overly

Summer internships give undergrads hands-on research experience

Six students spent the summer of 2006 participating in a CReSIS internship through the Research Experience for Undergraduates program (REU).

Bryce Carmichael (ECSU), Cheniece Arthur (ECSU), Uniquiea Wade (ECSU), and Alex Martinez (University of Puerto Rico - Mayaguez) spent their summer at the University of Kansas. Garry Cameron (ECSU) and Kevin Reynolds (ECSU) interned at the Byrd Polar Research Center at The Ohio State University.

Carmichael and Arthur, both computer science majors, worked with established CReSIS scientists and professors in simulating robots in Antarctica. Martinez, a

recent graduate in geology, and Wade, a computer science major, worked on validating measurements from CReSIS radars. Martinez worked on the Improved Coherent Antarctic Radar Depth Sounder (ICARDS) taken to Antarctica in December 2002. Wade processed data collected from the Frequency Modulation Continuous Wave (FMCW) airborne radar sent to Alaska in March 2006. For Wade, an upcoming sophomore, the experience has helped her figure out her direction within her field at an early stage in college.

"I would definitely like to keep studying about the Polar Regions," Wade said. "It's a new aspect of science." Wade also said she's interested in participating in field research in Antarctica in the future.

At OSU, Cameron and Reynolds, both studying elementary education and mathematics, worked on a new Web site for

the research center and learned the best methods to present complicated scientific information to the general public.

"This experience will definitely benefit me down the road," Cameron, an upcoming senior, said. "I've looked into how young students take this kind of information in, and how I can make it adaptable and apply it to the classroom."



Uniquiea Wade, right, works with the MCRDS radar sent to Greenland in the spring of 2006.



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2006 Talks and Events

Conferences Held

--April 20-21, 2006: Midwest Glaciology Meeting, Pennsylvania State University, University Park, PA

Conferences Attended

--April 2-7, 2006: Sridhar Anandakrishnan (PSU) and Richard Alley (PSU), European Geosciences Union General Assembly, Vienna, Austria

Posters

--04/06/06: H. Horgan, S. Anandakrishnan, and T. Dupont (PSU), "Locating the grounding line using GLAS ICESat laser altimetry data --- Ross Ice Shelf, Siple Coast, West Antarctica," European Geosciences Union General Assembly, Vienna, Austria

--04/07/06: R.A. Bindschadler, S. Anandakrishnan, D.E. Voigt, I. Joughin, R.A. Alley, M.A. King, P. Winberry, H.J. Horgan, and L.E. Peters (PSU), "Details of Tidally Modulated Stick-Slip Motion of Ithillans Ice Stream, West Antarctica," European Geosciences Union General Assembly, Vienna, Austria

--04/07/06: J.P. Winberry, S. Anandakrishnan, R.B. Alley, R.A. Bindschadler, M. King, D. Voigt, and I. Joughin (PSU), "Basal mechanics of ice stream stick-slip," European Geosciences Union General Assembly, Vienna, Austria

--04/07/06: L. Peters, S. Anandakrishnan, and D. Voigt (PSU), "Subglacial regime of ice stream D, West Antarctica," European Geosciences Union General Assembly, Vienna, Austria

--04/25/06: Josh Meisel and Kalonie Hulbutta, "Modeling Global Sea Level Rise with GIS," Mid-America GIS Symposium, Kansas City, MO

Talks

--03/07/06: Xingong Li, "GIS Analysis of Global Risk Area and Population by Sea Level Rises," Association of American Geographer annual meeting, Chicago, IL

--03/15/06-03/29/06: Byron Parizek, "Ice-sheet dynam-

ics: a non-'glacial' response to climate change," Earth System Science Department Seminar at University of California, Irvine, Irvine, CA, California State University, Fresno, Fresno, CA, College of New Jersey, Ewing, NJ.

--03/30/06: Richard Alley, "Reading the history of climate," Boy Scout troop, Mount Nittany Methodist Church, Lemont, PA

--04/04/06: Richard Alley, "Projecting Ice Sheet Changes," medal lecture as recipient of first Louis Agassiz medal, European Geosciences Union Cryospheric Section, Vienna, Austria

--04/04/06: Arvin Agah, "Polar Mobile Robots," KU student chapter of Association for Computing Machinery, Lawrence, KS

--04/06/06: S. Anandakrishnan, "Ice stream basal seismicity reveal basal conditions," European Geosciences Union General Assembly, Vienna, Austria

--04/11/06: Richard Alley, "Going to Greenland -- Science, Moraines and Musk Oxen," Pennsylvania State University Geological Sciences Club, University Park, PA

--04/18/06: Richard Alley, "Musk Oxen and Moraines, and What They Tell Us About Climate," Pennsylvania State University Chi Epsilon Pi Meteorology Honor Society keynote address, University Park, PA

--04/20/06: Richard Alley, "Seasons in the Sun: New Insights on Abrupt Climate Change from Terrestrial Records," North Central Section of the Geological Society of America, Akron, OH

--04/20/06: Jan Wuite, Ken Jezek, and Karl Leibfacher, "Flow velocities of Antarctica's outlet glaciers," Midwest Glaciology Meeting, University Park, PA

--04/20/06: Indrajit Bhattacharya and Ken Jezek, "Comparison of Accumulation Rate Time Series in Central Greenland," Midwest Glaciology Meeting, University Park, PA

--04/21/06: Sridhar Anandakrishnan, "Ice stream basal seismicity reveal basal conditions of ice streams," Midwest Glaciology Meeting, University Park, PA

--04/21/06: Richard Alley, "Glacier-Extent Climate Recorder," Midwest Glaciology Meeting, University Park, PA

--04/21/06: Stephen Mather, Katy Farness, and Ken Jezek, "Backscatter coefficients: Antarctic Dynamics and the RAMP Project," Midwest Glaciology Meeting, University Park, PA

--04/26/06: Richard Alley, "Putting global warming into context: science, scenarios, and society," National Science Foundation Geosciences Directorate Distinguished Lecturer/Earth Day Lecturer, Washington, DC

--5/11/06: David Braaten, "Climate Change & Ice Sheets", Emporia State University, Emporia, KS.

--05/16/06: Ernesto Rodriguez, Anthony Freeman, Kenneth Jezek, and Xiaoqing Wu, "A New Technique for Interferometric Soundings of Ice Sheets," European Conference on Synthetic Aperture Radar (EUSAR), Dresden, Germany

--05/17/06: Prasad Gogineni, John Paden, Torry Akins, Chris Allen, David Braaten, and Kenneth Jezek, "Wideband synthetic aperture radar imaging of sub-surface interfaces in glacial ice," European Conference on Synthetic Aperture Radar (EUSAR), Dresden, Germany

--05/17/06: Kenneth Jezek, Ernesto Rodriguez, Anthony Freeman, Prasad Gogineni, John Curlander, Xiaoqing Wu, Chris Allen, William Krabill, and John Sonntag, "Glaciers and Ice Sheets Mapping Orbiter Concept," European Conference on Synthetic Aperture Radar (EUSAR), Dresden, Germany

--5/19/06: David Braaten, "Center for Remote Sensing of Ice Sheets (CRISIS) Education and Diversity Program," NSF Polar Advisory Board, Arlington, VA.

--5/24/06: David Braaten, "The Center for Remote Sensing of Ice Sheets (CRISIS): Ice Sheet Remote Sensing from Top to Bottom," University of Iceland, Reykjavik, Iceland.

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