

the icebreaker

Center for Remote Sensing of Ice Sheets

PSU TEAM RETURNS FROM A SUCCESSFUL FIELD SEASON IN ANTARCTICA

by Knut Christianson

A field team consisting of Huw Horgan, Paul Winberry, Leo Peters, Luke Zoet, and Knut Christianson from Penn State University and Brandon Gillette, a middle school science teacher from Olathe, KS with PolarTrec, recently returned from a 2-month field season in Antarctica.

The objectives were twofold: to characterize the material at the bed of the West Antarctic Ice Sheet divide ice core site (WAIS) and to investigate the ice dynamics, glacial and subglacial properties near the grounding line of Thwaites Glacier, the largest outlet glacier in the Amundsen Sea Embayment. The team persevered in spite of poor weather, logistical delays, and crevasses and completed all of their objectives.

After a 1-day delay in Christchurch due to weather, the team arrived in Antarctica on December 1. This first weather delay was a harbinger of future difficulties for the field party. The team flew to WAIS on December 11 after preparing their cargo and attending various training courses with topics ranging from snow mobile maintenance to crevasse extraction. Although most of the activities at this field camp of 60+ people were directed towards extracting a 3450 m ice core which will provide the highest resolution record of greenhouse gases to date, the team's focus was on imaging the material beneath the ice/bed interface. The planned timeframe for this objective was 7-10 days at WAIS before continuing to Thwaites Glacier for a 5-6 week deployment.

Due to the short time the team had at WAIS, they immediately swung into action and began establishing



Above: Leo and Huw prepare the Conestoga wagon for seismic data acquisition.

the seismic line using handheld GPS receivers to orient the line and insuring accurate spacing of shot-holes with a laser rangefinder. Since the objective was to characterize the material underneath the core site, the line was situated as close to the drilling site as possible. The team's hopes to begin drilling shot-holes the next day were thwarted by a 3-day storm with winds of 45 mph. After an enforced hiatus due to the storm, drilling commenced 3 days later using a hot-water drill. The drill used two jet-fuel powered burners to heat water to approximately 150°F and channel this hot water into the ice sheet to create holes approximately 10 cm wide and 30 m deep. Once the holes were drilled, explosives were lowered to the bottom of each hole and the holes

were backfilled with snow to prevent an explosion from reaching the surface which allows seismic energy to escape. Just as drilling was completed, another storm hit WAIS. Winds of over 60 mph paralyzed the camp for another 3 days with visibilities of about 1 m.

At the next opportunity the team quickly began shooting the seismic line. This procedure involved detonating the explosives that have been lowered down a shot-hole, recording the sound generated by the explosion on 48 sensitive microphones (geophones), moving the geophones which are clipped into a 960 m cable with 20 m spacing, and repeating this procedure until the survey is complete. The sound waves reflect off interfaces in the ice and below the ice providing information

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RESEARCHER FINDS GROUND BELOW GLACIER PLAYS PART IN MELTING

by Mike Krangs

A KU/CRISIS researcher has discovered that the thickness of the Earth's crust, not just global warming, is contributing to the melting of glaciers in Greenland. Kees van der Veen, associate professor of geography, and his collaborators presented their findings recently at the American Geophysical Society in San Francisco. In the northeast part of Greenland's ice sheet is an "ice stream," a fast-moving channel carrying ice from as far as 400 miles inland to sea.

Van der Veen and Center for Remote Sensing of Ice Sheets colleagues used airborne radar, coupled with gravity measurements taken by the Naval Research Laboratory, to determine the thickness of the Earth's crust below the glacier. They found that the thickness of the crust varied, sometimes widely, across the large island.

Below the ice stream, the crust was thinner than throughout the rest of

We know that in Antarctica there are a dozen or so ice streams that have nothing to do with global warming. – Kees van der Veen

the Greenland glacier. The layer below the crust, the mantle, contains liquid magma, which warms the crust enough in the thin areas to heat the basal ice to the melting point. This creates a lubricating effect, allowing the ice to slip out to sea quicker than other areas.

Working with Ralph Von Frese, professor of earth sciences at Ohio State University, and Timothy Leftwich, a postdoctoral researcher at CRISIS, Van der Veen estimated the geothermal heat was 20 percent higher at the top of the thin area of the crust than in other regions.

The researchers will continue to research the thickness of the Earth's crust below other parts of the Greenland Ice Sheet

to determine the extent to which the variations are causing the ice to melt. They then plan to move on to Antarctica to see if similar fluctuations are contributing to melting of the icy continent.

"We know that in Antarctica there are a dozen or so ice streams that have nothing to do with global warming. These are naturally occurring phenomena. But we want to find out what is causing them," van der Veen said.

The melting, whether caused by sub-glacial temperatures or global warming, presents a potential problem for humanity. When the glaciers melt, ocean levels rise, which could eventually put many inhabited coastal areas under water.

TEACHER, GILLETTE, SHARES EXPERIENCES

by Brandon Gillette

You walk outside, the chill in the air hits you like a thousand knives. The wind is howling at 50+ miles per hour blowing the barely falling snow reducing visibilities to just a few feet. Yet once the storm clears, there is something about the incredible reflection from the ice packed surface that nearly blinds you as the sun hovers in the midday sky. Sound like a fun place? This fall I had the unique opportunity to travel nearly 25,000 miles round trip to the highest, driest, coldest and windiest place on this earth! Sounds crazy I know, but this was truly one of the most amazing experiences of my life.

Through a professional development program called PolarTREC (Teachers and Researchers Exploring and Collaborating) I spent five weeks in Antarctica working with graduate students from Penn State University and CRISIS (Center for Remote Sensing of Ice Sheets). PolarTREC is an educational research experience funded by the National Science Foundation and managed by the Arctic Research Consortium of the United States (ARCUS), in which

K-12 teachers participate in polar research, working closely with scientists as a pathway to improving science education.

Leaving in late November, I traveled to Christchurch, New Zealand, home of the U.S. Antarctic Program. Here I met the five other team members I would be traveling with, Huw, Paul, Peter, Leo and Knut, all graduate students with Sridhar Anandkrishnan at Penn State University. The overall focus of this trip was to study the movement of ice sheets across the Antarctic continent, specifically the West Antarctic Ice Sheet (WAIS) and Thwaites Glacier, looking at the boundary layer beneath the ice and the land below. We were looking to understand the influences of ice flow, which can ultimately lead to sea level rise.

I must admit that there wasn't a great deal of actual data collection that occurred while on the field part of the trip, however, it proved to be the result of a truly authentic Antarctic experience. We hunkered down through two storms at WAIS Divide with the worst of the two subjecting us to winds that

topped 55 miles per hour and forced us to sleep on the floor of the galley for a night.

When all was said and done with the storms, we were able to get some data collected. We spent a late afternoon and evening using a hot water drill to cut through the ice to a depth of thirty meters. Then it was time to set the instruments to collect the data, a series of geo-phones to measure the time for the wave from the initial explosion to travel to the bottom of the ice and reflect back to the surface. The instruments are so sensitive that we had to wait for camp to shut down after dinner for us to begin our work. We spent two late nights, till around midnight, detonating explosives to hopefully help understand some of the characteristics of the ice sheet and how it is moving over time.

This truly was the experience of a lifetime and I thank all those involved that helped to make this a reality and such a great experience. A huge thank you also has to go to the field team from Penn State that made the trip such a memorable experience.

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on glacial and subglacial structure.

Despite two severe storms, the team was able to complete the planned experiment in the original 10-day timeframe. At the conclusion of this work, Brandon departed WAIS for McMurdo since he had to begin teaching in early January. After completing their first objective, the team heard that the Basler (a modified DC-3 aircraft) was out of commission and that the only planes available for deep field landings were the 2 Twin Otters. The team had planned to use the Basler and was delayed at WAIS until December 30.

On December 30, a twin otter arrived at WAIS allowing Huw and Luke to conduct a reconnaissance flight. Due to the presence of massive crevassing near the grounding line, the camp was moved up glacier to a back up site at 75°15' S, 108° 31' W. During the next several days 24 differential GPS units were deployed on Thwaites Glacier in order to precisely measure the surface velocity of the glacier. By January 4, all GPS stations were deployed and the team had established a camp consisting of a 20' endurance tent for cooking and science and 3 sleeping tents. After digging out an Air National

Guard fuel drop designed to facilitate transportation to Thwaites and Pine Island Glacier, Leo and Paul quickly established a 10 km seismic line. Paul, Luke and Knut deployed 3 broadband seismometers to listen to the glacier's movement. Shot tests determined that ~1.2 kg of explosives planted in shot-holes 15 m deep were needed to collect high quality data. After drilling and planting explosives, the team then began shooting the line. 48 geophones were evenly spaced on a 960 m cable. After each shot, the team would dig out the end of the line and move 24 geophones and 480 m of cable to the head of the line and rebury the geophones. Far offshoot shots were detonated to provide 4-fold data. Shallow refraction experiments using a hammer as a seismic source were also conducted. Within a week of arriving on Thwaites the team had collected 10 km of high-resolution seismic data.

Then the winds resumed with sustained winds of up to 25-30 mph continuing for 3-4 days straight with 2-3 days of decent weather between storms. The high winds create noise on the geophones which makes data more difficult to interpret. Therefore, on windy days, teams of 2, usually Knut and Luke or Huw and Paul, drove a phase-coherent ice-penetrating

radar system designed at PSU up and down the glacier collecting several hundred kilometers of radar data and discovering several small crevasses along the way. The radar gives detailed information on internal reflectors and provides a quick way of mapping the bedrock topography beneath the glacier. Concurrent GPS data also allowed detailed mapping of the surface features of Thwaites. In addition to the radar data, and in spite of the high winds, the team was able to collect an additional 5 km of seismic data before retrieving the GPS units deployed on Thwaites and returning back to WAIS on January 28 after 24 days without contact with the outside world. After 4 days of quick packing at WAIS and McMurdo, the team flew to New Zealand on February 1 after 63 days on the ice. The data collected at WAIS will provide valuable information on what kind of material is under the ice and will be an important factor in deciding whether a sediment core is drilled after conclusion of the ice core drilling. The Thwaites data is the most detailed data set collected on this important glacier and will give important information on the changing dynamics of this area of West Antarctica.

STUDENT JOURNALISTS RUHL AND BAZAA JOIN CENTER

Beth Ruhl

I am truly pleased to be back at CReSIS after a semester spent in Berlin, Germany doing a travel writing internship. Previous to my internship, my duties at CReSIS included writing articles for The Icebreaker and creating press releases to inform the general public about our research. I will still be doing similar work for CReSIS as I continue my journalism studies at KU, but now I hope to start broadening the number of audiences we reach including K-12 students, college students, laypeople, scientists, industries and policy makers. I also hope to improve the CReSIS website by adding interactive media features that better explain our work. One of my favorite things about

working at CReSIS has been working with a dedicated team of students, scientists, staff and faculty and helping them show the world the importance of climate change research.

Uyanga Bazaa

Coming to KU for my Masters in Journalism and Mass Communication in August 2007 was full of new challenges, experiences and a lot of fun, which is still continuing now. I had been working as a reporter at the national television station in Mongolia for about three years, as well as a Public Relations Officer for Save the Children UK for over a year,

before I came to the United States. My first job here will be as a Student Journalist for CReSIS, and I'm thrilled to be part of the Center. I'm always excited about my profession, meeting new people and getting to know more about issues such as global warming and the environment. I enjoy delivering the messages of organizations such as CReSIS that have a great mission. I like to share what I've learned about people who have been doing great things. I believe this job will enrich my experience in the United States, and that I will be able to contribute to CReSIS through my professionalism and dedication. I look forward to meeting you all!

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TALKS, EVENTS AND MEETINGS

Presentation to Congressional Staffers from Kansas delegates (Brownback and Roberts) on Center activities - S. Gogineni, Lawrence, KS (10/12/07)

Presentation to the Subcommittee on Investigations and Oversight, House Committee on Science and Technology - R. Alley, Washington, DC (10/17/07)

"Climate Change and Sustainability", Central Ohio Summit on Sustainability and the Environment, E. Mosley-Thompson, Columbus, OH (11/14/07)

"Climate Change and CRISIS" On-Line Chat, Lawrence Journal World - D. Braaten (9/4/07)

"What the World's Glaciers are telling us about Climate Change", New Executives Climate Change Symposium - L. Thompson, Stanford University (9/5/07)

"Understanding Climate Change, the Leadership Ohio Class XIV [Conservation in Ohio] - E. Mosley-Thompson, The Wilds in Cumberland, OH (9/14/07)

"Convenient Truth: Opportunities for Climate Change Messaging at Zoos and Aquariums" Association of Zoos and Aquariums (AZA) Annual Conference - C. Landis, Philadelphia, PA (9/18/07)

"Understanding Climate Change" the National Conversation on Climate Action - L. Thompson, College of Law, University of Toledo, Toledo, OH (10/4/07)

"Climate Related Research at KU", Kansas EPSCoR Meeting - Energy, Climate, and the Future: The Role of Kansas" D. Braaten, Topeka, KS (10/10/07)

"Understanding Climate Change," "Impact of Global Warming on the Climate of China," and "Climbing Your Mountains" presentations on China's Einstein Lecturer Tour (a ten-day, multi-city tour to Beijing, Xian, and Kasgar, China) - L. Thompson, Chinese Academy of Sciences; Beijing, Xian, and Kasgar, China (10/10/07 - 10/17/07)

"Science, Skepticism, and Climate Change: Data and Debates" - R. Alley, Bucknell University, Lewisburg, PA (10/11/07)

"Probing the Ice Sheets to Understand Rapid Changes" SACNAS National Conference - D. Braaten, Kansas City, MO (10/12/07)

"How We Know What We Know [About Climate Change]" Presentation C. Landis, The Ohio State University at Marion, Marion, OH

"Ice Sheet Remote Sensing from Top to Bottom", Conference on Facts, Ideas, and U.S. Climate Change Policy, KU School of Law and the Center for Progressive Reform- D. Braaten, Lawrence, KS (10/20/07)

"Global Warming", Forum for the Future: An Energy and Environmental Discussion - R. Alley, Penn State University, State College, PA

"Global Warming (and Energy): The Latest (and Greatest?)," PennFuture Global Warming Conference - R. Alley, Gwynedd-Mercy College, Gwynedd-Mercy, PA (10/27/07)

"Understanding Climate Change"- L. Thompson, Rutgers University, New Brunswick, NJ (10/29/07)

"Ice Sheets and Sea Level: What Is Happening, Why It Is Happening, and What It Might Mean," 2007 AAAS Abelson Advancing Science Seminar New Horizons in Polar Science - R. Alley, Washington, DC

"Physical in Search of Social: Global Warming, Energy, and Other Big Questions" - R. Alley, Pennsylvania Geographical Society, Johnstown, PA (11/2/07)

"Climate Changes: Stories from the Ice" The Ohio State University Colleges of the Arts and Sciences Renaissance Rediscovery Weekend E. Mosley-Thompson, Columbus, OH (11/2/07)

"Understanding Climate Change" OSU Alumni Lecture Series - L. Thompson, Columbus, OH (11/2/07)

"How We Know What We Know [About Climate Change]" Presentation C. Landis, First Congregational Church, Columbus, OH (11/4/07)

"Understanding Climate Change" County Farmers Association - C. Landis, Croton, OH (11/6/07)

"Get Rich and Save the World - Or Else" - R. Alley, Carnegie Institution, Washington, DC (11/8/07)

"Get Rich and Save the World: Global Warming, Peak Oil, and Our Future" - R. Alley, Adrian College, Adrian, MI (11/14/07)

"Remote Sensing of Ice Sheets Educational Activities: Ice, Ice Baby" Supercomputing 07 - L. Hayden, Reno, NV (11/14/07)

"Center for Remote Sensing of Ice Sheets (CRISIS)" Supercomputing 07 - S. Gogineni, Reno, NV (11/14/07)

"How We Know What We Know [About Climate Change]" Battelle Seniors Association - C. Landis, Columbus, OH (11/15/07)

"Climate Change: The Power of One", 2007 Environmental Conference, Stark County Parks District - E. Mosley-Thompson, Massillon, OH

"Latest Images of the Ice" Haskell Indian Nations University Symposium-- D. Braaten, Lawrence, KS (7/23/07)

"Acid Deposition and Ecosystems" Haskell Indian Nations University Environmental Science Seminar - D. Braaten, Lawrence, KS

Alaska Native/American Indian Climate Change Working Group Symposium, Haskell Indian Nations University - D. Wildcat, Lawrence, KS (7/22/07 - 7/23/08)

"A Calving Law for Ice Shelves: Spreading-Rate Control of Calving Rate" West Antarctic Ice Sheet Meeting - R.B. Alley, I. Joughin, H.J. Horgan, T.K. Dupont, B.R. Parizek, S. Anandakrishnan, and K.M. Cuffey, Sterling, VA (9/6/07)

"Waist Deep in the Big Salty: Ice Sheets and Sea Level" Abrupt Climate Change Conference - R. Alley, Madison, WI (9/14/07)

"Physical Properties of the WAIS Divide Deep Core", West Antarctic Ice Sheet Divide Ice-Core Meeting - R. Alley, J. Fitzpatrick, K. Cuffey, M. Spencer, D. Reusch, and S. Yergey, North Lake Tahoe, NV (10/4/07)

"Using GIS and LIDAR for Modeling and Visualization of Localized Sea Level Rise" SACNAS National Conference - K. Hulbutta, Kansas City, MO (10/12/07)

"Understanding Climate Change" Distinguished Scholar Seminar Series L. Thompson, University of Florida, Gainesville, FL (11/1/2007)

"Monitoring the Antarctic Ice Shelf Energy Balance using Robotic Rovers" CERSER Fall Distinguished Lecture Series - D. Lampkin, Elizabeth City State University, Elizabeth City, NC (11/08/07)

"Comparison of AWS Sonic Altimetry Accumulation and AMPS Precipitation in East Antarctica", CRISIS All-Hands meeting - D. Steinhoff, Columbus, OH (11/14/07)

"Force Budget of Nioghalvfjordsfjorden Glacier, Northeast Greenland", CRISIS All-Hands -- L. Beem, Columbus, OH (11/14/07)

"Abrupt Climate Change: Past, Present, and Future", International Pacific Research Center - L. Thompson, University of Hawaii at Manoa, Honolulu, HI (11/15/07)

"Recent Tropical Paleoclimate Ice Core Records Yield Evidence for Asynchronous Glaciation" and "Understanding Climate Change" MGG&G Seminar Series, Oregon State University - L. Thompson, Corvallis, OR (11/29/07)

"Understanding Climate Change", Bluffton College Forum Lecture: L. Thompson, Bluffton, OH (12/4/07)