NEWSLETTER OF THE NATIONAL ICE CORE LABORATORY — SCIENCE MANAGEMENT OFFICE

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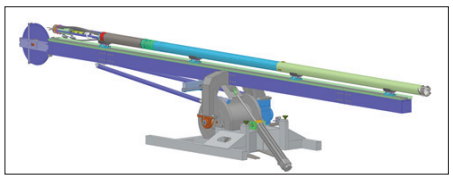

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# The National Ice Core Laboratory – 2013 and Beyond!

ON JANUARY 30, 2013 the National Science Foundation (NSF) and the United States Geological Survey (USGS) entered into a new Interagency Agreement (IAA) for "Operations and Maintenance of the National Ice Core Laboratory". The period of performance for this new IAA is February 1, 2013 and expires February 28, 2018.

This new 5-year IAA is for the continued 1) operations and maintenance of the NICL facility, 2) servicing of the ice core community with samples, and 3) day-to-day operations of the NICL-Science Management Office (NICL-SMO). This IAA integrates the NICL and NICL-SMO into one entity and brings all of the NICL-related functions into one funding umbrella (see Figure 1). Figure 1 shows how the organizational structure of the NICL and NICL-SMO changed from the previous IAA on the left into the current IAA on the right.

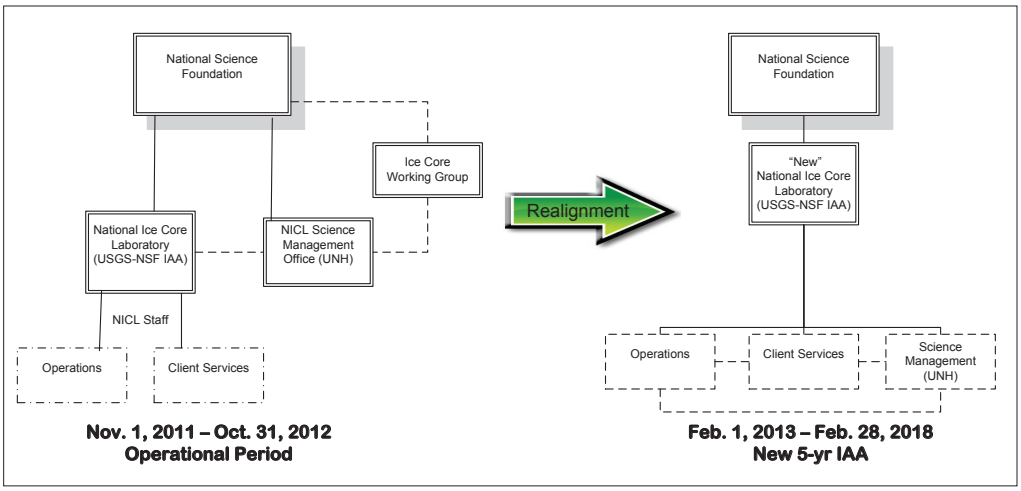


***Figure 1**. Organizational Charts for Operational Period (Nov. 1, 2011 – Oct. 31, 2012) and the new 5-year IAA Period of Performance (Feb. 1, 2013 – Feb. 28, 2018)*

**What has changed in the new NICL organizational structure?**

The duties for the NICL staff remain the same. Those duties include performing operations such as the day-to-day operations and maintenance of the NICL facility, providing a safe and convenient lab space for processing ice cores, and performing client services such as ensuring cores are readily available to clients, ensuring the currency and availability of ice core inventory records, and assisting researchers in sampling events as much as possible. A change from previous agreements between NSF and USGS is that the Science Management Office is now a part of the NICL agreement and no longer a separate agreement between NSF and the NICL-SMO. A subcontract for the science management of NICL was awarded to the University of New Hampshire (UNH). The Science Management Office (SMO) at UNH serves as the primary

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# The National Ice Core Laboratory – 2013 and Beyond!

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contact for scientists interested in access to ice cores; provides guidance to NSF and NICL staff on topics related to sample access, distribution, inventory, policy issues, operation and maintenance of the NICL, and future directions for ice core research; assists scientists and the public with matters related to ice core science; and hosts the new NICL/NICL-SMO website (http://www.icecores.org).

Prior to 2013, the NICL-SMO worked very closely with and coordinated the Ice Core Working Group (ICWG). In 2012 the ICWG was realigned as a working group to the Science Advisory Board of the Ice Drilling Program Office (http://www.icedrill.org/about/sab.shtml). Although the ICWG is no longer coordinated by NICL-SMO, Mark Twickler (NICL-SMO Science Director) continues to rely on the ICWG for advice pertaining to the NICL facility.

**So how will this affect the ice core community?**

To the ice core community there will likely be little or no obvious change to how you carry out your research and interact with the NICL staff or NICL-SMO. Hopefully, your experiences will continue to be positive and we are able to improve our services to you. There are several exciting changes that make positive improvements to our facility and services.

***Long Range Strategic Planning for NICL***

The NICL facility uses R-22 Freon (HCFC-22). This refrigerant is currently being phased out. This phase-out schedule (http://www.epa.gov/ozone/title6/phaseout/22phaseout.html) requires that the U.S. reduce its consumption of HCFCs by 90% below the U.S. baseline by January 1, 2015 and 99.5% below the baseline by January 1, 2020. R-22 can no longer be installed in new refrigeration systems; however, a refrigeration system such as the NICL facility which uses R-22 can continue to operate provided the R-22 has been recovered and recycled/reclaimed. Simply replacing R-22 in the NICL refrigeration system with a newer, environmentally friendly refrigerant is not feasible. The new refrigerants do not have the lubricity and other characteristics that are compatible with the existing equipment.

In addition, the storage capacity of the freezer is nearing its limit. The NICL main storage is now filled to about 95% of its capacity. Main storage has the ability to house an additional 3,500 tubes of 4-inch core.

NSF, NICL, NICL-SMO and the Ice Drilling Program Office are working together on developing a plan that will strategically address the following questions: How much ice core will be collected over the next 5, 10, 15, 20 years? What ice cores need to be kept? Which ones could be de-accessed? What will it take to retrofit the existing freezer? Should another smaller freezer box be built to assist during the retrofitting of the NICL freezer to a new refrigerant? What other improvements can be made to the facility? What is the best management structure for the long-term operation of the facility?

A report on the Long Range Strategic Planning for NICL will be submitted to NSF in 2014. If you would like to be a part of this report, please contact Mark Twickler via mark.twickler@unh.edu.

***NICL and NICL-SMO Website***

Prior to the new IAA the NICL and NICL-SMO had separate websites. With the integration of these two entities, the NICL-SMO combined both websites and UNH now hosts a new and much improved NICL website (http://www.icecores.org). One can now learn about the NICL and NICL-SMO through one portal. This new site is easy to navigate through and contains information about the NICL and NICL-SMO, how to access ice core samples, detailed information

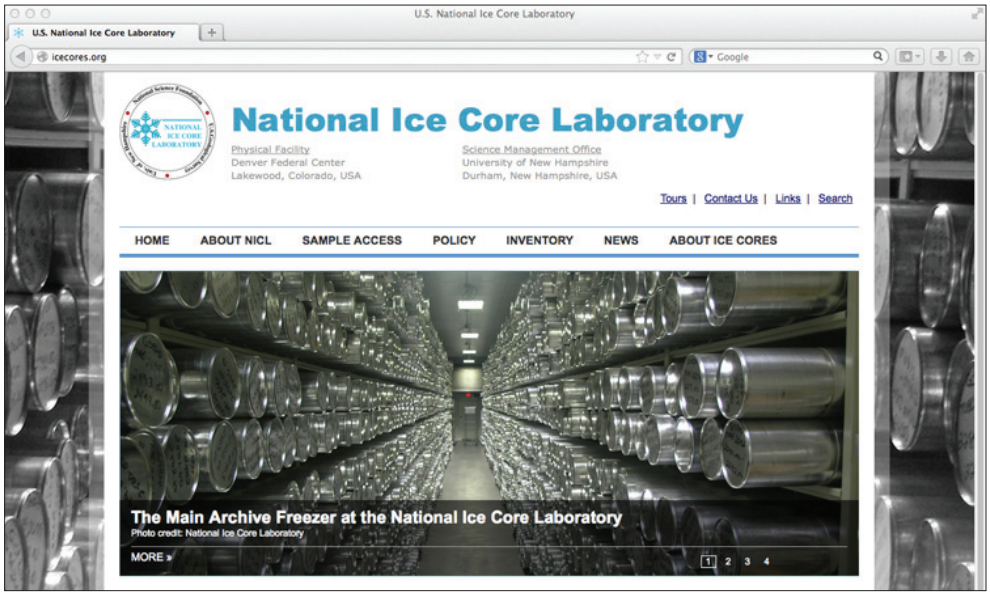


***Figure 2.*** *Screenshot of the new NICL/NICL-SMO website (http://www.icecores.org)*

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# The National Ice Core Laboratory – 2013 and Beyond!

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about NICL use and ice core sample allocation policy, access to the NICL inventory, information about NICL tours, and general information about ice cores. While the new website hosted by UNH is now active, the old NICL USGS website is still temporarily active. Eventually, only the NICL database will be hosted on the USGS website.

***Outreach***

The new 5-year IAA also includes plans to expand the NICL outreach effort. This has already begun. Brian Bencivengo, NICL Assistant Curator, worked extensively with the NICL staff and the University of Colorado, Denver, to develop a Microsoft PowerPoint presentation that is now being used for each NICL tour given. This presentation provides each tour with an exciting look into what goes on before ice gets to the NICL and then what happens when the ice does arrive here. This presentation goes over the background about ice core science discussing how scientists choose where to drill ice cores, how the ice forms, how the ice cores are drilled and retrieved, what field camps are like in Antarctica, what happens in the NICL freezer, and what the data collected from the ice cores tell us. We are looking into other venues in which to share the work that occurs at NICL with those individuals unable to visit us here at the NICL facility.

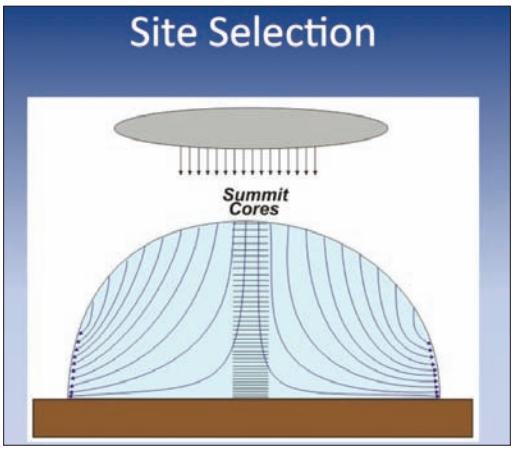


***Figure 3.*** *A new Microsoft PowerPoint presentation for NICL tours explains, among other things, how research scientists choose a good site for drilling and retrieving ice cores.*

***2013 and Beyond***

The NICL and NICL-SMO have a lot of plans for the next five years. While we continue to service the ice core community's immediate needs, we are looking to the future to determine how we can best address many questions – even those that have not yet been asked. If you would like more information about the NICL or NICL-SMO, check out our website (http://www.icecores.org), and click "Contact Us" with any questions or comments. We look forward to hearing from you.

*This work is funded by the National Science Foundation under Interagency Agreement PLR-1306660 (U.S. Geological Survey).*

**In-Depth**

***In-Depth*** is published semi-annually by the **National Ice Core Laboratory - Science Management Office (NICL-SMO)**.

We are interested in project stories and news from the ice coring community. Please contact us if you are interested in submitting a story or news item to *In-Depth*.

***In-Depth*** **Newsletter**

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Masthead photos courtesy of Lonnie Thompson and Michael Morrison

## Upcoming Meetings

**27-30 October 2013**
Geological Society of America, Denver, CO, USA
http://community.geosociety.org/2013AnnualMeeting/Home

**9-13 December 2013**
AGU Fall Meeting, San Francisco, CA, USA
http://fallmeeting.agu.org/2013/

**10-14 March 2014**
International Symposium on Sea Ice, Hobart, Australia
http://seaice.acecrc.org.au/igs2014/

**17-20 March 2014**
13th International Conference on the Physics and Chemistry of Ice (PCI-2014), Hanover, NH, USA
http://engineering.dartmouth.edu/pci-2014/

**17-22 August 2014**
International Workshop on Ice Caves (IWIC), Idaho Falls, ID, USA
http://www.iwic-vi.org/

**18-23 August 2014**
International Symposium on the Changing Arctic Cryosphere, Edmonton, Alberta, Canada
http://www.igsoc.org/symposia/2014/alberta/

**22-24 September 2014**
WAIS Divide Ice Core Science Meeting, La Jolla, CA, USA
http://waisdivide.unh.edu/meetings/

# Reconstructing Central Alaskan Precipitation Variability and Atmospheric Circulation over the Past Millennium

By Dominic Winski, Dartmouth College

*The ice-drilling field camp with Mt. Hunter in the background. Photo: Mike Waszkiewicz*

IN MAY OF 2013, a collaborative team led by Erich Osterberg (Dartmouth College), Cameron Wake (University of New Hampshire), and Karl Kreutz (University of Maine) returned to Denali National Park to collect two ice cores to bedrock from the Central Alaska Range, completing a campaign 6 years in the making. We expect these cores to provide a wealth of information about Alaskan temperature, precipitation, wind patterns, volcanic activity and pollution over at least the past 1000 years.

In recent years, Alaska has experienced some of the most dramatic warming and loss of mountain glaciers in the world. However, there are few climate proxy records from Central Alaska to put these modern changes into the context of geologically recent cold and warm periods such as the Little Ice Age and Medieval Climate Anomaly. The aim of our project is to fill this knowledge gap on the dynamics between climate change and mountain glacier response in this globally significant environment.

Over five previous field seasons, we collected meteorological data, ice thickness and flow measurements, and shallow ice cores and snow pit samples from several regions within the Park to find the best location for extracting an ice core (see *Uncovering Denali, In-Depth, Fall 2008*). After investigating several options within the Alaska Range, we concluded that the Mt. Hunter summit plateau is an ideal ice-drilling site. This location is high enough in elevation so as to experience little summer melting, and is also flat lying with simple stratigraphy and few crevasses. These characteristics should provide a continuous and well-preserved ice core climate record.

*Mike Waszkiewicz (L) and Brad Markle (R) inside the drill tent with the Eclipse Ice Drill. Photo: Dominic Winski*

Though we also selected the site based on relative ease of access, the Mt. Hunter Plateau remains one of the most inaccessible regions in North America. In May, we flew onto the Kahiltna glacier via ski plane from Talkeetna, AK. Because Mt. Hunter Plateau is at 13,000 feet elevation, it was necessary to spend the first two weeks of our field season acclimatizing on the West Buttress of Denali before making the helicopter flight up to the drill site. When we arrived at Mt. Hunter, we quickly got to work setting up the solar- and wind-

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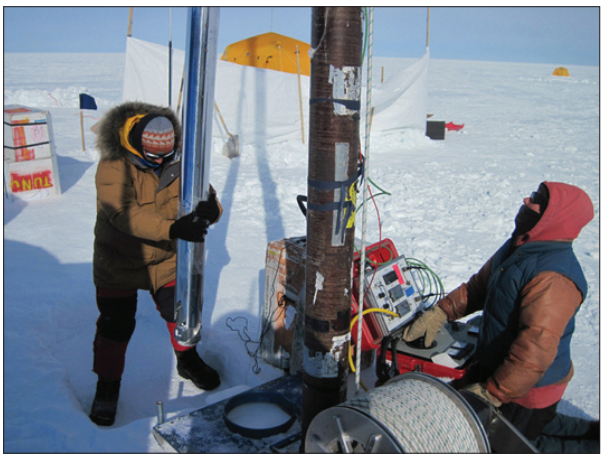
# A 2000 Year Record of Atmospheric Aerosols and Gases Collected from the High Arctic

By Olivia Maselli, Desert Research Institute

*View of the ice-drilling field site at Tunu, Greenland. Photo: Olivia Maselli*

IN MAY 2013 a group of 4 researchers from the Desert Research Institute (DRI) in Reno, Nevada and Oregon State University, travelled to the far north east of the Greenland ice sheet and spent 3 weeks at the remote site in order to drill two adjacent ice cores. The site name, Tunu, translates as 'East' or 'Backside' in Greenlandic at its location (78N, 33E) is marked only by a nearby solitary automatic weather station ~200 km inland at an altitude of ~2000 m. The purpose of the drill campaign was to collect an ice core that went back to 2000 years b.p. at a low snow accumulation, high Arctic site - time permitted that we were also able to drill a second, replicate core just 3 meters away.



*Going down for another meter of quality core. Photo: Olivia Maselli*

*Clearing the core barrel of chips so the core can be extracted. Photo: Michael Sigl*

Temporal records of aerosol concentrations archived in the ice sheet are dependent upon the air masses that move over the site. At Tunu, air masses typically move from northern Europe over the North Atlantic and carry with them proxies of increased industrialization such as toxic heavy metals or soot as well as indicators of more local climatic conditions such as sea ice extent or sea surface temperatures. Once these aerosols are deposited on the ice sheet they can influence its physical properties by, for example, decreasing the albedo at the ice surface or even affecting the structure of the ice matrix itself. Comparison of the aerosol and greenhouse gas records from the Tunu ice cores with records from an array of other Greenlandic ice cores will give us insight into if and how the aerosol concentrations preserved in the ice effect the preservation of the gases in the ice.

The drill campaign at Tunu was a very successful one. Led by Beth Bergeron (Ice Drilling Design and Operations) two great quality 4-inch cores were dry drilled to depths of 213 and 143 meters, with only a one-day hiatus due to bad weather. Obtaining ice cores that are free from drill fluid contamination was an essential part of this study as the presence of drilling fluid can easily compromise the measurement of Total Organic Carbon (TOC) as well as affecting the performance of the other non-organic ultra trace instruments that are used to analyze the ice core.

The cores were shuttled to the USA via Basler aircraft, NSF's C130 Hercules and finally two

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## Reconstructing Central Alaskan Precipitation Variability and Atmospheric Circulation over the Past Millennium

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powered Eclipse Ice Drill under the direction of IDDO driller Mike Waszkiewicz. The Mt. Hunter plateau glacier is just over 700 feet thick, and we were able to drill two ice cores all the way to the bottom in the span of 3 weeks.

While on Mt. Hunter we took the opportunity to conduct as much research as we could in addition to collecting the ice cores. Seth Campbell (UMaine and CRREL) gathered radar profiles and GPS points to measure the depth of the ice and the velocity of the surface ice flow. We also dug many snow pits, four of which were sampled for a variety of chemical properties, which will tell us about recent climate changes. These data will help us to interpret our long-term ice core record. Finally, we set up two weather stations which are continuously collecting temperature, snow depth, wind speed, radiation, photographs and more, and sending the data back to us by satellite modem.

Remarkably good weather allowed us and the ice cores to make a safe trip off the mountain two weeks ahead of schedule. The ice was immediately transported to the National Ice Core Lab (NICL) in Colorado via freezer trucks where it will be thoroughly measured and processed for chemical sampling. Some of the ice will remain in archives at NICL so that future scientists will have access to the Mt. Hunter core as new analyses are developed. The rest of the ice will be transported to Dartmouth College where we will melt and analyze the cores in the coming year or so.

Many thanks to all of our supporters including the National Science Foundation, the National Park Service, IDDO, CH2MHill Polar Services, Talkeetna Air Taxi, PolarTREC, and our many invaluable volunteers.

For more information about the project, visit:
http://now.dartmouth.edu/2013/07/dartmouth-drills-at-denali-to-document-climate-change/

*This work is funded by the National Science Foundation under Grant Numbers AGS-1204035 (Dartmouth College), AGS-1203838 (University of Maine) and AGS-1203863 (University of New Hampshire).*

## A 2000 Year Record of Atmospheric Aerosols and Gases Collected from the High Arctic

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refrigerated trucks and arrived at NICL in July where they were promptly cut into meter long sticks ready for analysis. The measurement of the Tunu cores was performed at the Ultra-trace Chemistry Lab at DRI and was complete by mid-August. The cores were analyzed in a rapid, high temporal resolution, continuous melt technique where both aerosols and gases trapped in the ice are measured simultaneously. The fact that the cores were freshly drilled with no drill fluid and were in great condition has resulted in a spectacular 2000 year record of from the high Arctic location. Processing of the ice core records is now underway, and is already revealing the complex relationship between aerosol and gas records and their preservation in the ice sheet.

A detailed account of the field campaign as well as the recently completed analysis campaign can be found at our blog http://icecores.blogs.dri.edu/.

*This work is funded by the National Science Foundation under Grant Numbers PLR-1204176 (Desert Research Institute) and PLR-1204172 (Oregon State University).*

*A section of firn from the Tunu cores is prepped and awaiting analysis at DRI. Photo: Olivia Maselli*

*Melting the ice for analysis. The ice cores are melted and analyzed using a continuous technique at DRI. Photo: Michael Sigl*

# South Pole 1500-Meter Ice Core Project

By South Pole Ice Core Project Team †

† Eric Saltzman, Murat Aydin, Eric Steig, TJ Fudge, Tom Neumann, Kimberly Casey, Mark Twickler and Joe Souney

**Project Overview**

THE SOUTH POLE ICE CORE project is a U.S. effort funded by the National Science Foundation (NSF) to drill and recover a new ice core from South Pole, Antarctica. The ice core will be drilled to a depth of 1500 meters and provide records of stable isotopes, aerosols, and atmospheric gases spanning approximately 40,000 years. The South Pole site preserves unique climate records by combining cold temperatures typical of East Antarctica with a relatively high accumulation rate due to West Antarctic influence. The South Pole Ice Core extends the international array of ice cores used to investigate environmental change since the last glacial/interglacial transition. The scientific goal is to assess and understand changes in atmospheric chemistry, climate, and biogeochemistry. Drilling is planned for the 2014-2015 and 2015-2016 field seasons, and a new intermediate-depth drill will be used to recover the ice core.

**Project Organization**

With support from NSF's Division of Polar Programs, UC-Irvine (Saltzman–Lead PI and Aydin), University Washington (Steig) and the University of New Hampshire (Twickler and Souney) — with assistance from NASA-GSFC (Neumann) — provide the overall scientific coordination for the project, which includes site selection, field operations, core processing at the National Ice Core Laboratory, data management, and communications/workshops.

Logistical support is provided by NSF's Antarctic Research & Logistics Integration program and is managed by Leah Street with the Antarctic Support Contract (ASC). Drilling support is provided by the U.S. Ice Drilling Program and is led by Jay Johnson (drill development) and Tanner Kuhl (lead driller).

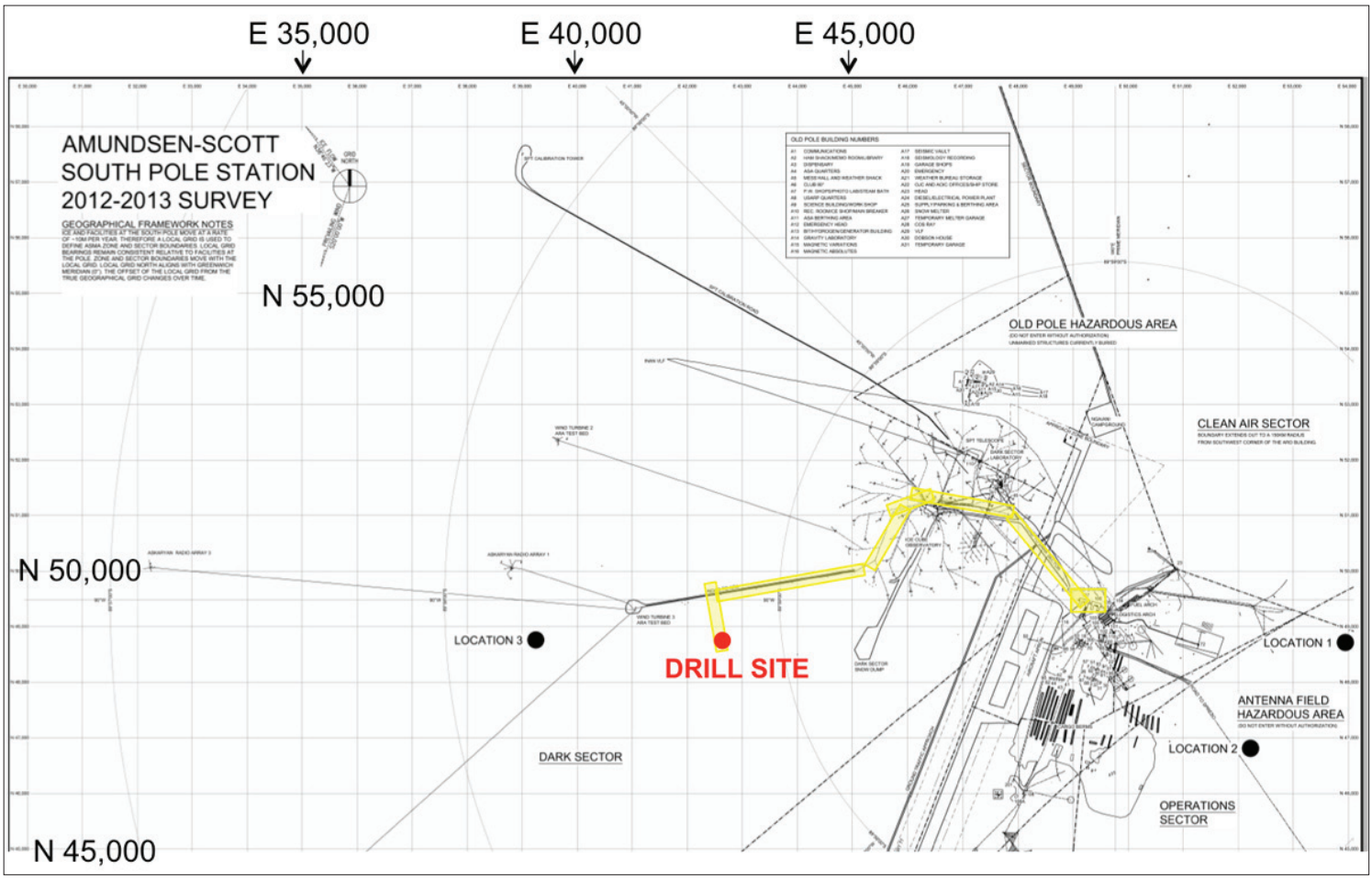


***Figure 1.*** *Map of Amundsen-Scott South Pole Station. The approximate location of the South Pole Ice Core drill site is marked with the red circle and labeled 'DRILL SITE'. The drill site is roughly 2.7 km travel distance from Elevated Station.*

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# South Pole 1500-Meter Ice Core Project

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**Site Selection and Preparation**

During FFY 2013, Tom Neumann (NASA-GSFC), TJ Fudge (University of Washington) and Kimberly Casey (NASA-GSFC) led site selection activities using existing radar, accumulation, ice core, flow velocity, depth-age and surface elevation data. After reviewing the existing glaciological data, and after discussions with NSF and ASC regarding logistical considerations, a drill site for the South Pole Ice Core was established and approved by NSF in August 2013.

The drill site is in the Dark Sector at roughly 89.98S, 95.10W / N 48 800, E 42 600, approximately 200 meters perpendicular off the Road to ARA Wind Turbine 3 Test Bed (Figure 1). The site is roughly 2.7 km travel distance from Elevated Station.

During the 2013-2014 field season, ASC will conduct a 100m x 100m GPR survey centered on 89.98S, 95.10W to finalize the exact location of the drill site. ASC will also prepare the road(s) to the field site and compact snow surfaces for the buildings that will be erected at the field site during the 2014-2015 field season. In addition, the drilling fluid (ESTISOL-140), borehole casing, and ice core boxes/tubes will arrive to McMurdo Station via the resupply vessel in February 2014, where they will winter-over.

**Schedule**

Figure 2 shows the schedule for the project.

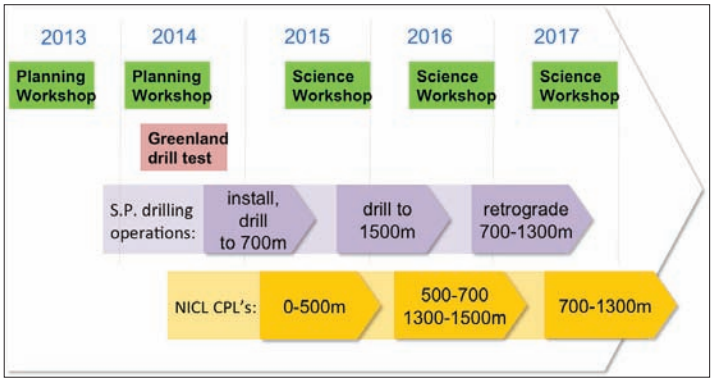


***Figure 2.*** *Generalized schedule for the South Pole Ice Core project.*

Drilling is planned for the 2014-2015 (from 0 to ~700 m / through the Holocene) and 2015-2016 (from ~700 to 1500 m / 40,000 years) field seasons. The goal is to install the drill, drill to 700 meters depth, and retrograde all non-brittle ice (nominally 0-500 m) during the first season (2014-2015). The goal for the second season (2015-2016) is to finish drilling to 1500 m depth, retrograde all of the brittle ice that wintered-over from the previous season (500-700 m), retrograde all of the newly drilled ductile ice (1300-1500 m), winter-over the newly drilled brittle ice (700-1300 m), and uninstall the drill. While the only activity currently scheduled for the 2017-2018 field season is to retrograde the previous season's wintered-over brittle ice, the project has received permission from ASC to use the season to finish drilling in the event that we are unable to reach 1500m by the end of the 2016-2017 season.

Core processing lines will be held at the National Ice Core Laboratory during the summers of 2015, 2016 and 2017.

The first planning workshop for the project was held in February 2013 in Boulder, CO, and the next planning workshop is scheduled for February 2014 (see 2014 Planning Workshop below). Science workshops for funded PIs will be held in the fall of 2015, 2016 and 2017.

In late April – early June 2014 the new Intermediate-Depth Drill will be field tested in Greenland at the new Isi Station (~5 km NE of Summit).

**Proposals to Analyze the Ice Core**

Currently, there are no projects funded to analyze the South Pole Ice Core. The main target date for ice core analysis proposals is the April 2014 NSF Antarctic Research solicitation deadline. Proposals to work on the South Pole Ice Core need a letter of support from the project's Scientific Steering Committee (SSC), currently composed of Eric Saltzman, Eric Steig, Murat Aydin, and Tom Neumann. To contact the SSC regarding a letter of support, email contact@spicecore.org.

The South Pole Ice Core is 9.8 cm in diameter, about ½ the volume of the WAIS Divide Ice Core, so availability of ice will be less. However, with some advanced planning and creative sampling work we should still be able to accommodate a number of projects that want to analyze the ice.

**2014 Planning Workshop**

The next planning workshop is scheduled for February 2014 in Irvine, California. As the details for the workshop are established in the

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# South Pole 1500-Meter Ice Core Project

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coming months, they will be posted on the project's website at http://spicecore.org/meetings/.

The planning workshop is intended to give scientists interested in participating in the project an opportunity to discuss science goals and analytical measurements, as well as an opportunity to coordinate the submission of science proposals to the 2014 NSF Antarctic Research solicitation.

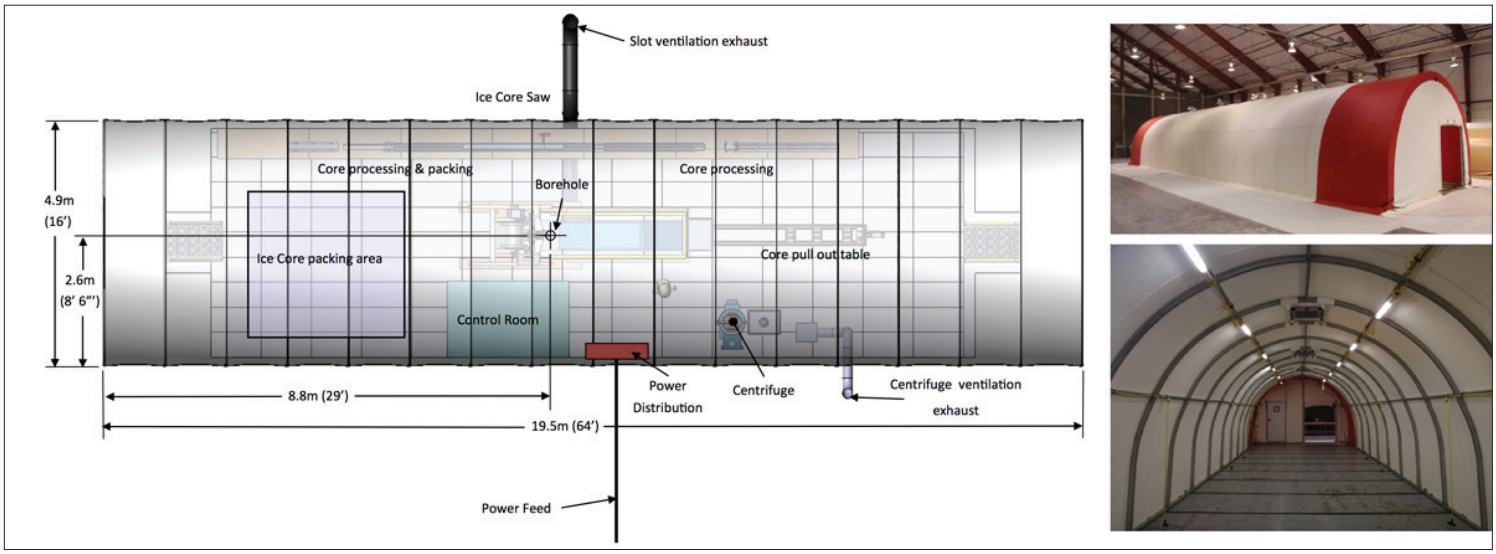


***Figure 3.*** *SolidWorks rendering (left) and photos (right) of the un-insulated WeatherPORT for housing the drilling and core processing operations. The WeatherPORT tent is 19.5m L x 4.9m W x 2.8m H (64' x 16' x 9') and covers a trench that is 15m L x 4.6m W x 1.5m D (49' x 15' x 4.9'). Not shown is an underground ice core storage area 7.6m L x 4.6m W (25' x 15') that comes off of the ice core packing area. The tent is steel-framed and is rated for 65 knot winds and 269 kg/m² snow load. Drawing courtesy of Jay Johnson (IDDO/UW-Madison). Photos courtesy of Tanner Kuhl (IDDO/UW-Madison).*

### South Pole Field Operations

Field operations will be carried-out by a ten-person field team operating 24 hours/day, 6 days/week, with 3 people per shift (2 drillers, 1 core handler). The field team will be housed at Elevated Station and commute daily (~2.7 km) to the drill site.

The U.S. Ice Drilling Program's new Intermediate-Depth Drill (IDD) will be used to recover the ice core. The IDD is much smaller and more mobile than the drill used on the recently completed WAIS Divide Ice Core project. An un-insulated WeatherPORT will house the drilling and core handling operations, and will remain standing between drilling seasons.

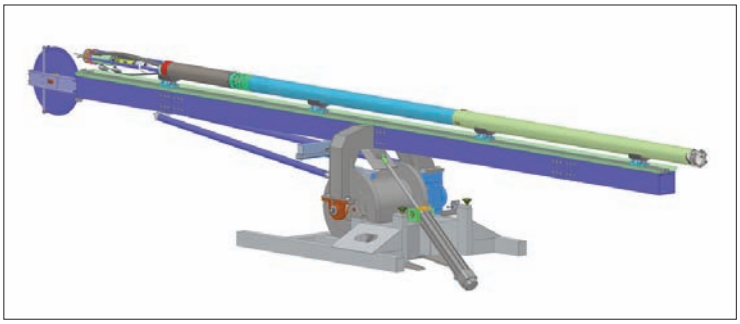

***Figure 4.*** *The Intermediate-Depth Drill's tilting tower and winch, shown above, is a brand new design by IDDO using a lot of new technological advances from the DISC Drill. The tower is modular allowing it to fit inside a Twin Otter or similar sized aircraft. Drawing courtesy of Jay Johnson (IDDO/UW-Madison).*

### Contact Information

The best way to stay informed about the South Pole Ice Core project is by subscribing to our email list. To subscribe, go to the project's website at  and fill-in your name and email address in the 'Subscribe to our E-Mail List' box. If you need to send us an email, the best email address to use is contact@spicecore.org.

*This work is funded by the National Science Foundation under Grant Numbers PLR-1142517 (University of California-Irvine), PLR-1141839 (University of Washington) and PLR-1142646 (University of New Hampshire).*

NSF Press Release 13-182

# NSF, U.S. Antarctic Program Partners, Working to Restore Antarctic Research Season to the Maximum Extent Possible

## Efforts continue to mitigate effects of October's partial government shutdown

**October 28, 2013**

Officials at the National Science Foundation (NSF)--working cooperatively with the agency's private-sector, military and interagency partners--are restoring field science supported by the U.S. Antarctic Program, the nation's research program on the southernmost continent, to the maximum extent possible, following the October federal government shutdown.

NSF, which has a Presidential mandate to manage the U.S. Antarctic Program, was required to suspend most of its activities in Antarctica during the recent 16-day partial shutdown and move towards a reduced operations, or "caretaker" status at each of the three U.S. Antarctic stations, until federal funding could be restored.

In mid-October, after a Continuing Resolution was approved to keep the government running until mid-January, NSF and its U.S. Antarctic Program partners began examining the planned research schedule to see how much could still be accomplished by the end of the field season, in February of 2014, while simultaneously ramping back up the complex logistical framework needed to support the science.

The 16-day interruption caused some early-season research in the vicinity of McMurdo Station to be deferred--either because of the complexity of the logistics needed to support the science or because the research itself was planned for a short and specific duration--and also delayed preparations for research scheduled to take place later in the season. Research that was deferred this season, but that will be supported next year, will displace new starts from the proposals currently in review.

Despite the setbacks, a cooperative effort among NSF; the agency's operations and research support contractor, Lockheed Martin; the Department of Defense, which provides critical airlift and other support to the program; and other U.S. agencies has allowed NSF to develop a schedule for deploying researchers to recover the tempo of research to the extent possible.

The process of recovery from the shutdown is ongoing and schedules still evolving, but as of Oct. 24, 2013, some 49 of the 77 scheduled projects in the McMurdo area will deploy this season, with some of those 49 deploying with reductions or modifications in scope, but in a way that allow them to meet the principal science goals for the season. Projects may include one or more investigators supported by separate grants.

*Passengers disembark from an Air Force C-17 Globemaster aircraft near McMurdo Station in the 2011 photo. Credit: Jean Varner, National Science Foundation*

Also as of Oct. 24, a total of 13 planned deployments in the McMurdo vicinity have been deferred for various reasons. A further 15 projects remain to be evaluated.

Although the program weathered a long federal government shutdown in the 1990's, the circumstances were different than this year's, because that shutdown occurred later in the fiscal year.

The unusual circumstances, unique in the Antarctic Program's more than 50-year history, have caused the cancellation of some large-scale research for the season, including most of the support for NASA's Long-Duration Balloon facility; a camp on Mt. Erebus, atop the world's southernmost active volcano; a field camp for the West Antarctic Ice Sheet (WAIS) Divide project; and an over-ice traverse to support portions of the Whillians Ice Stream Subglacial Access Research Drilling (WISSARD) Project.

Principal investigators on deferred projects have been alerted to their status.

NSF's decisions about which projects it is able to support were based upon a range of factors, including:

- a need to insure the continuity of long-term data sets
- time-criticality of observations or studies,
- potential effects on young or early-career investigators, and
- international or interagency partnerships.

NSF maintains three year-round stations in Antarctica: McMurdo, Amundsen-Scott South Pole and Palmer. The effects of the shutdown were felt most among projects based from McMurdo Station, on Ross Island.

Although some effects will be felt at South Pole, the station opens later

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in the research season than McMurdo and the effects are anticipated to be primarily related to potential delays of the delivery of science cargo or movement of people.

Palmer, on the Antarctic Peninsula near South America, is the smallest of the three stations and is supported by a different logistical stream than the other two stations. Research at Palmer Station and on the USAP research vessels *Nathaniel B. Palmer* and the *Laurence M. Gould* is expected to proceed largely as planned.

Collectively, the science at these stations represent approximately 100 additional projects.

-NSF-

**Media Contacts**

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## National Science Foundation Projects Related to

## Ice Cores or Ice Core Data

The table below shows projects related to ice core research that have been funded by the National Science Foundation (NSF) since the last issue of *In-Depth* was published. To learn more about any of the projects listed below, go to the NSF Award Search page ( http://www.nsf.gov/awardsearch/ ) and type in the NSF Award Number. If you have a newly-funded NSF project that was omitted from this listing, please let us know and we will add it to the next issue of *In-Depth*.

| Title of the Funded Project | Investigator | Award Number |
|---|---|---|
| Anisotropic Ice and Stratigraphic Disturbances | Waddington, Ed | 1246045 |
| Assessment of the natural perchlorate source using perchlorate history from Greenland ice cores | Cole-Dai, Jihong | 1203533 |
| Collaborative Research: A 1500m Ice Core from South Pole | Saltzman, Eric<br>Steig, Eric<br>Twickler, Mark | 1142517<br>1141839<br>1142646 |
| Collaborative Research: Climate Controls on Aerosol Fluxes to Taylor Dome and Taylor Glacier | Aciego, Sarah<br>Gabrielli, Paolo | 1246702<br>1242799 |
| Collaborative Research: Continuous Records of Greenhouse Gases and Aerosol Deposition During the Holocene: Testing the Fidelity of New Methods for Reconstructing Atmospheric Change | Brook, Edward<br>McConnell, Joseph | 1204172<br>1204176 |
| Collaborative Research: Investigating the potential of carbon-14 in polar firn and ice as a tracer of past cosmic ray flux and an absolute dating tool | Brook, Edward<br>Petrenko, Vasilii<br>Severinghaus, Jeffrey | 1204084<br>1203779<br>1203686 |
| Collaborative Research: Investigating Upper Pleistocene Rapid Climate Change using Continuous, Ultra-High-Resolution Aerosol and Gas Measurements in the WAIS Divide Ice Core | Brook, Edward<br>McConnell, Joseph | 1142041<br>1142166 |
| Collaborative Research: P2C2--Reconstructing Central Alaskan Precipitation Variability and Atmospheric Circulation during the Past Millennium | Kreutz, Karl<br>Osterberg, Erich<br>Wake, Cameron | 1203838<br>1204035<br>1203863 |
| Collaborative Research: Refining Long-term Climate Records from the Renland Ice Cap | Sowers, Todd<br>White, James | 1304077<br>1304109 |
| Collaborative Research: SNOWpack Photodenitrification from the Antarctic and Arctic Cryosphere (SNOWPAAC) | Alexander, Becky<br>Henze, Daven | 1244817<br>1244958 |
| Collaborative Research: Sonic Logging the NEEM Corehole, Greenland | Pettit, Erin<br>Waddington, Edwin | 1208806<br>1208635 |
| Collaborative Research: The Taylor Glacier, Antarctica, Horizontal Ice Core: Exploring changes in the Natural Methane Budget in a Warming World and Expanding the Paleo-archive | Brook, Ed<br>Petrenko, Vasilii<br>Severinghaus, Jeff | 1245821<br>1245659<br>1246148 |

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# National Science Foundation Projects Related to Ice Cores or Ice Core Data

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| Title of the Funded Project | Investigator | Award Number |
|---|---|---|
| Collaborative Research: VeLveT Ice - eVoLution of Fabric and Texture in Ice at WAIS Divide, West Antarctica | Obbard, Rachel<br>Pettit, Erin | 1142035<br>1142167 |
| Completing the WAIS Divide Ice Core $CO_2$ record | Brook, Edward | 1246465 |
| Development of a Laser Spectroscopy System for Analysis of $^{17}O_{excess}$ on Ice Cores | Steig, Eric | 1341360 |
| Doctoral Dissertation Research: Using Ice-Core Data to Reconstruct Atmospheric Mercury Deposition Over the Past 17,000 Years | Osterberg, Erich | 1232844 |
| EAGER: Improving Ice Core Observations of Large Volcanic Eruptions, and Their Effect on Global Climate Change, with a Novel Sulfur Isotope Method | Adkins, Jess | 1340174 |
| Ethane measurements in Greenland ice cores: Developing a preindustrial record | Aydin, Murat | 1204248 |
| Fugitive Gases (Helium, Neon, and Oxygen) in the WAIS Divide Ice Core as Tracers of Basal Processes and Past Biospheric Carbon Storage | Severinghaus, Jeffrey | 1143619 |
| Investigating Source, Chemistry and Climate changes using the Isotopic Composition of Nitrate in Antarctic Snow and Ice | Hastings, Meredith | 1246223 |
| Molecular Level Characterization of Dissolved Organic Carbon and Microbial Diversity in the WAIS Divide Replicate Core | Foreman, Christine | 1141936 |
| MRI: Development of a High-power, Large Antenna Array and Ultrawideband Radar for a Basler for Sounding and Imaging of Fast-flowing Glaciers and Mapping Internal Layers | Hale, Richard | 1229716 |
| MRI: Development of a Laser-ultrasonic Ice Core Tomography System | van Wijk, Kasper | 1229722 |
| NEEM basal ice, assessing the attributes of a cold, deep, dark ecosystem | Skidmore, Mark | 1204223 |
| NSF East Asia and Pacific Summer Institute (EAPSI) for FY 2013 in China | Cox, Thomas | 1316822 |
| NSF East Asia and Pacific Summer Institute for FY 2012 in Japan | Lundin, Jessica | 1209328 |
| Operations and Maintenance of the National Ice Core Laboratory | Adrian, Betty | 1306660 |
| Optical Fabric and Fiber Logging of Glacial Ice | Bay, Ryan<br>Talghader, Joseph | 1142173<br>1142010 |
| P2C2: High-resolution Reconstruction of the South American Monsoon History from Isotopic Proxies and Forward Modeling | Vuille, Mathias | 1303828 |
| Reactive Gas Chemistry in the Dome C Snowpack and its Influence on Surface Layer Chemistry and Ice Core Records | Helmig, Detlev | 1142145 |
| Searching for Abrupt Climate Change Precursors Using Ultra High Resolution Ice Core Analysis | Kurbatov, Andrei | 1203640 |
| Tephrochronology of the WAIS Divide Ice Core: Linking Ice Cores through Volcanic Records | Dunbar, Nelia | 1142115 |
| The Effects of Soluble Impurities on the Flow and Fabric of Polycrystalline Ice | Baker, Ian | 1141411 |

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