

Ice

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Cover picture: Spiral icicle extruded from the tubular steel frame of a jungle gym in Moscow, November 2010.
Photo: Alexander Nevzorov.

Scanning electron micrograph of the ice crystal used in headings by kind permission of William P. Wergin,
Agricultural Research Service, US Department of Agriculture

EXCLUSION CLAUSE. While care is taken to provide accurate accounts and information in this Newsletter, neither the editor nor the International Glaciological Society undertakes any liability for omissions or errors.

From the Editor

Dear IGS member

Although this is the last issue of 2010, I am writing this in February 2011. I have just returned from the 15th Alpine Glaciologists Meeting – always an enjoyable meeting. In preparing my presentation for the meeting, compiling the statistics about our performance this past year, it dawned on me that we are at a watershed in the history of the IGS. For the last few years we have been working on ‘repairing’ things that were not working as they should.

First we attacked the very long turnover time between submission and publication. We believe we have resolved that issue and now we are one of the fastest journals in the field. We have done this without compromising our standards. The quality of our journals is as high as when we won the ALPSP award some years ago. We still check every reference cited and copy edit every paper and we believe our copy editors are some of the best. We maintain our ‘house style’ so all our journals have the same consistently high quality. And once we get the proofs back from you, we make the corrections and then proof-read everything before we publish it on the web.

Once the publications were in order, we turned our attention to the membership and finances. As some of you may know

our membership had plummeted since 2001. We were down to just over 500 members and the situation was becoming critical. We reviewed and modernized our systems and installed a membership management system which gives us much greater control, over both membership data and financial matters.

Now this is all water under the bridge – we have turned things around on those two fronts. That leaves us with the question: what next? What are we going to do now? We need a new ‘mission’, a new ‘goal’. What should that be? We have some ideas but we would really like to hear from you, our members. What would you like to see us tackle next? We have a very efficient team in the IGS office and we are keen to tackle new challenges on your behalf. Before we reveal our thoughts we would like to hear from you. So put your thinking cap on and help us set our new goals.

Finally I would like all of you to encourage your colleagues and students to join the IGS. We have been able to turn the drop in membership around and, at present, we have attained the second-highest membership levels in the history of the IGS but are still slightly short of the previous maximum, set in 2001.

Magnús Már Magnússon
Secretary General



Recent work

Australia

ICE CORES

Aurora Basin North ice core drilling: past and present climate

M. Curran (AAD & ACE CRC), D. Dahl-Jensen (Univ. Copenhagen), B. Frankel (AAD & ACE CRC), J. McConnell (DRI), V. Morgan (ACE CRC), A. Moy (AAD & ACE CRC), T. v.Ommen (AAD & ACE CRC)

To obtain a climate record in excess of 2000 years, the ice core drilling expedition is proposed for Aurora Basin, between Law Dome and Dome C. The derived ice core will be used to compare coastal and inland Antarctic records. This will improve interpretation of ice core climate records and increase our knowledge of the role of Antarctica in the global climate system.

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Concentration and isotopic measurements of radiatively important gases in the southern atmosphere

D. Etheridge (CMAR), M. Bender (Princeton Univ.), S. Coram (CMAR), R. Langenfelds (CMAR), I. Levin (Univ. Heidelberg), A. Smith (ANSTO), A. Staver (CMAR), P. Steele (CMAR), and M. v.d.Schoot (CMAR)

Gases released by human activity (greenhouse and ozone depleting gases) are responsible for global change. They are long-lived and well-mixed in the atmosphere. The Antarctic regions, remote from industrial and land plant activity are ideally located to measure global changes in the gases. The CSIRO sampling network represents the most comprehensive, long-running Southern Hemisphere program. With continuing innovation in measurement and interpretive models, it is ideally positioned to detect possible climate-induced regional changes in carbon uptake, as well as monitor global changes. It also provides essential background information to the new challenge of monitoring integrated emissions from the Australian continent.

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East Antarctic and Circum-Antarctic climate history in Queen Mary Land: an Australian contribution to ITASE

I. Goodwin (Macquarie Univ.), M. Curran (AAD & ACE CRC), A. Moy (AAD & ACE CRC), and T. v.Ommen (AAD & ACE CRC)

The climate variability of the Southern Ocean sector of the circum-Antarctic and East Antarctic is being investigated using ice core studies.

Ice cores retrieved from 100 m deep boreholes in Wilkes Land, East Antarctica, provide a 200-300 year archive of climate history. The project will produce data on the history of atmospheric circulation in the Southern Ocean sector of the circum-Antarctic, associated with the Antarctic Circumpolar Wave (ACW) and the El Nino Southern Oscillation (ENSO) and the Southern Annular Mode of climate variability. The proxy climate data on surface temperature, frequency of precipitation events, snow accumulation rates, moisture source, strong katabatic wind events, and atmospheric blocking south of eastern Australia, have been combined with instrumental meteorological records to understand the mechanisms controlling the interaction between atmospheric circulation between south-east Australia and Antarctica. The project will form a component of the International Trans Antarctic Scientific Expedition (ITASE).

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High resolution studies of cosmogenic beryllium isotopes (10Be and 7Be) at Law Dome

A. Smith (ANSTO), M. Curran (AAD & ACE CRC), D. Etheridge (CMAR), A. Moy (AAD & ACE CRC), J. Pedro (UTAS), T. V.Ommen (AAD & ACE CRC)

Naturally-occurring radioactive isotopes are produced in the Earth's atmosphere by cosmic rays, at a rate controlled by the activity of the Sun. Currently, the Sun is the least active it has been in the last century, and it is important to understand how this affects the climate and the production of cosmogenic beryllium: 10Be and 7Be. Using the new Air-link we can now rapidly return ice core samples to Australia for measurement of the short-lived 7Be isotope. This project will use measurements of cosmogenic beryllium in Antarctic ice to improve our interpretation of past solar activity and climate change.

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Ice core paleoclimatology

T. v.Ommen (AAD & ACE CRC), M. Curran (AAD & ACE CRC), M. Duldig (AAD), B. Frankel (AAD & ACE CRC), V. Morgan (ACE CRC), A. Moy (AAD & ACE CRC), J. Pedro (ACE CRC), T. Vance (ACE CRC)

Prediction of future climate change requires knowledge of past changes. Polar snow forms an archive of environmental conditions that is accessible by drilling and analysing ice cores. This project uses ice core data to reconstruct records,

including past temperature and atmospheric composition, to improve understanding of the climate system.

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ICE SHEETS, GLACIERS AND ICEBERGS

Ice sheet-atmosphere interaction and surface climatology of interior Antarctica

I. Allison (ACE CRC) and P. Heil (AAD & ACE CRC) Automatic weather stations are used to provide surface meteorological data from remote regions of the Antarctic ice sheet. A network of more than 10 stations is operated. These measure a range of different parameters every hour and relay the data to Australia via a satellite link. The data are used for meteorological forecasting, to support aircraft operations, to provide climatic information, for studies of the surface wind processes over the ice sheet, and to support a variety of other research programs such as the interpretation of proxy climate data in ice cores.

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Ice shelf – ocean interaction in the cavity beneath the Amery Ice Shelf

M. Craven (AAD & ACE CRC), I. Allison (ACE CRC), H. Fricker (Scripps, UCSD), and J. Hunter (ACE CRC)

Most snow falling on Antarctica drains via ice streams and floating ice shelves to the sea where the dominant loss mechanisms are iceberg calving and basal melting. Ocean interaction with the shelves influences the Antarctic mass budget, and modifies the water properties and circulation patterns of the ocean. This project will directly measure ocean characteristics, ocean currents, and basal melting & freezing processes, using boreholes melted through the Amery Ice Shelf into the underlying ocean cavity. The project is linked with others investigating the ice shelf flow and mass budget, and the ocean circulation north of the shelf.

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ICECAP – Casey/Aurora Basin Component

T. v.Ommen (AAD & ACE CRC), D. Blankenship (Univ. Texas), J. Holt (Univ. Texas), J. Roberts (AAD & ACE CRC), M. Siebert (Univ. Edinburgh), R. Warner (AAD & ACE CRC), A. Wright (Univ. Edinburgh), D. Young (Univ. Texas), and N. Young (AAD & ACE CRC)

The ICECAP Project will conduct a major airborne survey in East Antarctica. The survey will employ multi-frequency ice penetrating radar, laser altimeter, magnetometers and a gravity meter to study a large and relatively unexplored part of the continent. The survey extends from Casey, inland across the Aurora Subglacial Basin, which holds

some of the deepest and possibly oldest ice on the continent. This will improve understanding of the ice sheet itself, its past, and potential future impact on sea-level, and of the underlying geology. It will also guide the search for suitable ice-core sites for recovering the oldest possible record.

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Antarctica – past, present, and future: exploring the dynamic interactions of ice sheet and ice shelves within the global climate system through numerical modelling

R. Warner (AAD & ACE CRC), R. Greve (Hokkaido Univ.), B. Legresy (CNRS), R. Massom (AAD & ACE CRC), and J. Roberts (AAD & ACE CRC)

The balance between ice accumulation and loss for Antarctica will be investigated using numerical simulations, to predict changes in sea level and input of fresh water to the Southern Ocean. The physics of ice flow and transitions between ice sheet, ice streams and ice shelf flow will be treated in detail. Coupled models will also examine interaction between floating ice shelves and the ocean circulating beneath, since this contact provides an important path for climate warming to influence the loss of ice. Comparisons with present day field observations and projections for sea-level and climate change will be developed.

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Mass balance of the Totten basin in East Antarctica: estimation and calibration from ground, air and space-based observations (TOT-Cal)

C. Watson (UTAS), R. Coleman (UTAS), H. Fricker (Scripps), B. Legresy (CNRS), J. Roberts (AAD & ACE CRC), and P. Tregnoing (ANU)

Regions of Antarctica are undergoing significant change in response to the Earth's changing climate. This project will provide a state of the art contemporary insight into the changing behaviour of the Totten drainage basin in East Antarctica – an area of vital importance in understanding ice/ocean/ atmosphere and climate interactions in the Australian region of Antarctica. We will estimate the contribution of the Totten Glacier drainage basin to present-day sea level rise and simultaneously provide a critical validation of the European Space Agency's CryoSat-2 satellite mission over this region.

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Structure and dynamics of the Dalk Glacier and comparison to other outlet glaciers in Prydz Bay and Mawson Coast

C. Wilson (UMelb)

The Dalk Glacier, located in the vicinity of the Larsemann Hills, is one of the outlet glaciers that contributes to the drainage of the East Antarctic ice sheet. An investigation will be undertaken to identify and monitor zones of fast flowing ice and

relate these to the development of crevasse fields. These observations will be related to the dynamics of the Srsdal Glacier (Vestfold Hills) and the outlet glaciers in the Framnes Mountains.
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Change in ice shelf – ice stream systems

N. Young (AAD & ACE CRC), R. Coleman (UTAS), H. Fricker (Scripps, UCSD), and B. Legresy (CNRS) Ice streams and ice shelves are components of the Antarctic continental ice cover that are likely to respond earliest to changes in the environment. This project investigates a selection of ice stream–ice shelf systems in East Antarctica, to detect and assess change in their flow regimes and the subsequent contribution to Sea Level Rise. Measurements are made using satellite remote sensing of ice velocity and strain rates, surface topography, ice thickness, and under the floating sections, basal melt/freezing rates, providing observations from a broad area, and complementing direct observations from field surveys.

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Distribution, size and dissolution of Antarctic icebergs

N. Young (AAD & ACE CRC) and J. Jacka (ACE CRC)

This is an observational project based on visual records, collected on all voyages of the Australian Antarctic Research Program, of icebergs in the Southern Ocean, and with every voyage south it adds data to an international data collection which is co-ordinated in Norway. The data are also added to the local web-based data set, which is used to carry out statistical calculations to estimate the melt rate of the icebergs. The iceberg melt rate in the warmer waters north of the Antarctic Continent may indicate what the melt rates of the continental ice might be, given a warmer climate than currently exists.

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SEA ICE AND GLACIMARINE PROCESSES

Variability of the coastal Antarctic climate derived from fast-ice observations

P. Heil (AAD & ACE CRC), and I. Allison (ACE CRC)

Fast ice is sensitive to change in the (polar) climate system. We monitor the fast-ice (and snow) thickness, its annual growth curve and extent through weekly in-situ measurements offshore from Davis and Mawson stations, East Antarctica. Our data are used to extend an ongoing long-term record at those locations, and combined with meteorological observations to analyze ice-atmosphere interactions, and to identify any changes in the forcing balance. For example,

relationships between interannual change in the fast-ice parameters and within the large-scale climate system are explored. Sampling multiple locations near each station enables identification of oceanic forcing on the fast-ice growth.

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Studying high-frequency Arctic and Antarctic sea-ice dynamics using drifting buoy data

P. Heil (AAD & ACE CRC) and C. Geiger (Univ. Delaware)

In-situ observations of sea-ice drift from the Arctic and Antarctic together with auxiliary data will be used to determine the contribution of daily and sub-daily motion on the overall drift. The cyclical character induces repeated opening and closing of the ice pack, which has been shown to increase the net ice-growth rate, hence impacting the sea-ice volume, which is a crucial parameter within the climate system. Here we seek to study the variability observed in sea-ice dynamics, to attribute it to changes in the climate system, and to gauge the effect of this variability on sea-ice thickness and volume.

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An observatory of coastal sea ice and environment

P. Heil (AAD & ACE CRC), S. Gerland (NPI), T. Haskell (IRL), P. Langhorne (Univ. Otago), R. Massom (AAD & ACE CRC), and B. Wienecke (AAD)

Antarctic fast ice is a crucial climate component, and of critical importance to the survival of higher predators and to shipping and (intra-continental fixed-wing) aircraft operations. Neither its base state nor its variability are well documented. We shall deploy several digital environmental monitoring systems to collect regional-scale* data on spatio-temporal variability of fast ice. The aim is to initiate an ongoing high-resolution data series of fast-ice extent and meteorological parameters for our analysis of the fast ice response to atmospheric circulation changes. Our data on fast-ice variations will be well suited to study the variability in breeding success of Emperor penguins.

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Winter foraging success of Southern Ocean predators in relation to stochastic variation in sea-ice extent and winter water formation

M. Hindell (UTAS), M. Fedak (Univ. St Andrews), I. Field (Macquarie Univ.), C. Guinet (CNRS), and J. v.d.Hoff (AAD)

This study will use innovative technology to measure the winter spatial foraging patterns and net energy gain of adult female elephant seals (and potentially Weddell seals), while simultaneously providing high-resolution data on the physical nature of the water column in which the seals live. By combining biological and physical data with satellite derived sea-ice information, this

study will improve our understanding of predator foraging success (and therefore mechanisms which regulate population trajectories) and provide physical oceanographers with fundamental data on the importance mechanisms that determine the winter ice and bottom water formation that under-pin the Antarctic marine ecosystem.

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The Southern Ocean branch of the Meridional overturning circulation: new observations of vertical mixing

H.E. Phillips (UTAS), and N.L. Bindoff (ACE CRC & CMAR)

The Southern Ocean ventilates much of the world ocean and regulates its capacity to store heat and carbon. Over 60 carbon dioxide is in the southern hemisphere oceans. Recent studies suggest vertical mixing, a key process in this ventilation, is strong where the Antarctic Circumpolar Current, the largest current in the world, crosses rough bottom topography. Using newly-developed velocity sensors attached to Argo profiling floats we will measure vertical mixing to help us better understand the meridional overturning circulation and the factors that may cause it to slow or shut down.

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Tidal effects on the ice concentration and lead fraction over the continental shelf and slope off Wilkes Land

R. Robertson (ADFA)

Sea ice and tides are important factors affecting ocean-atmosphere heat transfer and deep water formation. They affect climate and the global thermohaline circulation. Generally, tidal processes were ignored in coupled sea ice/ocean models and sea ice was ignored in tidal models. Here, a coupled sea ice/ocean model is used to evaluate tidal effects on sea ice and deep water formation in the continental margin off Wilkes Land. The model results will both support and be verified against results from an observational sea ice program. The project will also investigate the effects of warming of circumpolar deep water on sea ice.

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Investigation of physical and biological processes in the Antarctic sea ice zone during spring using in situ, aircraft and underwater observations

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This work will improve our understanding of the relationship between Antarctic sea ice and South-

ern Ocean ecosystems, and make use of cutting-edge technology for the calibration and validation of satellite data over Antarctic sea ice. In particular, radar and laser altimetry from a helicopter and upward-looking sonar and radiometer measurements from a long-range Autonomous Underwater Vehicle (AUV), will provide regional-scale measurements not previously available in the Antarctic pack ice. The work will vastly improve our understanding of the volume of ice in ridges and the relationship between ice and snow thickness and the distribution of sea ice algae.

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LARGE-SCALE PROCESSES

Interactions between small scale cyclones and sea ice and their role in the Southern Ocean climate system

Amanda Lynch (Monash Univ.), J.J. Cassano (Univ. Colorado), J. Maslanik (Univ. Colorado), A. Rinke (AWI), J. Bareiss (AWI), and K. Dethloff (AWI)

The Southern Ocean cyclone belt has a strong influence on Australian weather and climate. This project will allow improvements in the understanding of intense small scale cyclones in the region. Importantly, the research will highlight key sensitivities in the coupling between these atmospheric circulations and the underlying sea ice. Further, the compilation of an updated Southern Ocean cyclone climatology will provide a basis for evaluating future changes in cyclone distribution and frequency of occurrence in the Antarctic region. Finally, by leading this unique international collaboration with German and US scientists, the profile of Australian scientists in Antarctic atmospheric research will be strongly enhanced.

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Mesoscale atmospheric circulations in Terra Nova Bay

Amanda Lynch (Monash Univ.)

Small cyclones over the Southern Ocean, through their transport of heat and moisture, represent an important component of the maintenance of Southern Hemisphere climate. The relationship between these cyclones and persistent openings in the sea-ice ('polynyas') remains uncertain. This project will participate in a U.S.-funded observational program in Terra Nova Bay. The data collected will be combined with state-of-the-art modelling techniques to advance the understanding of atmospheric processes responsible for the development and decay of small Southern Ocean cyclones and to explore the interactions between these cyclones and the underlying surface conditions, including sea-ice extent, thickness, concentration, motion, and temperature.

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Polar lows over the subantarctic waters

Ian Simmonds (UMelb)

The subantarctic region is frequently subject to violent small storms which often arrive with little warning. The most extreme of these are referred to as 'polar lows', and are accompanied by very strong surface winds. They present serious hazards to shipping and are difficult to forecast. The project will make use high-resolution satellite-derived surface winds over the Southern Ocean to identify these features. Complementary satellite data will be used to determine the temperature and moisture vertical profiles within these systems. This information will allow an identification of the physical processes operating and hence offer the potential for improved forecasting.

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Arctic sea ice decline and the 'Arctic amplification'

Ian Simmonds (UMelb) and J.A. Screen (UMelb)

The rise in Arctic near-surface air temperatures has been almost twice as large as the global average in recent decades, a feature known as 'Arctic amplification'. Increased concentrations of atmospheric greenhouse gases have driven Arctic and global average warming; however, the underlying causes of Arctic amplification remain uncertain. The roles of reductions in snow and sea ice cover and changes in atmospheric and oceanic circulation, cloud cover and water vapour are still matters of debate. A better understanding of the processes responsible for the recent amplified warming is essential for assessing the likelihood, and impacts, of future rapid Arctic warming and sea ice loss. Here we show that the Arctic warming is strongest at the surface during most of the year and is primarily consistent with reductions in sea ice cover. Changes in cloud cover, in contrast, have not contributed strongly to recent warming. Increases in atmospheric water vapour content, partly in response to reduced sea ice cover, may have enhanced warming in the lower part of the atmosphere during summer and early autumn. We conclude that diminishing sea ice has had a leading role in recent Arctic temperature amplification. The findings reinforce suggestions that strong positive ice temperature feedbacks have emerged in the Arctic, increasing the chances of further rapid warming and sea ice loss, and will probably affect polar ecosystems, ice-sheet mass balance and human activities in the Arctic.

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Antarctic meteorology and its interaction with the cryosphere and the ocean

T. Vihma (Finnish Meteorological Institute), H. Savijärvi (Univ. Helsinki), and P. Uotila (CMAR)
The Antarctic climate system is undergoing rapid

changes spanning through all system components. Reasons for and interactions between these changes are not well known. This is related to our inaccurate knowledge on the processes controlling Antarctic meteorology and the exchange processes between the atmosphere, snow, ice, and the sea. One of the uncertainties in the mass balance of the ice sheet is related to atmospheric transport of moisture from lower latitudes to the Antarctic and Southern Ocean: estimates based on various methods and data sets have a lot of scatter. The role of cyclones in the moisture transport is well recognized but that of mesoscale cyclones, which are not well detected by large-scale models, is poorly known. Other atmospheric system components are also quantitatively not well known and reliably represented in numerical weather prediction and climate models. The overall objective of the project is to obtain better understanding on atmospheric and cryospheric processes in the Antarctic, and to utilize this in developing better parameterization schemes for NWP and climate models. The study will concentrate on the following topics: (1) surface energy balance over continental ice, ice shelves, and sea ice, (2) the atmospheric boundary layer over the sea ice zone, and (3) mesoscale meteorology over selected regions.

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REMOTE SENSING

Remote sensing of near-coastal Antarctic sea ice and its impacts on ice shelves and ecosystems

R. Massom (AAD & ACE CRC), N. Adams (BoM), R. Aster (NMT), C. Barbraud (CNRS), P. Heil (AAD & ACE CRC), J. Lieser (ACE CRC), D. MacAyeal (Univ. Chicago), T. Scambos (Univ. Boulder), V. Squire (Univ. Otago), and A.P. Worby (AAD & ACE CRC)

The research will derive improved estimates of East Antarctic fast-ice extent and thickness, and their variability, from satellite data. These will be used to explicitly test relationships between fast ice/other environmental parameters and Emperor penguin population dynamics. We shall also combine observations with a wave-ice shelf-sea ice interaction model to test the hypothesis that catastrophic ice shelf break-up events along the Antarctic Peninsula are linked to increased ocean wave energy associated with sea-ice extent anomalies (driven by atmospheric anomalies), and/or long-period swell from far-remote storms. This work will aid comprehension of processes responsible for recent rapid ice-shelf demise.

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Measuring changes in mass balance of Antarctica

P. Tregoning (ANU)

Changes in temperature of the oceans and atmosphere cause changes in the size of polar ice sheets and mountain glaciers, as well as changes in global sea level. Space-geodetic techniques (such as satellite altimetry, space-gravity missions, GPS) can be used to measure present-day changes in the volume of water stored on the continents in the form of polar ice caps. Changing volumes indicate exchanges of water with the oceans, inducing increases/decreases in sea level. The research involves improving the geodetic analysis techniques – including in-situ validation in Antarctica – to derive more accurate mass balance estimates. This includes improving atmospheric and tidal models used in the reduction of the raw space-geodetic observations.

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Present-day glacial isostatic adjustment of Antarctica

P. Tregoning (ANU), G. Ramillien (CNRS), H. McQueen (ANU), D. Zwartz (ANU)

Understanding present-day melting patterns of polar ice caps and the contribution to present-day sea level variations requires first unravelling the puzzle of how the continents are still adjusting after the melting that has occurred since the Last Glacial Maximum around 10,000 years ago. The present-day glacial isostatic adjustment of Antarctica generates uplift of the continent that is detectable by space-geodetic observing techniques. The Gravity Recovery and Climate Experiment (GRACE) is sensitive to the induced gravity changes, while satellite altimetry and ground-based GPS can measure directly the vertical movement of the surface. These effects must be removed from GRACE and altimetry estimates of temporal changes in ice in order to estimate present-day mass balance changes that might be occurring as a result of global warming. Since 1998, we have operated remote GPS installations in East Antarctica to measure the rate of uplift currently occurring as a result of ongoing glacial isostatic adjustment. Considerable care is required in the analysis of the GPS data to ensure that rates with an accuracy of < 1 mm/yr can be estimated.

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NUMERICAL MODELLING

Multiple equilibria in the Southern Ocean thermohaline circulation and links to global climate

M. England (Univ. New South Wales)

The ocean's thermohaline circulation (THC) plays a fundamental role in global climate, transporting

heat poleward and regulating the uptake of anthropogenic CO_2 . Multiple steady-states in the THC have been identified in the North Atlantic, including an 'off' state where no deep water is formed, yet little is known regarding the possibility for multiple equilibria of the Southern Ocean THC. This study aims to (1) examine hysteresis behaviour and possible multiple equilibria of the Southern Ocean THC, and (2) quantify the role of the Southern Ocean THC by examining the difference between 'on' and 'off' states in various water-masses.

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Investigation of ice edge controls

P. Heil (AAD & ACE CRC), and R. Stevens (UTAS)

In this study stand-alone numerical sea-ice model is used to investigate the contributions of thermodynamic and dynamic processes in controlling the equatorward ice-edge position, and to assess how the ice-edge location responds within past and future climate scenarios. The relative contributions of sea-ice growth (thermodynamic processes) and of ice advection (dynamic process) to the ice-edge advance will be assessed. Sensitivity studies will reveal how these may change in changing climate forcing. To separate the importance of the various processes, a number of forcing parameters will be investigated: E.g., how do winds impact on the north-south movement of the ice edge? How does wave-ice interaction influence the ice-edge position? How persistent are seasonal extreme locations of the ice-edge, and what are the dominant processes in maintaining the annual maximum ice-edge position?

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Improvement of sea ice model component of the ACCESS coupled model

S. O'Farrell (CMAR) and P. Uotila (CMAR)

The sea ice component of ACCESS coupled climate model is the CICE 4.0 model from LANL. The sea ice component is also part of the AusCOM sea ice-ocean system. There are number of upgrade planned in both systems, including upgrading to version 4.1, designed to get realistic ice thickness patterns. These include tuning ridging parameterization, ocean turning angles, and testing the inclusion of tides. The atmospheric component of ACCESS model is the UM atmospheric component from the UK Meteorological office. In collaboration with our UK colleagues we plan to upgrade the coupling approach so that we can directly couple in ice albedo parameterizations, test out the internal reflections of shortwave radiation from the CICE code, and implement the multilayer sea ice option.

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Southern Ocean physical oceanography and cryosphere linkages [SOPHOCLES]

S. O'Farrell (CMAR), and I. Wainer (Univ. Sao Paulo)

SOPHOCLES was formed to improve our understanding of how Southern Ocean ice processes are represented in models, with time scales ranging from daily sea ice forecasting to decadal climate change. SOPHOCLES seeks to engage the observational community to take full advantage of new satellite data and in situ data. All components of the cryosphere – including sea ice, glaciers, ice-shelves, and icebergs and their associated freshwater and heat fluxes to the ocean – will eventually be addressed.

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ECOLOGY WITHIN GLACIAL SYSTEMS

Experimental studies into growth and ageing of krill

S. Kawaguchi (AAD), R. King (AAD), and S. Nicol (AAD & ACE CRC)

The experimental krill research program is focussed on obtaining life history information of use in managing the krill fishery – the largest Antarctic fishery. In particular, the program will concentrate on studies into schooling, growth, aging, behaviour and reproduction of krill as well as into the operation, behaviour and trends of the krill fishery.

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Sea ice primary production off eastern Antarctica

A. McMinn (UTAS), K. Meiners (AAD & ACE CRC), and P. Ralph (UTS)

Climate change is causing massive changes to the Antarctic and Southern Ocean ecosystems. This project will estimate primary production within the seasonal sea ice zone and estimate the likely changes in production in future. In particular we will investigate the effects of changing sea ice extent and increased temperatures. This should allow us to determine how much food will be available for krill, seals and penguins.

Email: andrew.mcminn@utas.edu.au

Effect of global change on the primary production of Antarctic coastal ecosystems

A. McMinn (UTAS), and P. Ralph (UTS)

Global climate change will lead to a reduction in the duration and thickness of sea ice in Antarctic coastal areas. We will determine whether this will lead to a decrease in primary production and food value to higher predators.

Email: andrew.mcminn@utas.edu.au

An integrated study of processes linking sea ice and biological ecosystem elements off East Antarctica during winter

K.M. Meiners (AAD & ACE CRC), S. Allen (CSIRO), I. Allison (ACE CRC), A. Brierley (Univ. St Andrews), A. Constable (AAD & ACE CRC), A. Davidson (AAD), G. Hosie (AAD), S. Kawaguchi (AAD), A. McMinn (UTAS), S. Nicol (AAD & ACE CRC), T. Trull (UTAS & CMAR), V. Wadley (AAD), G. Williams (Univ. Pierre et Marie Curie), A.P. Worby (AAD & ACE CRC), and S. Wright (AAD & ACE CRC)

During austral winter 2007 a multidisciplinary survey of the processes linking sea ice with biological elements of Antarctic marine ecosystems has been conducted. The survey provides large-scale information on sea ice biological and physical parameters in the 115-130 degree East sector off East Antarctica. The distribution of sea ice algae and krill has been observed using an Autonomous Underwater Vehicles (AUV) operating under the sea ice. Shipborne measurements and an intensive sea ice sampling program complement the AUV data. This study will evaluate whether or not there is a close dependency of the ecosystem on the physical environment, i.e. such as the sea-ice extent, and how sea ice and snow do affect algal biomass.

Email: klaus.meiners@acecrc.org.au

Coupled physical-biological processes in the Antarctic sea ice zone

K.M. Meiners (AAD & ACE CRC), A. Constable (AAD, ACE CRC), A. Davidson (AAD), P. Heil (AAD & ACE CRC), S. Kawaguchi (AAD & ACE CRC), J.L. Lieser (ACE CRC), R.A. Massom (AAD & ACE CRC), S. Nicol (AAD & ACE CRC), A. McMinn (IMAS/UTAS), P. Strutton (UTAS), A.P. Worby (AAD & ACE CRC), and S. Wright (AAD & ACE CRC)

This project will determine the physical and biological factors that determine ice algal and pelagic production in the sea ice zone. The proposed work contributes to the assessment and prediction of climate change impacts on Antarctic marine ecosystems by providing data for ice algal primary production and ecosystem model calibration and validation.

Email: klaus.meiners@acecrc.org.au

Resilience of Antarctic marine benthic invertebrates and the ecological consequences of environmental change

K. Miller (UTAS), M. Byrne (Univ. Sydney), and C. King (AAD)

Environmental change is by far one of the major crises facing our planet in recent times. This project will contribute specifically to understanding the effects of climate change and other human-

induced impacts on marine species in Antarctica. Through studying key ecological and biological processes in marine benthic invertebrates we will better understand the spatial scale of populations, the nature of the processes that maintain those populations, how environmental change will affect those processes, and the levels of genetic diversity and resilience in Antarctic marine communities. Taken together this information will enable better, more informed management of Antarctic marine ecosystems.
 Email: karen.miller@utas.edu.au

GEOSCIENCES AND GLACIAL GEOLOGY

Subsurface investigations of Marine Plain
 D. Gore (Macquarie Univ.), R. Bingham (Univ. Bristol), C. Murray-Wallace (Univ. Wollongong), R. Powell (Nth Illinois Univ.), P. Quilty (UTAS), G. Skilbeck (UTS), J. Whitehead (UTAS)
 Marine Plain at Vestfold Hills contains a unique record of sea level, climate and glacial history within its sediments and microfossils. Analyses of marine shells and sediment taken from Marine Plain and nearby glacial deposits, will reveal how this part of coastal East Antarctica changed during the Neogene (26 million years-the present).
 Email: damian.gore@mq.edu.au

Geoscience Australia geomagnetic and seismological observatories
 A. Hitchman (GA), C. Budgen (GA), and P. Crosthwaite (GA)
 Australia's geomagnetic observatories measure slow changes in the Earth's magnetic field originating in the Earth's core and the more rapid variations caused by electric currents in the upper atmosphere, related to solar activity. The observatories are part of a global network of over

200 geomagnetic observatories. There are many practical applications of the data. Australia's seismological observatories are also part of a global network and are used for detecting and locating earthquakes and nuclear explosions. The data are used for research into the Earth's interior, hazard reduction and monitoring of nuclear test ban treaties.
 Email: adrian.hitchman@ga.gov.au

ABBREVIATIONS

AAD	Australian Antarctic Division
ACE CRC	Antarctic Climate and Ecosystems Cooperative Research Centre
ADFA	Australian Defence Force Academy
ANSTO	Australian Nuclear Science and Technology Organisation
ANU	Australian National University
BoM	Bureau of Meteorology
CMAR	CSIRO Division of Marine and Atmospheric Research
CNRS	Centre National de la Recherche Scientifique
DRI	Desert Research Institute
IRL	Industrial Research Limited
NMT	New Mexico Institute of Mining and Technology
NPI	Norwegian Polar Institute
UMelb	University of Melbourne
UTas	University of Tasmania
UTS	University of Technology – Sydney

Petra Heil
 AAD & ACE CRC, Australia



International Glaciological Society

JOURNAL OF GLACIOLOGY

Papers accepted for publication between 16 August 2010 and 28 February 2011. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

Streaming flow of an Antarctic Peninsula palaeo-ice stream both by basal sliding and deformation of substrate

Benedict T I Reinardy, Robert D Larter, Claus-Dieter Hillenbrand, Tavi Murray, John F Hiemstra, Adam Booth

Measurement of vertical profiles of snow specific surface area with a one centimeter resolution using infrared reflectance: Instrument description and validation

Laurent Arnaud, Ghislain Picard, N Champollion, Florent Domine, J C Gallet, E Lefebvre, Michel Fily, Jean Marc Barnola

Changes in temperature and glacier melt from weather-station observations in the Melville Bay region of North-West Greenland

Dirk van As

Effects of flow regime and sensor geometry on snow avalanche impact pressure measurements

Djebar Baroudi, Betty Sovilla, Emmanuel Thibert

Ross Ice Shelf in situ radio-frequency ice attenuation

Taylor Barrella, Steven Barwick, David Saltzberg

The statistical physics of iceberg calving and the emergence of universal calving law

Jeremy N Bassis

Glacier changes in the Garhwal Himalayas, India

from 1968 to 2006 based on remote sensing

Rakesh Bhambri, Tobias Bolch, Ravinder K Chaujar, Subhash Chandra Kulshreshtha

Strong-wind events and their influence on the formation of snow dunes: observations from

Kohnen Station, Dronning Maud Land

Gerit Birnbaum, Johannes Freitag, Ralf Brauner,

Gert König-Langlo, Elisabeth Fischer, Sepp

Kipfstuhl, Hans Oerter, Catharina H Reijmer,

Elisabeth Schlosser, Sérgio Henrique Faria,

Hinnerk Ries, Bernd Loose, Andreas Herbert,

Michael G Duda, Jordan G Powers, Kevin W

Manning, Michiel R van den Broeke

A short history of the thermomechanical theory of glaciers

Heinz Blatter, Ralf Greve, Ayako Abe-Ouchi

Thin blade penetration resistance and snow strength

Chris Borstad, David M Mcclung

Modeling time series of microwave brightness temperature at Dome C, Antarctica, using

vertically resolved snow temperature and

microstructure measurements

Ludovic Brucker, Ghislain Picard, Laurent

Arnaud, Jean Marc Barnola, Martin Schneebeli,

Hélène Brunjail, Eric Lefebvre, Michel Fily

Mass-balance terms revisited

J Graham Cogley

Recent volume and area changes of the

Kaskawulsh Glacier, Yukon Territory, Canada

Foy, Luke Copland, Christian M Zdanowicz,

Michael N Demuth, Chris Hopkinson

Incorporating Arbitrary Basal Topography in the Variational Formulation of Ice Sheet Models

John K Dukowicz, Stephen F Price, William H

Lipscomb

Permanent fast flow vs. cyclic surge behavior:

numerical simulations of the Austfonna ice cap, Svalbard

Thorben Dunse, Ralf Greve, Thomas Vikhamar

Schuler, Jon Ove M Hagen

Creep and plasticity of glacier ice: a material science perspective

Paul Duval, Maurine Montagnat, Fanny

Grennerat, Jérôme Weiss, Jacques Meyssonier,

Armelle Philip

Extracting the temporal signal of a winter and

summer mass balance series: application to a

6-decade record for Sarennes Glacier (French Alps)

Nicolas Eckert, Hassine Baya, Emmanuel Thibert,

Christian Vincent

Icequakes coupled with surface displacements for predicting glacier breaking-off

Jérôme Faillettaz, Martin Funk, Didier Sornette

Mt. Ortles as a first potential ice core drilling site in South Tyrol, Eastern European Alps
Paolo Gabrielli, Luca Carturan, Jacopo Gabrieli, Roberto Dinale, K Krainer, H Hausmann, Mary Davis, Victor S Zagorodnov, R Seppi, Carlo Barbante, Giancarlo Dalla Fontana, Lonnie G Thompson

Assessment of multispectral glacier mapping methods and derivation of glacier area changes 1978-2002 in the Central Southern Alps, New Zealand
Endre Gjermundsen, R Mathieu, Andreas Kääb, Trevor J Chinn, Blair Fitzharris, Jon Ove M Hagen

From ice shelf tributary to tidewater glacier: continued rapid recession, acceleration and thinning of Röhss Glacier following the 1995 collapse of the Prince Gustav Ice Shelf on the Antarctic Peninsula

Neil Franklin Glasser, Theodore A Scambos, J Bohlander, Martin Truffer, Erin C Pettit, B J Davies

A variationally-derived, depth-integrated approximation to a higher-order glaciological
Daniel N Goldberg

Antarctic ice shelf thickness from satellite radar altimetry
Jennifer Griggs, Jonathan L Bamber

Permafrost on mountain slopes – development and challenges of a young research field
Wilfried Haeberli

In situ measurements of firn compaction profiles using borehole optical stratigraphy
Robert L Hawley, Edwin D Waddington

Mountain glacier velocity variation during a retreat-advance cycle quantified using sub-pixel analysis of ASTER images
Frédéric Herman, Brian Anderson, Sébastien Leprince

Seismic sensor array for monitoring an avalanche start zone: design, deployment and preliminary results
Alec van Herwijnen, Jürg Schweizer

Modelling distributed and channelized subglacial drainage: the spacing of channels
Ian J Hewitt

Multidecadal retreat of Greenland's marine-terminating glaciers
Ian M Howat, Alex Eddy

Using a draw-wire sensor to continuously monitor glacier melt
John Hulth

Existence and stability of steady state solutions of the shallow ice sheet equation by an energy minimization approach
Guillaume Jouvét, Jacques Rappaz, Ed Bueler, Heinz Blatter

Interfacial and structural relaxations of snow under isothermal conditions
Henning Loewe, K Spiegel, Martin Schneebeli

Spatial patterns of surface hoar properties and incoming radiation on an inclined forest opening
Eric R Lutz, Karl W Birkeland

Localized uplift of Vatnajökull ice cap, Iceland: subglacial water accumulation deduced from InSAR and GPS observations
Eyjólfur Magnússon, Helgi Björnsson, Helmut Rott, Matthew J Roberts, Finnur Pálsson, Sverrir Guðmundsson, Richard A Bennett, Halldór Geirsson, Erik Sturkell

Low frequency bursts of horizontally-polarized waves in the Arctic sea-ice cover: a signature of remote, regional-scale icequakes?
David Marsan, Jérôme Weiss, Jean-Philippe Metaxian, Jacques Grangeon, Pierre-François Roux, Jari J Haapala

Analysis of critical length measurements for dry snow slab weak layer shear fracture
David M McClung

Complete determination of ice crystal orientation using Laue X-ray diffraction method
Atsushi Miyamoto, Ilka Weikusat, Takeo Hondoh

Effect of a cold margin on ice flow and sediment transport at the terminus of Storglaciären, Sweden
Peter L Moore, Neal R Iverson, Keith A Brugger, Denis Cohen, Thomas S Hooyer, Peter Jansson

The effect of fluctuations in surface density, accumulation and compaction on elevation change rates along the EGIG line, Central Greenland
Elizabeth M Morris, Duncan J Wingham

A scanning electron microscope technique for identifying the mineralogy of dust in ice cores
Rachel W Obbard, Ian Baker, David J Prior

Transmission of solar radiation through clouds over melting glaciers: a comparison of parameterisations and their impact on melt modelling
Francesca Pellicciotti, Thomas Raschle, Thomas Huerlimann, Marco Carenzo, Paolo Burlando

The crossover stress, anisotropy, and the flow law at Siple Dome, West Antarctica
Erin C Pettit, Edwin D Waddington, William D Harrison, Thröstur Thorsteinsson, Daniel H Elsberg, John Morack, Mark A Zumberge

Surface mass balance, thinning, and iceberg production, Columbia Glacier, Alaska, 1948-2007
Lowell A Rasmussen, Howard B Conway, Robert M Krimmel, Regine Hock

Size of snow particles in a powder-snow avalanche

Marie Rastello, Fabrice Rastello, Hervé Bellot, Frédéric Ousset, François Dufour

Bayesian estimation of basal properties of Rutford Ice Stream, West Antarctica, from surface data
Melanie Raymond, G Hilmar Gudmundsson

An energy-balance model for debris-covered glaciers including heat conduction through the debris layer

Tim D Reid, Benjamin W Brock

Short-term surface ice motion variations measured with a ground-based portable real aperture radar interferometer

Patrick Daniel Riesen, Tazio Strozzi, Andreas Bauder, Andreas Wiesmann, Martin Funk

The basal roughness of Pine Island Glacier, West Antarctica

David M Rippin, David G Vaughan, Hugh F J Corr

What do glaciers tell us about climate variability and climate change?
Gerard Roe

Repeated jökulhlaups at Russell Glacier, Kangerlussuaq, West Greenland: a reappraisal of the jökulhlaup cycle concept

Andrew John Russell, Jacob C Yde, Jonathan L Carrivick, Meredith Williams, Thomas Ingeman-Nielsen

Magnesium methanesulfonate salt found in the Dome Fuji ice core

Toshimitsu Sakurai, Hiroshi Ohno, F Elif Genceli, Shinichiro Horikawa, Yoshinori Iizuka, Tsutomu Uchida, Takeo Hondoh

A simple and updated pneumatic method for uniaxial ice compression in the laboratory: experimental settings and creep test results on glacier ice

Denis Samyn, M Dierckx, J P Remy, T Goossens, Jean-Louis Tison

The atmospheric snow transport model: SnowDrift3D

Simon Schneiderbauer, Alexander Prokop

Automated processing of internal ice layers in radio-echo soundings

Louise C Sime, Richard C A Hindmarsh, Hugh F J Corr

Field investigation of near-surface metamorphism of snow

Andrew E Slaughter, Edward E Adams, P J Staron, R H Shertzer, D J Walters, D McCabe, D Catherine, I Henniger, T Leonard, M Cooperstein, H Munter

Glide avalanche response to an extreme rain-on-snow event, Snoqualmie Pass, Washington, USA
John Stemberis, Charles Rubin

Evaluation of cloudiness over Monte San Valentín (Northern Patagonia Icefield) from 2000 to 2008 using MODIS observations: implications for paleoclimate investigations from ice cores
Françoise Vimeux, Fabienne Maignan, Corentin Reutenauer, Bernard Pouyard

Subgrain boundaries in Antarctic ice quantified by X-ray Laue diffraction

Ilka Weikusat, Atsushi Miyamoto, Sérgio Henrique Faria, Sepp Kipfstuhl, Nobuhiko Azuma, Takeo Hondoh

Waterfall ice: mechanical stability of vertical structures

Jérôme Weiss, Maurine Montagnat, Benjamin Cinquin-Lapierre, Pierre-Alexandre Labory, Luc Moreau, F Damilano, D Lavigne

Snow isotope diffusion rates measured in a laboratory experiment

L Gerko van der Wel, V Gkinis, Veijo Allan Pohjola, Harro A J Meijer

Glacier subsurface heat-flux characterizations for energy balance modelling in the Donjek Range, southwest Yukon Territory, Canada
Brett Wheler, Gwenn E Flowers

An improved transient-type ice-penetrating radar
Shengbo Ye, Bin Zhou, Bingheng Wu, Bo Zhao, Guangyue Fang

Greenland ice sheet mass balance: distribution of increased mass loss with climate warming; 2003-2007 versus 1992-2002

H Jay Zwally, Jun Li, Anita C Brenner, Matthew A Beckley, Helen J Cornejo, John P Dimarzio, Mario B Giovinetto, Thomas A Neumann, John W Robbins, Jack L Saba, Donghui Yi, Wei Li Wang

ANNALS OF GLACIOLOGY 51(56)

The following papers have been selected for publication in Annals of Glaciology 51(56) (thematic issue on Microbiology and Biogeochemistry of Glacial and Permafrost Environments), edited by Andy Hodson and Martyn Tranter

Carbon fluxes through bacterial communities on glacier surfaces

Alexandre M Anesio, Birgit Sattler, Christine Foreman, Jon Telling, Andy Hodson, Martyn Tranter, Roland Psenner

Methane flux and high-affinity methanotrophic diversity along the chronosequence of a receding glacier in Greenland

Teresa G Bárcena, Jacob C Yde, Kai W Finster

Detecting biogeochemical activity in basal ice using fluorescence spectroscopy

J D Barker, J L Klassen, M J Sharp, S J Fitzsimons, R J Turner

Recent hydrologic change in a Colorado Alpine basin: an indicator of permafrost thaw?

Nel Caine

The mass–area relationship within cryoconite holes and its implications for primary production

J Cook, A Hodson, J Telling, A Anesio, T Irvine-Fynn, C Bellas

Characterisation of dissolved organic matter (DOM) from glacial environments using total fluorescence spectroscopy and parallel factor analysis

Ashley Dubnick, Joel Barker, Martin Sharp, Jemma Wadham, Grzegorz Lis, Sean Fitzsimons, Miriam Jackson

The cryoconite ecosystem upon the Greenland Ice Sheet

Andy Hodson, Carl Bøggild, Edward Hanna, Philippe Huybrechts, Harry Langford, Karen Cameron, Alexandra Houldsworth

Biogeochemistry and dissolved oxygen dynamics at a subglacial upwelling, Midtre Lovénbreen, Svalbard

T D L Irvine-Fynn, A J Hodson

The microstructure and biogeochemistry of Arctic cryoconite granules

Harry Langford, Andy Hodson, Steve Banwart, Carl Bøggild

Sr, Nd, and Pb stable isotopes of surface dust on the Urumqi Glacier No. 1 in western China

Naoko Nagatsuka, Nozomu Takeuchi, Takanori Nakano, Emi Kokado, Zhongqin Li

Biogeography of cyanobacteria from Antarctic ice-free areas

Z Namsaraev, M-J Mano, R Fernandez, A Willemotte

Modelling the impacts of a nitrogen pollution event on the biogeochemistry of an Arctic glacier

Tjarda J Roberts, Andy Hodson, Chris D Evans, Kim Holmén

Laser-induced fluorescence emission (LIFE) from Lake Fryxell cryoconites

Birgit Sattler, Michael C. Storrer-Lombardi, Christine M. Foreman, Markus Tilg, Roland Psenner

In-stream uptake and retention of C, N and P in a supraglacial stream

Durelle Scott, Eran Hood, Michael Nassry

Cyanobacterial communities on Qiyi glacier, Qilian Shan, China

Takahiro Segawa, Nozomu Takeuchi

Organic matter content and quality in supraglacial debris across the ablation zone of the Greenland Ice Sheet

Marek Stibal, Emily C Lawson, Grzegorz P Lis, Ka Man Mak, Jemma L Wadham, Alexandre M Anesio

Structure and formation process of cryoconite granules on Ürümqi Glacier No. 1, Tien Shan, China

Nozomu Takeuchi, Hiromu Nishiyama, Zhongqin Li

Measuring rates of gross and net rates of gross photosynthesis and net community production in cryoconite holes: a comparison of field methods

J Telling, A M Anesio, J Hawkins, M Tranter, J L Wadham, A J Hodson, T D L Irvine-Fynn, M L Yallop

Effects of loss of perennial lake ice on mixing and phytoplankton dynamics: insights from High Arctic Canada

Julie Veillette, Marie-Josée Martineau, Dermot Antoniades, Denis Sarrazin, Warwick F Vincent

Benthic diatom flora in supraglacial habitats: a generic level comparison

M L Yallop, A M Anesio

Basal ice microbiology at the margin of the Greenland Ice Sheet

Jacob C Yde, Kai W Finster, Rob Raiswell, Jørgen P Steffensen, Jan Heinemeier, Jesper Olsen, Haraldur P Gunnlaugsson, Ole B Nielsen

Annals 51(56) is now complete

ANNALS OF GLACIOLOGY 52(57)

The following papers have been selected for publication in Annals of Glaciology 52(57) (thematic issue on Sea Ice in the Physical and Biogeochemical System), edited by Mats Granskog

Part 1

The most frequent spatial fields of sea ice concentration anomalies for Summer-Autumn and how were they related to the Southern Hemispheric atmospheric circulation during the period 1979–2009

Sandra Barreira, Rosa Hilda Compagnucci

A new modelling framework for sea ice mechanics based on elasto-brittle rheology
Lucas Girard, Sylvain Bouillon, Jérôme Weiss, David Amitrano, Thierry Fichet, Vincent Legat

Multi-satellite sensor analysis of fast ice development in the Norske Øer ice barrier
Nicholas E Hughes, Jeremy P. Wilkinson, Peter Wadhams

Resolving sea ice microstructure using cross borehole resistivity tomography
Keleigh Jones, Malcolm Ingham, Daniel Pringle, Hajo Eicken

Drag and wave attenuation in the marginal ice zone

Alison Kohout, Michael H Meylan, D Plew

Characteristics of sea ice in the Okhotsk coastal polynyas revealed from satellites, ice-profiling sonar, and digital camera observations
Sohey Nihashi, Naoto Ebuchi, Yasushi Fukamachi, Shuhei Takahashi

Observing regional-scale ice-atmospheric interaction processes with helicopter-borne sensors and moored upward looking sonars
Simon Prinsenberg, Ingrid K Peterson

Grease ice thickness parameterisation
Lars H. Smedsrud

Texture, meteoric ice contribution, and growth processes of the sea ice in the Baltic Sea
Jari Uusikivi, Eloni Sonninen

Satellite observations of seasonal and interannual variations of sea-ice freeboard and thickness in the Weddell Sea (2003–09)
Donghui Yi, H Jay Zwally, John W Robbins

Part 2

Sea ice and snow densities and hydrostatic equilibrium assumption from in situ measurements in Fram Strait, Barents Sea and Svalbard coast
Sanja Forsström, Sebastian Gerland, Christina A Pedersen

Sea ice and snow observations by adventurers travelling on Arctic sea ice
Sebastian Gerland, Christian Haas

Behaviour of dissolved organic matter during formation of natural and artificially grown Baltic Sea ice

Susann Haase, Colin Stedmon, Mats A Granskog, Anssi V Vähätalo, Louiza Norman, Gerhard Dieckmann, David N Thomas, Riitta Autio, Hermanni Kaartokallio

Performance of a multi scale correlation algorithm for the estimation of high resolution sea ice drift and deformation patterns from SAR images

Thomas Hollands, Wolfgang Dierking

Acceleration of sea ice melting due to transmitted heat through ponded ice area in the Arctic Ocean: results of in situ observation from ice breakers in 2006 and 2007

Motoyo Itoh, Jun Inoue, Koji Shimada, Sarah Zimmermann, Takashi Kikuchi, Jennifer Hutchings, Fiona McLaughlin, Eddy Carmack

A comparison between polynya area and associated ice production and mooring-based measurements of temperature, salinity, and currents in the southwestern Ross Sea, Antarctica
Stefan Kern, Stefano Aliani

An intercomparison between AMSR snow depth and satellite C and KuBand radar backscatter data for Antarctic sea ice

Stefan Kern, Burcu Ozsoy-Cicek, Sascha Willmes, Marcel Nicolaus, Christian Haas, Stephen F Ackley

A new snow thermodynamic scheme for large-scale sea-ice models

Olivier Lecomte, Thierry Fichet, Martin Vancoppenolle, Marcel Nicolaus

The importance of wind-blown snow redistribution to snow accumulation on and mass balance of Bellingshausen Sea ice
Katherine C Leonard, Ted Maksym

Freeboard, snow depth and sea ice roughness in East Antarctica from insitu and multiple satellite data

Thorsten Markus, Robert Massom, Tony Worby, Victoria Lytle, Nathan Kurtz, Ted Maksym

Ion fractionation in young sea ice from
Kongsfjorden, Svalbard
Sönke Maus, Susann Muller, Juliane Büttner,
Sabina Brütsch, Thomas Huthwelcker, Margit
Schwikowski, Frieder Enzmann, Anssi V Vähätalo

Antarctic sea ice extents and concentrations:
comparison of satellite and ship measurements
from IPY cruises

Burcu Ozsoy-Cicek, Stephen F Ackley, Anthony
Worby, Hongjie Xie, Jan Lieser

Springtime CO₂ exchange over seasonal sea ice
in the Canadian Arctic archipelago
Timothy N Papakyriakou, Lisa Miller

Arctic sea ice melt in 2008 and the role of solar
heating
Donald K. Perovich, Jacqueline A Richter-Menge,
Kathleen F Jones, Bonnie Light, Bruce C Elder,
Christopher Polashenski, Daniel LaRoche,
Thorsten Markus, Ronald Lindsay

Solar partitioning in a changing Arctic sea ice
cover

Donald K Perovich, Kathleen F Jones, Bonnie
Light, Hajo Eicken, Thorsten Markus, Julianne
Stroeve, Ronald W Lindsay

Thermodynamical investigation of an evolving
grease to pancake ice field
Sara de la Rosa, Sönke Maus, Stefan Kern

Comparison of different retrieval techniques for
melt ponds on Arctic sea ice from Landsat and

MODIS satellite data
Anja Rösel, Lars Kaleschke

Multiice core sodium, nssulfate, and
methlysulfonate correlations with Antarctic sea
ice extent – an enhanced ice core sea ice extent
proxy
Sharon B Sneed, Paul A Mayewski, Daniel A
Dixon

Monitoring Antarctic sea ice as seen by ASAR
and AMSRE and observed during two IPY field
cruises: a case study
Ahmet E Tekeli, Stefan Kern, Stephen F Ackley,
Burcu Ozsoy-Cicek, Hongjie Xie

Retrieval of sea ice thickness distribution in the
Sea of Okhotsk from ALOS/PALSAR backscatter
data
Takenobu Toyota, Shuji Ono, Kohei Cho, Kay I
Ohshima

Antarctic sea ice altimetry: scale and resolution
effects on derived ice thickness distribution
Blake P Weissling, Stephen F Ackley

Kuband radar penetration into snow cover on
Arctic sea ice using airborne data
Rosemary Willatt, Seymour Laxon, Katharine
Giles, Robert Cullen, Christian Haas

Annals 52(57) is now complete

ANNALS OF GLACIOLOGY 52(58)

The following papers have been selected for publication in Annals of Glaciology 52(58) (thematic issue on Snow, Ice and Humanity in a Changing Climate), edited by Douglas R. MacAyeal and Perry Bartelt

Present weather sensors tests for measuring
drifting snow
Hervé Bellot, Florence Naaïm-Bouvet, Alexandre
Trouvilliez, Christophe Genthon

Sensitivity of snow avalanche simulations to
digital elevation model quality and resolution
Yves Bühler, Marc Christen, Julia Kowalski, Perry
A Bartelt

Glaciers, snow and ski tourism in Austria's
changing climate
Andrea Fischer, Marc Olefs, Jakob Abermann

Glacier flow measurement and radio-echo
sounding at Aurora Peak, Alaska in 2008
Takehiro Fukuda, Shin Sugiyama, Sumito Matoba,
Takayuki Shiraiwa

Initial results of the SeaRISE numerical
experiments with the models SICOPOLIS and
IcIES for the Greenland Ice Sheet
Ralf Greve, Fuyuki Saito, Ayako Abe-Ouchi

Altitudinal dependency of snow amounts in two
alpine catchments: can catchment wide snow
amounts be estimated via single snow stations or
precipitation gradients?
Thomas Grünwald, Michael Lehning

Parameterization of the shear strength of faceted
crystals during equi-temperature metamorphism
Hiroyuki Hirashima, Osamu Abe, Atsushi Sato

Seasonal variations of snow chemistry at NEEM,
Greenland
Takayuki Kuramoto, Kumiko Goto-Azuma,

Motohiro Hirabayashi, Takayuki Miyake, Hideaki Motoyama, Dorte Dahl-Jensen, Jørgen P Steffensen

Iceberg capsize tsunamigenesis
Douglas R MacAyeal, Dorian S Abbot, Olga V Sergienko

Records of sea-ice extent and air temperature at the Sea of Okhotsk from an ice-core of Mount Ichinsky, Kamchatka

Sumito Matoba, Takayuki Shiraiwa, Akane Tsushima, Hirotaka Sasaki, Yaroslav D Muravyev

Wind and drifting snow gust factor in an Alpine context

Florence Naaim-Bouvet, Mohamed Naaim, Hervé Bellot, Kouichi Nishimura

Simulation of snow avalanche model test using computational fluid dynamics
Kenichi Oda, Shuji Moriguchi, Isao Kamiishi, Atsushi Yashima, Kazuhide Sawada, Atsushi Sato

Estimation of the electrostatic charge of individual blowing snow particles by wind tunnel experiment

Satoshi Omiya, Atsushi Sato, Kenji Kosugi, Shigeto Mochizuki

'Sticky spots' and subglacial lakes under ice streams of the Siple Coast, Antarctica
Olga V Sergienko, Christina L Hulbe

Geodetic mass balance of the Azarova Glacier, Kodar Mountains, eastern Siberia and its links to the observed and projected climatic changes
Maria Shahgedanova, Viktor V Popovnin, Alexander Aleynikov, Chris R Stokes

Interannual changes in sea ice conditions on the Arctic sea routes obtained by satellite microwave data

Hiroki Shibata, Kazutaka Tateyama, Hiroyuki Enomoto

Rapid change of tundra snow surface hardness in Alaska

Konosuke Sugiura, Daqing Yang

Spatial distribution of surface ablation in the terminus of Rhonegletscher, Switzerland
Shin Sugiyama, Takeshi Yoshizawa, Matthias Huss, Shun Tsutaki, Daisuke Nishimura

Glaciological and meteorological variation around Suntar-Khayata Range in Eastern Siberia
Shuhei Takahashi, Konosuke Sugiura, Takao Kameda, Hiroyuki Enomoto, Yuri M Kononov, Maria Dmitrievna Ananicheva, Gregory Kapustin

Study of the large-scale dry slab avalanche, and extent of damage to cedar forest at Makunosawa valley in Myoko, Japan

Yukari Takeuchi, Hiroyuki Torita, Kouichi Nishimura, Hiroyuki Hirashima

Changes in glacier dynamics under the influence of proglacial lake formation in Rhonegletscher, Switzerland

Shun Tsutaki, Daisuke Nishimura, Takeshi Yoshizawa, Shin Sugiyama

Glacier and glacial lake inventory of Bhutan-Nepal using ALOS data: Part I Methods and preliminary results

Jinro Ukita, Chiyuki Narama, Takeo Tadono, Tsutomu Yamanokuchi, Nobuhiro Tomiyama, Sachi Kawamoto, Chika Abe, Tsuyoshi Uda, Hironori Yabuki, Koji Fujita, Kouichi Nishimura

Variations of glacial lakes and glaciers in the Boshula Mountain Range, Southeast Tibet, from the 1970s to 2009

Weicai Wang, Tandong Yao, Xiaoxin Yang

Directional freezing experiment on unsaturated sand, loam, and silt loam

Kunio Watanabe, Tetsuya Kito, Tomomi Wake

Chemical characteristics in the snow pit at Murododaira, Mt Tateyama in Japan

Koichi Watanabe, Yukiko Saito, Syoko Tamura, Yuki Sakai, Nagisa Eda, Mikiko Aoki, Manami Kawabuchi, Hirotugu Yamada, Ayumi Iwai

Recent fluctuations of meteorological and snow conditions in Japanese mountains measured with the snow and weather observation network
Satoru Yamaguchi, Osamu Abe, Sento Nakai, Atsushi Sato

Variability of atmospheric freezing level height and its impact on cryosphere in China
Yinsheng Zhang, Y Guo

More papers for *Annals* 52(58) will be published in the next issue

ANNALS OF GLACIOLOGY 52(59)

The following papers have been selected for publication in Annals of Glaciology 52(59) (thematic issue on Earth's Disappearing Ice: Drivers, responses and impacts), edited by Kees van der Veen

Climatic controls of glacier distribution and glacier changes in Austria
Jakob Abermann, Michael Kuhn, Andrea Fischer

Sensitivity of the frozen-melted basal boundary to perturbations of basal traction and geothermal heat flux: Isunnguata Sermia, western Greenland
Douglas Brinkerhoff, Toby W Meierbachtol, Jesse V Johnson, Joel T Harper

High-resolution study of layering withing the percolation and soaked facies of the Greenland icesheet

Joel Brown, Joel T Harper, W Tad Pfeffer, Neil F Humphrey, John H Bradford

Present and future states of Himalaya and Karakoram glaciers
J Graham Cogley

Numerical model of ice mélange expansion during abrupt ice-shelf collapse
Nicholas Guttenburg, Dorian S Abbot, Jason M Amundson, Justin C Burton, L Mac Cathles, Douglas R MacAyeal, Wendy W Zhang

Modeling of firn compaction for estimating ice-sheet mass change from observed ice-sheet elevation change

Jun Li, H Jay Zwally

The historical global sea level budget
John C Moore, Svetlana Jevrejeva, Aslak Grinsted

The triggering of sub-glacial lake drainage during rapid glacier drawdown: Crane Glacier, Antarctic Peninsula

Ted A. Scambos, Etienne Berthier, Christopher A. Shuman

Validation of a method for determining the depth of glacial melt ponds using satellite imagery
William A Sneed, Gordon S Hamilton

Dynamics and mass balance of four large East Antarctic outlet glaciers
Leigh A. Stearns

Tropical glaciers, recorders and indicators of climate change, are disappearing globally
Lonnie G Thompson, Ellen S Mosley-Thompson, Mary Davis, Henry H Brecher

More papers for *Annals* 52(59) will be published in the next issue

Annual General Meeting 2010

Wednesday 23 June at 11:00,

Hokkaido University Conference Centre, Hokkaido University, Sapporo, Japan.

The President, Dr Eric Brun, was in the chair.

58 persons from 13 countries were present, of whom 46 were IGS members.

1. *The previous AGM's minutes*

The Minutes of the last Annual General Meeting, published in ICE, 2009, No 150, p. 3–7, were approved on a motion by T.H. Jacka seconded by A. Ohmura and signed by the President.

2. *The President's report*

The President gave the following report for 2009–2010:

Dear Members, Ladies and Gentlemen

The International Glaciological Society has completed its 74th year. It's a great pleasure for me to present the report on the Society's activities for the past year.

I will start this report with an outlook of our publication activities.

In 2009, we published 6 issues of the *Journal of Glaciology*, all in a timely fashion. The last issue of 2009 was published online in mid December. We published 1115 pages in total in 2009, compared with 963 pages in 2008. And 2010 looks like it will be a substantial volume, as well, with the commemorative 200th issue of the *Journal* closing the year.

At the time of this AGM, we have published the first 2 issues of 2010 and the 3rd issue is well advanced.

Volume 51 of the *Annals* is also well on track. We are due to publish 3 issues in 2010 and we have now published 2 of those, *Annals* 51(54) (Snow and Avalanches) and 51(55) (Glaciology in the International Polar Year). The papers for *Annals* 51(56) (Microbiological Processes in the Cryosphere) have started to come in and we should have completed that issue before the end of the year. *Annals* 51(56) is the first *Annals* issue that does not have a symposium 'associated' with it. We are hoping to make this a regular feature of the *Annals*.

In 2009 we again saw a record number of submissions for the *Journal*. This is a continuation of the trend, we have seen in the last few years. In 2006, we had a record 122 submissions. In 2007 we surpassed this record by 25, 147 submissions in total. In 2008 we had 153 submissions. In 2009 we just beat the previous year's record by 2 submissions. This year, we are almost 2 months

ahead of last year with 84 submissions so far. The challenge remains to ensure that the Society's publications, especially the *Journal*, are seen as the best place to publish.

Moreover, despite the increasing number of submissions, the time from submission to publication continues to decrease, while maintaining a very high standard regarding the scientific and editing quality of the *Journal of Glaciology*.

For the continuous efforts which this success is based on, I would like to acknowledge our Chief Scientific Editor, T.H. Jacka, its editorial team, the Publication Committee, chaired by Christina Hulbe, the IGS Production Manager, Christine Butler, the IGS staff in Cambridge and our SG, Magnus Mar Magnusson.

We are now in our second year of the *Annals* of Glaciology under the auspices of the new *Annals* editorial policy. We submit all our *Annals* issues to Thomson and have requested that the *Annals* be included in the Science Citation Index. It is a very important issue for the future of the *Annals*, but we are still waiting Thomson's decision.

The online submission system for the *Journal* is finally live. After a necessary time of adjustments, things seem to be working fine. The next goal is to make the *Annals* live before too long. The fact that the *Journal* and the *Annals* have the same format will make things easier.

We have completed the 2009 publication of ICE and are hoping to be up to date by the end of 2010. ICE has also grown in size considerably – what used to be a 15 to 20 pages newsletter is now 40 to 70 pages long. We are hoping to move to an online ICE in the near future.

During the last AGM in Newcastle, July 2009, I reported the concern of the IGS Council regarding the decrease in the IGS membership. Our Secretary General put this issue at the top of his priorities. It looks as if we have been able to stem the decline in our membership. In fact we have more paid up members so far this year, than we have had in several years. We note a surge of new members, as can be seen by the list that appears in every issue of ICE. We need to continue to press former members to rejoin.

The Council, which met on Monday and Tuesday, paid a particular attention to the Treasurer's report. The Society's finances are still in fairly good shape but we ran a not insubstantial

deficit in 2009 compared with a small deficit in 2008, a small profit in 2007 and a bigger profit in 2006. This year's accounts are, in many respects, a truer reflection of the health of the Society than previous years.

The basic problem is that our income has dropped by 19% and our expenditure has increased by 14%, compared with the previous year.

On the expenditure side, the Society should be somewhat encouraged that many of the items were 'one off' payments in 2009. The Council is confident regarding the capacity of the IGS to regain the equilibrium in our budget in the coming years.

We are now in our second year of using the new membership management software. It has substantially helped in the running of the Society and simplified several tasks within the office, with the online membership renewal and symposium registration system; it has made things considerably easier. We will have to make some organisational changes within the office in line with the introduction of the new software.

The staff in the office now numbers eight people. The staffing amounts to approximately two and a half full time positions in production, two positions in administration and one position in membership/subscriptions. The pension plan is now fully implemented.

The IGS sponsored the International Symposium on 'Glaciology in the International Polar Year' at the University of Northumbria in July 2009.

We co-sponsored a conference on 'Ice and Climate; a view from the South' in February 2010. It was held in Valdivia, Chile and was very successful. We are hoping to have a fully sponsored IGS symposium in South America in the near future.

We have just returned from the 'Sea Ice in the Physical and Biochemical System' symposium held in Tromsø, Norway. It was attended by almost 200 people and was very successful. The local organizers deserve the credit for the success.

The symposium 'Snow, Ice and Humanity in a Changing climate', here in Sapporo, is already a very great event. We all enjoy the quality of the programme, the outstanding organisation and the friendship of our hosts.

The registration for the Byrd Polar Center celebratory symposium 'Earths Disappearing Ice; Drivers, Responses and Impacts' is underway and going well.

In addition we are working on symposia in San Diego (2011), Helsinki, Paris and Alaska in 2012, South America (2013), Canada, 2013–14 and Australia in 2014. We are also planning a

meeting in China in 2015 and a symposium in Boulder in 2016.

I would like to end this report by announcing that Council decided to award Dr Tim H. Jacka a Richardson Medal. The Richardson Medal is awarded, from time to time, in recognition of outstanding service contributions to the International Glaciological Society and to glaciology.

Jo Jacka is awarded 'For tireless personal service in the Society's missions to expeditiously publish scientific articles of the highest quality and to organize symposia that both broaden glaciological knowledge and international participation in glaciological research'. Jo is present at this AGM and I would like to present him with the medal.

The Secretary General invited members to discuss the President's report.

No questions were raised

D. MacAyeal proposed, and A Ohmura seconded, that the President's report be accepted. This was carried unanimously.

3. The Treasurer's report

The Secretary General, on behalf of the treasurer Dr I.C. Willis, presented the following report with the Financial Statements for the year ended 31 December 2009.

The state of the Society's finances is best summarised by considering the changes from 1 January 2009 to 31 December 2009, as shown on page 11 of the accounts. In the table, the Restricted Fund is money earmarked specifically for costs associated with the Seligman Crystal. The Unrestricted Funds is everything else.

Restricted Funds: increased very slightly from £8993 to £9059 due to the accrued interest of £66. No crystals were manufactured during 2009.

Unrestricted Funds: decreased by £122,565 from £566,249 to £443,684 showing that the income to IGS largely from membership, sales of the *Journal* and *Annals*, page charges and symposia attendance exceeded expenditure associated with *Journal* and *Annals* printing and publication, and associated office support, and office support for activities related to running symposia.

Total: The Society had net resources expended before revaluation of £123,603 resulting in the negative movement in the Society's funds of £122,499 in 2009 compared to a much smaller loss of £4,837 in 2008, a net profit of £11,327 in 2007 and a profit of £29,799 in 2006.

This gradual slide from profit to loss over the last 4 years should be of concern to the Society and one that it must try to reverse over the next few

years, as continued loss is clearly unsustainable. Compared to 2008, the Society's income fell by £72,021 (19%) and its outgoing expenditure went up by £52,659 (14%).

In more detail, income is itemised in notes 2-5, pages 15-16 and expenditure is listed in notes 6-8, page 17. The accounts are presented slightly differently from previous years, but last year's figures have been recalculated to reflect new headings. These headings are: '*Journal*, Ice & Books', '*Annals*', and 'Meetings/Symposia' to reflect the three main activities of the Society.

Income:

Note 2. Voluntary income increased slightly from £1,931 to £1,987 due to an increase in royalties (which more than offset a decrease in donations).

Note 3. As predicted last year, Investment income shows a marked decline from £29,986 to £4,973 due to the poor interest rates this year compared to previous years. This reflects the global recession.

Notes 4 & 5. Compared with 2008, income from membership subscriptions, sales of the *Journal*, Ice & Books, sales of *Annals*, and conferences & symposia are all down in 2009.

Membership subscriptions are shown to be down by £3,211 from £48,080 to £44,869. Actually, membership numbers have remained stable (at around 610). The drop reflects the artificially high figure in 2008, when part of the 2008 income reflects back payments by members prior to 2008. Part of the 2009 figure also reflects back payments prior to 2009. There was a drive by the IGS office to bring the membership payments up to date. Most of this happened in 2008 but this continued into 2009.

Journal sales to libraries and other organisations were up only slightly by £1,482 from £82,987 (2008) to £84,469 (2009). This is despite the Society moving to the publication of 6 issues per year in 2009 from 5 in 2008, i.e. an increase of 20%. This reflects the increased cost to libraries/organisations increasing from £275 in 2008 to £313 in 2009, i.e. by less than 20%. It also reflects falling sales to libraries/organisations, some of whom are cancelling often long held subscriptions. We believe this is at least in part as a result of the recession.

Page charge income increased by £11,697 from £76,744 to £88,441 (i.e. an increase of 15%). This compares to an increase of £21,695 (2007-8) and a drop of £18,659 (2006-7). Page charges to authors remained the same from 2008 to 2009. The increased income of just 15% compared to an increase in pages published of 46% is because fewer authors were able to honour page charges in 2009 compared to 2008.

Total income from *Annals* is down by £31,155 from £95,790 to £64,635, down by about 30%. This is despite the fact that 4 issues were published in 2009 but only 3 in 2008. Income from sales to libraries / other organisations was down by £14,393 from £42,903 to £28,510. This mostly reflects a change in accounting procedures. Previously, *Annals* income was credited in the year the income was received, whereas now it is credited in the subsequent year, the year the libraries / organisations actually receive the *Annals*. Thus, the 2009 volumes were credited in the 2008 accounts, whereas the 2010 volumes will not be credited until 2010, leaving 2009 with an apparent, but not real, drop in income from this source. More worryingly, some of the drop in income from this source is due to some libraries/organisations cancelling orders for *Annals*. As with the *Journal* above, we believe this is at least in part as a result of the recession.

Page charge income was down from £36,657 to £28,892, despite 4 issues being published in 2009 compared with 3 in 2008, reflecting more pages printed in 2009 than 2008. As with the *Journal*, this reflects the fact that fewer authors honoured pages charges in 2009 cf. 2008.

Expenditure:

Note 6. The direct costs associated with editing, printing, publishing and distributing the *Journal* and *Annals* and material for Meetings / Symposia increased by £16,568 from £105,167 to £121,735 compared to a decrease of £9,513 (2007-8) and a decrease of £34,860 (2006-7) and a decrease of £12,269 (2005-6). Printing costs increased by 23% and wages and salaries increased by 30%, which partly reflects the increased number of *Journal* Issues published. As mentioned above, 1 more *Journal* issue and one more *Annals* were published in 2009 cf. 2008. In total, 46% more pages were printed in 2009 cf. 2008. The increased printing costs and salary costs reflect the increased numbers of pages produced. [Interestingly, proof reading and editorial costs declined by 19% suggesting the proof readers / editors were much more efficient in 2009 cf 2008!]

Note 7. The support costs associated with *Journal*, *Annals* and Meetings / Symposia activity have increased by £39,475 from £232,956 to £272,431, an increase of 17%. This compares with an increase of £77,793 (50%) from 2007-8. The big hikes are associated with:

i) telephone, stationery & postage, due mostly to having to post *Journal* issues separately to members after the official distribution date due to late processing of membership dues (this will hopefully not recur in future now that members can renew online);

ii) computer costs, due to final implementation of the new MRM membership database system (training and software) and the scanning of back issues of the *Journal*;

iii) wages and salaries, mostly due to the employment of Trevor Margerson throughout 2009 (he was appointed part way through 2008) and the additional appointment of the equivalent of close to two full time student helpers. Trevor and the students were employed to clear up the existing membership database, put it in a format that could be imported into the new MRM software, and chase up those members who had not paid membership dues. These tasks have now largely been completed.

So, these three items of expenditure were 'one off' items and should not recur in the future.

Travel and subsistence costs, largely the Secretary General representing the Society at various Meetings, have also increased. Symposium support costs have dropped by £6,894, from £28,072 to £21,178 (i.e. dropped by 25%) whereas the Society ran two Symposia in 2009 compared with 4 in 2008 (i.e. a 50% drop). The relative increase in support cost per symposia from 2008 to 2009 is because the remote location of one of the 2009 symposia (Manali, India) and because the IGS paid for an officer to represent us at the IACS council meeting the IACS/IAHS Montreal conference and to travel onwards to the Northumbria Symposium. The provision of doubtful debts has also decreased this year by £11,938, since substantial effort with a lot of success has been extended on chasing up aged debts. As note 16 on page 20 shows, net debtors (i.e. after the provision has been removed) amounted to £110,481 in 2008 whereas in 2009 this was £49,859. The reduction in the net debt and the provision for the debt is therefore a very good thing for the Society. The new management software system, MRM, including the members online payment facility, and the direct link between MRM and the accounts software, SAGE, should make invoice and membership dues processing much more streamlined and efficient in the future compared to the recent past.

Note 7. Governance costs associated with running the Society as a Charity have remained stable.

Summary

The Society's finances are still in fairly good shape but there would still appear to be room for improvement in the way the Society operates. We ran a not insubstantial deficit in 2009 (~27% of funds) compared with a small deficit in 2008 (<1% of total funds), a small profit in 2007 (~2% of total funds) and a bigger profit in 2006 (~5.5% of total funds). This year's accounts are, in many

respects, a truer reflection of the health of the Society than previous years. In previous years, income appeared more than it really was, as many invoices were not actually paid. This led to the large 'debtors' figure and the need to make a large provision for that debt, in case it was never received. This year, the 'debtors' figure has been reduced and provision for the possibility that the debt will never be recouped have both dropped.

The basic problem, of course, is that our income has dropped (by 19%) and our expenditure has increased (by 14%) compared with the previous year.

On the income side, as the Society does not wish to increase page charges substantially, it must work at increasing the proportion of authors who pay at least something towards the costs of publishing their articles, preferably the full amount. Faster invoicing and the ability to pay online may help with this. The Society should also work more at increasing membership. [This is already underway: current membership in June 2010 is 625 compared with last year's membership of 610]. The Society must also try to ensure that library subscriptions to the *Journal* and *Annals* do not continue to slip; ideally we'd like to see them increase. A big drop in income is due to the much poorer interest rates in 2009 cf. 2008. This is likely to continue to be an issue for the Society for several years. The Society should consider moving some of its investments into a higher yielding, but still low risk, account.

On the expenditure side, the Society should be somewhat encouraged that many of the items were 'one off' payments in 2009. Total staff costs (note 12, page 19) were up by ~£32k and while ~£10k of this reflects an increase in direct costs associated with publishing extra pages in the *Journal* and *Annals*, ~£25k was associated with support costs, largely the employment of people to manage the membership data base, its transition to the new management software system, and the retrieval of aged debts from members and libraries / other organisations. Similarly, ~ 10k was due to increased postage of the *Journal* to members who had not paid their dues at the start of the year and who received their copies after the main mail out. Computing costs were up ~14k due to the final training in and implementation of the new management software system.

The poor management of the Society's accounts in recent years, particularly in terms of maintaining the membership database, processing membership payments, and sending out invoices and reminders promptly has cost the Society, both in terms of lack of income (some aged debts will now never be paid, hence the provision for aged debts in the recent accounts) but also in

terms of extra expenditure (the employment of extra staff in 2008-9 to make amends and chase up some of the debtors).

Now that the Society has in place the new joint MRM-SAGE management & accounting system, it is in a perfect position to send out invoices and reminders promptly, process membership dues for the year at the end of each preceding year, and return its wages and salaries associated with support costs back to those it saw prior to 2008. Fast and efficient use of the MRM-SAGE system by all IGS staff will be crucial in this regard.

Ian C. Willis, Treasurer

14th June 2010

The Secretary General invited members to discuss the Treasurer's report.

No questions were raised

T.H. Jacka proposed, and A Sato seconded, that the Treasurer's report and the draft accounts be accepted and he, the President and the Secretary General be authorized to sign off the accounts on behalf of Council. This was carried unanimously.

4. Election of auditors for 2010 accounts

The Secretary General proposed that the Society retain the same auditors as previous years as the 2010 accounts will be the final stage of the merger

of the new system implemented by the IGS. The present auditors are familiar with the accounts of the Society which would minimize the effort needed to complete the 2009 audit.

On a motion from the Secretary General, S. Sokratov proposed and T.H. Jacka seconded that Messrs Peters Elworthy and Moore of Cambridge be elected auditors for the 2010 accounts. This was carried unanimously.

5. Elections to Council

After circulation to members of the Society of the Council's suggested list of nominees for 2010–2013, no further nominations were received, and the following members were therefore elected unanimously.

Elective Members:

Dorthe Dahl-Jensen (Denmark)

Matti Leppäranta (Finland)

Liu Shiyin (China)

Johannes Oerlemans (The Netherlands)

The appointment of the new IGS officers and Council members was confirmed by the AGM.

6. Other business

No other business was raised

The AGM was adjourned at 13:00 on a motion from T.H. Jacka seconded by P. Bartelt.



Books received

Ralf Greve, Heinz Blatter. 2009. Dynamics of ice sheets and glaciers. *Advances in Geophysical and Environmental Mechanics and Mathematics* (K Hutter, series ed.). Springer-Verlag, Berlin, Heidelberg, . 287pp 105 illus. ISBN: 978-3-642-03415-2 (Cloth), e-ISBN 978-3-642-03415-2 (e-book); \$129.00.

Robert H. Webb, Diane E. Boyer, Raymond M. Turner, eds. 2009. *Repeat photograph: methods and applications in the natural sciences*. Island Press, Washington. 392pp 105 illus. ISBN: 978-1-59726-712-0 (Cloth); \$ 125.00. ISBN 978-1-59726-713-7 (Paper); \$75.00.



Richardson Medal for IGS Chief Editor Jo Jacka

T. H. 'Jo' Jacka has served pivotally in the proliferation of glaciological knowledge by leading the effort to edit and publish scholarly articles in the Society's periodicals, and by organizing symposia that both enrich the science of glaciology and broaden the international stature of the Society. He began his service as a Scientific Editor of the *Journal of Glaciology* with Volume 38 in 1992, and continued in this service for 5 years. He left the *Journal's* editorial staff at the end of 1997 to be the Chief Scientific Editor of two volumes (29 and 39) of the *Annals of Glaciology* (representing the sixth and seventh International Symposia on Antarctic Glaciology, ISAG-6 and ISAG-7, held in Lanzhou and Milan). These two *Annals* volumes presented 116 scientific articles covering 884 pages involving the international glaciological community's most cutting edge research on the nature of the Antarctic ice sheet. Following publication of Volume 39 of the *Annals*, Dr Jacka took on the Chief Editorship of the *Journal of Glaciology* (with Volume 49, in 2003) in which position he currently serves the Society as the head of its flagship journal.

With Volume 54 (2007) the *Journal* received the prestigious Association of Learned and Professional Society Publishers (ALPSP) Charlesworth Award for 'best learned journal' with special recognition for design and production quality. This extraordinary honour was the result of constant collaborative effort between the Chief Editor, in supplying accepted papers of the highest scientific quality, and the production staff and General Secretary of the Society, who bear the responsibility of quickly converting edited manuscripts into an attractive printed product. Not least of the contributions toward the changes the *Journal of Glaciology* underwent in the process of earning this prestigious award is the fact that, since the beginning of Dr Jacka's editorship, the *Journal* is attracting more and better submissions from the glaciological community.

To illustrate the increase in quality and quantity of scholarly article publication in the *Journal of Glaciology*, an example of how the *Journal* has changed since the beginning of the 1990s is provided as follows. Prior to T.H. Jacka's tenure as Chief Editor, Volume 37 (1991) of the *Journal* presented only 51 papers printed across 422 pages. During the sixth year of Dr Jacka's editorship, Volume 54 (2008) of the *Journal* published 79 schol-



Fig. 1. Jo Jacka is awarded the Richardson Medal by IGS President Eric Brun

arly articles ranging across 764 pages. This represents an increase of 54% in articles published and an 81% increase in pages published. The articles are considered to be better, more informative and more in-depth, as the average article has grown between 1991 and 2008 from 8.2 pages to 9.6 pages, and the use of coloured illustrations has become a regular feature.

Among the reasons commonly heard in the glaciological community for the growth of the *Journal of Glaciology's* annual publication is the fact that the review process has become better managed, speedier and more constructive. Glaciologists now consider the *Journal of Glaciology* to be a much more attractive outlet for their scientific and scholarly work than they did during the 1990s when, at times, the review process would take 6 months to a year or longer. The efficient management of the review process, leading to a timely accept/reject decision with all revisions in place prior to the next step of in-house copyediting and production, has been a critical aspect of improving the *Journal's* speed of publication. Under the present arrangements, many articles submitted to the *Journal* in rough form ultimately appear in print in polished form all within one year. The article by Catania and others (2008), for example, was submitted in April 2008, accepted in revised form in July and appeared in colour as the first article (of 19 in the same issue) of issue 187 of Volume 54, published in 2008. While this most important achievement of the *Journal* is ultimately a collaborative process, involving (using 2008 figures) 17 Scientific Editors, five in-house

production staff, and four copy-editors, Dr Jacka's leadership of the review and scientific editing process is significantly responsible.

The most intangible, yet most vital, aspect of Dr Jacka's leadership of the scientific publication of both the *Journal* and the *Annals* (he was made the IGS Chief Editor, responsible for all IGS publications in 2008), is the thinking, writing and dialogue that Dr Jacka performs in concert with the authors of papers submitted by glaciologists of a variety of backgrounds, stature and skill levels. Once a submitted manuscript passes muster sufficiently to be within the realm of possible publication, Dr Jacka will engage in detailed, and always respectful, argumentation over the nature of the science presented and the way in which language is used to make the science understood by the community. Dr Jacka often suggests revisions to text or alternative argumentation logic and even rewrites some of the explanation on many papers

that ultimately are published in the *Journal* and *Annals*. His work is always done without personal recognition, yet is ultimately responsible for creating a healthier venue for the glaciological community's most important form of interchange.

Dr T.H. Jacka continues in full force as the IGS Chief Editor with the specific responsibility for the *Journal of Glaciology* and as an overseer and quality control expert of the *Annals of Glaciology*. His work is energetic, time-consuming, selfless and of great value to glaciological scientists whose backgrounds, skill levels and experience do not as readily allow publication of new ideas. His work merits recognition by the Society through the award of the Richardson Medal.

Eric Brun, President



Staff changes

Since the last issue of ICE Linda Gorman, who had been with the IGS for 24 years, has left. Linda worked with three Secretary Generals: Hilda Richardson first employed her and Linda worked with her until Simon Ommanney took over as SG in 1992. When Simon retired in 2003 she continued to work with the present Secretary General.

Linda was for most part the main contact for IGS members: she used to send out handwritten notes reminding members to renew and communicated whatever information needed to be conveyed to members.

The IGS thanks Linda for her long and faithful service to the Society.



New Chair for Awards Committee

Martyn Tranter has now taken over as the Chair of the Nominations Committee, replacing Pat Langhorne who has served as Chair for the past two terms. Pat and her team have done a terrific job and the IGS is very grateful for them.

We are going to use the change of chairmanship to wipe the nomination slate clean. We will solicit new nominations for the Seligman Crystal and the Richardson Medal soon, and information about the material that is needed will be posted on the IGS website shortly. Details will also be published in the next edition of *ICE*.

❄ The Magnificent Seven

Report from the IGS conference on 'Snow, Ice and Humanity in a Changing Climate'

Sapporo, Japan, 21–25 June 2010

The first fallen snow
is barely enough to bend
the junquil leaves

Matsuo Basho

... snow crystals may be called letters sent from
heaven.

Ukichiro Nakaya

For *Hikaru* Magnú-san, honorable 'shining Magnús', the journey had become an unbroken succession of reverses and afflictions. He had been travelling long and far, most recently to a Nordic country where the first IGS symposium of 2010 had recently finished. He was now moving inexorably along the *Tōkaidō*, the road to *Edo*, to pay his respects to the *Shōgun* and to seek the element of his passion: the precious, spirit-filled masterpiece of Japanese steel: the *Katana*. However, as he approached the 25th station, or the Castle of the Snow Covered Ski Slopes near the village of *Sapporo*, on the island of *Hokkaido*, in the land of *Japan*, he was met by a mob of nervous snow and ice scientists. One stepped forward and said:

'Honorable *samurai*, our *honmaru* has been afflicted with the problems of snow, ice and a changing climate and we are concerned about its effect on humanity. We implore you to come to our city to conduct a symposium that will teach us the secrets of these problems.'

Hikaru Magnú-san replied,

'I shall be happy to accept this challenge, however I shall need to recruit five additional *samurai* to help me in this task.'

There was no question which *samurai* would be chosen by the *Hikaru* Magnú-san, because he was familiar with the best in the land and chose those with distinctive skills and personalities: First, there was Atsushi Sato, a master of snowcraft and *shōgun* of many ice covered prefectures. This would be the leader of the local organizing committee. Next, there was Osamu Abe, an expert in *onsen* etiquette; Kumiko Goto-Azuma, a learned woman who wore the *kimono* of the 35 sacred glaciological equations; the good humored Shin Sugiyama (who was accompanied by his band of experts in both Japanese hospitality and the organization of scientific meetings, including: Yoshiyuki Ishii, Yuji Kodama, Sumito



Fig. 1. The villagers await



Fig. 2. Co Chief Editors Perry Bartelt and Doug MacAyeal muster their seven samurai scientific editors and conference organizers during the ice-breaker.

Matoba, Hiroki Matsushita, Kazuki Nakamura, Koichi Nishimura, Toshihiro Ozeki and Nozomu Takeuchi). Finally, there was the Chief Expert of scientific *shodō*, Perry Bartelt (accompanied by seven specialists in scientific calligraphy, also known as Scientific Editors, whose names shall appear in an upcoming issue of *Annals of Glaciology*).

There were now six *samurai* to conduct the meeting, however, a clownish *rōnin* named MacAyeal tagged along despite attempts by the others to drive him away. So that made seven, the seven *samurai*, who would organize and conduct the great symposium on Snow, Ice and Humanity in a Changing Climate, held at Hokkaido University in Sapporo during June, 2010.

Here is the tale of the Symposium on Snow, Ice and Humanity in a Changing Climate that the seven *samurai* helped to facilitate:

The symposium was held on the picturesque campus of Hokkaido University, the second oldest (founded in 1918) of the *magnificent seven*, the National Seven Universities (*zenkoku shichidaigaku*) of Japan. This venerable university



Fig. 3. Kampai!



Fig. 4. Koji Fujita and his wife Akiko training the next generation of snow and ice scientists in the arts of 'icebreaking'....

is the home of the Institute of Low Temperature Science, which was founded by Japanese physicist and glaciologist Ukichiro Nakaya, the pioneer of snow and ice science – both basic and applied. The traditional 'icebreaker' was held in a newly renovated faculty club of the university which was located next to the former laboratory where Professor Nakaya conducted his famous studies of snow flake geometries and created the world's first artificial snowflake. A large hexagonal stone sits in front of the faculty club to commemorate Professor Nakaya's contribution to snow and ice science. A most wonderful honor was enjoyed by all visitors and locals alike when Professor Goro Wakahama, an honorary member of the IGS, and Prof. Norikazu Maeno, former president of the IGS, arrived at the icebreaker to help raise spirits (and glasses of *saki*) with the friendly salutation: *Kanpai!*

Scientists from 17 countries gathered during the 5-day symposium to present 70 talks and 105 posters ranging across the full spectrum of



Fig. 5. Professors Goro Wakahama and Atsushi Sato train the ISG Secretary General, with ice-sheet modellers Ralf Greve and Olga Sergienko looking on, in the fine points of enjoying Japanese spirits.



Fig. 6. Prof. Atsumu Ohmura asks a penetrating question during the symposium. Prof. Renji Naruse looks over his shoulder.



Fig. 7. Snow and Ice scientists, young and old, gather for spirited discussion at the poster session....



Fig. 8. Irina Sokratova making a point during the poster session.



Fig. 9. Jo Jacka explains to his sushi chef how to edit a *Journal of Glaciology* paper...

snow and ice research. Of particular note was the fact that this symposium combined several sub-communities of glaciological scientists, bringing together those who specialize in snow and avalanche research with those who specialize in glaciers and ice sheets. New frontiers of glaciological research were emphasized in several of the oral and poster sessions, including: the state of Himalayan glaciers, mass-balance trends of glaciers in Asia, proglacial lake outburst floods and their impact on humans, avalanche hazard mapping, and forecasting of snow and ice systems ranging from avalanches to ice-sheet sea level contributions. One of the special highlights of the symposium was an hour-long address given by former President of the IGS Professor Atsumu Ohmura on the state of the cryosphere in a changing climate.



Fig. 10. The best part of the *onsen* experience is cooling off at the end....



Fig. 11. Differences between the Western and Eastern diet

Besides the great hospitality of the city of Sapporo, the flavorful food and the comfortable hotels and *ryokan*, attendees of the symposium were treated to a special suite of excursions during the mid-week break and to a delightful Japanese barbeque at the Sapporo Beer Garden. Among the highlights of the mid-week excursions were visits to beautiful outdoor sculpture displays, instructions in the art and science of making *sushi* and brewing *sake*, and a visit to a facility that used snow as a means of reducing summer air conditioning costs. For the most intrepid attendees, a visit to a traditional Japanese onsen (hot spring bath) was arranged, along with extensive instruction in both the etiquette and techniques for enjoying a truly Japanese experience in a most (ahem) 'stripped down' manner. It is unlikely that any previous IGS symposium offered attendees such an intimate and personal view of their colleagues as was enjoyed in the steamy hot waters surrounded by the beautiful natural terrain of Hokkaido. The evening at the Sapporo Beer Garden was notable not only for the relatively robust consumption of



Fig. 13. This tie will really make you look like a glaciologist...



Fig. 14. Sapporo's got talent!

one of Japan's most favored beverages but also for the unique way in which food was presented and prepared. Each table was presented with unending platters of lamb, fish and vegetables à la Genghis Khan, and guests cooked their own meals over a small cast iron stove or *shichirin*.

A highlight of the week was the award of the Richardson Medal of the IGS to a most deserving



Fig. 12. One must be very thoughtful about important choices...



Fig. 15. All you can cook barbeque, Japanese style...



Fig. 16. Thankfully, Magnús has his hand on something solid, otherwise the whole group would fall down...

and completely surprised Jo Jacka at the annual 'business' meeting of the IGS on Thursday. This award, described elsewhere in ICE, recognizes Jo for his enduring and extraordinary service to the Society.

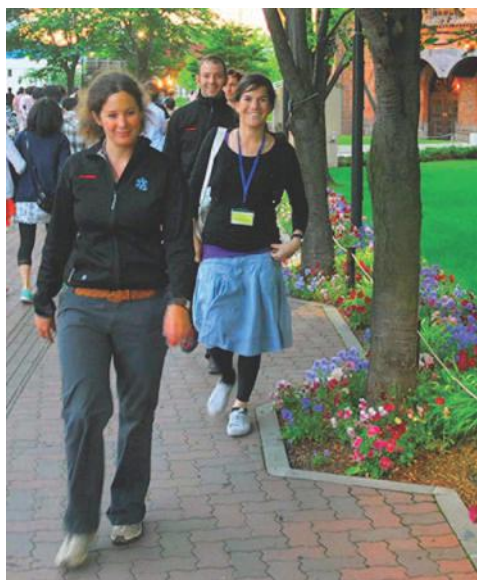


Fig. 17. On the way to the Sapporo Beer Garden to meet Genghis Kahn....

At the close of the meeting, the attendees who had come from far away to join the symposium concluded that the glaciological sciences in Japan are extraordinarily vibrant and that Japanese hospitality, for a third time (Sapporo 1984, and Nagaoka, 1992), had successfully called together the world's glaciological scientists to examine snow and ice problems of important consequence for all of humanity.

On the seventh day, the day after the symposium closed and the glaciologists from far and wide scattered home, *Hikaru* Magnú-san picked up his bundles of journal samples and silk IGS snowflake ties, and threw a strand of straw into the air. He inspected the strand carefully when it landed and noted with resignation that it pointed not south toward *Edo* but rather east, toward a city named in honor of an Italian discoverer from 1492 who wanted to find a westward sea route to Japan (but who got stuck along the way in an intervening continent). *Hikaru* Magnú-san hoisted his bundles and balanced his *Katana* over his shoulder and began to walk the dusty road toward Columbus, Ohio, where the third IGS symposium to be held in 2010 would occur soon thereafter.

Doug MacAyeal



REPORT FROM THE BRITISH BRANCH MEETING

Institute of Geography and Earth Sciences, Aberystwyth, 15-17 September, 2010

Aberystwyth's own Coen brothers, Alun and Bryn Hubbard, showed true glaciological grit in organising and running another BBM that fulfilled the perennial requirement of multi-level combinations of great academic, scientific and social stimulation for young and old. The general scientific standard of the younger generations continues to excel – the standard of poster and oral presentations continues to outcompete anything persons over 20 years older could put together. Competition for the prestigious John Glen Prize was ever fierce, and the young recipients of the oral and poster prizes were Sue Cook (Swansea) and Victoria Brown (Durham), respectively. John also performed one of the most memorable and inspirational of prologues to a meeting that most of us have witnessed. The evening of the 15th commenced with an icebreaker that followed through to a 40-minute presentation. The presentation lasted 90 minutes, charting the history of glaciology in the UK since the Second World War. There were no PowerPoint slides, old fashioned slides or overheads. Instead, we had a first-hand account of how the discipline developed, with generous praise for the existing hierarchy and the new and developing peer group. The most fitting tribute is that no one felt cheated of time in the bar, and it all finished too soon. This was a hard act to follow, but speakers in the following sessions on Modelling of snow, ice surface processes and ice dynamics, Greenland mass balance and surface hydrology, Geomorphology and glacial reconstruction, Valley glacier processes and landforms, Remote sensing of ice and snow, and Antarctic structure, dynamics and subglacial lakes

managed personfully. There were numerous fine presentations, and the parallel poster sessions worked admirably too.

A UK Polar Network Mentoring Session was held during the late afternoon of the 16th. The AGM of the IGSBB followed. It was addressed by the IGS Secretary, Magnús Magnússon. The BB is in rude health, both in terms of leadership, administration and finance. Officers will carry forward to next year, when the cavalcade of talent will change. A very healthy sign is that there is almost naked competition to host the next meetings. The British Antarctic Survey will host the meeting in 2011, Aberdeen in 2012 and Loughborough, Bristol, Exeter and/or Southampton will fight for the privilege in 2013–16.

The Annual Dinner was held at Consti Restaurant, at the northern end of the Aberystwyth sea front, reached by a cable car run to the top of the cliff. Food, service and conversation were sufficiently copious, well received and ribald to maintain the proud traditional of BBM past. Stand out moments fade beyond a vague recollection that there were plenty. Attendance during the morning sessions of the 17th was outstanding given the good time we all had the night before.

We are all very grateful for the great welcome, organisation and entertainment offered us by the Centre for Glaciology. BAS are moving already to equal this next year.

Martyn Tranter

Meetings of other societies

Modelling glacial erosion: processes and uncertainties

Workshop on Glacial Erosion Modelling

Unterägeri, Switzerland, 29 April–1 May 2010

Deeply incised valleys are common features in the Alps and their foreland. These valleys are of large practical and scientific interest, influencing the dynamics and hydrology of ice masses, presenting opportunities for glacial and climate reconstruction, and raising management issues related to aggregate, groundwater and hydrocarbon resources and radioactive waste disposal in deep geological repositories. Although the principles of glacial erosion are generally known, the formation of deeply incised valleys in the foreland of the Alps, referred to as deep glacial erosion, remains incompletely understood. In particular, the question as to when, where, and how future glaciations can lead to deep glacial erosion is relevant for the siting and long-term safety of radioactive waste repositories in northern Switzerland.

A workshop organized by the National Cooperative for the Disposal of Radioactive Waste (Nagra) in collaboration with the University of Zürich and held in Unterägeri, Switzerland in April 2010 was aimed at evaluating the state-of-the-art of modelling glacial erosion as a means for developing a better understanding of the subglacial processes governing landscape evolution in the Alpine foreland of northern Switzerland in past as well as future cold environments. An international group of leading experts was invited to contribute to an assessment on what quantitative information glacial erosion modelling can provide in view of safety aspects related to radioactive waste repositories in Switzerland.

The workshop was organised around a suite of presentations and discussions about observations and measurements related to glacial erosion as well as possibilities and challenges of glacial erosion modelling in view of future ice ages. The presentations were short introductions with the idea to acquaint all participants with the current state of research in the different areas of expertise. The discussions were structured in a way that led to answers to key questions.

The participants suggested that the deformation and thermomechanics of glacier ice are reasonably well understood and ice cover extent and

ice flow paths can be modelled with good confidence. In contrast, basal processes including glacier hydrology, ice-bed interaction, sliding, sediment transport and interactions with permafrost are comparatively poorly understood and require considerable additional model development to be usefully incorporated into comprehensive coupled models. In this respect, glacier hydrology was particularly acknowledged as being important for realistic simulations of ice dynamics and erosional processes.

The participants generally agreed that prognostic modelling is beyond our present capabilities and not recommended because of substantial uncertainties in the quantification of basal processes and the relevant climate forcing for future glacial cycles. Instead, they suggested that diagnostic modelling has potential value for understanding processes and quantifying uncertainties and for testing sensitivities and process parameterizations.

According to the participants, modelling strategies that hold promise include ensemble modelling to explore the range of outcomes over the entire range of uncertainty in variables and extremal (end-member) modelling to bracket best and worst cases. These approaches can lead to the identification of potentially important processes and parameters and thus the component models needed (e.g. glacier hydrology, glacial sedimentary processes) for comprehensive coupled models.

The main outcomes of this workshop are summarized in Nagra Working Report NAB 10-34 which can be obtained by emailing urs.fischer@nagra.ch.

URS H. FISCHER

**National Cooperative for the Disposal of
Radioactive Waste (Nagra), Wettingen,
Switzerland**

WILFRIED HAEBERLI

**Department of Geography, University of Zürich,
Zürich, Switzerland.**

The Northwest Glaciologists' Meeting

Fairbanks, Alaska 8–10 October 2010

The annual Northwest Glaciologists' Meeting was hosted by the University of Alaska, Fairbanks (UAF) on 8–10 October 2010. The meeting was dedicated to Keith Echelmeyer, who passed away on October 2nd but left a great legacy of scientific accomplishment and adventurous spirit. To pass on some of the lessons in motivation and get-it-done spirit that Keith provided to those he worked with, Chris Larsen (University of Alaska, Fairbanks) talked about his experience studying the sheer margin of Whillans Ice Stream with Keith, including stories and photos of scientific discovery and exploration.

As usual, talks were primarily presented by graduate students, but included presentations by faculty, National Park Service and U.S. Geologic Survey researchers, and a few fantastic undergraduates. Both days of the meeting included groups of talks about projects focused on a particular location and linking a variety of techniques or smaller research projects. Project areas we heard about include: Belcher Glacier on the Devon Island Ice Cap; Eklutna Glacier in the Chugach Mountains, Alaska; Yaktse Glacier in Icy Bay, Alaska; and Mt Waddington, Alaska. Appropriate to our location, most talks discussed Alaska-based research, providing a great overview of current mountain glacier and ice cap research. Other topics covered during the meeting ranged

from glacier influence on coastal freshwater input to ice movement during snowball earth events to current work on Jakobshavn Isbræ and Whillans Ice Stream.

At the end of the first day Tad Pfeffer (University of Colorado INSTAAR) gave the keynote talk, which was open to the greater UAF community, on 'Improving on AR4 – How can the IPCC AR5 make a better future sea level change forecast?' He discussed the importance of examining what happens decade-by-decade as well as on millennium timescales in order to provide information that is useful for policymakers. He also encouraged more geographically complete observations, work to improve our understanding of dynamics and interannual variability, and coordination of independent records. Regarding the last point, Tad noted that maintaining independent records is an important strength, but should be carefully balanced with improved coordination for problem solving. Finally, he said that glaciers and ice caps will play a critical role over the coming decades, but there are still significant gaps in our knowledge and resources regarding this category of glaciology. So there was plenty for all of the attending graduate students to get to work on!

Following the keynote, everyone headed to Matt Nolan's (University of Alaska, Fairbanks)



Fig. 1. Snacks, coffee, and conversation make for another productive Northwest Glaciologists' Meeting, hosted by the University of Alaska, Fairbanks. Photo: Regine Hock



Fig. 2. Magnús Magnússon, Regina Carns, Matthew Sturm, and Tad Pfeffer show off their IGS ties, which were selling like hotcakes! Photo: Andy Aschwanden

house, 'The Castle'. Evening entertainment and eats included (but weren't limited to!): a huge bonfire; endless fireworks, including some in the bonfire; a chocolate fountain; fresh Alaska salmon; stargazing from the castle tower; and a visit from the troopers to make sure that we weren't going to burn down the neighborhood. Fun was had by all!

Along with interesting talks and busy conversation, the meeting also included an impressive research summary by Regina Carns (University of Washington), whose poetic fame continues to grow (see ICE 152/153). She provided this sonnet in iambic pentameter:

'A Hypothesis Regarding Crystal Fabrics in Firn'
by Regina Carns

Disordered crystals tumble from the sky
To settle on a vast expanse of white
Cold and windy, desolate and dry
As constant sunshine follows lengthy night
In summer sunlight, each grain sublimates
And vapor flees to colder, deeper places
Condensing there on grains of snow at rates
That differ on the base and prism faces
Those with their favored faces toward the flow
Outstrip their neighbors, gain an edge in size
These larger grains steal yet more mass and grow
Their surface energy to minimize.
Mean angles skew toward this victorious faction
As demonstrated by X-ray diffraction.

PRECEDING WORKSHOP: PISM

The meeting was preceded by a two-day workshop on the Parallel Ice Sheet Model (PISM) developed at UAF, which continues to improve and expand and is used by a variety of research groups around the globe. This first workshop covered the following topics: introduction to PISM & theoretical basis, installation, tools for pre- and post-processing, verification and validation, and tutorials



Fig. 3. Martin Truffer celebrates a successful ice meeting, with fire. Photo: Andy Aschwanden.

including SeaRISE examples. For more information on PISM: <http://www.pism-docs.org>

POST-MEETING FIELD TRIP: PERMAFROST RESEARCH TUNNEL

After the meeting, many participants took advantage of the opportunity to take a tour of the CRREL Permafrost Research facility. Highlights included standing at the intersection of several large ice wedges, viewing 15 000-year-old bison fossils, and getting what for many was their first up-close look at permafrost. We also heard about the plans for expanding the research facility. In winter 2011, a second tunnel will be excavated and connected to the first tunnel, providing a new area for expanded research. For more information see: <http://permafrosttunnel.crrel.usace.army.mil>

Twila Moon

University of Washington, Earth & Space Sciences

Thank you to Andy Aschwanden and Regine Hock for providing photos of the events.

UK Polar Network Circumpolar Remote Sensing

On September 20, 2010 over 30 students and researchers came together at the UKPN's Circumpolar Remote Sensing Workshop hosted by Cambridge University's Scott Polar Research Institute.

The day featured a range of sessions including Freely Available GIS and Remote Sensing Resources for Polar Research, Innovation in Imaging Antarctica, Airborne LiDAR for Glaciology, Real-time Reception and Analysis of Satellite Data, Remote sensing to address mapping needs for environmental management in Antarctica, and Ice Shelf Retreat in Antarctica. PDF and video recordings of the day's presentations are (or will be shortly) available through www.polarnetwork.org – just look under our Past Events section.

In addition, five (enthusiastic!) panelists from universities, research institutes, and a remote sensing consultancy also sat on a career discussion panel to help attendees answer questions about moving forward in their journey to move

from early career to more experienced. They stressed the importance of building your skill set throughout your career, making connections in your research community, and always making sure to have fun and play with your data.

Many thanks to our presenters and panelists: Fiona Danks, Ken Dean, Adrian Fox, Peter Fretwell, Colin Harris, Hamish Pritchard, and Gareth Rees.

We would very much like to thank our supporters the Earth Observation Tech Cluster (www.eotechcluster.org), Environmental Research & Assessment, and the 11th International Circumpolar Remote Sensing Symposium.

The UKPN is the UK branch of the international organization APECS (the Association of Polar Early Career Scientists, www.apecs.is).

Allen Pope, allen.pope@polarnetwork.org



Notes from the Production Team

We are keen to minimize the possibility of errors being introduced during the copyediting and typesetting of papers submitted in LaTeX. It will be of great help to us if, when preparing the electronic files of your final accepted paper you, you do the following:

- Use the igs class file (downloadable from <http://www.igsoc.org/production/igs-v2.00-distrib.zip>). Please don't alter this style file as we will always use our version rather than yours.
- If the use of other non-IGS styles is unavoidable, include the '.sty' files with your submission and add explanatory comments to the text so that we can understand the effect you are striving for
- Name your individual figure files in a style that states both the manuscript number and the figure number (e.g. '11J299Fig01.eps' or '61A012Fig03').
- Submit each figure as a single file rather than lots of separate elements (i.e. combine the files for '62A077Fig1a', '62A077Fig1b'.... '62A077Fig1z' into a single '62A077Fig1.eps' file). We know LaTeX can compile these, but the resulting composites are rarely the right size and shape.
- Include a pdf version of your final accepted paper along with your text, bibliographic and figure files. This will help us to check in our typeset version of your paper that all figures and equations are correctly numbered and in the correct position.

Thank you

Craig Baxter
IGS Production



INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on Interactions of Ice Sheets and Glaciers with the Ocean



Scripps Seaside Forum
Scripps Institution of Oceanography
La Jolla, California, USA
5–10 June 2011

Co-sponsored by:

- ❄ National Science Foundation (NSF)
- ❄ National Aeronautics and Space Administration (NASA)
- ❄ Scientific Committee on Antarctic Research (SCAR)
- ❄ WRC Climate and Cryosphere Project (CliC)
- ❄ Scripps Institution of Oceanography
- ❄ Forum for Research into Ice Shelf Processes (FRISP)

SECOND CIRCULAR
November 2010
<http://www.igsoc.org/symposia/>



The International Glaciological Society will hold an International Symposium on 'Interactions of Ice Sheets and Glaciers with the Ocean' in 2011. The symposium will be held on the oceanfront in La Jolla, California, USA, from 5–10 June 2011. The Symposium is joined with the annual Forum for Research into Ice Shelf Processes (FRISP) meeting. FRISP (<http://folk.uib.no/ngfso/FRISP/index.html>) is a subcommittee of the Scientific Committee on Antarctic Research (SCAR) Working Group of Glaciology.

THEME

The mass balance of the Antarctic and Greenland ice sheets and the circulation of the adjacent oceans are strongly coupled through physical processes occurring at the ice-ocean interfaces at the fronts and bases of ice shelves and glacier tongues, and the termini of tidewater glaciers. Improved understanding of these processes is essential so that they can be realistically represented in models of how ice sheets and glaciers would evolve in a changing climate, and to improve predictions of global ocean circulation and sea level change. The goals of this symposium are to: (1) assess the state of our knowledge of ice-ocean interactions; and (2) discuss what is needed for development of reliable, quantitative models of ice sheet evolution.

We hope this symposium will attract experts in ice shelf, ice sheet, glacier, ocean and climate studies whose research addresses interactions of the ocean and ice in the global climate system using in situ observations, remote sensing and/or modelling. We encourage contributions on all

aspects of ocean interactions with ice sheets and glaciers, towards achieving the symposium goals. Come and attend what will be a stimulating and productive symposium in a beautiful setting in Southern California.





SUGGESTED TOPICS

The thematic focus of the Symposium is on ice–ocean interaction in the broadest sense, and all interpretations of this theme will be welcome as submissions for presentation at the meeting. Suggestions for specific topics of interest are:

1. Mass balance of ice shelves and tidewater glaciers, including the physics of melting and freezing at the ice–ocean interface and iceberg calving, forcing from ocean and atmosphere, and sensitivity to climate change.
2. Dynamics of ice shelves and tidewater glaciers, including: the response to changes in surface and basal mass balance; response to tidal forcing; impact of calving events; and processes influencing ice rheology and susceptibility to fracture.
3. Coupling between grounded and floating ice, including controls on the location of grounding lines, response of inland ice to thinning and break-up of ice shelves and termini of tidewater glaciers, transmission of tidal forcing across the grounding line.
4. Oceanic response to the input of ice, including the impact of meltwater and drifting icebergs on regional and global ocean circulation and sea level.
5. Role of atmosphere/sea ice/ocean processes in delivering ocean heat to glaciated coastlines, including the impact of past, present and future climate variability.
6. Records of change in ice shelves and tidewater glaciers, including time series derived from direct observation and studies of the past impacts of ice sheet–ocean interaction preserved in the ice core and marine geological record.
7. Observational and modelling techniques that advance our understanding of ice sheet–ocean interaction, including strategies for understanding and monitoring ocean forcing and ice sheet/glacier response, techniques for coupling ice sheet/shelf models with ocean circulation/climate models.





ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper (either oral or poster) at the Symposium will be required to submit an abstract by 4 March 2011. A collection of submitted abstracts will be provided for all participants at the Symposium. The Council of the International Glaciological Society has decided to publish a thematic issue of the *Annals of Glaciology* on 'Ice–ocean interaction' which is consistent with the Symposium themes. Submissions to this issue will not be contingent on presentation at the Symposium, and material presented at the symposium is not necessarily affirmed as being suitable for consideration for this issue of the *Annals*. Participants are encouraged, however, to submit manuscripts for this *Annals* volume. The deadline for receiving *Annals* papers is 22 April 2011.

VENUE: The symposium will be held at the new Scripps Seaside Forum, an extraordinary, oceanfront conference center facility located in the heart of Scripps Institution of Oceanography, with a breathtaking view over the Pacific Ocean. Just steps from the sand, it offers a relaxed and comfortable atmosphere, yet provides conference support through state-of-the-art audio-visual equipment ranging from 3D projection systems, multiple computer connections, and surround-sound. The beachfront location offers plenty of opportunity for relaxation during conference breaks.

REGISTRATION FEES

All fees are in US Dollars, USD

– Participant (IGS member):	\$520
– Participant (not IGS member):	\$600
– Student or retired IGS member:	\$260
– Accompanying person (21+):	\$100
– Accompanying person (12–20):	\$60
– Accompanying person (<12):	Free
– Late registration surcharge (after 25 March 2011):	\$80

REGISTRATION BY MAIL: Though we strongly prefer registration through the website, it can also be done by filling in and returning the back page of this circular. If payment by credit card is not possible, contact the IGS office to arrange for a bank transfer. Payments made after 25 March 2011 must include the





additional \$80 late-registration fee. When completed, please send the form to the Secretary General at the IGS address.

ACCOMPANYING PERSONS: The accompanying person's registration fee (\$100 for 21 and over; \$60 for ages 12–20; under 12 free) includes the icebreaker, the Tuesday evening reception, and the symposium banquet. Short excursions and activities in and around San Diego will be offered on request at additional cost.

STUDENT/POSTDOC support: NSF and NASA have provided funds to partially support student and postdoc attendance at this symposium. If you would like to apply for these funds, please send a justification letter and your proposed abstract title and a summary to hafricker@ucsd.edu by 4 February 2011. If you are not a student or postdoc, but have limited access to travel funds, your application will also be considered.

LOCATION: San Diego is renowned for its idyllic climate, enjoying beautiful weather year round with an average daily temperature of 70.5°F (21.4°C). California's second largest city and the USA's eighth largest, San Diego has a citywide population of nearly 1.3 million. As well as its beaches, San Diego has an impressive array of world-class family attractions, such as the San Diego Zoo and Wild Animal Park, Sea World San Diego and LEGOLAND California. San Diego offers an expansive variety of things to see and do, appealing to guests of all ages. This would be the ideal destination for an accompanying family! The most difficult decision to make regarding a trip to San Diego is determining what to do and see among the region's vast and diverse offerings.

GETTING TO SAN DIEGO: San Diego International Airport (SAN) is conveniently located right in the city center, which is about 14 miles from La Jolla. Transfer from the airport is an easy 25-minute journey by taxi, Cloud 9 Shuttle, or rental car. The airport is served by most of the major airlines and has direct flights to most US cities including: Denver, Dulles, BWI, New York, Chicago. For European attendees, British Airways are conveniently starting a non-stop daily flight from London Heathrow to San Diego in June 2011. Travelling on other airlines from Europe or Australia you will need to connect in a US hub, most likely on the East coast of the US or at LAX or SFO. Flying to LAX and then surface transport to La Jolla is another feasible option.





ACCOMMODATION: Blocks of rooms (at \$139 + tax for a single) have been held at two hotels near Scripps Institution of Oceanography: the Hotel La Jolla and the La Jolla Shores Hotel. Both these hotels have shuttles and are also located an easy 20-minute walk along the beach from the conference venue. For those who prefer to stay elsewhere, the venue is on Bus Route 30, which passes through Downtown La Jolla and Pacific Beach, so you can seek accommodation in these places. There are also vacation rentals in La Jolla for larger groups or families.

PARKING: Parking can be quite tricky at Scripps Institution of Oceanography if you do not have a permit. If you do need to bring a car in on any of the days, please let us know so we can have some day permits available for purchase (at \$8 each).

MID-WEEK ACTIVITIES: After the first couple of days looking wistfully at the beach during breaks, you will finally get the chance to spend some time there mid-week. In keeping with IGS tradition, Wednesday afternoon will be reserved for recreation, and we will offer a selection of waterfront activities for your enjoyment and relaxation: surfing, sea-kayaking, stand-up paddle-boarding, beach volleyball and walking. Just tell us when you arrive on site which of these activities you prefer. There will be a fee for these activities.

RECEPTIONS: There will be an icebreaker reception at ‘Surfside’ next to the Scripps Forum on Sunday 5 June from 4–7pm. Come along to meet your fellow delegates, get orientated at the conference site and pick up your registration package. Scripps Emeritus Professor Walter Munk has generously offered his La Jolla home ‘Seiche’ to the conference for a reception on the Tuesday evening – this is an occasion not to be missed!

BANQUET: The banquet will be held on Thursday evening at a waterfront restaurant on the beautiful San Diego bay. This promises to be a memorable evening with your colleagues and friends. Transport to the restaurant from the conference venue will be provided.

The receptions, banquet and all luncheons are included in the registration fee.

Information will be updated on the conference website, <http://www.igsoc.org/symposia/2011/California/> as it becomes available.





SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)

LOCAL ORGANIZING COMMITTEE

Helen Amanda Fricker (Chair), Sarah Gille, Laurie Padman, Eric Rignot, Ted Scambos and Slawek Tulaczyk

SCIENTIFIC STEERING AND EDITORIAL COMMITTEE

Chief Editor: Slawek Tulaczyk (University of California, Santa Cruz)

Associate Editors include: Poul Christoffersen, Helen Amanda Fricker, David Holland, Stan Jacobs, Adrian Jenkins, Laurie Padman, Eric Rignot, Michiel van den Broeke, Douglas MacAyeal, Ted Scambos and Fiammetta Straneo

CONTACTS FOR FURTHER INFORMATION

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Local symposium website: <http://glaciology.ucsd.edu/igs2011> (from 3 January 2011)

IMPORTANT DATES

Abstract submission deadline:	4 March 2011
Notification of acceptance:	18 March 2011
Pre-registration deadline:	25 March 2011
Paper submission deadline:	22 April 2011
Deadline for refund:	29 April 2011
Registration and Icebreaker:	5 June 2011
Conference begins:	6 June 2011
Final revised papers deadline:	12 August 2011





INTERNATIONAL SYMPOSIUM ON INTERACTION OF ICE SHEETS AND
GLACIERS WITH THE OCEAN
San Diego, California, USA, 5–10 June 2011
REGISTRATION FORM

Register online at www.igsoc.org/symposia/2011/California/registration

Family Name: _____

Given Name: _____

Address: _____

Tel: _____ E-mail: _____

Accompanied by:

Name: _____ Age (if under 21) _____

Name: _____ Age (if under 21) _____

Dietary and other requirements: _____

Registration fees (US dollars)

Participant (IGS member)	\$520
Participant (not IGS member)	\$600
Student or retired IGS member	\$260
Accompanying person (21+/12–20)	\$100/\$60
Late registration surcharge (after 25 March 2011)	\$80

TOTAL REGISTRATION FEES £ _____

Payment of registration fee by MasterCard, VISA or American Express

Card number

Expiration / CVV (last 3 numbers on signature strip)

Name of card holder as shown on card: _____

Signature: _____

Obituary: Keith Echelmeyer

On 9 October Keith Echelmeyer, an accomplished adventurer and glaciologist, peacefully passed away in his home, surrounded by friends and his loving wife Susan. Keith was an inspiration for everyone who knew him, first in his life as an active glaciologist and mountaineer, then later in his 8-year battle with a malignant brain tumor.

Keith was a broadly-based glaciologist, equally impressive in the field as he was with theoretical studies and data analysis. His PhD studies with Barclay Kamb at the California Institute of Technology focused on the flow of Blue Glacier in the Olympic Mountains of Washington. He combined detailed field measurements with theoretical analysis and numerical models. In a series of papers with Barclay Kamb he presented the first detailed analysis of longitudinal coupling in glaciers and ice sheets. He developed finite element methods to model the flow of Blue Glacier and to analyze the stress and flow pattern of ice flowing around a turn. At Caltech he also became involved in research on high-pressure phases of ice, a topic that continued to fascinate him throughout his career. During a post-doctoral stay in China he directly observed basal motion in a cold-based glacier, combining careful measurements with an in-depth analysis of enhanced deformation of debris-rich ice.

Keith moved to Fairbanks in 1984, attracted by the vast wilderness of Alaska with its many unclimbed mountain peaks, and numerous unexplored glaciers. He became an Assistant Professor of Geophysics at the Geophysical Institute and the Department of Geology and Geophysics at the University of Alaska Fairbanks, and was later promoted to Associate and then Full Professor. He was designated Professor Emeritus upon his retirement in 2004. Keith regularly taught graduate classes in Ice Physics and in Glaciers, and also helped develop a very popular introductory undergraduate course 'Glaciers, Earthquakes, Volcanoes'. Among his many research collaborators, his work with Will Harrison stands out most, co-authoring 27 peer-reviewed papers.

Keith had an uncanny knack to spot the important problems in glaciology before most others did. He then used his unique abilities as observer, mountaineer and glacier pilot to address these problems. He became interested in fast-



Photo: Chris Larsen.

flowing glaciers after working with colleagues on the dynamics of Variegated Glacier, a surge-type glacier in Southeast Alaska. During the mid-1980s he established a field program at Jakobshavn Isbræ in collaboration with colleagues at the Geophysical Institute and at ETH Zurich. This work resulted in a series of papers characterizing the glaciological setting of Jakobshavn and elucidated the mechanism of fast flow. Keith pioneered the use of seismic methods to measure deep fjord geometries with temperate ice. He demonstrated for the first time that Jakobshavn Isbræ flows in a very deep channel that is grounded up to 1500 m below sea level. The same methods were successfully employed at deep temperate glaciers in Alaska such as Ruth, Taku and LeConte Glaciers. The now classic series of papers on Jakobshavn Isbræ have become a foundation for the current interest in this outlet glacier as it undergoes rapid retreat and acceleration.

The discovery of fast moving ice streams in flat and relatively thin ice in Antarctica led to an extensive study in collaboration with colleagues at the Geophysical Institute and Caltech. Keith quickly recognized the important role of the margins for the force balance of these ice streams. In a series of field experiments in the heavily crevassed marginal area, they documented exceptionally high velocity gradients. Numerical modeling led to a conclusion of weakened ice and large lateral stresses. Temperature profiles and repeat velocity surveys allowed precise

determinations of margin migration rates and lateral shear stresses. Working in these highly crevassed zones came with large logistical hurdles that he was able to overcome. His work in the Antarctic was recognized by the renaming of former Ice Stream F to Echelmeyer Ice Stream.

The realization that glaciers in deep fjords or marine basins can retreat unstably led Keith to push for work in the Amundson Sea Embayment in the early 1990s. His proposal was not funded then, as it was judged to be too difficult logistically. Instead he concentrated his energy on glaciers closer to home. At the time, sea level rise estimates from Alaska were based on surveying stakes on just a few glaciers. This bothered Keith so he combined his passion for flying with a need for a broader survey of Alaskan glaciers by fitting his small airplane with a laser profiler and precise positioning instruments. His pioneering work led to the first reliable estimate of volume change of Alaskan glaciers and the realization that ice loss in Alaska contributed as much to sea level rise as the entire Greenland Ice Sheet. Much of this was accomplished with a very minimal budget, especially within the context of other airborne science. Keith knew how to stretch a budget for maximum scientific output, and the only time he violated this frugal approach was when it came to purchasing gourmet cheese for field work!

Since his days as an undergraduate, Keith had had an interest in isostatic rebound and the theory behind it. He helped initiate a study of ice volume change and consequent uplift history at Glacier Bay, Alaska: a place with some of the highest rebound rates on Earth. Keith had broad interests and became involved in many other projects including till and sediment deformation, and the flow and structure of rock glaciers. He also continued his interest in surging and tidewater glaciers. The topic of fast glacial flow

always interested him and he had long dreamed of organizing an international conference focused on that topic. Through his efforts, the conference took place in June 2002 in Yakutat, Alaska, in a setting of magnificent glaciers and high mountains. Unfortunately, Keith was not able to participate. Two days before the meeting started, he flew his airplane to Yakutat. Shortly after landing, he began experiencing a series of violent seizures and was Medivaced to Anchorage. There, he was diagnosed with an advanced stage of a cancerous brain tumor.

Keith loved challenges, but this was far bigger than any he had ever faced. However, his indomitable will to live surprised his doctors and everyone around him: he refused to be confined to a wheel chair, learned how to walk and ski again, and continued to do trips to the Brooks Range, a place that was dear to his heart. Keith realized that he would never regain his physical and mental prowess. Yet, he never became bitter or resigned. Instead he made the best with the cards fate had dealt him, inspiring those around him. When the end was close, he refused hospital care. Instead, cared for by his incomparable wife, he died at home as he wished, with great dignity.

His exploits in wilderness travel, mountain climbing, and glacier field work are legendary. His resilience in living with his brain tumor and his display of love and compassion in his final years inspired us all. The field of glaciology has lost a giant and many of us have lost a friend. We will think of his spirit wandering the mountain ranges, speculating on new routes, and planning the next challenge.

Martin Truffer

Sigfús Johnsen at 70

Sigfús Johnsen: ice physicist, ice core scientist, 'drill master', friend and colleague, was 70 years old on 27 April 2010. So how do you celebrate the 70th birthday of one of the pioneers in a scientific field? Sigfús's Icelandic and Danish colleagues had a great plan. First you invite all his colleagues to a symposium in his honour in Iceland just before his birthday. They will all want to come, they will make their travel plans and prepare their talks. Then you arrange a giant firework display as a national celebration, in the form of the eruption of Eyjafjallajökull. This seems like a great idea, until international airspace is closed, and you have to rearrange the whole thing!

So it was that around 50 foreign guests and a lot of Icelandic colleagues arrived in Reykjavík in late August to celebrate the 70.3th birthday of Sigfús Johnsen. Following instructions from Thorstein Thorsteinsson and Arný Sveinbjörnsdóttir, who led the organising committee, we came from ten nations and four continents to celebrate Sigfús's life and work so far. The contingent included what appeared to be the entire staff of the glaciology group from Copenhagen, where Sigfús has spent most of his working life.

The symposium started with an Icebreaker, including a slide show of the now infamous

volcano itself. There followed two days of fascinating talks. For those of us a little younger than Sigfús, the talks about the early days in Copenhagen, the pioneering isotope studies with Willi Dansgaard, time at Camp Century, the development of the ISTUK ice core drill, all leading to the Dye 3 drilling, made fascinating history. The talks included many photographs of Sigfús doing science, solving practical problems, and Sigfús with his future wife, Palla, and his Danish colleagues. These were a reminder both of the difficult conditions, and of the fun they all had, setting traditions that still carry on in Greenland and Antarctic ice core camps today. Further talks reminded us of the GRIP project in the early 1990s, described in the symposium programme as the 'crown jewel'. This was where I myself joined the long list of ice core scientists who regard Sigfús as one of their scientific mentors, as he inspired me with his generous knowledge and enthusiasm. On to the NorthGRIP project of the next decade and then the still-continuing NEM project, Sigfús has been an ever-present figure in the drill and science trenches, and of course the scientific literature. Those who would like to read more about his earlier achievements are referred to the Seligman crystal article in volume 117 of ICE.

The rest of the symposium set itself the goal of discussing the latest science in areas that most interest Sigfús: ice cores and palaeoclimate, glaciers and ice sheets and volcanism. The extent of his influence can be illustrated by the talks by Japanese scientists about ice drilling in Antarctica and by a Canadian scientist about ice on Mars.

The formal symposium ended with the presentation of yet another honour to Sigfús. He is already a winner of the Oeschger Medal of the EGU, and one of the elite band of holders of our own Seligman Crystal. At the symposium dinner he had been made an honorary member of the Icelandic Glaciological Society. Now he received in addition an honorary doctorate from the University of Iceland.

The symposium included two further social occasions. The symposium dinner was attended by Sigfús's family and friends as well as the symposium participants. Dorthe Dahl-Jensen gave the main speech but, in the tradition of these events, many of us felt moved to present



Fig. 1. Sigfus is presented with an honorary doctorate from the University of Iceland.



Fig. 2. Sigfus enjoying the afternoon refreshment break at Eyjafjallajökull, the cause of the postponement of his birthday symposium. The culprit was now completely peaceful, although the glacier was still covered in ash.

the compliments of our nation or scientific community. As the evening continued, the other diners became tolerant of these somewhat rambling tributes, and even the Icelandic folk-singing gave pleasure! On behalf of our Secretary General, I presented the compliments of the IGS to Sigfús in the form of a verbal message, a letter and a commemorative plate.

Finally, the international part of the symposium ended with a wonderful field trip. Two coaches, with large wheels for fording streams, set out on a beautiful sunny day in the direction of Thorsmörk. There was a brief interlude as one of the coaches disgorged its entire stock of engine oil on to the road in a couple of minutes; however, no one was to be deterred, and another coach appeared and took us onwards. An afternoon refreshment stop was held under the now calm volcano and glacier of Eyjafjallajökull, and the excitement of crossing



Fig. 3. The splendid barbecue was fully appreciated by all.

the many streams to the hut at Langidalur began. Many of us were able to climb to the fantastic vantage point of Valahnukur, and, by the time we walked down, a splendid barbecue, orchestrated by Palla and other Icelandic hosts was waiting for us, allowing one final toast to Sigfús before the long return to Reykjavík.

So, after a slight delay (we can only assume that 4 months was needed to complete the private birthday party in Iceland), Sigfús was allowed to become officially 70. The Icelandic Gods were appeased, and the volcano kept quiet this time. Many happy returns to Sigfús. Hip Hip....

Eric Wolff



Glaciological diary

** IGS sponsored

* IGS co-sponsored

2010

5–10 September 2010

24th International Polar Conference

Obergurgl, Austria

Website: <http://imgi.uibk.ac.at/polartagung-2010/>

6–10 September 2010

12th International Conference on the Physics and Chemistry of Ice

Sapporo, Japan

Contact: Chairperson Yoshinori Furukawa (Hokkaido University)

Website: <http://www.lowtem.hokudai.ac.jp/PCI-2010/>

12–16 September 2010

6th Canadian Conference on Permafrost

Calgary, Alberta, Canada

Website: <http://ninja.pro.net/disk2/geocalgary10/index.php?lang=en>

Contact: Jim Henderson [permafrost@geo2010.ca]

14–25 September 2010

Karthus course on Ice Sheets and Glaciers in the Climate System

Sponsored by: The Institute for Marine and Atmospheric Research, Utrecht University, The Netherlands The Niels Bohr Institute, University of Copenhagen, Denmark Ice2Sea project, European Union Karthus, Italy

Website: http://www.phys.uu.nl/~wwwimau/education/summer_school (coming soon)

15–17 September 2010

****International Glaciology Society: British Branch Meeting**

Centre for Glaciology, Institute of Geography & Earth Sciences, Aberystwyth University, Aberystwyth, UK

Website: <http://www.aber.ac.uk/en/iges/igsbb2010>

20–23 September 2010

HydroPredict'2010

2nd International Interdisciplinary Conference on Predictions for Hydrology, Ecology, and Water Resources Management: Changes and Hazards caused by Direct Human Interventions and Climate Change

Prague, Czech Republic

Website: <http://www.natur.cuni.cz/hydropredict2010/>

20–24 September 2010

11th International Circumpolar Remote Sensing Symposium

Cambridge, UK

Prior to the conference (Monday 20 September 2010), there will be a 1-day UK Polar Network Workshop on Circumpolar Remote Sensing

Website: <http://alaska.usgs.gov/science/geography/CRSS2010/>

Contact: Allen Pope [allen.pope@polarnetwork.org]

23–25 September 2010

17th Annual WAIS (West Antarctic Ice Sheet) Workshop

Lake Raystown Resort, Raystown, PA, USA

Website: <http://www.eesi.psu.edu/WAISWorkshop.shtml>

26–30 September 2010

International conference: Global Change and the World's Mountains

Perth, UK

Website: <http://www.perth.uhi.ac.uk/mountainstudies/2010>

27–30 September 2010

Remote Sensing in Hydrology 2010 Symposium

Jackson Hole, Wyoming, USA

Website: <http://www.remotesensinghydrology.org/>

Contact: Christopher Neale (VP ICRS) [christopher.neale@usu.edu]

30 September–1 October 2010

Autonomous Polar Observing Systems Workshop

William F Bolger Center, Potomac, Maryland, USA

Website: http://www.iris.edu/hq/polar_workshop2010/index.php

Contact: Leigh Sterns [stearns@ku.edu]

8–9 October 2010

Northwest Glaciologists Meeting 2010

University of Alaska Fairbanks, Fairbanks, Alaska, USA

Website: <http://glaciers.gi.alaska.edu/events/northwest/>

15–17 October 2010

4th Graduate Climate Conference

Pack Experimental Forest, Mount Rainier, Washington, USA

Website: <http://uwpcc.washington.edu/gcc>

24–27 October 2010

Northern Research Forum 6th Open Assembly – Our Ice Dependent World

Oslo and Kirkenes, Norway

Website: <http://www.nrf.is/>

27–30 October 2010

II International Symposium: Reconstructing Climate Variations in South America and the Antarctic Peninsula over the last 2000 years

Valdivia, Chile

Website: <http://www.cecs.cl/pages2010/>

Contact: lpages-valdivia@cecs.cl

28–30 October 2010

****International Glaciology Society Nordic Branch Meeting 2010**

Geocenter, Copenhagen, Denmark

Website: <http://sites.google.com/site/nigs2010/>

3–6 November 2010

Circumpolar Ecosystems in a Changing World: Outcomes of the International Polar Year

Edmonton, Alberta, Canada

Website: <http://www.eas.ualberta.ca/ipy/>

8–10 November 2010

MicroPerm Workshop:

An international workshop to initiate the circumpolar integration of permafrost microbiological studies

Potsdam, Germany

Website: <http://microperm.org/>

Contact: Dirk Wagner [Dirk.Wagner@awi.de]

12–13 November 2010

18th Arctic Conference

Bryn Mawr, Pennsylvania, USA

A conference website for program information and registration will be available soon.

Contact: lpages-valdivia@cecs.cl

18–19 November 2010

UK Polar Network Workshop – Polar Sedimentary Processes and Archives workshop

Loughborough University, Loughborough, UK

Website: <http://www.surveymonkey.com/s/SBXD9MW>

E-mail lboroworkshop@polarnetwork.org

22–23 November 2010

International Arctic Conference: Geopolitical Issues and Equations in the 21st Century

Lyon, France

Website: <http://www.pacte.cnrs.fr/spip.php?article2268>

7–9 December 2010

Second International Symposium on Arctic Research

Tokyo, Japan

Website: <http://www-arctic.nipr.ac.jp/isar2/toppage/isar2top.htm>

12 December 2010

PYRN–APECS Career Development Workshop

San Francisco, California, USA

Held in conjunction with the 2010 Fall AGU Meeting

Website: <http://apecs.is/agu2010>

Contact: Kristin Timm [kristin@arcus.org]

13–17 December 2010

American Geophysical Union Fall Meeting

San Francisco, California, USA

Website: <http://agu-fm10.abstractcentral.com/index.jsp>

2011

12–14 January 2011

UKPN Science Communication Workshop

Aberdeen, UK

The UK Polar Network is pleased to announce the Science Communication workshop as the next in the 2010–2011 series of UKPN career skills workshops

Website: <http://www.polarnetwork.org/machform/view.php?id=20>

23–29 January 2011

Arctic Frontiers 2011: Arctic Tipping Points

Tromsø, Norway

Website: <http://www.arcticfrontiers.com/>

1–3 February 2011

2nd CryoSat International Workshop: CryoSat Validation Workshop

Frascati (Rome) Italy

Website: <http://www.cryosat2011.org/>

2–4 February 2011

IASC Network for Arctic Glaciology: Workshop on the dynamics and mass budget of Arctic glaciers

Winter Park, Colorado, USA

Website: <http://www.iasc-nag.org/activities.html>

Contact: Andreas Ahlstrøm [apa@geus.dk]

7–9 February 2011

INTIMATE workshop – Integrating Ice core, Marine and Terrestrial records: Towards High-Precision Chronologies

Potsdam, Germany

Contact: Achim Brauer [brau@gfz-potsdam.de], Christine Gerschke [gerschke@gfz-potsdam.de]

18 February 2011

International Conference on the Diversity of Research on Geophysical and Environmental Sciences

held in honor of Prof. Dr Kolumban Hutter on the occasion of his 70th birthday

Zürich, Switzerland

Website: <http://www.igsoc.org:8000/www.vaw.ethz.ch/news/index>

24–25 February 2011

15th Alpine Glaciology Meeting (AGM)

Munich, Germany

Contact: Christoph Mayer [Christoph.Mayer@lrz.badw-muenchen.de]

28 February–1 March 2011

Community Earth System Model – Polar Climate Working Group Meeting

Boulder, Colorado, USA

Website: http://www.cesm.ucar.edu/working_groups/Polar

28 February–11 March 2011

Canadian Society of Hydrological Sciences Short Course: Physical Principles of Mountain and Cold-Climate Hydrology

Kananaskis, Alberta, Canada

Website: http://www.cwra.org/Branches/CSHS/Principles_of_Hydrology_Workshop.aspx

14–18 March 2011

5th Zooplankton Production Symposium

Pucon, Chile

Special session: Zooplankton in Polar Ecosystems and Extreme Environments:

Contact: Julie Keister [jkeister@u.washington.edu]

16–17 March 2011

Water in Mountain Areas: Better Observations for Better Forecasting

200th session of the Comité Scientifique et Technique de la Société Hydrotechnique de France

Lyon, France

Website: http://www.igsoc.org:8000/www.shf.asso.fr/117-1-les_manifestations-16.html

20–25 March 2011

Gordon Research Conference on Polar Marine Science: Exploring Complex Systems in Polar Marine Science

Ventura, California, USA

Website: <http://www.grc.org/programs.aspx?year=2011&program=polar>

For the first time, this conference will be preceded (19–20 March) by the new Polar Marine Science Gordon-Kenan Research Seminar on Contributing to the Understanding

of Complex Polar Marine Systems, for early-career scientists

Website: http://grc.org/programs.aspx?year=2011&program=grs_polar

23–26 March 2011

IASC Workshop on automated measuring systems on glaciers

Pontresina, Switzerland

Website: <http://www.projects.science.uu.nl/iceclimate/workshop/>

Contact: Carleen Tijm-Reijmer [c.tijm-reijmer@uu.nl]

24–25 March 2011

7th Annual Polar Technology Conference

Albuquerque, New Mexico, USA

Website: <http://polartechnologyconference.org/>

27 March–1 April 2011

Arctic Science Summit Week 2011

Coex Center, Seoul, South Korea

ASSW 2011 will have an integrated Science Symposium covering the theme: ‘The Arctic: The New Frontier for Global Science’, which will take place. 29–31 March.

Website: <http://www.assw2011.org/>

3–8 April 2011

General Assembly of the European Geosciences Union (EGU 2011)

Vienna, Austria

Website: <http://meetingorganizer.copernicus.org/EGU2011/sessionprogramme/CR>

10–14 April 2011

Symposium on the Application of Geophysics to Environmental and Engineering Problems

Charleston, South Carolina, USA

Session: Cold Regions Geophysics.

Conveners: Beth Astley [Beth.Astley@usace.army.mil], Bruce D. Smith [bsmith@usgs.gov]

Website: <http://www.eegs.org/sageep>

12–12 April 2011

Association of American Geographers 2011 Annual Conference

Seattle, Washington, USA

Website: <http://www.aag.org/>

15–16 April 2011

Ice Drilling Science Community Planning Workshop

Herndon, Virginia, USA

Website: <http://icedrill.org/science-planning-workshop-2011/>

Contact: Mary Albert [Mary.Albert@Dartmouth.edu]

22–27 April 2011

International Polar Year (IPY) 2012

Conference: From Knowledge to Action

Montréal, Québec, Canada

Website: <http://www.ipy2012montreal.ca/>

27–28 April 2011

Antarctic Science Symposium: Celebrating the completion of the IceCube Neutrino Detector

Madison, Wisconsin, USA

Website: <http://internal.icecube.wisc.edu/meetings/2011/antsci/>

Contact: Kim Kreiger [kim.kreiger@icecube.wisc.edu]

2–4 May 2011

American Meteorological Society: 11th Conference on Polar Meteorology and Oceanography

Boston, Massachusetts, USA

Website: <http://www.ametsoc.org/meet/>

Contact: John Cassano [john.cassano@colorado.edu]

3 May 2011

Association of Polar Early Career Scientists Early Career Research Workshop: Shaping the Future of AMAP

Copenhagen, Denmark

Website: <http://apecs.is/workshops/amap-2011>

Contact: Jennifer Provencher [ipy-outreach@apecs.is]

23 May–4 June 2011

2011 Summer School: Modeling of the Arctic Climate System

Fairbanks, Alaska, USA

Contact: Tohru Saito [saito@iarc.uaf.edu]

30 May–2 June 2011

European Association of Remote Sensing Laboratories (EARSeL) Symposium 2011

Prague, Czech Republic

Website: <http://www.igsoc.org:8000/www.earsel.org/symposia/2011-symposium-Prague/>

31 May–3 June 2011

Sixth International Conference on Arctic Margins

Fairbanks, Alaska, USA

Website: <http://www.gi.alaska.edu/icam6>

Contact: B. Coakley [bernard.coakley@gi.alaska.edu]

1–3 June 2011

European Association of Remote Sensing Laboratories (EARSeL) Workshop on Remote Sensing of the Coastal Zone

Prague, Czech Republic

Website: <http://www.igsoc.org:8000/www.earsel.org/symposia/2011-symposium-Prague/>

5–10 June 2011

****International Symposium on Interactions of Ice Sheets and Glaciers with the Ocean**

Scripps Institution of Oceanography, La Jolla, California, USA

Contact: Secretary General, International Glaciological Society

6–9 June 2011

WHISPERS: 3rd Workshop on Hyperspectral Image and Signal Processing – Evolution in Remote Sensing

Lisbon, Portugal

Website: <http://www.ieee-whispers.com/>

12–17 June 2011

***International Symposium on Physics, Chemistry and Mechanics of Snow**

Yuzhno-Sakhalinsk, Russia

Website: <http://snowphysics.fegi.ru/en/main.html>

Contact: Sergey Sokratov [sokratov@geol.msu.ru]

19–24 June 2011

International Offshore and Polar Engineering Conference:

ISOPE Arctic Science & Technology Symposium

ISOPE Arctic Materials Symposium

Maui, Hawaii, USA

Website: <http://www.isopec2011.org/>

Contact: Simon Prinsenber [PrinsenberS@mar.gc.ca] or Howie Jin [h.jin@exxonmobil.com]

22–24 June 2011

6th Antarctic Meteorological Observation, Modeling, and Forecasting Workshop

Hobart, Tasmania, Australia

Website: http://cawcr.gov.au/events/amomfw_2011

22–26 June 2011

7th Congress of the International Arctic Social Sciences (ICASS VII)

Akureyri, Iceland

Website: <http://www.iassa.org/meetings/60-icass-vii->

Contact: Lara Olafsdóttir [larao@svs.is], Jon Haukur Ingimundarson [jhi@unak.is], Joan Nymand Larsen [jnl@unak.is]

27 June–9 July 2011

Norwegian Research School for Climate Dynamics Summer School:

Role of sea ice in the climate system

University Centre in Svalbard

Website: <http://www.resclim.no/>

28 June–7 July 2011

**International Union of Geodesy & Geophysics
IUGG XXV General Assembly
Earth on the Edge: Science for a Sustainable
Planet**

Melbourne, Australia

Website: <http://www.iugg.org/assemblies/2011melbourne/>

10–14 July 2011

**Advances in Sea Ice Forecasting: 21st
International Conference on Port and Ocean
Engineering under Arctic Conditions**

Montreal, Canada

Website: <http://www.poac11.com/>

10–16 July 2011

**11th International Symposium on Antarctic
Earth Sciences**

Edinburgh, UK

See conference website

20–22 July 2011

**Summer School: Remote Sensing for Polar
Scientists**

University of Reading, Reading, UK

Website: <http://www.surveymonkey.com/s/VPYRWJX>

Contact: Jennifer Hall [j.hall@sheffield.ac.uk]

20–27 July 2011

**International Union for Quaternary Research
Congress**

Bern, Switzerland

Website: <http://www.inqua2011.ch/>

Contact: Christian Schluechter [christian.schluechter@geo.unibe.ch]

20–27 July 2011

Geohydro 2011

Canadian Quaternary Association (CANQUA)/
International Association of Hydrogeologists
(IAH-CNC)

Québec, Canada

Website: <http://geohydro2011.ca/>

1–12 August 2011

**Bert Bolin Centre's Arctic Climate Summer
School**

Abisko Research Station, Lake Tornatrask,
Sweden

Website: <http://www.bbcc.su.se/2011-summer-school-on-arctic-climate.html>

Contact: Anna Krusic [anna@krusic.org]

15–20 August 2011

18th Northern Research Basins Symposium

Starting in Bergen, Norway

Website: <http://www.18thnrb.com/>

22–26 August 2011

**Second International Symposium on
Mountain and Arid Land Permafrost**

Ulaanbaatar, Mongolia

Website: <http://www.geography.mn/>

28 August–1 September 2011

**Air-Surface Interactions: Chemistry from
Molecular to Global Climate Scales**

American Chemical Society National Meeting
Denver, Colorado, USA

Contact Amanda Grannas [amanda.grannas@villanova.edu]

29 August–1 September 2011

**Climate Change in High Mountain Regions –
From Understanding of the Past to Modelling
of the Future**

Salzburg, Austria

Website: <http://www.zamg.ac.at/veranstaltungen/125jahresonnblick>

Contact Wolfgang Schöner [wolfgang.schoener@zamg.ac.at]

5–9 September 2011

**Avalanches and Related Subjects IV
International Conference: The contribution
of theory and practice to avalanche safety**

Kirovsk, Murmansk region, Russia

Website: <http://cas.apatit.com/>

13–24 September 2011

**Karthus course on Ice Sheets and Glaciers
in the Climate System**

Karthus, Italy

Website: http://www.phys.uu.nl/~wwwwimau/education/summer_school/

14–16 September 2011

UK Arctic Science Conference 2011

Leeds, UK

Website: <http://www.ukarcticsscience.org/>

Enquiries to: arcticinfo@leeds.ac.uk

24–28 October 2011

**World Climate Research Programme Open
Science Conference: Climate Research in
Service to Society**

Denver, Colorado

Website: <http://www.wcrp-climate.org/conference2011>

Contact the conference secretariat at [info.conf2011@wcrp-climate.org]

27–29 October 2011

****International Glaciology Society Nordic
Branch Meeting 2011**

NVE, Oslo, Norway

Contact: Liss M. Andreassen [mailto:lma@nve.no]

7–9 November 2011

***Ice Deformation: from the model material to ice in natural environments – Conference in honour of Paul Duval**

(part of the ESF project MicroDICE)
Grenoble, France

Website: <http://microdice.eu/activities/ice-deformation-from-the-model-material-to-polar-ice/>

5–9 December 2011

American Geophysical Union Fall Meeting

San Francisco, California, USA

Website: <http://www.agu.org/meetings/>

2012

22–27 April 2012

IPY From Knowledge to Action Conference

Montreal, Québec, Canada

See news release at: <http://www.ainc-inac.gc.ca/ai/mr/nr/s-d2009/23301-eng.asp>

23–26 April 2012

Interpraevent 2012 – 12th Congress: Protection of Living Spaces from Natural Hazards

Grenoble, France

Website: <http://www.interpraevent2012.fr/>

June 2012

****International Symposium on Seasonal Snow and Ice**

Helsinki, Finland

Contact: Secretary General, International Glaciological Society

25–29 June 2012

25–29 June 2012

****International Symposium on Glaciers and Ice Sheets in a Warming Climate**

Fairbanks, Alaska, USA

Contact: Secretary General, International Glaciological Society

25–29 June 2012

Tenth International Conference on Permafrost

Tyumen, Russia

Website: <http://ticop2012.org/>

13–25 July 2012

SCAR 2012: Antarctic Science and Policy Advice in a Changing World

Portland, Oregon, USA

Conference website available soon

Contact: Andrew Fountain [andrew@pdx.edu]

1–5 October 2012

***International Symposium on Ice Core Science**

Giens, France

Contact: Secretary General, International Glaciological Society

2013

8–13 July 2013

Joint IACS/IAMAS Conference: Air and ice – interaction processes

Davos, Switzerland

Contact: Charles Fierz [fierz@slf.ch]

2014

March–April 2014

****International Symposium on Sea Ice**

Hobart, Australia

Contact: Secretary General, International Glaciological Society



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