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Contents

Cover picture: Pálsfjall, a nunatak in southwestern Vatnajökull made of rhyolite, formed in a subglacial eruption. In the background, two cauldrons caused by geothermal activity at the glacier bed form a glacier without a terminus (Photograph by Oddur Sigurðsson)

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

From the Editor

Dear IGS member

It is with great pleasure that I can report to you that the efforts of our Chief Journal Editor have started to pay off. In issue 179, mailed out at the beginning of January, the average time between submission and publication was 320 days. In the first issue of 2007, issue 180, which was sent out at the beginning of March, the corresponding time was 240 days. If we add to that the average time from acceptance to publication of around 100 days, we have been able to bring the total time from submission to publication to less than a year. And we have done this without sacrificing any of our well established quality. Of course there are publications that have taken longer than a year but correspondingly there are publications that have taken considerably less. Unfortunately there are those who do not return their corrections to the editor promptly and also some who do not return their proofs to the IGS office in good time. We will not halt publication to wait for those stragglers but will bump the offending papers back an issue and may even tell authors to resubmit. In this very competitive field of science publications, we cannot allow a few slow papers to damage the reputation that we have all worked so hard to achieve.

This is the last issue of *ICE* for 2006. Although we are well into 2007 now we are working towards bringing *ICE* up to date as we have done with our other publications. This issue has our first ever report from Spain and in the next issue will be a long-awaited report from down under. Our members there have been busy and have now formed an IGS New Zealand branch. This is a very welcome addition to the various IGS branches already in place. Should you feel the urge to establish a branch in your country or region please feel free to contact the IGS office with your proposals. As an IGS branch you will have full access to *ICE* as a vehicle for notices and reports and we can even set up a special branch section within our web site.

Speaking of our web site, hopefully by the time you read this we will have established a 'Members site' as a part of our regular site. You must be an active and paid-up member to gain access. Every member will be issued with a membership number and a generic password. The first time you log on to the site you will be required to change your password to one of your own choosing. You will receive your membership number with your next issue of the *Journal*. It will be printed in the bottom right hand corner of the cover sheet and in the form 07M987. Some of you may recognize the number, as it is the same one that we have issued to you as an access number for online access through Ingenta.

So what will be on this 'Members site'? First off, we are planning to set up direct access to all our online articles, both the *Annals* and the *Journal*. Currently, through Ingenta, you can only access the *Annals* you have acquired, either by attending the associated symposium or subsequently purchasing the volume in question. Through our members site we are hoping that you will have full access to everything we have on the web. We will also move the online papers located on our site on to the 'Members site'.

We have received various suggestions from you about what we could include on the membership site. But we can never have enough good ideas so please keep them coming. We will be setting up a 'Links' page. The links we will post must be directly connected to the cryospheric sciences and must be accompanied by a short blurb on what the site is about and preferably a single picture. We will also be setting up a page where you can post research and/or academic postings. What else can we do to make the IGS a more active learned and professional society? Please send your suggestions to us at the IGS office.

Magnús Már Magnússon
Secretary General

Recent work

Spain

* denotes research team leader

NUMERICAL MODELLING OF GLACIER DYNAMICS

Full Stokes thermomechanical modelling of glaciers

M. Corcuera, J.M. Corrales, M. Cuadrado, F.J. Navarro*, J. Otero, J.L. Romero (UPM), R.C.A. Hindmarsh, C. Martín (BAS)

This is one of the central lines of research by the Grupo de Simulación Numérica en Ciencias e Ingeniería (http://www.krios-hyperion.com/) of UPM, in close collaboration with researchers from BAS. Full Stokes (or at least high order) is key to modelling ice flow in areas, such as ice divides, transition zones or valley glaciers, where the assumptions of the Shallow Ice Approximation (SIA) do not hold.

The model is made up of three sub-models: dynamic (full Stokes system), thermal (advection-diffusion equation) and free-surface evolution (dynamic characteriation of free surface). The model is solved by an iterative procedure that uncouples these three sub-models. The Stokes system is solved by a Galerkin finite element method with mixed velocity-pressure formulation; the thermal equation is solved by a modified artificial diffusion (streamline-upwind) finite element method; and the free surface evolution equation is solved by semi-lagrangian methods. When applying the model to predicting radar layer architecture, the age equation is added to the system, and also solved by semilagrangian methods.

The applications so far include 2D time-dependent modelling of Roosevelt Island (Ross ice shelf, West Antarctica) for grounding line retreat dating and rheology testing purposes, and 3D steady-state dynamics of Johnson's glacier (Livingston Island, Antarctica) aimed at determining the present-day velocity, strain and stress fields.

Numerical simulation of ice-sheet evolution

N. Calvo, J. Durany (UVIGO), R. Toja, C. Vázquez* (UDC)

This team is working, within the framework of the shallow ice approximation, on modelling the global and coupled moving boundary problems governing the thermomechanical and hydrological processes present in the ice masses. The proposed highly nonlinear coupled system of PDE's models three main problems: the upper surface profile evolution, the ice velocity field and the temperature distribution.

Profile and temperature models are posed as free boundary problems in which the ice sheet extent and the location of the interface between cold and temperate ice are additional unknowns. Additionally, an energy balance equation is incorporated to the model in order to obtain real atmospheric temperature boundary conditions.

Concerning numerical methods, a Lagrange–Galerkin approximation is combined with a duality algorithm for maximal monotone operators for the profile problem. In the thermal problem, nonlinear viscous terms are treated by a Newton method, and two-phase Stefan formulation and Signorini boundary condition by duality methods. Moreover, Lagrange–Galerkin discretizations are considered and simulations take advantage of high-performance computing techniques when required.

Modelling of ice streaming and ice flow in the neighbourhood of the grounding line

M. Fontelos (CSIC-UAM), A.I. Muñoz, E. Schiavi*(URJC)

During the last 5 years, this research team has been involved in several topics in the field of environmental science, mainly concerned with the analysis of different mathematical models applied to glaciology. In particular, the focus has been the mathematical study of two phenomena: the ice streaming (Muñoz, Schiavi) and the behaviour of the ice flow in the neighbourhood of the grounding line (Fontelos, Muñoz, Schiavi).

A mathematical model describing the ice streaming has been proposed and analysed, proved the existence (joint work with J.I. Díaz, UCM) and uniqueness (joint work with J.I. Tello, UCM) of its solutions and solved numerically (joint work with N. Calvo, J. Durany, UVIGO and C. Vázquez, UDC).

A model coupling the two different flow regimens that meet at the grounding line (ice-sheet and ice-shelf flows) has been developed. The main problem addressed has ben that of determining the velocity field in the neighbourhood of the grounding line for different ice rheologies, including the common Glen rheology.

RADAR STUDIES AND REMOTE SENSING

Radioglaciological studies in Livingston Island, Antarctica, and Spitsbergen

J.J. Lapazaran, F. Machío, F.J. Navarro*, R. Rodríguez-Cielos (UPM), B. Benjumea (ICC), Andrey Glazovsky, Yury Macheret, Evgeny Vasilenko (IGRAS), P. Glowacki (IGPAS), J. Jania (USIL), A. Ahlstrøm (GEUS)

Radar studies have been undertaken at both Arctic and Antarctic locations, using ground-penetrating radars with central frequencies of 18, 25 and 200 MHz.

In Antarctica, the fieldwork has focused on Livingston Island, with emphasis on Hurd Peninsula ice cap (Johnsons and Hurd glaciers), and additional works in Bowles Plateau and all the main ice divides of the island. This work has been done in close cooperation with Russian and Danish researchers. In addition to radio-echo sounding (RES) profiles aimed at determining the ice thickness, bedrock topography, ice-bed interface properties and glacier internal structure, common mid-point (CMP) measurements have also been done with the purpose of determining the water content in temperate ice through the use of Looyenga equations relating radio-wave velocity (RWV) and water content. The latter work has been combined with similar work by seismic methods (in this case, by using Riznichenko relation between seismic velocities and water content) done in cooperation with T. Teixidó (at present at IAG). Radar and seismic methods have been combined not only to study water content, but also to analyse other ice properties and glacier structure.

Fieldwork in the Arctic, done in cooperation with Russian and Polish researchers, has focused on Spitsbergen. Extensive RES profiling and CMP measurements have been done in Aldegondabreen, Fridtjovbreen, Hansbreen, Ariebreen and Amundsenisen Plateau. This work has similar aims as those described above, though in this case a strong emphasis has been given to the investigation of glacier hydrology and polythermal structure. In addition to RES and CMP measurements, the works performed on Hansbreen also include fixed-point continuous (every minute) measurements and repeated measurements of the same profile at different times, as well as repeated CMP measurements at different seasons, aimed at analysing the time and seasonal variations of water content.

Many of these radar studies already undertaken or planned in Spitsbergen are linked to IPY Glaciodyn project.

The Spanish-Russian cooperation in radioglaciology also includes radar equipment development.

Monitoring the ice cap of Livingston Island

J. Calvet*, D. García-Sellés (UB)

The research of this team focuses on the monitoring of the reduction in area of the glacier cap covering Livingston Island, Antarctica, from British aerial photographs of 1956 and Landsat-TM and SPOT images from 1986 to present. An average reduction of 4.3% has been observed between 1956 and 1996. Detailed analyses of ice front retreat-advance have been performed for 13 different segments in which the overall ice front of Livingston Island has been subdivided.

From the mid-nineties, a continuous monitoring (every other year approximately) of the main ice fronts of the ice cap covering Hurd Peninsula (in which the Spanish Antarctic Station Juan Carlos I is located) has been done by repeated photogrammetry. Lidar technology has also been incorporated for such purpose during the Antarctic campaign 2006/07. Photogrammetric techniques have also been employed by this team to retrieve the surface topography of Hurd Peninsula, which has been used to estimate, in cooperation with researchers from the UPM the volume changes of these glaciers during the last decades (see mass balance section).

MASS BALANCE

Mass balance monitoring in Livingston Island, Antarctica, and ice-volume change estimates in Arctic and Antarctic glaciers

J.J. Lapazaran, F. Machío, C. Molina, F.J. Navarro*, J. Otero (UPM), J. Calvet, D. García-Sellés (UB), Andrey Glazovsky, Yury Macheret, Evgeny Vasilenko (IGRAS)

In the mid-nineties, researchers from the UB deployed a net of stakes for ice velocity and mass balance measurements on Johnsons glacier, Livingston Island, Antarctica. This net was later (early 2001) made more dense by the UPM researchers, and another net was deployed by them on the neighbouring Hurd glacier (Johnsons and Hurd are the two main units that make up Hurd Peninsula ice cap). At present, this is a quite net dense net (some 50 poles for an ice cap about 10 km^2) in which ice velocity and accumulation–ablation measurements are being done regularly during the austral summers (the nearby Juan Carlos I station is only opened during the summer season), together with density measurements in ice pits at three different locations, usually repeated four times during each summer season. Data standardization is being done at present with the aim of incorporating the mass balance data from these glaciers into the WGMS bulletins.

These data have also been used as input to numerical models of ice dynamics.

The ice volume change of Hurd Penisnla ice cap during the period 1956–2000 has been estimated by comparing the surface topography retrieved by photogrammetric methods from 1956 British aerial photographs and that determined from total station and differential GPS measurements done in 1999/2000 by the UB-UPM team. This study shows a 10% decrease in ice volume during the period 1956–2000, equivalent to an average annual balance of –0.23 m in water equivalent (w.e.) during this period.

Similar works have been undertaken in Aldegondabreen, Spitsbergen, in cooperation with Russian researchers, for the period 1936–1990. In this case, the estimated reduction in ice volume has been of 38%, equivalent to an average annual balance of –0.7 m w.e.

GPS GLACIOLOGY

GPS glaciology of tidewater glaciers in East Greenland

P. Elósegui*, J. de Juan (CSIC-IEEC)

Major tidewater and outlet glaciers provide a natural testbed for investigating the delicate connection that exists between the cryosphere, hydrosphere, and atmosphere. Understanding the flow dynamics at these glaciers, and their response to external forcing, is key to our ability to understand the interactions of this coupled cryo-hydro-atmosphere system and model its evolution. Intensive field campaigns involving spatially dense, temporally long, high-rate GPS measurements can provide the data to characterize the spatio-temporal variations of ice surface deformation of these glaciers with exquisite detail. We have conducted the first of a series of campaigns at the fast-moving Helheim Glacier, East Greenland, during the Arctic summer (June–August 2006), and proposed follow-on experiments at Helheim Glacier and Kangerdlugssuaq Glacier, East Greenland, during the summer seasons through 2009. This interdisciplinary investigation, which also integrates seismological, glaciological, and satellite remote sensing data, is a collaborative effort involving scientists from the Lamont-Doherty Earth Observatory (G. Ekström, M. Langer and M. Nettles), Harvard-Smithsonian Center for Astrophysics (J. Davis), University of Maine (G. Hamilton and L. Stearns), Geological Survey of Denmark and Greenland (A. Ahlstrøm, T. Jorgensen, and T. Larsen) and Danish National Space Center (R. Forsberg, S. Khan and L. Stenseng).

GLACIER HYDROLOGY

GLACKMA (GLAciares, CrioKarst y Medio Ambiente) and GLACE (GLAciers, Cryokarst and Environment)

C. Domínguez (USAL), A. Eraso* (UPM)

During fieldwork performed at both temperate and subpolar glaciers from 1985 onwards, this team has been observing and analysing the occurrence of endoglacial and subglacial water flows and drainages in both types of glaciers. Those present in the subpolar glaciers are similar in character, though not so intense, as those in the temperate glaciers. Because glacier discharge variations almost immediately follow and are very sensitive to variations in air temperature, this team has been deploying since 2000, within the frames of GLACKMA/GLACE projects, different Experimental Catchment Areas (CPE) for continuous monitoring of glacier discharge. At present there are six stations at different latitudes of both hemispheres. Every station registers time series with hourly intervals of, among other parameters, specific glacier discharge. The locations of these stations are:

In the Southern Hemisphere:
- CPE-BCAA – 62°S, in insular Antarctica
- CPE-ZS – 51°S, in Chilean Patagonia
- CPE-VER – 65°S, in the Antarctic Peninsula.

In the Northern Hemisphere:
- CPE-ALB – 79°N, in Svalbard
- CPE-KVIA – 64°N, in Iceland
- CPE-TARF – 68°N, in Sweden.

It is planned to extend this glacier monitoring network, establishing at least an additional station at each hemisphere. The aim is to use this multiyear time series of glacier discharge from the CPEs to analyse the latitudinal distribution of glacier discharge variations in response to global warming.

SNOW RESEARCH

Investigation of snow avalanches by seismic methods

G. Furdada, G. Khazaradze, E. Suriñach*, I. Vilajosana, J.M. Vilaplana (UB)

Since 1994 the avalanche research group at the University of Barcelona, (http://www.ub.es/allaus/) has been studying the seismic signals produced by snow avalanches with the aim of improving remote detection and obtaining information about avalanches. Classic seismological techniques often employed in studying earthquakes and in determining crustal structure by means of refraction–reflection wide angle seismic profiles have been applied to the characterization of avalanche seis-

mic signals. Signals from natural and artificially released avalanches at ski resorts in the Pyrenees and at experimental sites in Switzerland and Norway have been studied. The availability of more than 50 seismic records of snow avalanches of different type and size enables us to identify the specific characteristics of seismic signals generated by avalanches. Current studies of the group are focused on determining the physical parameters (avalanche speed, energy transmitted to the ground, size and type of avalanche) that can help in the description of the phenomena. Reproducibility (avalanches of similar characteristics – type, size – produce similar seismic signals at the same site) is observed. Seismic signals depend on the recording site. The results obtained are consistent with the findings using other instruments (Doppler radar, load cells, pressure plates and video) that measure avalanche properties.

Radioelectrical properties of snow

L. Cancer, J.A. Cuchí* (UNIZAR)

The GTE (Group of Technology in hostile Environments) of the University of Zaragoza is interested on VLF radio-wave propagation through rocks and other materials, including snow. Within the frames of the EXPRES project (techniques of automated EXPloration in REScue applications), the GTE has focused on modelling the magnetic field at the three-component medium air-snow-soil. The goal is to improve the performance of radioavalanche beacons used for rescue. In addition, during the past three years a cooperative work of field data collection has been undertaken with the EMMOE (Military School of Mountain), aimed at measuring the electric conductivity of different kinds of snow bed in the Pyrenees and the Alps.

GEOLOGICAL AND GEOMORPHOLOGICAL RESEARCH IN GLACIAL ENVIRONMENTS, AND PERMAFROST STUDIES

Rock glacier dynamics in high mountain environment: Pyrenees

E. Serrano* (UVA), A. Atkinson, J.J. San José (UNEX), J.J. González-Trueba (UNICAN)

Thirteen active rock glaciers have been studied in the Pyrenees. At present, measurements are made on the movement, displacement and changes in the structure of rock glaciers in Argualas (published data) and Posets (unpublished data) rock glaciers. Vertical electric sounding, debris surface analysis and a topographical survey were performed on Argualas rock glacier between 1991 and 2000. High precision measurement records were obtained using a total station. Horizontal and vertical movements of the rock glacier were measured by means of 16 steel rods. Similar works are being made by GPS in Posets rock glacier and terrestrial photogrammetric methods are applied on Posets rock glacier and Posets glacier. Horizontal and vertical angles and distances to each rod are measured and total and annual average displacements are derived from the field survey, the emergence value for each rod, the horizontal displacement and slope of each control point. The horizontal and vertical displacement rates in different sectors of the rock glacier are compared and the inferred surface deformation is characterized by both extensional and compressive flows, thinning of the frozen body and melt features. At Argualas the horizontal and vertical displacements showed annual variations related to atmospheric thermal changes, pointing to a high sensitivity of the rock glacier.

Permafrost distribution, periglacial processes, Little Ice Age evolution and current glaciers in the Spanish high mountain Pyrenees and Cantabrian mountains

E. Serrano* (UVA), J.J. San José (UNEX), J.J. González-Trueba (UNICAN), R. Martín (SLUM), E. Martínez de Pisón (UAM), R. Lugon (IUKB), E. Reynard (UNIL), R. Delaloye (UNIFR)

This team is working on glacial evolution during the Pleistocene and Holocene, the changes from glacial to periglacial environments and the recent and current periglacial processes and mountain permafrost distribution. Works are being done on the Pyrenees Permafrost map and the evolution of current glaciers and the study of sporadic permafrost, periglacial processes and changes from glacial to periglacial environments in the high mountain of Picos de Europa (Cantabrian Mountains).

Little Ice Age: LIA glacier advance has been registered in three of the main Spanish high mountain areas: Pyrenees, Picos de Europa and Sierra Nevada. In Pyrenees the LIA glacierization is manifested in 15 different massifs where there are up to 100 cirques. However, nowadays glaciers remain only in the highest peaks. Three glaciated areas have been differentiated: (1) a marginal area with glacial processes related to altitude, orientation and Mediterranean environments; (2) a marginal area at Picos de Europa, related to oceanic environment and topographical factors; and (3) an area of high mountain glacial processes in the Pyrenees with rather large (as compared to the others) glaciers, several orientations, complex evolution and internal variations between massifs and glaciers. These researchers have found several LIA glacier variations in the Iberian mountains: historical maximum (from the end of the 17th to the beginning of the 18th century), minor retreat,

secondary regrowth (mid-19th century) and continuous retreat (from the end of the 19th to the beginning of the 20th century), followed by the almost complete extinction of the glaciers and increase in the periglacial domain.

Pyrenees: The deglaciation evolution and the transition from a glacial environment to a periglacial one have been established from geomorphological maps, the glacial phases reconstruction from depositional landforms and paleoELA reconstruction. Five main morphogenetic phases are defined. The LIA morphogenetic evolution is made up of six main phases.

The study of permafrost in the Pyrenees has been made by geoelectrical investigations and thermal measurements on the LIA forefields of several glaciers and massifs. The aim is to assess the internal composition of sedimentary bodies (debris rock glaciers and moraine deposits) located in this pro-glacial environment. At Posets Massif, ground ice was prospected using two DC resistivity techniques: vertical electrical soundings and resistivity mapping at a fixed pseudo depth. Extreme specific resistivities ranging between 1 and 25 MΩm were detected under a thin (1–2 m) unfrozen layer, indicating the presence of a massive ice layer, probably buried glacier ice. This ice of glacial origin probably superimposed former permafrost bodies, i.e. a much thicker layer of perennially frozen ground. Cold subsurface temperatures measured on the deposits indicate that buried glacier ice could have been preserved on top of permafrost since the end of the LIA or former Holocene glacier advances. This stratigraphy demonstrates that interactions exist between the glacial deposits and the permafrost bodies, due to the complex thermal history of the permafrost in this massif of the high Pyrenean mountains.

Picos de Europa: The Picos de Europa massif was the only high mountain area glaciated during the Little Ice Age in the Cantabrian range. This team has studied the periglacial processes and the thermal regime of soil. Using the analysis of the inherited morphological features, as well as historical documents, the last morphogenetic glacial phase has been reconstructed and mapped, showing six very small glaciers located in the highest cirques on Central and Western Massif in Picos de Europa. The results thus obtained confirm the existence of a little historical glacial advance, characterized by very small glaciers located below the regional ELA (at 2.600 m). The deglaciation process until the present time has caused the disappearance of these glaciers, reducing their surfaces and transforming them into non-dynamic ice bodies (relict stratified ice patches), so at the present time there are no glaciers in Picos de Europa.

Active and recent geological and geomorphological evolution in northern Antarctic Peninsula region

J. Casas, J. Gumuzzio, J. López-Martínez* (UAM), J.J. Durán, A. Maestro (IGME/ UAM), C. Martínez-Navarrete, L. Moreno (IGME), T. Schmid (UAM/CIEMAT), E. Serrano (UVA), M. Koch (BU), J.A. Cuchí (UNIZAR), P. Alfaro (UA), A. Navas (CSIC)

This team's research focuses on active and recent (Cenozoic) geological processes, including geomorphological evolution and neotectonics, in connection with landscape evolution, glacial fluctuations, sea level changes and raised beaches.

The geographical areas under study are the northern tip of the Antarctic Peninsula and the surrounding archipelagos; in particular, the South Shetland Islands (King George, Livingston, Deception, Elephant, Robert, Half Moon islands), the Group James Ross and Seymour islands, and the South Orkney Islands.

Within the geomorphological research, emphasis is given to periglacial processes and landforms, and occurrence of permafrost in connection with soils evolution and hydrology.

The main methodologies are geological and geomorphological mapping and remote sensing. The latter techniques include the use of Landsat, SPOT and Quickbird images. A project has also been approved within the Canadian Space Agency Radarsat-2 planned mission for 2007.

The team has published several geological and geomorphological maps, with scales from 1:10 000 to 1:50 000, as part of various international series.

The present and planned periglacial, permafrost and soils research by this team is part of ANTPAS, an IPY project on permafrost studies.

Similarly, the neotectonic studies, in particular those on fault population and stress fields analyses in the northern Antarctic Peninsula and southern Scotia Arch, are part of another IPY project, Plates & Gates.

Glacial and periglacial environments and processes

E. Martínez-Pisón* (UAM), R. Martín (SLUM), E. Serrano (UVA)

In addition to work already referred to above, this team is carrying out studies on glacier morphology, dynamics and retreat in the following glaciers in the Pyrenees: Aneto, Tempestades, Monte Perdido and Literola. Special attention is being paid to the evolution of these glaciers after the LIA, and also to the possibility of surge events in Monte Perdido and Literola glaciers during this cold period.

Post-LIA retreat and global warming response is also being analysed by this team in

Longyearbreen glacier, Spitsbergen. The behaviour of this cold glacier has been comparatively analysed against that of the glaciers in the Pyrenees, showing the high sensitivity of the Spanish glaciers.

Permafrost occurrence and characteristics are being studied, through the observation of several periglacial forms and processes such as polygons, stone circles, sorted stripes, etc., in Adventdalen (Spitsbergen), the Norwegian mountains (Jotunheimen) and Tucarroya cirque (Pyrenees).

Some additional works by this team include snow and avalanche studies in Alto Teide in the Canary Islands, the Pyrenees and Adventdalen in Spitsbergen.

Permamodel

J.J. Blanco, M. Hidalgo, M. Ramos* (UAH), R. Ortiz (MNCN-CSIC), S. Gruber, M. Hoelzle (UNIZH), C. Mora, M. Neves, G. Vieira (UL)

The PERMAMODEL project is primarily run by the Department of Physics of Alcalá University in collaboration with the Centro de Estudos Geograficos – Universidade de Lisboa. This project focuses on the study of the evolution of the thermal active layer in polar permafrost.

The field experiments are developed in Livingston (62°39' S, 60°21' W) and Deception (62°43' S, 60°57' W) islands in the maritime Antarctic. These islands have significant areas with ice-free terrain underlain by permafrost. The location of these islands close to the mean annual temperature isotherm of –1°C, and their position in the Antarctic Peninsula region, results in a very high sensitivity to climate change.

The goal of this project is the monitoring of the temperature gradient of the active layer, as an approach for the calculation of the energy balance of the ground and therefore for the study of climate change, being complementary to the standard meteorological observations. Furthermore, monitoring of the temperature gradient and thermal fluxes of the permafrost in boreholes down to the zero annual amplitude depth, allow the application of inverse modelling techniques for the detection of climate change in decadal, and even centurial, time scales.

The monitoring stations will be integrated in the international networks CALM-S (Circum-polar Active Layer Monitoring) and GTN-P (Global Terrestrial Network – Permafrost/WMO, FAO and IPA) in order to attain long-term data series (10–25 years). This action is linked to the IPY projects TST (Thermal State of Permafrost) and ANTPAS (Antarctic and sub-Antarctic Permafrost, Periglacial and Soil Environments).

ABBREVIATIONS

BAS: British Antarctic Survey, UK
BU: Boston University, USA
CIEMAT: Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
CSIC: Consejo Superior de Investigaciones Científicas
GEUS: Danmarks og Grønlands Geologiske Undersøgelse
IAG: Instituto Andaluz de Geofísica
ICC: Institut Cartogràfic de Catalunya
IEEC: Institut d'Estudis Espacials de Catalunya
IGME: Instituto Geológico y Minero de España
IGPAS: Institute of Geophysics, Polish Academy of Sciences
IGRAS: Institute of Geography, Russian Academy of Sciences
IUKB: Institut Universitaire Kurt Bösch, Switzerland
MNCN: Museo Nacional de Ciencias Naturales
SLUM: Saint Louis University, Madrid
UA: Universidad de Alicante
UAM: Universidad Autónoma de Madrid
UB: Universitat de Barcelona
UCM: Universidad Complutense de Madrid
UDC: Universidade Da Coruña
UL: Universidade de Lisboa
UNEX: Universidad de Extremadura
UNICAN: Universidad de Cantabria
UNIFR: University of Fribourg, Switzerland
UNIL: Université de Lausanne, Switzerland
UNIZH: Universität Zürich, Switzerland
UPM: Universidad Politécnica de Madrid
URJC: Universidad Rey Juan Carlos, Madrid
USAL: Universidad de Salamanca
USIL: University of Silesia
UVA: Universidad de Valladolid
UVIGO: Universidade de Vigo
UNIZAR: Universidad de Zaragoza

Francisco Navarro
IGS Spanish Correspondent

International Glaciological Society

ANNUAL GENERAL MEETING 2006

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

24 August 2006, Bristol-Myers Squibb Lecture Theatre (Lecture Theatre 1), Department of Chemistry, University of Cambridge, UK

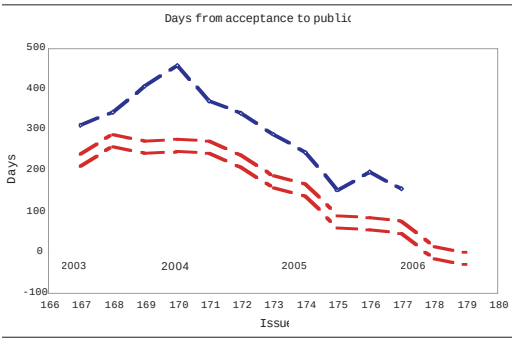
The President, Professor Atsumu Ohmura, was in the Chair.
66 members from 20 countries were present.

1. The Minutes of the last Annual General Meeting, published in ICE, 2005, No 137-138, p. 14–16, were approved on a motion by R.J. Braithwaite, seconded by K. Steffen and signed by the President.

2. The President gave the following report for 2005–2006:

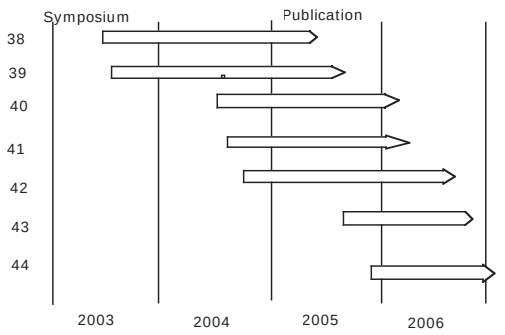
Ladies and gentlemen,
I must begin the report with a sad reminder that Dr John Heap, treasurer of the society for more than 30 years, died on March 8th of this year. He was Administrator of the British Antarctic Territory and the Director of Scott Polar Research Institute. Among his many accomplishments I would like to mention his role during the late 1970s negotiating the protection of Antarctic environment, which resulted in the 1982 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). I would like to ask you to observe a moment of silence now for John Heap.

I am very happy to report that the Society had a very successful year. It is an interesting coincidence that we can celebrate this occasion in a town where the society was founded exactly 70 years ago. The most important development is the shortening of the time between the acceptance and the publication of journal articles. This has also closed the gap between the designated and the actually appearing day of the journal. My predecessor put this as the highest priority, and the Chief Editor, the Secretary General and the production team have invested an enormous effort to achieve this result, including the modernization of the editing machinery. The time required from acceptance to actual publication was drastically shortened during the last year, so that potential contributors can now regard the journal as one of the most attractive means for publication. The following figure illustrates this. The top line shows the time



between acceptance and publication, while the area between the two bottom lines indicates the variation in the time between designated and actual publication; the middle line indicates designated publishing times in January, March, June and September whereas the lowermost line indicates publishing dates in March, June, September and December.

The *Annals* also made enormous strides to shorten the time between the symposium and publication. The following diagram shows the times of the symposium and of publication for the last seven issues. The ordinate is the volume number.



In the most recent issues from the symposia in Lanzhou and Dunedin, the proceedings will be out little more than one year after the symposium. This is not an easy accomplishment, because publication is always determined by the return of the very last proofread and corrected article. Realizing these accomplishments I feel it in order for us to get to know personally those in the publication team at headquarters. [The production team was individually introduced.]

To further close the gap between acceptance and publication, web-posting (as soon as papers are proofed) will start soon. This is at the top of the list of tasks for the rest of this year. Likewise, electronic submission and review will shortly be introduced. Especially with respect to the electronic review process, this is a useful addition and by no means a replacement of other means of review possibilities. Electronic access to back issues will be further extended to the older volumes. The simplification of access to the current issues is imperative and will be implemented, also before the end of the year.

A fall in submissions in 2005 was reported last year. The Chief Editor, Jo Jacka, however, reported that the number recovered in 2006. A fluctuation of that magnitude is not unusual for many academic journals. The following table presents the number of total submissions of glaciological articles and their relative weight among all papers.

	J. Glaciol.	JGR-C	JGR-D	JGR-F	*Gletscherk.*
2003	60	33	34	4	
2004	61	39	31	10	13
2005	72	20	18	19	
2006	30	13	21	21	
Total	223	105	104	54	13
%	100	8	15	27	100

The table shows that the *Journal of Glaciology* has a combined weight of JGR Series C and D. The appearance of Series F, *Earth Surface*, did not reduce the published articles in the journal. The Chief Editor reports this year that the earlier decreasing trend in submission of mathematically oriented articles in 2005 has reversed. This is due to the efforts of the Chief Editor and the Secretary General. It is, therefore, with a sense of relief that I report that Dr Jacka and the three scientific editors whose terms are coming to an end this year have agreed to serve for another term in the same functions.

At headquarters a slight change in procedures took place. The Secretary General introduced the changes mainly to accelerate publication as discussed earlier. The introduction of a new accounting software package, SAGE, enabled the team to better track financial matters, helping the organization of symposia and proceedings. Another very happy development is the successful negotiation by the Secretary General to cut the printing cost with Page Bros in Norwich by 50%.

Now, looking at the science of glaciology let me point out a fundamental problem that is not easy to solve. We are missing basic glaciological information, such as glacier surface and particularly ice volume. As these quantities are rapidly changing, it is embarrassing that we do not have a reliable set of data representing the present time. The World Glacier Inventory is complete only to 36%. With simplified inventory data 47% of the glacier surfaces are covered. There is an enormous geographic difference in the degree of completion. In some countries, the inventory has been completed for some time, so that future changes in glaciers can be compared to the glacier state of the late 20th century. In other countries with substantial glaciated areas, not even 20% of the existing surface has been covered. This problem is widespread in all fields of science today. Whether it is inventory work of the main features of glaciers, or determining a molecular structure of some parts of large molecules, or monitoring a slow change in radiation in the atmosphere or mass balance of glaciers, it requires a certain body of qualified workers to be engaged in a methodologically similar work year after year. It is difficult to write a paper frequently with a part of the accomplishment, until the time comes when it is finally possible to grasp a global situation or discover an important change in nature. We are aware that, without the painstaking and hidden works continued for decades, we will never understand where we are and what might happen in the future. How can we push the entire front of knowledge forward without suffering from a geographical bias, and credit these unnoticed dedicated workers in a fair manner?

The International Glaciological Society has served the cryosphere community during the last 70 years. We must work so that this tradition will continue. As this year is the 70th anniversary of the foundation of the society, the coming year, 2007, is the 60th anniversary of the *Journal of Glaciology*. These are important and valuable occasions and landmarks in this changing world. Equally important is the excellence in the scientific content of works that will be created by glaciologists, and this is totally dependent on individual ability and effort. The International Glaciological Society is happy and privileged to be able to serve the community further in the future.

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

M. Jeffries raised the issue of the diversity of the *Journa*l and what could be done to increase it. He suggested that the IGS should adopt a more aggressive approach in an effort to solicit more diverse submissions. He suggested that Council might set targets to that effect. V. Little suggested that the IGS might consider the occasional special issue focused on a particular topic.

M. Jeffries also asked about the availability of Council minutes to ordinary members. He suggested that the general membership deserved to know more about what Council discusses and decides. Openness and accountability are important. The Secretary General responded by saying that some issues that Council discussed are confidential in nature but Council might perhaps consider making a shortened version of its minutes available to members.

F. Navarro asked if it would be possible to make reviewers' comments available electronically in an effort to minimize the time spent on reviews. The SG responded that the IGS is looking into setting up an online submission system which would incorporate such a feature. The *Journal* Chief Editor responded by quoting his report to Council in which it is shown that, on average, the greatest delay at present is the time taken by authors to respond to reviewers.

R. Alley proposed, and R.A. Bindschadler seconded, that the President's report be accepted. This was carried unanimously.

3. The appointed treasurer, Dr. I.C. Willis, presented the following reported with the audited Financial Statements for the year ended 31 December 2005.

My name is Ian Willis and I was appointed treasurer by the Council to bridge the gap until this AGM when members of the Society have the opportunity to elect a new Treasurer. The nominations committee put forward my name as the new Treasurer and I accepted the nomination. I am very grateful for the trust and confidence that the nominations committee has placed in me. I realize that, if I am elected, it will be a difficult task to follow in the footsteps of John Heap, although I will do my best.

For those of you who don't know me, I'm a Senior Lecturer based here at the Scott Polar Research Institute and have been a member of the IGS since 1986. SPRI is the official address of the IGS and this will make it easy for me to follow the matters of the Society and oversee its operations.

This is the second Financial Statement of the IGS to reflect the implementation of new accounting procedures brought in by the SAGE accounting software. This year (2005) shows figures corresponding to the numbers presented in last year's (2004) Financial Statement.

The state of the Society's finances is best summarized by considering the changes from 1 January 2005 to 31 December 2005, as shown on page 7 of the accounts. In the table, the Accumulated Fund refers largely to costs associated with running the *Journal*, the Designated Fund refers to costs associated with running Symposia and the *Annals*, and the Restricted Fund is money earmarked specifically for costs associated with the Seligman Crystal.

Restricted Fund: increased from £7642 to £7907 as a consequence of accrued interest of £265.

Designated Fund: increased by £23 670 from £152 464 to £176 134 due largely to delayed production and printing costs associated with publication of *Annals 40-42*. [N.B. Income from libraries received, but expenses not incurred].

Accumulated Fund: decreased by £42 164 from £397 076 to £354 912 due mostly to increased production and printing costs of the *Journa*l (more pages published). This more than offset the small profit of £2035 in the value of investments due to an adjustment to market value (note 7, page 13).

Total*:* Society made a net loss of £18 229 in 2005 compared to a net gain of £21 290 in 2004.

In more detail, income itemized in note 2, page 10 and expenditure listed in notes 3 & 4, page 11.

Income:
Membership dues dropped by £7903 and *Journa*l sales were down by £7289. Sales of *Journa*l reprints by authors not paying page charges fell by £2018, although page charge income rose by £25 533 [N.B. authors paying page charges receive 100 reprints automatically for no extra charge]. N.B. Discounts and refunds at bottom of page refer to 10% discount given to agents selling *Journal* and *Annals* to libraries.

Expenditure:
Big expenses are associated with **printing and publishing** the *Journal* and *Annals.*, an increase of £107 739 compared to 2004. This reflects extra pages published (see below). Other major expenditure comes from the costs of **supporting** the *Journal* and *Annals*. IGS Office published five *Journal* issues and two *Annals* volumes and worked on two more *Journal* issues and two *Annals* volumes. Salaries and NI contributions appear to have fallen by £16 599 cf. 2004, whereas telephone, postage and stationary costs appear to have increased by £18 892. However, some of these discrepancies will be due to better internal accounting procedures adopted in 2005

cf. 2004. Costs of running symposia were higher in 2005 cf. 2004, because of relatively expensive conferences in NZ and China, but also due to delay in payment to Davos for expenses incurred at that meeting in 2004. In addition, provision has been made for doubtful debts amounting to £11 000. This is predominately made up of page charges not being honoured.

Finally, under ***Management and Administration*** are costs of IGS office undertaking activities not specifically associated with running the *Journal* or *Annals*. Saving of £8674 cf. 2004, mostly due to high professional fees in 2004 associated with setting up of SAGE accounting software.

Journal* and *Annals

In 2005, the Society published 770 pages in the *Journal of Glaciology* (3 & 4 of 2004 and 1, 2 & 3 of 2005) and 1019 pages in the *Annals of Glaciology* (38 & 39). In 2004 the figures were 444 for the *Journal* and 416 for the *Annals*.

This reflects a reorganization of the production procedures, which has considerably improved the efficiency of the production process so that the Society has been able to catch up on its backlog of printing as well as reduce the time lag between submission and publication. This continues to be a major priority for the IGS Office. As of this week we have already published 475 pages of the *Journal* this year and we are expecting to double that number by the end of it. In addition we have already published almost 900 pages of the *Annals* and are planning to publish another 360 pages this year.

Summary

The Society's finances are in fairly good shape but we shouldn't be complacent. We ran at a loss this year (~3% of total funds) cf. a slightly greater profit last year (~4% of total funds). It is important for us to maintain our inputs as well as operate carefully and efficiently to minimize our costs.

On the **inputs** side, we are particularly grateful to all those authors who have been both able and willing to support the Society by the provision of page charges. If you can, please build page charges into your grants in order to support the Society. Also, I would also make a plea to members of the Society to do all in their power to increase the membership. Although we are continuing to receive new members these are now beginning to fall behind those who are retiring or moving to other fields. Our target is a base of at least 1000 and there is still some way to go. Please encourage your colleagues and students to join. I believe they will find it is extremely good value for money. Also, please ensure that libraries in any institutions over which you have influence either maintain their subscriptions or take one out.

On the **outputs** side, I believe that Magnús is increasing the efficiency of the IGS office and he deserves our help and encouragement and support for what he is doing on our behalf. Under his management, we have now caught up in the publication of the *Journal of Glaciology* and are working hard at catching up with the *Annals of Glaciology*. It is also a pleasure to announce that we have been able to negotiate a reduction in printing costs with our printers, Page Bros, of about 50%. These changes took place this year and will thus be reflected in the Financial Statements for 2006.

Ian C. Willis, Treasurer (appointed)
22 August 2006

S. Anandakrishnan said that the IGS should not compromise the quality of its publications in an effort to reduce costs. At present membership of the IGS and attendance at its symposia provides very good value.

M. Jeffries suggested that something be done to encourage members to make a bequest to the IGS in their wills. Such fundraising by not-for-profits is not an unusual practice. For the IGS, it would be a way to generate income that could be used for special purposes above and beyond the day-to-day operation of the Society, e.g.. student travel grants, student prizes, education programmes, etc.

C.W.M. Swithinbank proposed, and S. Anandakrishnan seconded, that the Treasurer's report be accepted. This was carried unanimously.

4. *Election of auditors for 2006 accounts*. On a motion from the appointed Treasurer, I.C. Willis, C.W.M. Swithinbank proposed, and S. Anandakrishnan seconded, that Messrs Peters Elworthy and Moore of Cambridge be elected auditors for the 2006 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 2005–2008, no further nominations were received, and the following members were therefore elected unanimously.

Vice-President:	Matthew Sturm
Treasurer:	Ian C. Willis
Elective Members (4):	Jonathan Bamber
	Christina L. Hulbe
	Pramod K. Satyawali
	Thorsteinn Thorsteinsson

These appointments were unanimously approved by the AGM.

6. *Other business.*
No other business was motioned

The AGM was adjourned on a motion from C.R. Bentley, seconded by T.H. Jacka.

2005 SELIGMAN CRYSTAL AWARD

RICHARD B. ALLEY

22 August 2006, Bristol–Myers Squibb Lecture Theatre (Lecture Theatre 1), Department of Chemistry, University of Cambridge, UK

The Society's Council agreed unanimously in 2005 that a Seligman Crystal be awarded to Richard B. Alley. The Crystal was presented at the International Symposium on Cryospheric Indicators on Global Climate Change after the following introduction by the IGS President, Atsumu Ohmura.

Dear Richard, Ladies and Gentlemen

The Awards Committee unanimously nominated Richard Alley, Evan Pugh Professor of Geosciences at the Pennsylvania State University, as the next recipient of the Seligman Crystal for his prodigious contribution to our understanding of the stability of the ice sheets and glaciers of Antarctica and Greenland, and of erosion and sedimentation by this moving ice. Through the interpretation of paleoclimatic records from ice cores, Professor Alley has examined their response to past and future climate change. He has provided evidence that large, abrupt global climate changes have occurred repeatedly in the Earth's history and has contributed to our understanding of the driving mechanisms of these changes. At its meeting in Lanzhou, China, on 5 September 2005 the IGS Council unanimously agreed to award the Seligman crystal to Professor Richard B. Alley.

Professor Alley received his BSc and MSc from the Geology Department of Ohio State University. His PhD, completed in 1987, was carried out at the Department of Geology and Geophysics, University of Wisconsin-Madison, where he was mentored by experts such as Charles R. Bentley. After a short stint as a post-doc in Wisconsin, he was appointed to the faculty of the Pennsylvania State University, where he became Evan Pugh Professor of Geosciences in 2000.

Professor Alley has over 150 refereed publications, including numerous papers in high profile journals such as *Nature*, *Science*, and *Scientific American*. He has mentored more than 16 post-doctoral and graduate students and has won accolades for his undergraduate teaching (e.g. the Wilson EMS Teaching Award). His research efforts have been recognized by the Pennsylvania State University through their award of a Faculty Scholar Medal. Further, he has already received a number of awards from other organizations: the Horton Award of Hydrology Section of the American Geophysical Union, the D. & L. Packard Fellowship, the Presidential Young Investigator Award, the Easterbrook Award of the Quaternary Section of the GSA, and two Penn State awards for teaching and scholarship. He presented the Nye lecture to the American Geophysical Union in December 2004. He even has a glacier named after him, the Alley Glacier in the Britannia Range of the West Antarctic Ice Sheet, in honour of his study of ice streams.

He has a high public profile with more-than weekly interviews to TV and radio, in addition to educational outreach. This visibility has been fuelled by his award-winning book *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future*, published by Princeton University Press in 2000. He frequently provides advice at a very senior level to the US government on research activities to address the possibility of climate surprises (*Abrupt Climate Change: Inevitable Surprises*, National Academy Press, 2002). He has disseminated this information to a wider audience in *Science*.

His contribution to the glaciological community includes the 2001 editorship of an AGU publication, Alley, R.B. and R.A. Bindschadler, eds., *The West Antarctic Ice Sheet: Behavior and Environment*, American Geophysical Union, Antarctic Research Series v. 77, and as the chair of the National Research Council panel on Abrupt Climate Change, which produced *Abrupt Climate Change: Inevitable Surprises*, National Academy Press, 2002. He has served or is serving on a multitude of panels and advisory bodies to improve national and international research (the Abrupt Climate Change Panel, National Academy of Sciences; the Polar Research Board, National Academy of Sciences; the Paleoceanography and Paleoclimatology Panel of American Geophysical Union; the International Commission on Snow and Ice Working Group on Physics of Ice-Core Records; the Earth System History Advisory Committee to the National Science Foundation; the West Antarctic Ice Sheet Project Executive Committee; WAISCORES (West Antarctic Ice Sheet Coring) Executive Committee; the Ice Core Working Group; the West Antarctic Ice Sheet and West Antarctic Ice Cores Projects; the NOAA

Abrupt Climate Change Panel; Polar Research Board) as well as serving on the editorial boards of *Quaternary Research* and *Geology*.

Dear Richard, it gives me great pleasure in presenting you with the highest award that the International Glaciological Society has to offer and on behalf of the International Glaciological Society I have the honour to present you with the Seligman Crystal.

Figure 1 Professor Alley receiving the Seligman Crystal from IGS President Atsumu Ohmura

Professor Alley's reply:
President Ohmura, many thanks for those kind words. It is indeed an honor and a privilege to be here tonight. Some years ago, my wife Cindy had asked what awards in the field might be especially meaningful, and my reply started with 'Well, there's the Seligman Crystal…'. We are part of an important, interesting, exciting, exuberant field, and to be sharing in a little piece of the history of that field is a moving experience indeed.

As you might surmise, I'm a lucky person in many ways. My parents, Ruth and John, substituted love for money, and nurtured my early interest in geology (and many other things!), aided by Ann Kramer, who got me to the bottoms of caves and tops of mountains with a local rock club, and by many teachers and especially Nick Hainen.

I showed up at Ohio State with enough background in geology to land a summer job after my freshman year, and I was much more captivated by Ian Whillans and his ice dynamics than by cleaning fossils with a dental pick. Ian was a remarkable mentor, and when I wasn't saving his split-leaf philodendron with a hastily constructed paper-towel humidifier while he was in Antarctica, he had me working on radar layers in ice sheets, and water flow over Kelleys Island, and bomb horizons in firn cores. After Tony Gow came down and told us what to do, Ian advised my senior thesis on Dome C firn. I still feel his loss deeply.

During my sophomore year, David Elliot took me to the Antarctic Peninsula. His wisdom and knowledge have helped me many times. The field experience showed me one of the most beautiful places on the planet – seals and penguins and whales, icebergs and spectacular mountains and delicate fern fossils, and also gave me insight to the wisdom of anti-emetics in the Drake Passage.

Following graduation and marriage to my wonderful and patient wife Cindy, I informed Ian that no one could make a living at ice, and I needed to study something useful. But after assisting the geology field camp, interning in oil, and visiting every faculty member in Ohio State geology for advice on what was so interesting and exciting that it could form a life's work, I asked Ian to take me back.

Based on the idea that field work would start soon on ice stream B (now Whillans Ice Stream), he set me to modelling ice streams with longitudinal stresses. I couldn't make my model match reality, though. (Much later, Todd Dupont and Byron Parizek are redoing, and doing right, what I couldn't get at Ohio State.) So, while Ian was off on sabbatical with Dominique Raynaud, John Bolzan helped me freeze the ice stream to the bed, call it Dome C, and look at the slow response of the ice. Ian referred to this as the 'palace revolt', but approved my Master's degree anyway. He insisted for the PhD that a student go work with the best in the world, so he sent me off to join in the great things Charlie Bentley was doing at Wisconsin.

Great things were indeed happening at Wisconsin. Oh, my studies started out a little rough when my PhD melted on the way home from Antarctica, but I ended up with two more field seasons, Site A Greenland with Bruce Koci and Keith Mountain, and back to the Siple Coast. We never quite got around to building a privy at Site A, which made for an invigorating stay. I received much help from many Wisconsin professors in addition to Charlie, and particularly from John Perepezko in Materials Science.

Around this, Don Blankenship, Sean Rooney, Sridhar Anandakrishnan and others were finally figuring out why the ice streams go so fast – magnificent mud. I was able to help put the discovery in context as the lone geologist in a nest of geophysicists (which occasioned Marybelle, Charlie's wife, to greet me with raised eyebrow and the query 'So you're not a real scientist, then, are you?' Much later, we became friends and I appreciated her wit more; we miss her). We're still arguing about why ice streams don't go faster, but Don Blankenship's soft till with high water pressure is the lubricant. The pace of the science was breathtaking – the geophysicists often became

phase-shifted, working through the night when the computer was more available, and when I arrived by bicycle or cross-country ski in the morning, there as often as not was some new discovery sitting on my desk.

With over 20 refereed papers including first-authored and co-authored ones in both Nature and Science, and a funded NSF grant, I wasn't good enough to get a permanent Penn State job, but Eric Barron secured a term appointment for me, and eventually Penn State decided to keep me. (But first, they knocked a hole in the outside wall of my office and took away my heater, so I had a plastic sheet blocking the winter wind.) With one computer for my start-up package, I never bought much equipment or built a big lab, and when I finally did come into some money, I used it for salaries for good people. The world needs labs, but I've been very happy and fortunate with the people.

When we had scattered from Wisconsin, I was convinced that I'd never again enjoy such a deeply productive and satisfying collaboration. Luckily, I was completely wrong. My pit-digging and Tony Gow's instructions and good will were enough to get me into the GISP2 ice-coring project in central Greenland with chief scientist Paul Mayewski. Suddenly, I was collaborating with Tony, and Ken Taylor, Eric Saltzman, Jim White, Michael Bender, Joan Fitzpatrick, and on to Larry Wilen and the rest of that great team, as well as our counterparts at GRIP. We were on a mission – to make ice-core interpretation so reliably quantitative through layer counting, flow modelling, borehole thermometry, Jeff Severinghaus's brilliant breakthroughs on gas fractionation, and more, that we rightly could pound on the table and insist that we know what happened when. The amazing results of that international effort have surely changed our view of the planet. If you lean too far, the canoe does tip over; abrupt climate change is real. A lot of the work was done by Penn Staters, with Kurt Cuffey and Christopher Shuman among the notables.

During this time, I fell in with the 'Matanuska mafia' in an effort that led us to what may be the 'first law' of glacier-bed erosion. This stabilizing feedback is implicit in the papers by Rothlisberger and Hooke but required the visionary and careful science of Dan Lawson, Ed Evenson, Grahame Larson and company, and a great glacier.

The results of GISP2 encouraged Wally Broecker to ask me to participate in the abrupt climate change panels he organized, and the intellectual ferment of the 'Changelings'. Cross-disciplinary groups truly can move fields, and no one has recognized this as fully, and made it happen as often, as Wally. This also led me to field work with George Denton, and with

Figure 2 The audience can always be assured of an enthusiastic, informative and entertaining lecture by Richard

philanthropist, humanitarian, adventurer and scientist Gary Comer, who has done so much good for the broader field of abrupt climate change. I believe that our work affirming the dominant role of sea ice in amplifying North Atlantic switching presents challenges for the climate-modelling community and motivates greater attention to sea ice by glaciologists.

The West Antarctic community, formed originally by Bob Bindschadler, Ian Whillans, Charlie Bentley, and Doug MacAyeal, has stuck together for decades now under Bob's able leadership, and has been a source of collaborations, inspiration and willingness to listen to my ideas, no matter how crazy. This group continues to set a standard, which deserves emulation, for collaborative, multi-faceted study.

And standing out in the West Antarctic community, and more broadly, is my colleague Sridhar Anandakrishnan. He got me in trouble back at Wisconsin – I was helping to solder boards he designed for his passive-seismic experiment, and completely spaced out a class I was supposed to be running – but the data were worth the heat. He passed through Penn State several times before settling with us as an intellectually dominant force. The joy of having new discoveries suddenly appearing has returned. Ice-stream response to tides, like kicking the tyre of a used car to see if the door falls off, is a wonderful probe for the underlying physics, but Sridhar's contributions run far beyond that. I also must mention Todd Sowers, David Pollard, Don Voigt and others at Penn State, colleagues and inspirations.

The professorate brings students. Perhaps one of the most daunting challenges for a young professor, mere weeks into a career, is to have Kurt Cuffey walk through the door and start asking very pointed questions (including questions about glacier erosion that are not fully answered yet…).

Why he didn't just leave because I'm stupid is beyond me, but he started a chain of students who have opened doors. I have mentioned several already, but must add Anna María Ágústsdóttir, Sarah Das, Peter Fawcett, Mark Fischer, Dave Reusch and Matt Spencer, who continue to contribute notably to our profession, and Greg Jablunovsky, Wanda Kapsner, Greg Woods and many more who are making their way in the real world. The current students working with me are winners, as are many more working with Sridhar, and you might keep Penn State in mind if you're looking to hire a good one down the road, or if you know of someone looking for new horizons.

Students need to eat, and I am indebted to funding agencies and philanthropists, especially including NSF (and the new CReSIS Science and Technology Center), with the Gary Comer Foundation, the David and Lucile Packard Foundation, and NASA. The good folks working at these places are too often overworked and underappreciated.

My list of refereed papers and book chapters, first-authored or co-authored, is now around 170, with the names of about 170 different co-authors. A few have come and gone quietly but most represent true scientific collaborations, with Sridhar and I sharing 33 papers. This almost surely shows what I've long suspected – I'm not a very good scientist by myself. I measure a few things (counting layers in miles of ice cores, for example) but I'm not especially good at it. I make models, but they're not very sophisticated.

But I love the literature. I can happily read Weertman, Nye, Kamb and Garry Clarke, but also Lorius, Dansgaard, Oeschger and Raynaud, or Goldthwait, Dreimanis and Peter Clark, or Coble, Ashby and Perepezko. When one of you does the hard work and discovers something, I probably just finished reading the prequel to that story. The wave of ice-stream adjustment to the tides? Looks like the disturbance from the 1964 Alaska earthquake, heading for California. The pattern of Dansgaard–Oeschger events? Looks like the output of a nearly stochastically resonant oscillator. Freeze-on under Matanuska Glacier? Rothlisberger saw a much smaller relative in the Alps. I nearly went into journalism, and I harbor the dark secret that during my college years I sold a short piece of intentional fiction to a very obscure magazine. The world fits together into a great and beautiful plot, and the story of how the world works is more compelling and engaging than any fiction. And well over 100 of you have been gracious enough to fill me in on what is happening, and to let me help develop the characters and tell the story. When you present me with the Seligman Crystal, you truly are awarding it to yourselves, to the strength and brilliance of the community.

Now, I want to diverge a little bit, and I hope Magnús doesn't yell too loudly. A few years ago, the *New York Times* asked a fellow out fishing on a warm December day about the weather. He replied, 'It's global warming, dude… I don't care if the whole planet burns up in a hundred years. If I can get me a fish today, it's cool by me.'

More and more, I tell your stories outside of our community, to government officials and school groups and other scientific communities. (Recently, I've been averaging almost one talk per week, and I believe I've passed the one-reporter-contact-per-day level.) I've met some 'I don't care' people, but most do care, and they want answers from us. I have trouble giving those answers.

Consider, for a moment, two possible fictional futures.

It is the year 2706, and the International Glaciological Society has convened in Cambridge for the eighth centennial meeting on Cyrospheric Indicators of Global Climate Change. The world has continued burning fossil fuels on a business-as-usual path, the fuels are nearly gone, and except for a few bicyclists from Oxford, the meeting is virtual. CO_2 has passed eight times preindustrial levels. The CO_2 sensitivity proved to be a bit above 4°C and, even with the thermal inertia of the system, global temperatures are up more than 10°C, and more than double that in the polar regions. The ice sheets of Greenland and West Antarctica are almost entirely gone, East Antarctica's ice has retreated around its huge perimeter, and sea level has risen more than 20 meters, flooding the major coastal cities of the world. The economy largely collapsed following the refugee wars of the 2500s, and the IGS is the only pre-war learned society still in existence. Reliable model results are finally available and the disturbing fact emerges that just a little slowdown in emissions would have allowed the ice sheets to stabilize without too much sea-level rise. Our earlier failure to get the science right had terrible consequences.

It is the year 2706, and the International Glaciological Society has convened in Cambridge for the eighth centennial meeting on Cyrospheric Indicators of Global Climate Change. In 2010, the world adopted stringent controls to hold global warming below 2°C, in part to save the ice sheets. Widespread cheating broke out, and the wars to contain it that followed largely destroyed the world's economy, such that the IGS is the only pre-war learned society still in existence. Reliable model results are finally available, and the disturbing fact emerges that the ice sheets were much more resilient than previously believed, and that, even with a warming of 4°C, Jakobshavn and Pine Island would have

stabilized while snowfall increased in East Antarctica, so the wars and restrictions were largely unnecessary. Our earlier failure to get the science right had terrible consequences.

When I went to Antarctica in 1985/86, the military pilots were already thinking about GISP2. A meeting was arranged, and they asked me 'Will we fall in a crevasse at the Summit of Greenland?' I replied that crevasses were very unlikely there. The Commander then said 'If I trust you and go to the Summit and fall in a crevasse, I'm going to come back and find you, put your private parts (he used a more colourful colloquial term) in a vice, set the table on fire, and give you a butcher knife. Now, will we fall in a crevasse at the Summit?'

Suppose, for the sake of argument, that the members of the International Glaciological Society were asked whether we could predict the future of the ice with high confidence, whether either of my little fictions is entirely impossible, whether business-as-usual presents a clear and present danger, or many of the other questions that I am asked by reporters and policy-makers on a daily basis. And, suppose that something the Commander would appreciate were set up for us if we proved to be wrong, with future technologies bringing us back to life if need-be so the Commander could reach us, if society fell into either of those 'crevasses'. Could we get it right? I'm not too optimistic yet.

Credible estimates say that after a few decades of serious research, the world could reach a carbon-neutral state for a net yearly cost of something like 1% of the world economy. That is in line with other costs of clean-ups (sewers, trash collection, etc.), but it is one heck of a lot of money – maybe $400 billion ($4×1011) per year. Although little research has been done on economics of ice melt, it is fairly clear that the optimum path for humanity will be affected by the sensitivity of the ice sheets to CO_2 emissions. If you asked me, I would venture to suggest that even a little skill, a little clarity, in a $4×1011/year decision is of great value, and a lot of skill would be much more valuable.

In my role as one of your story-tellers, I have given talks to meetings of many sister disciplines, including climate dynamics, atmospheric chemistry, and others. I don't for a minute believe that they are smarter or harder working than you are, but I can assure you that many of those disciplines are bigger and better-funded, and so better organized and doing a better job providing policy-relevant results, about issues that often are smaller. While I think we know a fair amount about the future of snow cover, frozen ground and mountain glaciers (but with work still to do!), I think we're shakier on sea ice and even worse on the Greenland and Antarctic Ice Sheets.

I honestly don't know whether the policy-makers will increase the funding for ice research in the future. But, I know that many policy-makers are very concerned about ice, are reading our papers and keeping track of our work, and some of them are asking what might be done to improve our research. I believe we must invest more effort in figuring out how we really would answer the big questions, what resources would be required, and how we would entrain the necessary students and senior collaborators. And, we need to remain focused on answering those big questions, honestly, accurately, and simply.

We must consider, and aim for, a third future.

It is the year 2706, and the International Glaciological Society has convened in Cambridge for the eighth centennial meeting on Cryospheric Indicators of Global Climate Change. We have lots of co-sponsors from the other learned societies, who continue to appreciate the importance of ice studies. By the end of the second decade of the 21st century, the glaciologists had it right. They provided clear, compelling, narrowly constrained projections of cryospheric changes for different greenhouse-gas-loading scenarios. Faced with these solid results, policy-makers steered a near-optimal path, preserving economy and ice. Investment in energy research led to the biosiliceous solar breakthrough of 2042, unlocking vast stores of locally produced energy, and the world is more healthy, prosperous and peaceful than ever. Monitoring and study of all the elements of the cryosphere remains important, fine-tuning the climate to retain the diversity of the planet. The president of the society raises a toast to the memory of the pioneers who achieved so much, to you who are assembled here in 2006 for this wonderful conference.

Figure 3 Richard with his wife Cindy, and daughters Janet and Karen

I turned 49 last week, and I've been working in glaciology for 29 of those years. I am fortunate at a level that few people ever enjoy, for my family (wife Cindy, and daughters Janet and Karen), and for you. I love the ice, and I hope that I have great-great-great grandchildren who love it too. Our little backwater of environmental science, struggling to raise enough money to put our journals online, happens to be at the nexus of some of the biggest questions facing humanity. Getting along with each other may be the most important issue, but getting along with the planet is a close second, and the two are inextricably linked. I thank you for the opportunities you've given me to help, and for the honour you've bestowed on me this evening, and I urge you to greater efforts and greater vision for all of us.

I close with two images.

In Christian tradition, the rainbow is the sign of a promise from God that there will never be another global flood.

I spend a lot of time helping students realize that there never was a global flood and that the world is older than 6000 years, but coastal peoples did see an immense sea-level rise as melting of the mid-latitude ice-age glaciers flooded one-fifth of the land. I wonder whether the rainbow should serve as a sign of our commitment that the high-latitude ice not follow.

The musk oxen of Greenland are wonderful creatures, sort of the same size and shape as minivans but with better acceleration and cornering. When faced with a challenge, the musk oxen surround any young or sick in the group, and turn to face the challenge. I wonder whether we can't learn something from these great boreal beasts.

Figure 4 May the high-latitude ice not melt as a result of human activities

Figure 5 May we all turn to face the challenge of climate change

JOURNAL OF GLACIOLOGY

Papers accepted for publication between 1 January 2007 and 31 March 2007. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

Robert Bindschadler and Hyengu Choi
Increased water storage at ice-stream onsets: a critical mechanism?

Marion Bougamont, Elizabeth C. Hunke and Slawek Tulaczyk
Sensitivity of ocean circulation and sea-ice conditions to loss of West Antarctic ice shelves and ice sheet

Jason E. Box and Kathleen Ski
Remote sounding of Greenland supraglacial melt lakes: implications for subglacial hydraulics

A.L. Fortt and E.M. Schulson
Do loading path and specimen thickness affect the brittle compressive failure of ice?

Jason Gulley and Douglas Benn
Structural control of englacial drainage systems in Himalayan debris-covered glaciers

Pascal Haegeli and David M. McClung
Expanding the snow climate classification with avalanche relevant information – initial description of avalanche winter regimes for south-western Canada

Tim H. Jacka and A. Barry Giles
Antarctic iceberg distribution and dissolution from ship-based observations

Li Zhongqin, Li Chuanjin, Li Yuefang, Wang Feiteng and Li Huilin
Preliminary results from measurements of selected trace metals in the snow-firn pack on Glacier No. 1, East Tianshan, China

Glen E. Liston, Robert B Haehnel, Matthew Sturm, Christopher A. Hiemstra, Svetlant Berezovskaya and Ronald D Tabler
Instruments and Methods: Simulating complex snow distributions in windy environments using SnowTran-3D

L. MacLagan Cathles IV, L.M. Cathles III and M.R. Albert
Instruments and Methods: A physically based method for correcting temperature profile measurements made using thermocouples

Eyjólfur Magnússon, Helmut Rott, Helgi Björnsson and Finnur Pálsson
The impact of jökulhlaups on basal sliding observed by SAR interferometry on Vatnajökull, Iceland

David L. Morse, Edwin D. Waddington and L.A. Rasmussen
Ice deformation in the vicinity of the ice core site at Taylor Dome, Antarctica, and derived accumulation-rate history

J. Oerlemans
Estimating response times of Vadret da Morteratsch, Vadret da Palu, Briksdalsbreen and Nigardsbreen from their length records

Donald K. Perovich
Light reflection and transmission by a temperate snow cover

Erin C Pettit, Throstur Thorsteinsson, H Paul Jacobson and Edwin D Waddington
The role of crystal fabric in flow near an ice divide

Gerit Rotschky, Per Holmlund, Elisabeth Isaksson, Robert Mulvaney, Hans Oerter, Michiel R. van den Broeke and Jan-Gunnar Winther
A new surface accumulation map for western Dronning Maud Land, Antarctica, from interpolation of point measurements

M. Rousselot and U.H. Fischer
A laboratory study of ploughing

Shin Sugiyama, Anderas Bauder, Patrik Weiss and Martin Funk
Reversal of ice motion during the outburst of a glacier-dammed lake on Gornergletscher, Switzerland

Alexander V. Wilchinsky
The effect of bottom boundary conditions in the ice-sheet-ice-shelf transition zone problem

ANNALS OF GLACIOLOGY, VOLUME 46

The following papers from the International Symposium on Cryospheric Indicators of Global Climate Change held in Cambridge, England, 21–25 August 2006 have been accepted for publication in Annals of Glaciology *Vol. 46, edited by Martin J. Sharp. The papers are listed in alphabetical order by main author.*

Matthew J. Hoffman, Andrew G. Fountain and Jonathan M. Achuff
Twentieth-century variations in area of small glaciers and icefields, Rocky Mountain National Park, Rocky Mountains, Colorado, USA

Keith M. Jackson and Andrew G. Fountain
Spatial and morphological change on Eliot Glacier, Mount Hood, Oregon, USA

Peter Jansson, Hans Linderholm, Rickard Pettersson, Torbjörn Karlin and Carl Magbus Mörth
Assessing the possibility to couple chemical signal in winter snow on Storglaciären to atmospheric climatology

Martin O. Jeffries and Kim Morris
Some aspects of ice phenology on ponds in Central Alaska

Edward G. Josberge, William R. Bidlake, Rod S. March and Ben W. Kennedy
Glacier mass-balance fluctuations in the Pacific Northwest and Alaska, USA

Kadota Tsutomu and Davaa Gombo
Recent glacier variations in Mongolia

Stefan Kern, Gunnar Spreen, Lars Kaleschke, Sara de la Rosa Höhn and Georg Heygster
Polynya Signature Simulation Method polynya area in comparison to AMSR-E 89 GHz sea-ice concentrations in the Ross Sea and off Adelie Coast, Antarctica, for 2002-2005: first results

Gernot Koboltschnig, Hubert Holzmann, Wolfgang Schoener and Massimiliano Zappa
Contribution of glacier melt to stream runoff: if the climatically extreme summer of 2003 had happened in 1979…

Astrid Lambrecht and Michael Kuhn
Glacier changes in the Austrian Alps during the last three decades, derived from the new Austrian glacier inventory

Gwendolyn J.M.C. Leysinger Vieli, Richard C.A. Hindmarsh and Martin J. Siegert
Three-dimensional flow influences on radar layer stratigraphy

Jun Li, H. Jay Zwally and Josefino C. Comiso
Ice sheet elevation changes caused by variations in firn compaction rates induced by satellite-observed temperature variations (1982–2003)

Hans W. Linderholm and Peter Jansson
Proxy data reconstructions of the Storglaciären mass balance record back to AD 1500 on annual to decadal timescales

Walter N. Meier, Julienne Stroeve and Florence Fetterer
The declining Arctic sea ice: how much of an indicator of change is it?

Carmen Molina, Francisco Navarro, Jaume Calvet, David García-Sellés and Javier Lapazaran
Hurd Peninsula glaciers, Livingston Island, Antarctica, as indicators of regional warming: ice volume changes during the period 1956-2000

Marco Möller, Christoph Schneider and Rolf Kilian
Glacier change and climate forcing in recent decades at Gran Campo Nevado, southernmost Patagonia

Øyvind Nordli, Elin Lundstad and A.E.J. Ogilvie
A late winter-early spring temperature reconstruction for Southeastern Norway from 1758 to 2006

C. Nuth, J. Kohler, H.F. Aas, O. Brandt and J.O. Hagen
Glacier geometry and elevation changes on Svalbard: a baseline dataset

Atsumu Ohmura, Andreas Bauder, Hans Müller and Giovanni Kappenberger
Long-term change of surface mass balance and the role of radiation

Hongxi Pang, Yuanqing He, Wilfred H. Theakstone and David D. Zhang
Soluble ionic and oxygen isotopic compositions of a shallow firn profile, Baishui Glacier No. 1, southeastern Tibetan Plateau

Victoria Parry, Peter Nienow, Douglas Mair, Julian Scott, Bryn Hubbard and Duncan Wingham
Investigations of meltwater refreezing and density variations in the snowpack and firn within the percolation zone of the Greenland ice sheet

G. Picard, M. Fily and H. Gallee
Surface melting derived from microwave radiometers as a climatic indicator in Antarctica

Addy Pope, Tavi Murray and Adrian Luckman
DEM quality assessment for quantification of glacier surface change

Terry D. Prowse, Barrie R. Bonsal, Claude R Duguay and Martin P. Lacroix
River-ice break-up/freeze-up: a review of climatic drivers, historical trends and future predictions

Rajmund Przybylak
Recent air temperature changes in the Arctic

Valentina Radiç, Regine Hock and Johannes Oerlemans
Volume-area scaling approach vs flowline model in glacier volume projections

Kai Rasmus and Aike Beckmann
The impact of global change on low-elevation blue ice areas in Antarctica; a thermo-hydrodynamic modelling study

L. A. Rasmussen, L. M. Andreassen and H. Conway
Reconstruction of mass balance of glaciers in southern Norway back to 1948

Angelika H.H. Renner and Victoria Lytle
Sea ice thickness in the Weddell Sea: a comparison of model and upward looking sonar data

David B. Reusch and Richard B. Alley
Antarctic sea ice: a self-organizing map-based perspective

Wolfgang Schöner and Reinhard Böhm
A statistical mass balance model for reconstruction of LIA ice mass of glaciers of European Alps

Thomas Vikhamar Schuler, Even Loe, Andrea Taurisano, Trond Eiken, Jon Ove Hagen and Jack Kohler
Calibrating a surface mass balance model for the Austfonna ice cap, Svalbard

Maria Shahgedanova, Viktor Popovnin, Alexander Alaynikov, Dmitry Petrakov and Christopher R Stokes
Long-term change and inter-annual and intra-seasonal variability in climate and glacier mass balance in the Caucasus Mountains, Russia

Oddur Sigurðsson, Trausti Jónsson and Tómas Jóhannesson
Relation between glacier front variations and summer temperature in Iceland since 1930

C.R. Stokes, V. Popovnin, A. Aleynikov, S.D. Gurney and M. Shahgedanova
Recent glacier retreat in the Caucasus Mts, Russia, and associated increases in supraglacial debris cover and supra/proglacial lake development

Shin Sugiyama, Andreas Bauder, Conradin Zahno and Martin Funk
Evolution of Rhonegletscher, Switzerland over the past 125 years and in the future: application of an improved flowline model

C.I. van Tuyll, R.S.W. van de Wal and J. Oerlemans
The response of a simple Antarctic ice flow model to temperature and sea level fluctuations over the Cenozoic era

Caixin Wang and Aike Beckmann
Investigation of the impact of Antarctic ice shelf melting in a global ice-ocean model (ORCA2-LIM)

Wang Feiteng, Li Zhongqin, R. Edwards and Li Huilin
Long term changes in the snow-firn pack stratigraphy on Glacier No. 1 in the Eastern Tianshan Mountains

J. Paul Winberry, Sridhar Anandakrishnan and Andy M. Smith
Changes in speed near the onset of Bindschadler Ice Stream

Xiao Cunde, Liu Shiyin, Zhao Lin, Wu Qingbai, Li Peiji, Liu Chunzhen, Zhang Qiwen, Ding Yongjian, Yao Tandong, Li Zhongqin and Pu Jiancheng
Observed changes of cryosphere in China over the second half of the 20th century: an overview

Yao Tandong, Duand Kequin, L.G. Thompson, Wang Ninglian, Tian Lide, Xu Baiqing, Wang Youqing and Yu Wusheng
Temperature variations over past millennium on the Tibetan Plateau revealed by four ice cores

Jacob Clement Yde and Niels Tvis Knudsen
20th century glacier fluctuations on Disko Island, Greenland

Jing Zhang, Uma S. Bhatt, Wendell V. Tangborn and Craig S. Lingle
Response of glaciers in northwestern North America to future climate change: an atmosphere/glacier hierarchical modeling approach

A REPORT FROM THE CAMBRIDGE SYMPOSIUM

The International Symposium on Cryospheric Indicator for Global Climate Change
21–25 August 2006

Cambridge, England, has a deep and extensive connection with science. It practically oozes from between the cobblestones on the ancient streets. There is no better place for a professional scientific organization to hold a meeting. On 21 August 2006 the IGS took advantage of Cambridge as their headquarters' site to host the International Symposium of Cryospheric Indicators of Global Climate Change. The five-day meeting benefited from the additional sponsorship of the Word Climate Research Program (WCRP)'s Climate and Cryosphere (CliC) Program, the Scientific Committee on Antarctic Research (SCAR), the International Union for Geology and Geophysics' Commission for Cryospheric Sciences (IUGG-CCS), the Scott Polar Research Institute (SPRI) and the British Antarctic Survey (BAS).

The high-quality science to be discussed attracted most of the 245 registrants from 22 countries, but the enjoyable surroundings drew an unusually large contingent of accompanying persons who were seen strolling the winding streets and more than a few pubs of this charming English town throughout the week. Ages ranged from less than four to more than four-score. No one ever seemed to be bored.

Figure 1 Registration took place at the Scott Polar

With the IGS's main office right around the corner from SPRI, where registration took place (or through the back parking lots if you had a local guide), the full complement of office staff were on hand to greet participants with a warm smile and transfer digital presentation files to the meeting computers. Rounding out the official staff were Jo Jacka, the *Journal of Glaciology*'s Chief Editor, Martin Sharp, the *Annals* Chief Editor appointed for this meeting, and his supporting board of 36 Scientific Editors, most of whom could attend the meeting.

IGS symposia are traditionally preceded by a social icebreaker and this meeting was no exception as young and old colleagues greeted each other in the SPRI lobby the evening before the meeting began.

Figure 2 The Icebreaker was held in the Scott Polar museum, a very appropriate location

Many participants stayed in the residential buildings of Downing College, not far from the meeting site. This location invited residents to commute to the sessions by a delightful walk along gravel pathways across the well-manicured College grounds before risking a quick dash between cars zipping along Lensfield Road and the safety of the lecture halls in the Chemistry Building of Cambridge University. These auditoria are immediately adjacent to SPRI and let people flow between the two buildings during session breaks. Many lively conversations filled both buildings and the small parking lot between.

The symposium was opened by Atsumu Ohmura, whose ever-enthusiastic remarks were followed by additional welcomes from Barry Goodison (CliC Chairman), Georg Kaser (IUGG-CCS President), Tom Lachlan-Cope (Local Organizing Committee Chair), and Martin Sharp (Chief Editor of *Annals 46*). Following the introductions and welcomes, the scientific

sessions began with the first of 22 oral sessions and two posters sessions conducted during the week. The CliC Project Areas played a prominent role in the organization of the sessions with each of the four areas receiving a devoted session. Multiple sessions have never proved popular with symposium participants, but the sheer volume of the submitted presentations required such a solution. Fortunately, the distance between auditoria was short and session chairs did an admirable job of keeping speakers to the published schedule, so disruptions between presentations were kept to an acceptable minimum. A special word of praise is due those individuals who oversaw the flawless downloading, organization and display of all the presentations.

Figure 3 Around 300 people attended the symposium

Popular meetings in small spaces are always challenging and forced a large number of excellent posters to be packed into the limited space of SPRI's ground floor. Viewers used every conceivable nook to conduct intense discussions about the wide range of subjects beautifully illustrated on the poster boards. And as is becoming more the norm, many laptop computers were drawn to host their own discussion or support or counter a point made by one of the poster presenters. No-one seemed to mind the cramped quarters of the SPRI lobby on the second evening, when wine and hors d'oeuvres were served compliments of CIRES for an immensely enjoyable reception.

The mid-week break gave people a welcome opportunity to take fuller advantage of our locale by shedding their symposium focus and becoming tourists. Some used the free time to embark on walking tours of Cambridge highlighting the historic scientific landmarks that make Cambridge unique in the history of science; others adopted a personal itinerary, roaming Cambridge shops in search of surprise treasures; others simply took the time to relax in the peaceful surroundings of

Figure 4 The talks were presented in the Chemistry building

Cambridge, while three busloads of eager participants accepted the offered excursion to Ely Cathedral. I was among the last group. Ely rests 25 kilometres north of Cambridge and the journey there takes one through a varied mix of English countryside, villages and farms. Approaching the 'Ship of the Fens' from the low-lying countryside lets one appreciate why the island of Ely was an important town in this region for one and a half millennia. The cathedral was built on the site of a double monastery founded in 670 and surrounding the cathedral are many of the monastic buildings exhibiting the longevity of that enterprise. The cathedral itself is a most impressive Gothic structure in its own right, is 'only' 900 years old, is built in the shape of a cross and has an impressively high-vaulted ceiling above its nave. The weather was cold and damp this day, true to the English reputation, and set the many intriguing gargoyles, with their often grotesque and sometimes comical faces, to work channelling the rain from the roof into waterfalls along the cathedral's walls.

Not all IGS symposia highlight the exceptional scientific achievements of an individual member with the presentation of a Seligman Crystal, but this meeting was one of the lucky ones. Richard Alley, an unequalled lecturer as well as a scientist of rare and diverse capabilities, treated the evening audience to an entertaining view of his journey to his present high stature as the Evan Pugh Professor at The Pennsylvania State University. His wife Cindy and his undergraduate mentor, Charles Bentley, himself a recipient of the Seligman Crystal in 1990, were among the very special guests for this celebratory evening. The evening started a bit late, however, as the Crystal to be awarded had to be recovered from a closet within which it had been locked for safety's sake.

The banquet is always a highlight of any IGS symposium. The cloudy skies looming much of

Figure 5 Richard Alley with the Seligman crystal, and his mentor, Charles Bentley

Figure 6 The banquet took place in the historic setting of St John's College Main Hall

the week turned to a persistent downpour as hungry ticket holders wound through the narrow streets along varied routes through the town to St John's College. Once there, coats were hung and people's spirits lifted as their clothes dried out and old conversations were continued and new ones began. Always the epitome of refined behaviour, the serving staff of St John's lavished the banqueters with a delicious meal, embellished with excellent wine. Many short and not so short speeches were given by the many dignitaries at the head table. Most memorable in this reporter's mind was a very expansive and detailed description of polythermal glaciers by IGS President Atsumu Ohmura.

In the afterglow of the banquet, the last day's sessions began with the quality of presentation showing no sign of slacking. However there always comes a final talk and participants must close their programmes, turn off their laptops and depart the venue. This meeting offered one very welcome final act, however, as an Awards Committee organized by IUGG/CCS had been working throughout the meeting behind the scenes. They were tasked with the extraordinarily difficult job of deciding which one oral presentation and poster presentation should be granted an extra measure of distinction and its author given a token of special achievement from IUGG/CCS for an exceptionally effective presentation. After Georg Kaser acknowledged the difficulty of deciding from among so many meritorious presentations, the entire audience seemed to agree with the committee's results when Peter Kuipers Munneke was asked to step forward and receive the award for the most effective oral presentation ('A model for studying Antarctic snow surface albedo under clear and cloudy conditions') and Matthias Huss was rewarded for making the best poster presentation ('Retreat scenarios of Unteraargletscher, Switzerland, using a coupled ice-flow mass-balance model'). Both among the younger participants, this last action of appreciation and acknowledgement of the exceptional skills of those newer members of our cryospheric community let everyone leave the meeting with confidence that our science is indeed in very capable hands and that as cryospheric indicators of global climate change continue to manifest themselves, we will meet again in the near future to exchange scientific findings and enjoy each other's company.

Robert Bindschadler
Maryland, USA

IGS NORDIC BRANCH ANNUAL MEETING

2006: The Polar Environmental Centre, Tromsø, Norway

One more successful, well attended, well organized and well performed Nordic Branch meeting was added to the record Nordic Branch meetings as the Norwegian Polar Institute hosted the 2006 meeting on 26–28 October in Tromsø. There were over 50 participants, the meeting being divided into ten separate sessions, with 42 oral and six poster presentations. All Nordic countries were represented, and we were visited by glaciologists from most of the countries bordering the Nordic sphere. The attender who came from furthest away was from the USA. The presentation topics spanned most of the whole field of glaciology, from historical reconstructions of events of past ice sheets to issues of global change, ice core records and the fate of tropical glaciers. The geographical regions with most presentations were Svalbard, followed by Norwegian and Greenland glaciers. The most presented glacier was the ice field Holtedahlfonna, followed by the ice cap Austfonna. The usually notorious Storglaciären was not discussed, and a long tradition was broken.

The presentations were of excellent quality, and the audience learned a good part of cutting edge Nordic glaciology. The bell IPY sounded in many presentations, and several scientists took this occasion as a step forward on the planning for the coming IPY activities. The sheer number of presentations puts restrictions on the report, as it is not possible to summarize them all. One presentation to be singled out would be those by Gunnar Østrem, the nestor?? of Norwegian glaciology, who has attended most of the Nordic Branch meetings, and by Nils Haakensen, who presented varve sedimentology of the proglacial lake Nigardsvatnet, and their 38-year record of repeat monitoring of the growth of the ice-river-fed delta. Gunnar showed us all that keeping track of sediments and ordering them is hard work in these cold and torrential waters, but that a handful of enthusiastic students on the staff can make a difference. Gunnar will be 80 years old this year, and we take the opportunity here to congratulate Gunnar on many years of achievements in Nordic glaciology!

The days were busy with interesting talks and enjoyable discussions around the coffee table in the pauses and the evenings were busy with scheduled cultural activities. On the first evening the auditorium went to the flicks – an old movie from 1933 about aboriginal Arctic people directed by W.S. van Dyke named *Eskimo* was found in the stacks of the Norwegian Polar Museum by the organizing committee. Stunning pictures of whale hunting in open canoes and authentic 'Eskimo-turns' thrilled the audience. The film showed a world that no longer exists, and we were able to see another aspect of the global change issue. The cultural scene the second evening was another form of change. After the banquet, the chief organizer of the meeting, Jack Kohler, hustled up guitars, amps and a drum set, and a handful of string-itchy glaciologists took the stage. The combo delivered a few stringy three-cord tunes á la garage-rock, the crowd went dancing, and soon the stage was an osmosis of artists and audience. By midnight, when the reporter left the scene, the band was mostly composed of the original audience, now turned artists. One highlight of the polar concertos was when Geerke took the floor and performed two of her own fine-tuned ballads on the electric organ.

Figure 1 The group photo

Praise should be given to the organizing committee, not only for an excellent meeting but for the bountiful amounts of pizza and fully adequate volumes of beer for dinner on the first day, and also kettle after steamin kettle of the local speciality Baccalao, and bag-in-box fluids as provisions for the day after. The sight of a snow-covered Tromsø lighted the hearts of all arriving glaciologists, especially the 'southlings' who had not yet seen any of the white crystals this season. It was reported that several glaciologists were seen on the recently laid ski tracks,

happily steaming along the parallel grooves at odd hours. Some glaciologists who had forgotten to bring their devices of snow locomotion were heard to give deep sighs of disappointment, and this reporter even saw the sunlight glimmer in a tear on the chin of an Oslo-based glaciologist as the sun broke through the clouds, and the slopes of the local mountains invited pre-season telemarking. The organizing committee has told this reporter that they will issue warnings next time that skiers should bring ski wax with less friction factor, or provide skis with a better thermal diffusivity index. One of the hostels used by the participants went on fire one night, with a dramatic and heroic rescue staged by the local fire brigade. This reporter's personal explanation of the drama has a pair of overheated skis as the potential trigger of a cascade-like chain of events!

The next meeting will take place in Uppsala. See you all there!

Veijo Pohjola

IGS WESTERN ALPINE BRANCH ANNUAL MEETING

10 November 2006

Members present: Gilbert Babanian, Freddy Balestro, Gérard Bocquet, Françoise and J. Loup Boisset, François Bonnardot, Philippe Bouvet, Yann Breuil, Benoît Chanas, Bernard et Yolande Chanas, José-Antonio Cuchi, Romain Delunel, Emilie Devienne, Camille Garo, Bernard Guillot, Sophie Labonne, Bernard Lefauconnier, François Legagneux, Philippe Leopold, Magnús Már Magnússon, René Mansey, Françoise Manson, Alain Marnezy, J. Pierre and Véronique Moreau, Philippe Mouy, Charles Obled, Yves Peysson, Maryse Poireau, Georges Sogno, Claire Spaïni, Anne and François Valla.

Apologies: J. Pierre and Nicole Courtin, Paul and Margot Decker, J. Pierre and M. Claude Feuvrier, Françoise Gady-Larrose, Sylvain Jobard, Brigitte and Claude Kaiser, Giovanni and Maja Kappenberger, André Sangay, Kurt and Geneviève Seiler, André Thomas.

We had the great pleasure this year of welcoming our Secretary General from Cambridge; Magnús Már Magnússon arrived especially for this meeting. He presented a talk concerning the editorial activity of Journal of Glaciology and with graphs showed us how the time limit for publication has been reduced. The Internet access was also presented (www.igsoc.org and email address igsoc@igsoc.org)

IGS-SAO activity report: After the great field tour in Kamchatka last year, our 2006 meeting was held in the Spanish Pyrenees (Aragón region), organized by President José A. Cuchi helped by Luis Cancer. Gérard Bocquet showed us a diaporama relating to the Kamchatka trip, which is a nice complement to the video created by François Valla, who told us that Dr Yaroslav Muraviev (our glaciologist and volcanologist partner of Petropavlovsk-Kamchatka) will join us in Grenoble and the surrounding region for 3 weeks in December.

Financial report: Our Treasurer, François Valla, gave us the balance of the SAO count, which after the last meeting in Spain amounted to 2387.62€. A sum of around 800€ will be used for Dr Muraviev's stay in Paris, Grenoble, Chamonix, Annecy, Chambéry and Aix en Provence.

Future meetings: In 2007, from 29 August to 2 September, the meeting will be organized by Giovanni Kappenberger (from MeteoSvizzera, Locarno-Monti) and colleagues in the Basodino region.

In 2008 a field trip in Iceland and East Greenland is planned, to be managed by two young former students, Claire Spaïni and François Bonnardot. Both spent one academic year in Reykjavik in 2002 and have spend some time studying in Angmasalik on the east coast of Greenland.

Other possible projects for future meetings include Glaciers in Armenia or the Baltoro mountains.

Elections to the steering committee:

President :	Giovanni Kappenberger
Vice-Presidents:	François Bonnardot and Claire Spaïni
Treasurer:	François Valla
Secretary:	Gérard Bocquet

Secretary: Gérard Bocquet
English version: François Valla

Notes from the production team

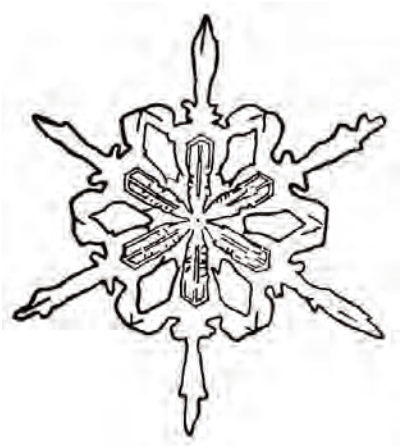
References
At the IGS office, we check all the references in the reference lists you submit to us very thoroughly before publishing them in the *Journal* and *Annals*. This can be quite a time-consuming task, even though our extensive database has almost 100 000 entries! It would be very helpful to us if you could:

- remember that the point of the reference list is to make it easy for your readers to access the source
- please be as accurate as possible when citing authors and year of publication
- ensure all references cited in the text are included in the list and *vice versa*
- cite papers presented at conferences as book chapters in the conference proceedings, citing title of book, chapter (paper) title and page numbers
- not include posters and abstracts in reference lists
- please include name of publisher, city of publication and any editors in books/ conference proceedings/book chapters (remembering that the venue of the conference is not necessarily the place of publication)
- if the reference is fairly obscure, e.g. in a language other than English and not in a well-recognized journal, or perhaps a government or commercial report, please supply as much information as possible, so that it can be verified and entered in our database
- give us the transliterated Russian title in Russian references as well as the English translation
- remember that no personal communications, web page addresses (URL) or unpublished papers should be cited in the reference list; these can be included in the text if necessary.

Illustrations
Thank you all for submitting your figures labelled clearly in Arial, Optima or similar sans serifs. We think this has improved the appearance of the publications a great deal.

INTERNATIONAL GLACIOLOGICAL SOCIETY

INTERNATIONAL SYMPOSIUM ON DYNAMICS IN GLACIOLOGY



Limerick, Ireland
17–22 August 2008

CO-SPONSORED BY:

University of Limerick
MACSI (Mathematics Applications Consortium for Science and Industry)

FIRST CIRCULAR

March 2007

Registered Charity

The International Glaciological Society will hold an International Symposium on Dynamics in Glaciology in 2008. The symposium will be held in Limerick, Ireland, from 17–22 August.

THEME

Mathematical and computational modelling have formed an integral part of the development of glaciology since its development as a quantitative science. Early examples of this are the development of the theory of kinematic (surface) waves on glaciers, the theory of glacier sliding over hard beds, and the theory of subglacial drainage. As the theory of such phenomena develops, new observations and insights motivate the construction of new and better theoretical models. Recent examples include the dynamics of ice motion over subglacial till, the formation of subglacial landforms, and the ice dynamic behaviour which causes Heinrich events.

This conference will focus on the interplay between novel glaciological observations, and the models which are necessary to explain such observations. It will focus on the study of phenomena in glaciology which are dynamic in nature, involving variation in time and/or space. The purpose of the meeting is to bring together field scientists and experimentalists who have intriguing observations to report with theoreticians and modellers who have been studying such phenomena. A particular encouragement will be to enable a workshop atmosphere in which open problems and observations will be discussed.

TOPICS

The suggested topics include:

1. Surging glaciers. Are the different types of surging glacier (Variegated/Trapridge type) amenable to a unified theoretical description? Can theories predict surging behaviour quantitatively?
2. Ice streams. Are ice streams due to thermal runaway? Hydraulic runaway? Are they topographically controlled?
3. Jökulhlaups. Is the Nye theory satisfactory? When can we expect sheet floods of the 1996 Grímsvötn type to occur?
4. Ice sheets and climate change. Can the Milankovitch mechanism cause the initiation of ice ages? Can climate change cause marine ice sheet collapse? Is the current behaviour of the Greenland Ice Sheet climatically controlled?
5. Glacial geomorphology. How are drumlins and eskers formed? What causes mega-scale glacial lineations?
6. Subglacial hydrology. Are the Röthlisberger/linked cavity/canal theories of drainage satisfactory? What sort of theory is appropriate under an ice sheet?
7. Extraterrestrial ice. How can we explain the troughs on the Martian ice caps, or the wrinkled crust of Europa?
8. Paleoglaciology. Do we understand Heinrich events? What caused Dansgaard-Oeschger events? Can we explain Snowball Earth?

SESSIONS

Oral and poster presentations will be held on four and a half days. There will be ample opportunity for poster displays.

PUBLICATION

Selected papers from the symposium will be published by the Society in the Annals of Glaciology. All papers (including those based on posters) will be refereed and edited according to the Society's regular standards before being accepted for publication.

VENUE

The meeting will be held at the University of Limerick in the west of Ireland. Easy access to the University is via Shannon Airport, and the surroundings offer plenty of scope for glaciological, geological and geographical excursions (drumlins, limestone pavement, caves, hill forts, alpine flora).

ACCOMMODATION

Details will be given in the Second Circular.

FURTHER INFORMATION

If you wish to attend the symposium please return the attached form as soon as possible. The Second Circular will give further information about accommodation, the general programme, and preparation of abstracts and final papers. Copies of the Second Circular will be sent to those who return the attached reply form. Members of the International Glaciological Society will automatically receive one.

SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)

SCIENCE STEERING AND EDITORIAL COMMITTEE

Andrew Fowler (Chief Scientific Editor), Chris Clark, Garry Clarke, Richard Hindmarsh, Tavi Murray, Felix Ng, Christian Schoof.

LOCAL ARRANGEMENTS COMMITTEE

Andrew Fowler (Chairman), Stephen O'Brien, Alan Hegarty, Peg Hanrahan, Jenny Wright.

INTERNATIONAL GLACIOLOGICAL SOCIETY
INTERNATIONAL SYMPOSIUM ON DYNAMICS IN GLACIOLOGY
Limerick, Ireland, 17–22 August 2008

Family Name: _____

First Name(s): _____

Address: _____

_____

_____

_____

Tel: _____ Fax: _____

E-mail: _____

I hope to participate in the Symposium in August 2008 ☐

I expect to submit an abstract ☐

My abstract will be most closely related to the following topic(s):

_____

_____

_____

I am interested in an accompanying person's programme ☐

I am interested in an extended post/pre-symposium tour ☐

PLEASE RETURN AS SOON AS POSSIBLE TO:
Secretary General, International Glaciological Society,
Scott Polar Research Institute, Lensfield Road, Cambridge, CB2 1ER, UK
Local: Tel: 01223 355 974 Fax: 01223 354 931
Internat.: Tel: +44 1223 355 974 Fax: +44 1223 354 931
E-mail: igsoc@igsoc.org Web: http://www.igsoc.org

News

Garry K.C. Clarke's retirement symposium University of British Columbia, Canada

On 8 December 2006 a small group of glaciologists descended upon Vancouver, Canada, to celebrate the 65th birthday of Garry K.C. Clarke. After serving for many years on the faculty of the University of British Columbia, Garry entered 'mandatory retirement' at the end of 2006. Among his many scientific distinctions, Garry is a past president of the International Glaciological Society and the only recipient of both the Society's Richardson Medal and the Seligman Crystal. He is also a past president and Tuzo Wilson Medallist of the Canadian Geophysical Union, as well as a Fellow of the Royal Society of Canada and of the American Geophysical Union. Garry has made fundamental contributions to quantitative glaciology in areas ranging from glacier outburst floods, glacier surging, basal mechanics, ice-sheet modelling, subglacial instrumentation and the interaction of the cryosphere with the global oceans and atmosphere. To those of us who know him and have worked with him, Garry is much more than these accolades convey. As articulated by some of the symposium participants, Garry is a remarkable mentor, having the patience to afford his students freedom in their research and the wisdom to know when to offer his advice. Many of us have benefited from Garry's mentorship and insight, whether it be in the form of his generously distributed ideas, a weekend of his work that spawns thousand of lines of Fortran, a paper from three decades past that we still reread, or a kindly posed question at the Northwest Glaciology meeting.

To honour Garry on the occasion of his retirement, a one-day symposium was convened at the University of British Columbia. Styled after the long-standing Northwest Glaciology meetings that Garry was instrumental in initiating, this symposium was informal – free of abstracts and registration fees and self-catered by a buzzing posse of Garry's research group. The celebration began Thursday evening, with a reception and ice-breaker given by the UBC Department of Earth and Ocean Sciences. This brought together long-time UBC colleagues of Garry's and many of the symposium participants.

The symposium programme, which filled the day Friday, comprised 17 invited speakers coming from Iceland, Switzerland, the UK and all over North America. In attendance at the symposium were over 70 participants and many past students, postdocs and Trapridge Glacier field assistants of Garry's, including Erik Blake, Urs Fischer, Ed Waddington, Dan Stone, Tavi Murray, Shawn Marshall, Jeff Kavanaugh, Dave Hildes, Jeff Schmok, Barry Narod, Guy Cross, Marc Gerin, Fern Webb and Sean Fleming, as well as members of his current research group. Also in attendance was Stan Paterson, who still travels from his home

Figure 1 Garry Clarke in his usual good spirits

Figure 2 Symposium speakers with Garry Clarke (left to right): Julian Dowdeswell, Kurt Cuffey, Christian Schoof, Bob Anderson, Bob Bindschadler, Helgi Bjornsson, Neal Iverson, Will Harrison, Urs Fischer, Garry Clarke, Andrew Fowler, Andrew Weaver, Shawn Marshall, Martin Truffer, Charlie Raymond, Ed Waddington, Robin Bell, Richard Alley

on Quadra Island to attend such events. This event gave new graduate students from several northwest universities the opportunity to meet some of the people who have authored the books and papers they have recently read.

Represented among the symposium speakers were several of Garry's former students, some long-time members of the Northwest Glaciology community, several researchers from the latest generation of glaciologists, those with whom Garry has recently collaborated and other friends and long-time colleagues. The talks covered subjects ranging from the marine geophysical record of past ice sheets (Julian Dowdeswell) to the Southern Ocean influence on North Atlantic overturning (Andrew Weaver). Several personal and retrospective tributes were given, embodied by Ed Waddington's talk entitled 'The GKCC glacier sandwich: a savory filling of hot and cold flowing ice, served on an intricate web of basal processes moistened to perfection, and topped with a hearty layer of climate boundary conditions and a garnish of windpumping'.

Figure 3 Ed Waddington presenting his GKCC glacier sandwich talk

Alongside these tributes were presentations of current research addressing glacier surging (Helgi Bjornsson and Andrew Fowler), propagation of subglacial water pulses (Charlie Raymond), slip weakening of basal sediments (Neal Iverson), ice-sheet modelling (Shawn Marshall), simple formulations of mass balance, response times and glacier terminus dynamics (Will Harrison), subglacial instrumentation and basal mechanics (Martin Truffer and Urs Fischer), ice rheology (Kurt Cuffey), the relationship between subglacial lakes and ice-stream onset (Robin Bell), grounding line stability (Richard Alley), marine ice-sheet dynamics (Christian Schoof), glaciers and landscape evolution (Bob Anderson) and dynamic sub-ice-stream hydrology (Bob Bindschadler). Many speakers paid tribute not only to Garry but to the legacy of his students and their contributions to glaciology. Threaded throughout the scientific presentations was an articulated appreciation of Garry's scientific elegance, creativity, originality, and breadth of influence in our community.

Figure 4 Several generations of glaciologists were in attendance. Here from left to right: Brian Menounos, Hester Jiskoot, Tavi Murray, Barry Narod, Stan Paterson

Figure 5 An engaged audience

The celebration continued into the evening with a banquet held at St John's College on the UBC campus. In addition to most of the symposium attenders, a number of new guests arrived, including Garry's family and several members of the UBC Department of Earth and Ocean Sciences, one of whom – Bob Ellis – related the story of Garry's hiring at UBC. Guests enjoyed a clarinet duo and slide show during a cocktail hour before Tim Creyts opened the

banquet by reading a statement from Magnús Már Magnússon, the IGS Secretary General, acknowledging Garry's important and long-standing contributions to the IGS. Shortly thereafter, the banquet took an unexpected turn as Richard Alley borrowed a guitar and performed a ballad of Garry Clarke's CV (see lyrics reprinted below) which he composed in the Chicago airport. He was accompanied by Tim Creyts on banjo. This unchoreographed moment was one of the great highlights of the evening.

Figure 6 Richard Alley on guitar and Tim Creyts on banjo at the banquet

Garry Clarke
(to the tune of 'Casey Jones', and on the occasion of Garry's 65th birthday celebration, University of British Columbia, 8 December 2006), composed by R.B. Alley and performed by R.B Alley on guitar and T.T. Creyts on banjo

Listen, all you people, if you have the urge,
To this tale of epic quest to watch a glacier surge,
Trapridge Glacier is the one to see,
And the only one to capture it? G.K.C.C.
He started out to study it in '69,
Sam Collins ran the survey and it looked just fine,
Bob Metcalfe got some radar there in '72,
With Garry set to learn just what that ice would do.

Chorus
Garry Clarke, with his eyes wide open,
Bless his soul, all set if it should go,
Garry Clarke, the world is really hopin'
That you'll get to watch it surge and see a high-speed show.

As long as he was waiting for the surge to start,
Saved the Arctic Institute before it fell apart,
He did it so completely, people said 'We guess,
You'd better go to Cambridge, help the IGS.'
No surge into the 80s, he was waiting still,
When at the drill-hole bottom he discovered till,
Best students on the planet then proclaimed 'Oh, crud,
We came to study ice and now we're stuck in mud.'

Chorus
Garry Clarke, kept his tireless vigil,
Instruments logging through the year,
Garry Clarke, the only individ'al,
To watch and never blink as the great surge drew near.

While Tavi Murray figured out the till below,
Shawn Marshall set to programming the ice sheet flow,
And Erik Blake responded when the boss said 'Please,
Hot-water drill the glacier 'til it's like Swiss cheese.'
The Tuzo Wilson Medal of the CGU,
Their president and guided them in pathways new,
And showed the AGU that it would not suffice
To turn their backs on permafrost and snow and ice.

Chorus
Garry Clarke, the Richardson Medal,
Glaciology Society,
And of course their Seligman Crystal,
And in Canada a fellow Royal Society.

Wind pumping, thermal surging, and some borehole T,
Drag spools and stiff ploughmeters go where we can't see,
While following the layers in the ice flow field,
And tracking the meltwaters when the ice dams yield.
Jeff Kavanaugh, Dave Hildes, on to Christian Schoof,
Gwenn Flowers and Tim Creyts and more are living proof,
While most of us are stumbling out there in the dark,
The sun is always shining around Garry Clarke.

Chorus
Garry Clarke, elegance in action,
Picks the right one when two paths diverge,
Garry Clarke, what would be your reaction
After 37 years if it should start to surge?

During dinner, several tributes were read and stories related by some of the many Trapridgites in attendance. After dinner, guests cut into a large-

format cake rendered in the shape of Trapridge Glacier. The cake included a dirty basal (chocolate) layer, the distinctive medial (cookie-crumb) moraine, geophysically correct crevasse patterns and ice falls, and an edible figurine representing Garry while hot-water drilling.

Figure 7 Garry and the Trapridge Glacier layer cake

After dessert, Garry was presented with a 30×24" oil-on-canvas commissioning of the Trapridge Glacier camp and surroundings. This gift was given to him on behalf of many of his students and colleagues and was created by a local artist.

To cap off the evening, a reel-to-reel film that Garry and others had made several decades ago was dusted off and screened. The film, entitled *Glacier!*, documents an expedition to surge-type Rusty Glacier in the St Elias Mountains. Round-the-clock hot-point drilling was carried out to test the thermal regulation hypothesis of glacier surging. A young Garry Clarke and his companions travel to this remote area of the Yukon and show us what glaciology was like before many of the modern comforts were introduced. The suggestion in the film that basal thermal transitions may provide a 'simple' explanation of glacier surging garnered an audible chuckle from the audience.

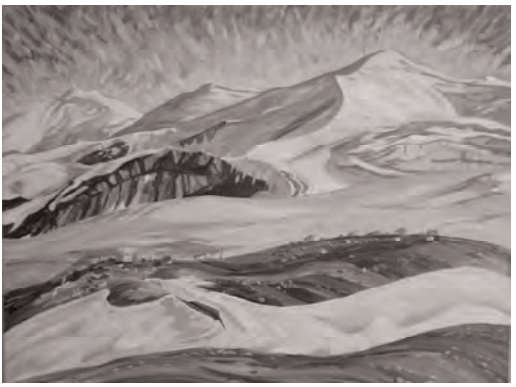


Figure 8 Oil on canvas painting of Trapridge Glacier Camp by local artist Tanya Behrisch

The celebration continued Saturday morning at the Clarke–Cruikshank residence where a champagne breakfast was hosted. Many of us once again enjoyed Garry and Julie's famous hospitality. All in attendance at these events agreed that it was a pleasure to celebrate someone who has made both important scientific- and generous personal contributions to our community. We all look forward to many more years of Garry's glaciological insight and friendship.

Gwenn Flowers & Tim Creyts

Books received

William F. Althoff. 2005. *Drift Station – Arctic Outposts of Superpower Science*, Potomac Books, Inc. Washington DC. 320 pp. 25 photographs; 1 map; 7 tables (ISBN-10: 1-57488-771-8, ISBN-13: 978-1-57488-771-6, (hardback), US$ 39.95.)

B. R. Mavlyudov. 2006. *Internal Drainage Systems of Glaciers*, Moscow: Institute of Geography, Russian Academy of Sciences. 396 pp. + xxxii. 218 illustrations, 37 tables. 480 bibli. (ISBN 5-89658-030-4, softcover) (in Russian).

Glaciological diary

** IGS sponsored * IGS co-sponsored

2007

15–16 January

Periglacial and paraglacial processes and environments, past, present and future
Geological Society, London, UK
Joint meeting between the Geological Society of London and the Quaternary Research Association
Organizers: Dr Jasper Knight (j.knight@exeter.ac.uk) and Dr Stephan Harrison (Stephan.Harrison@exeter.ac.uk), University of Exeter, UK
See: http://www.geolsoc.org.uk/template.cfm?name=Periglacial_and_Paraglacial

15–17 January

Workshop on the dynamics and mass budget of Arctic glaciers
GLACIODYN (IPY) meeting
IASC Working group on Arctic Glaciology, Pontresina, Switzerland
Convenors: J. Oerlemans (IMAU, Utrecht University; (j.oerlemans@phys.uu.nl) and C.H. Reijmer (IMAU, Utrecht University; c.reijmer@phys.uu.nl)
See: http://www.phys.uu.nl/%7Ewwwimau/research/ice_climate/iasc_wag/activities.html

12–16 February

3rd WGNE Workshop on Systematic Errors in Climate and NWP Models
San Francisco, USA
See: http://www-pcmdi.llnl.gov/wgne2007/

1–2 March

11th Alpine Glaciology Meeting
VAW, ETH Zürich
Zürich, Switzerland
Contact Martin Lüthi at luethi@vaw.ethz.ch

19–26 March

Karst and Cryokarst
25th Speleological School
8th GLACKIPR Symposium
Sosnwiec-Wroclaw, Poland
Contact: Andrzej Tyc at atyc@us.edu.pl or andrzejtyc@wp.pl

15–20 April

European Geosciences Union General Assembly 2007
Vienna, Austria
See: http://meetings.copernicus.org/egu2007/

2–5 May

37th Annual Arctic Workshop
Skaftafell National Park, Iceland
See http://www.earthice.hi.is/page/arctic

21–22 May

Workshop on 'Advanced concept for radar sounder'
Cambridge, UK
Contact: David Blake, British Antarctic Survey (d.blake@bas.ac.uk)
See: http://www.antarctica.ac.uk/Meetings/2007/ACRAS2007/

28 May–1 June

Glacier and ice sheets – processes and modelling
St John's, Newfoundland, Canada
Joint CMOS-CGU-AMS Conference
Conveners: Gwenn Flowers, Simon Fraser University, gflowers@sfu.ca; Sara Boon, University of British Columbia; boon@unbc.ca
See http://www.cmos2007.ca/en/index.htm

4–5 June

Conference on global climate change and sustainability
Tromsø, Norway
See http://www.wed.npolar.no/

15 June

UK Polar Network event
British AntarcticSurvey, Cambridge, UK
Contact: Liz Thomas; e-mail: LITH@bas.ac.uk

17–20 June

Cryogenic resources of polar regions
Salekhard City, Polar Cycle, West Siberia
Vladimir P. Melnikov Academician, Scientific Council on Earth Cryology, Russian Academy of Sciences; Yu. V. Neyolov Governor, Yamal-Nenets Autonomous District; Jerry Brown, President, International Permafrost Association
See: http://www.ikz.ru/permafrost/

27–29 June

ICESat-II Science Workshop
Washington, D.C. Area
Contact: Seelye Martin; office: +1 202-358-0746; cell: +1 206-708-9472; email: seelye.martin-1@nasa.gov

2–13 July

***Union Commission for the Cryospheric Sciences (UCCS) symposium**
24th General Assembly of the International Union of Geodesy and Geophysics, titled Earth Our Changing Planet.
Perugia, Italy.
See http://www.iugg2007perugia.it/

17–19 July
DESDynI Science Workshop
Location to be announced
Contact: Diane Wickland; email: Diane.E.Wickland@nasa.gov
or John LaBrecque; email: John.LaBrecque@nasa.gov

26 July–10 August
Field Course on Remote Sensing for Ecosystem Assessment
Kola Peninsula, Russian Arctic
contact: Gareth Rees,Scott Polar Research Institute, University of Cambridge, e-mail: wgr2@cam.ac.uk
or
Olga Tutubalina, Moscow State University, e-mail: olgatut@mail.ru

28 July–3 August
XVII INQUA Congress 2007
Cairns Convention Centre, Cairns, Australia
See http://www.inqua2007.net.au/

2–5 August
Geodiversity of Polar Landforms
IAG/AIG Regional Conference on Geomorphology
Longyearbyen, Spitsbergen, August 2-5,
Contact: Agata Buchwal, Institute of Paleogeography and Geoecology, Adam Mickiewicz University at kamzik@amu.edu.pl

15–16 August
IODP Topical Symposium: North Atlantic and Arctic Climate Variability
Bremen, Germany
See http://www.iodp.org/topical-symposium

27–31 August
Workshop: Glaciers in watershed and global hydrology
Obergurgl, Austria
Sponsored by International Commission on Snow and Ice Hydrology (ICSIH) and Commission for the Cryospheric Sciences (CCS) Contact: Regine Hock (regine.hock@natgeo.su.se); Tomas Johannesson, Reykjavik (tj@vedur.is); Gwenn Flowers, Vancouver (gflowers@sfu.ca); Georg Kaser, Innsbruck (Georg.Kaser@uibk.ac.at)
See http://www.ees.su.se/Obergurgl2007

29–31 August
Polar Dynamics: Monitoring, Understanding, and Prediction
Open science conference
Geophysical Institute, University of Bergen. Allegt 70, N-5007 Bergen, Norway
See: http://www.gfi.uib.no/conference2007/info.htm
E–mail: conference2007@gfi.uib.no

3–7 September
****International Symposium on Snow Science, Moscow, Russia**
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK
Web: http://www.igsoc.org/symposia

5–8 September
International Forum for Research into Ice Shelf Processes (FRISP)combined with the West Antarctic Ice Sheet (WAIS) Initiative
Algonkian Regional Park in Sterling, Virginia, USA
Contact: Adrian Jenkins (a.jenkins@bas.ac.uk)

11–14 September
The Annual Remote Sensing and Photogrammetry Society Conference
Special session under the context of Remote Sensing and Photogrammetry in Polar Regions
School of Civil Engineering and Geosciences, Newcastle University
See http://www.ceg.ncl.ac.uk/rspsoc2007/

11–22 September
Ice sheets and glaciers in the climate system
Karthaus, Italy
This summer course is meant for Ph.D. students who work on a glaciology-related climate project.
See:
http://www.phys.uu.nl/~wwwimau/education/summer_school/

12–13 September
***IGS British Branch meeting**
University of Edinburgh, Edinburgh, UK
See
http://www.geos.ed.ac.uk/research/eeo/events/igsbbm07
Contact: Steven Palmer, Mal KcMillan and Kate Briggs; igsbbm@staffmail.ac.uk

15 September
SEDIBUD Second workshop
Working Group on Sediment Budgets in Cold Environments
Abisko, Sweden
See http://www.geomorph.org/wg/wgsb.html
Contact: Achim Beylich (achim.beylich@NGU.NO) or
Scott Lamoureux (lamoureu@post.queensu.ca)

22–26 October
2nd Asia CliC Symposium
CAREERI, Chinese Academy of Sciences, Lanzhou, China
See http://www.casnw.net/clic/Asia_clic.html

25–27 October
***IGS Nordic Branch meeting**
Department of Earth Sciences, Uppsala University, Sweden
Contact: Rickard Pettersson; rickard.pettersson@geo.uu.se
See http://www.geo.uu.se/glaciology/NIGS/

26–27 October
Northwest Glaciologists (NwG) meeting,
Portland, Oregon, USA
See
http://www.glaciers.pdx.edu/NwG/default.html

2008

7–9 January
International Workshop on Snow, Ice, Glacier and Avalanches
Mumbai, India
See
http://www.csre.iitb.ac.in/csreworkshop/index.html
Contact: Dr. G.VENKATRAMAN; e-mail: gv@iitb.ac.in

28 January–17 February
Workshop on the dynamics and mass budget of Arctic glaciers
GLACIODYN (IPY) meeting
Obergurgl, Austria
Convenors:
J. Oerlemans (IMAU, Utrecht University)
email: j.oerlemans@phys.uu.nl
C.H. Reijmer (IMAU, Utrecht University)
email: c.reijmer@phys.uu.nl
See:
http://www.phys.uu.nl/~wwwimau/research/ice_climate/iasc_wag/activities.html

10–13 March
International Symposium on Mitigative Measures against Snow Avalanches
Egilsstadir, Iceland
See:
http://www.orion.is/snow2008/organizer.html

26–28 March
Workshop on mass balance measurements and modelling
Skeikampen, Norway.
Convenor: Glacier section at Norwegian Water Resources and Energy Directorate (NVE).
See http://www.nve.no/mbworkshop

26–30 May
Interpraevent 2008 – 11th International Symposium
Dornbirn Exibition Centre, Dornbirn, Austria
See: http://www.interpraevent2008.at/

9–13 June
****International Symposium on Radioglaciology and its Applications, Madrid, Spain**
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK
See: http://www.igsoc.org/symposia

29 June–3 July
9th International Conference on Permafrost
Celebrating the 25th Anniversary of the formation of the International Permafrost Association
University of Alaska Fairbanks, Fairbanks, AK, USA
See: http://www.nicop.orgn

8–11 July
SCAR/IASC 2008 Open Science Conference
St Petersburg, Russia
See:
http://www.ipy.org/index.php?/ipy/detail/scar_open_science_conference

17–22 August
****International Symposium on Dynamics in Glaciology**
Limerick, Ireland
Contact: Secretary General, International Glaciological Society,
See
http://www.igsoc.org/symposia/2008/ireland/

August/September
Workshop on World Glacier Inventory
Cold & Arid Regions Environmental & Engineering Research Institute
Lanzhou, China
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