

### NEWS BULLETIN OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY



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## News Bulletin of the **International Glaciological Society**

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Cover picture: Needle Hoar, Flagstaff Mountain, Colorado. Photo W.T. Pfeffer.

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Number 137/138

# From the Editor

### Dear IGS member

We are now nearing the completion of our second volume of the *Journal* using our new production procedures. The last issue of 2005 will be posted to you near the end of February 2006. The first issue of volume 52 is in production and should be posted near the end of March and subsequent issues should follow in June, September and December. That will bring us up to schedule for the *Journal*.

We still have some catching up to do on the *Annals* but we are planning to post *Annals* 44 near the New Year. That would bring us up to schedule for *Annals* as well.

In the first few publications after we switched to our new production procedures, we had some teething problems that have now been resolved. The quality of some figures in earlier publications was not satisfactory. We have now rectified this but it is imperative that you as authors follow our instructions as to how to prepare your manuscripts and in particular the submitted figures. Figures must be generated using a proper design platform and at the correct resolution, 600 dpi for line drawings and 400 dpi for raster figures. If possible, send us the line drawings in a vector format.

ICE is still behind but as you will notice, we have also changed the appearance and format of it. We have also introduced new columns such as the one you are reading right now. The reports from the symposia have been well received, I hope they give an insight into the 'other side' of our symposia and reflect how important the personal contacts made are. But ICE depends on material submitted by you, our members, so please send in more material, e.g. news and reports of other meetings of interest to glaciologists, both past and future ones. Reports from the field are always interesting to read, especially for those of us who do not go into the field very much any more. If you think something is interesting, the chances are that several of our members will think so as well. The more material we receive, the more incentive there is to keep ICE coming on a regular basis.

Finally, let me say now, when we are beginning to see the fruits of our efforts in reorganization, how interesting it has been. I would like to thank you for your patience and I hope that you will find it all worthwhile. We will certainly keep working on improvements on other aspects of the International Glaciological Society. And I would like to thank all the staff here at the IGS office for their effort and good spirits in what has been quite a difficult couple of years.

Magnús Már Magnússson Secretary General



### **Chile** Glaciological research in Chile and Antarctica by Chileans or foreigners in collaboration with Chileans

(For abbreviations used see page 13)

By national correspondents, Gino Casassa and Andrés Rivera

#### NATIONAL PROJECTS

#### Updating glacier inventory of Chile (GLIMS)

(F. Bown, C. Acuña G. Casassa CECS; A. Rivera CECS and UCH; P. Zenteno, UCH)

This project aims to complete and update the glacier inventory of Chilean glaciers. In Chile, 1751 glaciers have been inventoried by 2004 with an estimated total area of 15260 km<sup>2</sup> of ice. An estimated non inventoried area of about 5300 km<sup>2</sup> of ice remains, which is mainly located in Patagonia. This project is part of the Global Land Ice measurements from space (GLIMS) initiative, which is providing satellite images free of charge for mapping the Chilean glaciers. With this updated data set, the glacier inventory is being completed as well as measuring frontal and areal variations of glaciers all around the country.

#### Avalanche risks and protections manual

(Cedomir Marangunic and Paula Marangunic, GEO)

As part of Chile Highway Manuals, a manual on Avalanche Risks and Protections has been issued by the Ministry of Public Works. The manual, is an up to date compilations of snow physical characteristics, snow measurements techniques and instruments, snow stability, avalanche descriptions and mechanics, protection alternatives, risk analysis, rescue techniques, and roads and safety signals, and is available in digital format.

#### NORTHERN CHILE (18-31°S)

#### Paleoclimate from ice coring at Cerro Tapado

(M. Schwikowski, PSI and co-workers; P. Ginot, UB, presently at IRD; A. Rivera, CECS and UCH) Glaciochemical analysis is a key topic for reconstructing climate variability in the Andes. At Glaciar Cerro Tapado (30°08'S), a 36 m ice core was drilled to bedrock in 1999 and analysed for concentrations of major ionic species (Na<sup>+</sup>, K<sup>+</sup>, NH<sub>4</sub><sup>+</sup>, Ca<sup>+</sup>, Mg<sup>2+</sup>, NO<sub>3</sub>, Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>) and for stable isotope composition. Results from the analysis reveal the strong influence of post-depositional processes i.e., sublimation of water and

dry deposition on the chemical composition of the exposed snow surface. <sup>210</sup>Pb dating revealed that the ice core covers a period of about one century. Minimum values of <sup>210</sup>Pb initial activity and dH were identified as a signal of El Niño events.

#### Glacier hydrology in arid regions

#### (J. Milana, CEAZA)

Hydrological and glaciological studies are being undertaken in the basin of Río Elqui as part of water resource studies. As part of this research ice thicknesses have been measured at Cerro Tapado by means of a radar system.

#### Snow measurements

#### (Reported by C. Marangunic, GEO)

Dirección General de Aguas of the Ministry of Public Works continues manual measurements using Monte Rosa snow samplers, of existing snow routes in the mountains of the Andes of central Chile. In addition to it, and under a program to upgrade its network of meteorological stations, new snow pillows are being installed in stations located in the high mountains. Private companies operating in the high mountains operate a network of meteorological stations and various systems to measure snow fall. Among these are power utilities, mining companies (at El Teniente, El Bronce, Andina, Pelambres, previously at El Indio), and mining projects (Pascua Lama and El Morro).

## Avalanche studies, construction of protections and avalanche courses

#### (Reported by C. Marangunic, GEO)

Avalanche studies and construction of protections (mainly avalanche sheds) are being carried out by the Ministry of Public Works in the highway connecting Los Andes (Chile) and Mendoza (Argentina). Avalanches studies continue at several mining companies operating in the high Andes (El Teniente, El Bronce, Andina, Pelambres) to either protect existing roads or mine infrastructures, or to protect future expansions. Among installed protections are avalanche fences, nets, sheds, mounds, Gazex, Catex and Avalauncher guns; all of the mines operate systems for road controls on what is termed Winter Operation. Avalanche studies are also being performed at new mining projects. Recreational ski centers, like Portillo and Valle Nevado, perform on regular basis snow stability evaluations and, if considered necessary, artificial release of avalanches by manual emplacement of explosives. The ski instructors at these centers, must approve courses offered by the National School of Ski and Snowboard Instructors, dealing with measuring snow characteristics, snow stability assessments, and avalanche protections. Avalanche courses have also been performed in the last few years by several institutions in Chile aimed at professionals, technicians, military personnel, outdoor people and general public.

### Glaciological studies applied to mining operations

#### (Reported by C. Marangunic, GEO)

Several of the mining operations in the high mountains of central Chile, occur near existing glaciers and rock glaciers. Because of it, and to operate safely, these mining companies have had to perform extensive and detailed studies on glaciers and rock glaciers. Presently about 140 boreholes have been drilled, mainly on rock glaciers, some of them with ice thickness of over 100 m. The boreholes have been used to assess glacier stratigraphy, ice and debris thickness, bottom moraine thickness, basal sliding measuring bore-hole inclination, and temperature gradients. Temparture gradients have also been recorded on pits excavated in the surface debris layer of rock glaciers, and instrumented with temperature sensors. No fewer than 10 glaciers have a network of stakes to measure surface velocities, either manually during summer times, or by a robotic surveyor that continuously controls locations of prisms. Measurement nets to asses stresses on the surface of the glaciers have been installed in seven glaciers and rock glaciers, to determine variations of surface stresses during summer time. Ice thicknesses have been estimated employing gravity techniques, along traverses in no fewer than 13 glaciers, and radar techniques in no fewer than 14 glaciers. Combined (ice, heat, and water) or single balances have been performed in at least 14 glaciers and rock glaciers, including the bottom interface between ice and rock or till. Analysis of overall glacier mechanical stability (to prevent catastrophic sliding) has been performed in nine glaciers, considering various values of seismic accelerations and of pore pressure, and various conditions of material at the base of glaciers (from rock to cohesionless till). A computer program to predict changes of glacier behavior on intervened glaciers has been developed and successfully tested and upgraded on controlled glaciers.

#### CENTRAL CHILE (31-37°S)

#### Ice coring at Glaciar Esmeralda, Cerro El Plomo and Glaciar Mercedario

(D. Bolius, M. Schwikowski, B. Rufibach, T. Jenk, H. Gäggeler, PSI and UB; G. Casassa, CECS) A suitable site for paleoclimate studies from an ice core has been investigated in 2003-2005 in the central Andes of Chile and Argentina. Snow samples and a shallow firn core of 5.5 m were collected in 2003 at the upper flat part of Glaciar Esmeralda (33°14'S, 5300 m a.s.l.), Chilean central Andes. At a depth of 2.5 m superimposed ice was encountered. Analyses of concentration of major ions show that Glaciar Esmeralda is strongly influenced by formation and refreezing of melt water. Thus it was concluded that the Glaciar Esmeralda site is not adequate for paleoclimate studies. At Glaciar La Ollada. Cerro Mercedario (31°58'S, Argentina), a 13.5 m long shallow core was drilled at an altitude of 6100m. The firn was compact and homogeneous. The core was obtained at the area of the deepest ice (~126 m), spanning an estimated time of 17 years (1986-2002), vielding an average annual net accumulation of 0.45 m of water equivalent. Concentrations of major ions and stable isotopes of oxygen and deuterium show good potential for paleoclimate reconstruction. In 2005 a new core was drilled to a depth of 104 m at Glaciar La Ollada, which was shipped to PSI Switzerland, where it is presently being analysed. The ice temperature was -18.5°C at 20 m depth. In addition to ice and firn cores, ice depth data have been measured with an impulse radar, a GPR has been used for measuring firn stratigraphy and snow stakes have been installed and remeasured, in combination with differential GPS.

#### **Rock glaciers of Central Chile**

(F. Ferrando, UCH)

The Andes range between 31° and 32°S exhibit a large number of rock glaciers, all of them poorly studied, which are considered very important for sustaining runoff in the semiarid basins of rivers Limarí, Choapa and Aconcagua. This project seeks to understand the rock glacier behavior with emphasis in glacial geomorphology changes by analysing aerial photographs, direct measurements of surface topography using GPS and theodolite, and ice thickness by means of gravity data.

#### Assessing the impact of climatic variations on water resources from highly glacierised basins in developing countries

(F. Pellicciotti, J. Corripio, ETH; B. Brook, UD;

A. Rivera, CECS and UCH)

In this study, present and past water availability changes will be assessed as well as future changes in the Central Andes of Chile where water resources originate from glaciers and high mountains. Runoff in this region is scarce and there are water usage conflicts between several traditional and modern users. This project is analysing the available meteorological and hydrological data obtained in recent decades on the Río Aconcagua's basin. An ongoing glaciological programme is also being carried out, including updating of glacier inventories, and selection of pilot glaciers for detailed analysis. The approach adopted in this study integrates different modelling tools at a basin scale, considering glaciological, climate and hydrological components.

### Mass balance programme on Glaciar Echaurren Norte

(E. Weidenslaufer, F. Escobar, J. Quinteros, DGA) The longest continuous mass balance programme carried in South America since 1976 is being conducted by the Public Works Ministry of Chile in Glaciar Echaurren Norte (33°35' S 70°08'W), with three or four campaigns being organised per year to the glacier, where several glaciological measurements are taking place. The glacier has shown high interannual variability of the mass balance, with a strong relationship with ENSO events, characterized by positive mass balances during El Niño years and negative mass balances during La Niña events. The accumulated mass balance between 1975/76 and 2003/04 yielded –589 cm of water equivalent, determining a general trend of mass losses.

### Glaciology summer school on Glaciar Juncal Norte

#### (A. Rivera, CECS and UCH)

Glaciar Juncal Norte (33°02'S) located in the Aconcagua basin of Central Chile, is a partially debris-covered glacier experiencing moderate retreat in recent years, in contrast to other glaciers of Central Chile suffering high retreat rates and area shrinkage. This glacier is located a couple of hours away from the Chile-Argentina highway, being its lower tongue easily accessible on foot, having been selected as a site for student training while attending a glaciology course organised by Universidad de Chile, Santiago. Glaciological activities include mass balance, surface topography, subglacial topography and energy balance measurements, all of which are combined with training on mountaineering techniques (http://www.glaciologia.cl).

### Glaciology and dendrochronology on Glaciar Cipreses

#### (C. Le Quesne, UACH; C. Acuña, CECS).

Glaciers in the Chilean central Andes have shown significant frontal retreat, area shrinkage and ice thinning, in an accelerating trend during recent decades, presumably in response to atmospheric warming and reduction of precipitation. Nearly 1600 glaciers with a total ice area of ~1300 km<sup>2</sup> have been inventoried in the Chilean central Andes, which have experienced a total volume loss due to thinning and retreat of  $46 \pm 17$  km<sup>3</sup> of water equivalent between 1945 and 1996, affecting water resources availability for agriculture, mining and human consumption. The glacier with the longest record of historical variations in Chile is Glaciar Cipreses (34°33'S, 70°22'W), which has been systematically retreating and shrinking since 1860 in an accelerated trend during recent decades when the retreat rates tripled. This glacier was selected for paleoclimate studies, by analysing the relationship between glacier fluctuations and tree rings chronologies of Austrocedrus chilensis.

#### CHILEAN LAKE DISTRICT (37–41°S)

#### Glacier-volcano interactions in Southern Chile

(A. Rivera, CECS and UCH; G. Casassa, A. Wendt, CECS; J. Clavero, SERNAGEOMIN; E. Rignot, JPL; J. Corripio, ETH; B. Brock, UD) This is a glaciological project in the Lake District of southern Chile, where glaciers are located over icecapped volcanoes, in which retreat and shrinking have been commonly related to the ongoing climate changes taking place. The main aim is to differentiate glacier variations induced by climatic changes from glacier responses related to the volcanic activity. Two ice-covered volcanoes have been selected (Volcán Villarrica and Mocho-Choshuenco, 39°55'S, 72°02'W), with different historical eruptive history but a similar climatic context. The frontal and areal variations have been determined through the analysis of remotely-sensed satellite images and aerial photographs, and the ice surface changes have been accounted by comparison of digital elevation models at different dates. Radar ice thickness measurements have also been carried out. The mass and energy balances are being studied, with special emphasis on ash-covered surfaces. One of the expected results is the guantification of the water equivalent volume storage at each volcano and its relationship with potential volcanic hazards, especially in terms of lahar generation. An airborne survey was carried out in March 2004 onboard a DC8 aircraft from NASAD, collecting digital DEMs using an AIRSAR system. These data have been compared to GPS data in order to analyse ice elevation changes on active volcanoes.

#### Mass balance programme on Volcán Mocho Choshuenco

(A. Rivera, CECS and UCH; G. Casassa, F. Bown, C. Acuña, CECS; P. Zenteno, UCH) The first direct measurements of glacier mass balance have been carried out in southern Chile. In 2003 a monthly-based measurement programme was initiated on the south-eastern glacier of Volcán Mocho-Choshuenco, mainly due to its representativeness as an ice body which is presumably not affected by current volcanic activity. The glaciers of this volcano have been retreating and shrinking considerably in recent decades. The net mass balance of hydrological year 2003/2004 yielded -0.88 m ± 0.09 m of w.e. yr-1. This negative glacier mass balance together with the area shrinkage and frontal retreats are thought to be driven by climatic factors, particularly the tropospheric warming and a decrease in precipitation observed at regional meteorological stations.

#### Energy balance programme on Volcán Villarrica

(B. Brock, UD; A. Rivera, CECS and UCH;

G. Casassa, F. Bown, C. Acuña, CECS)

Energy balance studies at ice-capped volcanoes of Southern Chile have been carried out using an automatic weather station collecting data at 1800 m at the surface of Glaciar Pichillancahue. Since January 2004, the station has been recording incoming and outgoing shortwave radiation fluxes, net longwave radiation, air temperature and humidity, wind speed and wind direction. In addition, surface temperature of different thicknesses of continuous tephra layers, which insulate the underlying ice from atmospheric energy, have been monitored using thermistors connected to a datalogger. Snow melting is higher during the ablation season (January-March), obtaining a mean daily rate of 55 mm of water equivalent. In contrast, ash-covered ice melts 6-8% of the melting observed at bare surfaces, where thermal conductivity of ash yielded 0.45 W m<sup>-2</sup> K<sup>-1</sup>. Therefore, volcanic ash deposition is mainly associated with ablation reduction and a positive impact in glacier mass balance.

#### Firn coring in the Chilean Lake District

(G. Casassa, CECS; A. Rivera, CECS and UCH; J. Carrasco, DMC; S. Kohshima, TIT)

The paleoclimate potential of firn cores in the Lake District of Chile is being investigated. The glacier near the summit of Volcan Lanín (39°39'S, 3774 m a.s.l.) on the Chile–Argentina border has been selected for a preliminary campaign in 2005.

## Detection of crevasses using radio echo sounding systems

#### (R. Zamora, CECS)

A ground penetrating radar (GPR) system has been used for crevasse detection. The GPR is a GSSI SIR-3000 digital subsurface interface radar system operating in monostatic mode. The radar utilized pulses centered near 400 MHz (transducer model 5103 by GSSI) and an antenna transmit rate of 100 kHz. The range of the radar was set between 100 and 200 ns. A global positioning system (GPS) was used to locate the measurements. Experiments were made in temperate ice on a glacier of Volcán Mocho-Choshuenco, an ice-capped volcanic cone located in the Chilean Lake District. The radar was pulled by an operator walking across the crevasses. The profiles were made perpendicularly to crevasses of widths ranging from 10 cm to 1 m. Crevasses show clearly as apexes of diffraction hyperbolae spanning a depth of 8–16 m, which corresponds to the range setting used for the radar. Open crevasses show discontinuities in the firn stratigraphy located at the apexes of the hyperbolae. The GPR proved to be a valuable tool for detecting crevasses.

### Climate, vegetation, and glacier fluctuations in the Lake District of Chile

(P. Moreno UCH; G. Denton, UM; B. Andersen UO; C. Heusser, L. Heusser LDEOCU; T.

Lowell, UCI; C Schluchter, UB)

Determining the paleoclimate history of the Lake District of southern Chile has been the focus of this research since 1991. The emphasis is the development of replicate, high-resolution, precisely dated records of glacial and vegetation fluctuations during and since the Last Glacial Maximum. The goal of the research is to determine the causes and conseguences of climate change at multiple scales (regional, continental, hemispheric, global), taking advantage of the uniqueness of Patagonia as a key area for developing and testing hypotheses of global climate change. The research team has included specialists in the fields of glacial geomorphology, stratigraphy, palynology, and more recently, tree ring analysis, climate modelling, tephrochronology, organic geochemistry, and cosmogenic nuclide geochronology. The results of the work have been published as multiple individual papers and, collectively, as a special volume of Geografiska Annaler in 1999.

## PATAGONIA AND TIERRA DEL FUEGO (41–56°S)

## Glaciological studies applied to hydroelectric power operations

(Reported by C. Marangunic)

Power companies interested in developing hydroelectric power stations near glacier-dependent water sources, have performed combined ice-heat-water balances to assess the amount of water supplied by glaciers, mainly in the vicinity of the Southern Patagonia Ice Field. These studies include assessments of glacier variations, and the amount of water derived from present day negative mass balances of glaciers. Of particular interest has been the research on the artificial increase of surface glacier melting to augment water supply in cases of extreme drought. A computer program to evaluate precipitation (rain or snow) on large hydrographic basins from few sealevel meteorological stations located windward of the Andean range has been developed and tested with a network of ground meteorological and fluviometric stations located leeward of the Andes.

#### Climatic Changes for the last 1000 years in the Andes of Southern Chile (43-51°) from tree ring, glacier and documentary records.

(A. Lara, A. Wolodarsky, M. Solari, UACH; J. Aravena UMAG; A. Rivera CECS and UCH) The general objective of this project was to improve the understanding of high- and low-frequency climate fluctuations in the southern Chilean Andes (41–51°S) from the integration of tree-ring, glacier and documentary records. It is hypothesized that the simultaneous use of these proxy records will produce a more reliable estimate of climate variations during the last 1000 years, than any of these single paleoindicators taken separately. One of the specific objectives is to combine the tree-ring, glacier and documentary records to produce robust reconstructions of temperature and precipitation variations in the annual- to centennial-scales. Tree ring chronologies were reconstructed based upon Nothofagus Pumilio and Fitzroya Cupressoides for several sites (Monte Tronador, Volcán Apagado, Monte San Lorenzo and the SPI) where glacier variations and moraine mapping took place.

#### Climate variability reconstructed using tree-ring records and glacier fluctuations in the southern Chilean Andes (45–56°S)

(J. Aravena, UMAG and UWO; B. Luckman, UWO)

The aim of this research is to reconstruct the patterns of climate variability in southern Chile (45–56°S) through the complementary study of tree ring records and glacier fluctuations over the last 300-500 years. The use of different proxy records allows comparisons of past climatic fluctuations derived from independent sources, minimizing the inherent limitations and sources of error associated with each method, and providing confidence in the accuracy of the development of consistent reconstructions. The primary objectives are: 1) To provide high-resolution tree-ring records that characterizes the high and low-frequency natural climate variability; 2) To provide low-resolution glacier fluctuations records to characterize the low-frequency natural climate variability; and 3) To reconstruct the patterns of significant climatic variation over the last centuries in southern Chile using complementary studies involving tree-ring records and glacial fluctuations. The above objectives will be pursued through the development of a network of tree-ring width chronologies along the proposed latitudinal range from Pilgerodendron uviferum, and Nothofagus spp forests. The main climate response of the network of chronologies will be identified in order to reconstruct the fluctuations of temperature and precipitation during the last centuries. In addition, the fluctuations of selected glacier fronts in southern Chile over the last centuries will be reconstructed primarily by dendroglaciological methods. Climate variability records of medium and low frequency obtained from tree rings and glacier fluctuations will be compared analyzing the effects of latitudinal, longitudinal and elevation gradients.

## Early Holocene fluctuations of the North Patagonian Icefield

(N. Glasser, UCW; S. Harrison, UE; S. Ivy-Ochs, ETH; G. Duller UCW; Peter Kubik, PSI; K. Jansson, US; M. Aniya, UT;A. Rivera, CECS and UCH) Following research around the North Patagonian Icefield since 1991, we have, since 2000, developed three research initiatives in Patagonia. The first uses ASTER and Landsat ETM+ imagery to map the largescale geomorphology of the icefield and its surroundings. This map has then been used to assess the patterns of glacier behaviour around the North Patagonian Icefield during the Holocene. Recession of the icefield is marked by three distinct moraine sets. These moraine sets are interpreted as marking terminal positions related to the 'Little Ice Age' and two preceding, but as yet incompletely dated, phases of Holocene glacier expansion. There are strong contrasts in the patterns of glacier behaviour between the east and west sides of the North Patagonian Icefield, which cannot be attributed simply to an east/west differential in the rates of change of atmospheric temperature and precipitation. We argue here that glacier response to first-order climate forcing is tempered by second-order controls introduced by regional-scale topographic effects, notably glacier drainage basin extent and area. Second, we have undertaken a dating programme using cosmogenic isotope and optically stimulated luminescence dating to assess the age of glacial moraines and icecontact features in glaciated valleys on the western and eastern sides of the icefields. We have shown that the outlet glaciers were significantly advanced during the late Holocene (2-3 kaBP) and during the Pleistocene-Holocene transition. Third, we have investigated the sedimentology of glacial, proglacial and paraglacial landsystems in the region, to obtain an understanding of the icefield-wide variations in glacier depositional styles.

Ice coring from the Southern Patagonia Icefield (M. Schwikowski, PSI; A. Rivera, CECS and UCH; F. Sepúlveda, G. Casassa, CECS; J. Carrasco, DMC) Three shallow firn cores were retrieved covering an altitude range from 1543 to 2300 m a.s.l. so as to explore the suitability of high-elevated glacier sites at the Southern Patagonian Icefield as paleoclimate archives. The glaciochemical records from the two lower sites show the presence of superimposed ice, melt water formation and percolation. At the higher site the glaciochemical signature appears to be preserved, indicating that no significant melting has occurred. Thus, well-preserved paleorecords are assumed to be contained within glaciers at the Patagonia Icefields located higher than 2300 m. A deeper drilling is being planned at a higher elevation site.

## Mass balance investigations in the Patagonian icefields

(E. Rignot, JPL; A. Rivera, CECS and UCH; G. Casassa, CECS)

Mass balance is being investigated at the Northern and Southern Patagonia icefields (NPI and SPI

respectively) by means of remote sensing and ground truth data. SRTM data have been compared with DEMs generated from earlier cartographic data, pgotogrammetric restitution and stereoscopic restitution from ASTER imagery. Results have allowed assessing the total mass balance and the sea level rise contribution of the Patagonian icefields. A 10-m metal pole was installed in 1996 on the accumulation area of Glaciar Chico, which was still above the surface in 2004. Pole heights, together with snow pit data show an estimated average snow accumulation of 0.57 m.w.e. between 1994/95 and 2000/01. A thinning rate of 1.9 mw.e. was estimated for the mast site at Glaciar Chico, which is three times higher than the snow accumulation rate estimated for that part of the glacier. Climate data suggest an increase in temperature and a reduction in precipitation during most of the 20th century in the vicinity of HPS. Although these climate changes are the primary explanation for the observed ice-elevation changes of the glacier, ice-dynamics effects are also believed to play an important role. DEMs were also acquired in March 2004 onboard the NASA/JPL DC-8 aircraft. These DEMs will also be compared to GPS and RES data, in order to estimate the mass balance of Glaciar San Rafael and San Quintín of the NPI.

### Ice coring of Monte San Valentin and Monte San Lorenzo

(P. Ginot, B. Pouvaud, IRD: G. Casassa, CECS: A. Rivera, CECS and UCH; J. Carrasco, DMC) A 13.5 firn core was obtained in 2005 from an altitude of 3750 m below the summit of Cerro San Valentín, Northern Patagonia Icefield (NPI). A temperature of -12°C was measured at a depth of 10 m. A maximum ice thickness depth of ~160 m was measured with a radar system, together with differential GPS. The core was shipped to France where it is now being analysed. The site is in principle suitable for obtaining a paleoclimate record dating back a few centuries. Deep drilling is being planned for 2006. In addition to the ice coring a hydrological station has been installed on Glaciar Nef and geomorphological studies have started on the terraces around the margins of NPI with the aim of characterising the present climatic and hydro-glaciological regime of the area and studying the past changes.

## Helicopter borne measurements of ice thickness measurements

(V. Damm, D. Eisenburger, BGR; M. Jennet, TUHH; R. Carvallo, C. Cárdenas, UMAG; G. Casassa, CECS)

A helicopter-borne radar survey at 150 MHz was conducted in 1999 to obtain information about the internal structures and thickness of five high mountain glaciers in central Chile and two glaciers (Tyndall and Dickson) in Torres del Paine, Southern Patagonia Icefield. About 700 km of flight lines was measured. The quality of the data was influenced by strong signal scattering due to melt water layers in the temperate ice, the rough surface conditions of the glaciers and morphological effects of the high mountain area. At several lines a reflector was identified, which represents the firn/bare ice intersection. Reflections from the glacier/bedrock intersection are very weak and only limited to some locations in the case of the Patagonian glaciers.

#### Airborne survey of the Patagonian icefields

(A. Rivera CECS and UCH; G. Casassa, C. Acuña, R. Sinclair, C. Teitelboim, CECS; E. Rignot, JPL: W. Krabill, NASAW; R. Thomas, E. Frederick, S. Manizade, R. Russell, J. Sonntag, R. Swift, J. Yungel, EG&G; H. Brecher, OSU; P. Kanagaratnam, KU; P. Richter, J.M. Romero, J.C. Chiminelli and the ARMADA crew) In November and December of 2002 laser altimeter surveys were made over the Northern and Southern Patagonia Icefields (NPI and SPI respectively). The P-3 Orion was equipped with a NASA scanning laser altimeter, dual frequency GPS receivers and an inertial navigation unit that yielded a combined surface elevation accuracy of ±0.5 m along a total 4000 km flight track over the glaciers. Surveys covered most of NPI and provided a coverage of the northern and southern portions of SPI as well. The data allow to calculate glacier thickness changes over the ablation and accumulation areas. The data confirm the thinning of several meters/year observed in recent years at the ablation areas of Patagonian glaciers, with larger values at lower elevations and very small/negligible values at higher elevations, above the equilibrium line altitude.

#### Glaciology, paleoclimate and geology at Gran Campo Nevado

(R. Kilian, M. Fesq-Martin, O. Baeza UTRIER; C. Schneider, RWTH; H. Biester UH; G. Wendt UR; J. Behrmann, M. Schnirch, UF; J. Koch SFU; A. Santana, N. Butorovic, M.A. Godoi, M. Arévalo, UMAG; G. Casassa CECS)

The Gran Campo project is an interdisciplinary project comprising more than 20 scientists and students from 10 different universities in Germany and Chile, including botanists, geologists, geochemists, glaciologists and climatologists. The aims of the project are to study the multiple influences and changes of environmental conditions and ecosystems around Gran Campo Nevado, a 200 km<sup>2</sup> ice cap located in Península Muñoz Gamero, 200 km to the south of the Southern Patagonia Icefield (SPI) at 53°S, 73°W. Some of the current results include a glacier inventory and recent glacier variations, a detailed photogrammetric map, dendrochronological studies, geological and geochemical characterisation, paleoclimate studies based on peat bogs, lake sediments and marine sediments, submarine

sedimentology and bathymetry, and geomorphological studies.

### Airborne measurements using laser altimetry in Patagonia

(K. Keller, KMS, presently at COWI; R. Forsberg, KMS, presently at DNSC; N. Gundestrup NBI (deceased); G. Casassa CECS; A. Rivera, CECS and UCH), R. Cárdenas (UMAG)

The first airborne laser altimetry measurements of a glacier in South America were performed in November of 2001 over Glaciar Tyndall, Torres del Paine National Park, Southern Patagonia Icefield, onboard a Twin Otter airplane of the Chilean Air Force. A laser scanner of KMS was used, in combination with an Inertial Navigation System and dual frequency GPS yielding a nominal accuracy of 30 cm after data processing. A total of 235 km was flown over the ablation area of Glaciar Tyndall, with five longitudinal tracks with a mean swath width of 300 m, which results in a point spacing of approximately 2 m both along and across track. A digital elevation model (DEM) generated using the laser altimetry data was compared with a DEM produced from a 1975 Chilean map at 1:50000 scale. A mean thinning of  $-3.1 \pm 1.0$  m/year was calculated for the ablation area of Glaciar Tyndall, with a maximum value of  $-7.7 \pm 1.0$  m/year at the calving front at 50 m a.s.l. and minimum values between -1.0 and  $-2.0 \pm 1.0$  m/year at altitudes close to the equilibrium line altitude (900 m a.s.l.). The thinning is presumably a response to warmer and drier conditions prevailing in Patagonia in recent decades.

### Ice thickness measurements of Tyndall glacier

### (M. Godoi, R. Carvallo, M. Arévalo, UMAG, CEQUA)

Radar and GPS studies are being carried out at Lóbulo Zapata on Glaciar Tyndall, Southern Patagonia Icefield. The objective of the study is to characterise the glacier geometry and its changes. An impulse radar operting at ~2 MHz is used. A common-mid-point (CMP) survey has also been performed to determine electromagnetic wave velocity. Radar data are geolocated using differential GPS. A Geographic Information System is compiled for data representation and analysis.

#### Glacial geology at Glaciar Tyndall

(R. Fernández, CEQUA, INACH; J. Strelin,

#### R. Iturraspe, CADIC)

Research on glacial geology is being carried out on the periglacial sectors of Glaciar Tyndall, Southern Patagonia Icefield. The objective of the study is to understand the recent Neoglacial and Late Glacial history of the area. Moraine systems have been studied during field work and by means of analyses of satellite imagery and aerial photographs. Datable material has been collected from the moraine systems, fluvioglacial and glacio-lacustrine deposits.

## Crustal deformation and lake morphology after glacial retreat in Patagonia

(R. Dietrich, A. Wendt, TUD; J. Wendt, CECS and TUD; R. Kilian UTRIER; A. Rivera, CECS and UCH; G. Casassa, (CECS) M. Arévalo, CECS and UMAG)

The main aim of this ongoing work is to determine deformations of the earth's crust in the vicinity of the Southern and Northern Patagonian ice fields due to ice mass changes. Maximum uplift rates are expected near the ice divides. Precise repeated ground based observations are being carried out in the nortwestern sector of SPI using the Global Positioning System (GPS). Lake bathymetry and sediment structures were investigated by a Parametric Echo Sounding System SES 96 from Innomar.the last century. Maximum lake depth is ~800 m close the the present front of Glaciar O'Higgins, which has experienced a retreat of ~10km during the last century. Such over-deepened basins are most probably caused by recent glacial erosion. Recent geodetic work was started on the basin of Lago General Carrera, near the Northern Patagonia Icefield. In the future Synthetic Aperture Radar interferometry (InSAR) is planned to be applied, which also should provide information on surface displacements in the subcentimeter level.

#### Controls on Sediment Yields from Tidewater Glaciers from Patagonia to Antarctica

(B. Hallet, M. Koppes, UW; J. Anderson, RU; R. Fernández, INACH; C. Rodrigo, SHOA; G. Vargas, UCH; G. Casassa, CECS; A. Rivera CECS and UCH)

This study is being performed in glaciers of Patagonia and Tierra del Fuego and their respective fjords with the aim of assessing the role of glacier dynamics in determining glacial sediment yields through a combination of techniques and resources from glaciology and marine geology. Field work includes glaciers in the Antartic Peninsula as well. The basic hypothesis is that rates of glacial erosion are a function of sliding speed, and are therefore expected to diminish sharply as basal temperatures drop below the melting point. To test this hypothesis, sediment accumulation rates are being measured from seismic studies in fjord sediments, as well as dynamic characteristics of the glaciers producing the sediments, for several tidewater glaciers ranging from fast-moving temperate glaciers in Patagonia to slow-moving polar glaciers on the Antarctic Peninsula. Sediment yields will be assessed based on present glaciological and sedimentological data. Erosion rates will be determined by determination of sedimentation rates from seismic profiles and sediment core data. The dynamic properties and basin characteristics of each of the glaciers will be established in order to seek an empirical relationship between glacial erosion rates and ice dynamics. Field work will span from Patagonia to the Antarctic Peninsula, which offers a large latitudinal

range providing a large range of precipitation and glacier thermal regimes over relatively homogeneous lithologies and tectonic settings.

## Researches on glacio-marine geomorphology in submarine environments in Patagonia

(J. Araya-Vergara, UCH)

This work has been carried out by means acoustic methods (sub-bottom profiler) in the context of a program organized by the National Oceanographic Committee of Chile. The main landforms studied are fjords and submarine glacial piedmonts. Three categories of fjords have been discovered, if the nature of their bottom landforms is considered: a) The Northern Patagonia type with ponding esplanades composed of laminated rhythmites; b) the Central Patagonia type, in front of the Southern Patagonian Ice Field, with morainal banks interbedded with rhythmites of submarine out-wash esplanades; these features are thought to be formed by dumping from floating ice; and c) the Magellan type, with scarce depositional landforms and many sills and troughs, with important grounded-ice activity. On the other hand, three types of submarine piedmonts have been recognized, considering their type of bottom morphology: the Chilotan piedmont type, with multiphasic paraglacial landforms; the Magellan inner piedmont, formed by ice-contact processes developed in zones of grounded-ice, and exceptionally floating-ice: and the Magellan outer piedmont. formed by means of marine transgression over subaerial outwash plain.

#### Contribution of Thinning Glaciers of southern South America to Sea Level Rise

(E. Rignot, JPL; H. Conway, C. Raymond, UW; A. Rivera, UCH and CECS; G. Casassa, CECS) This project aims at studying the contribution to SLR of the glaciers in southern South America. Special emphasis is given to estimates of thinning in the accumulation area; analysis of upper-air NCEP-NCAR data and surface climate data, the role of ice dynamics and explanations for retreat. Some of the proposed results are reliable estimates of volume changes in the accumulation area; latitudinal gradients in mass balance; mapping of glacier velocities using InSAR and detection of temporal velocity changes to quantify thinning caused by changes in ice dynamics alone; and predictions of how the contribution to SLR might change in the future.

## Climate, vegetation, and glacier fluctuations in Patagonia

(P. Moreno UCH; C. Moy, SU; C. Stern UCB)

A research program was started in southern Patagonia with aim of developing an array of paleoclimate and paleovegetation records in NW and SW Patagonia in order to establish a regional chronology of climate and vegetation events. This will allow addressing detailed questions in the fields of paleoclimatology and paleoecology, with potential implications for allied fields such as glaciology, archaeology, ecology, and conservation.

#### Studies of the mass balance of Fuego-Patagonian glaciers

(V. Pohjola, J.Hedfors, UU; C. Porter PRF; A. Rivera, CECS and UCH)

The aim of the project is to gain information on the mass balance of glaciers in Tierra del Fuego, southern Chile. So far two glaciers have been studied, one glacier ('Glaciar Sinus') in the Bahia Pia catchment on Cordillera Darwin (54°45'S, 69°40'W) and one glacier ('Glaciar Hooke') on Isla Santa Inés (53°45'S, 72°30'W). So far a few records spanning several ablation seasons have been gathered. Ice flux through the two glaciers is estimated using GPS measurements and ice radar data. Mass change of these glaciers over longer time periods is estimated by the use of remote sensing data.

#### Glacier variations in Cordillera Darwin

(C. Porter PRF; A. Santana, UMAG and CEQUA) The variations of Glaciar Marinelli and other glaciers in Cordillera Darwin Ice Field are being investigated by analyses of satellite imagery, aerial photography and ground studies. Glaciar Marinelli is a calving glacier on the northern margin of CDI which has experienced a very large recession in recent decades. The glacier retreat is being studied in terms of precipitation and temperature trends recorded at regional meteorological stations which span close to a century. Automatic weather stations have also been installed close to the glaciers for characterising the local weather conditions.

### Glaciological research in the Northern Patagonia Icefield

(M. Aniya, G. Barcaza, T. Tanikawa TU; T. Aoki KAU; T. Sawagaki, T. Matsumoto, S. Iwasaki, N. Sato HU; M. Aoyama TMU; C. Tsujimura TGU)

Several field campaigns have been carried out since 2003 on Glaciar Exploradores, one of the main outlet non-calving glaciers of the Northern Patagonia Icefield, where a runoff and an automatic weather station were installed in order to measure the water balance of the glacier, as well as meteorological conditions prevailing in this region. This research also aims to reconstruct the Holocenic glacier variations in Patagonia by means of glacial landforms studies in the field, analysis of remotely sensed imagery and interpretation of hand-held aerial photography taken from airplanes. Ice fluxes and velocities have been computed by means of GPS measurements of painted rocks left on the glacier, allowing estimates of inter-season variations.

#### ANTARCTICA

## Airborne survey of the Antarctic Peninsula and West Antarctica

(R. Thomas, E. Frederick, S. Manizade, J. Sonntag, R. Swift, J. Yungel, EG&G; W. Krabill, NASAW; E. Rignot JPL; P. Gogineni, H. Ramamoorthy, P. Kanagaratnam, T. Akins KU; A. Rivera, CECS and UCH; C. Acuña, C. Teitelboim, F. Bown, R. Sinclair, R. Zamora, G. Casassa, CECS; J. Zwally, NASAG; H. Brecher OSU; and the ARMADA crew) In 2002 and in 2004 airborne surveys of glaciers were performed in the Antarctic Peninsula and in the Amundsen Sea sector by means of a Chilean Navy P3 aircraft based from Punta Arenas. Sensors included a laser altimeter, ice-penetrating radar, inertial navigation system, GPS receivers and a real-time navigation system. Data allow to measure ice thicknesses and surface topography variations. Comparison of 2002 airborne laser data with 2003/2004 ICESat data indicate significant thinning in the Amundsen sea glaciers, with magnitudes approximately double of prior thinning obtained by satellite radar altimetry in the period 1992-2000. In the Antarctic Peninsula thinning was also obtained in several ice shelf areas. Ice thickness data together with thinning data will improve earlier estimates and will be useful for future modeling studies of glacier response changes in climate and variations in ice dynamic conditions.

#### Glaciological research at Adelaide Island, Antarctic Peninsula

(A. Rivera, CECS and UCH; R. Zamora, D. Antúnez, G. Casassa, CECS; J. Quinteros, DGA and CECS)

The variations and dynamics of the southern edge of Fuchs Piedmont Glacier, Adelaide Island (67°45'09"S, 68°55'04"W) have been studied during a field campaign in 2002. The snow-covered surface of the glacier has been used since the 1960s for landing aeroplanes in support of British and more recently by Chilean operations in nearby Teniente Carvajal station, formerly known as Adelaide T. In recent years, snow conditions on the runway area have progressively deteriorated for landing operations with aeroplanes due to melting, which is occurring increasingly earlier in the summer season. Radio echo sounding, GPS and remotely sensed data have been analysed for mapping the crevasse and ice velocity fields, as well as the surface and subglacial topography of the area. The results show that the runway area is located on a local ice divide surrounded by crevasses which are progressively appearing on the surface of the glacier earlier in the summer, presumably due to higher snowmelt and perhaps higher ice velocities as well, in response to regional atmospheric warming. In the near future,

landing operations will be further affected as more crevasses will appear in the runway area if present warming trends persists. This situation is affecting all coastal areas in the Antarctic Peninsula and so the search for possible new locations of crevasse-free runways at higher elevations is recommended.

#### **Glaciological research at Patriot Hills**

(G. Casassa, CECS; A. Rivera, CECS and UCH; C. Cárdenas, R. Carvallo, UMAG; H. Lange, TST) Glaciological studies at Patriot Hills (80°18'S, 81°22'W) were performed in the period 1995–1997 sponsored by INACH. A recent campaign was made in 2004 sponsored by CECS and the Chilean Army, with the collaboration of Antarctic Logistics and Expeditions. Glacier elevation data and ice velocities have been obtained by differential GPS. Ice thicknesses have been measured using an ice radar. An average accumulation of 7 g cm<sup>-2</sup>a<sup>-1</sup> was obtained in the central part of Horseshoe Valley and a maximum ablation of  $-17 \text{ g cm}^{-2}$  a-1 at the edge of the blue ice area close to Patriot Hills. Changes in surface elevation of the glacier measured at 81 stakes in the period 1995-1997 show a mean thickening of  $+0.43 \pm 0.42$  m a<sup>-1</sup>, which, considering the uncertainties indicates that the ice sheet around Patriot Hills is in near steady state. The new 2004 data will allow to test if the glaciological conditions around Patriot Hills are still stable.

#### Scientific traverse to the South Pole

(G. Casassa, C. Teitelboim, R. Traub, R. Zamora, CECS; A. Rivera, CECS and UCH; J. Quinteros, DGA and CECS; J. Simões, UFRGS; L. Urrutia, M. Antivil, P. Carrasco, G. Collao, J. Hernández, C. Iturrieta, Chilean Army; and Patriot Hills Expedition Group)

A Chilean tractor convoy with 13 people onboard (12 Chileans and one Brazilian) left Patriot Hills on 13 November and reached the South Pole on 30 November 2004. The expedition returned to Patriot Hills on 31 December, with a total traverse time of 48 days, covering a total distance of 2411 km. The expedition was organised by CECS and the Chilean Army, and sponsored among others by the Ministry of Defense of Chile, Fundación Andes, Iniciativa Científica Milenio, the Brazilian Antarctic Programme, CNPq and Petrobras. A Swedish tractor Berco TL-6 composed of two bodies (front and rear) was used, pulling three Berco sledges with a total convoy length of 32 m and a maximum total load of 20 Ton. Scientific measurements included ice depth soundings by means of a 150 MHz ice depth radar on loan from the University of Kansas, USA. During the return on the way north high resolution radar soundings were performed of the top ~60 m firn layers of the glacier by means of a GSSI SIR 3000 400 MHz snow accumulation radar. Precise positioning control was provided by dual-frequency

Trimble NetRS GPS receiver on loan from The Ohio State University (OSU), USA. 54 stakes were deployed along the route, being measured by dualfrequency GPS on the way south and again on the way back north for deriving glacier velocities. A dual-frequency GPS base station at South Pole was operated by the National Science Foundation (NSF) of USA throughout the period of the tractor traverse, which will be used for processing of kinematic GPS data. Analysis of the radar data, kinematic GPS data, stake positions and heights will provide information on the characteristics of the ice sheet and its stability across the transition from the West Antarctic Ice Sheet (WAIS) to the East Antarctic Ice Sheet (EAIS). Six firn cores of a depth ranging from 4 m to 46 m were drilled along the route with a Swiss electromechanical drill, with a total of 225 m of firn samples which will be analysed for their chemical composition. In addition 105 surface snow samples were collected every 10 km along the route under clean conditions and every 20 km the surface (top ~1.2 m layer) snow density was measured with a Monte Rosa snow sampler. The firn core measurements, to be complemented with the snow accumulation radar data, will be a contribution to the International Trans-Antarctic Scientific Expedition (ITASE) programme, sponsored by the Scientific Committee on Antarctic Research (SCAR). These data will allow characterising in detail the climate change in the last 200 years, since the industrial revolution, and its spatial variability along the traverse route.

#### Mass balance of the Antarctic Peninsula glaciers from satellite Radar Interferometry and other data

(E. Rignot, JPL; R. Thomas EG&G; A. Rivera, CECS and UCH; and NASAD crew)

Antarctic Peninsula atmospheric temperatures have risen six times faster than the global average in recent decades, triggering glaciological and ecological events unique in the history of this region in the last 1000 years. In this project, we seek to assemble an extensive compilation of modern observations of the glaciers draining the Antarctic Peninsula in order to determine their state of mass balance, their evolution through recent times, and their overall contribution to sea level rise. A digital DEM was acquired in March 2004 onboard the NASA/IPL DC-8 AIRSAR system between 64°S and 70°S. These data in combination with laser data collected in 2002 and 2004 by NASA/CECS P3 airborne campaign will be complemented with ERS-1/2 InSAR-derived DEMs further south to provide comprehensive, quality DEM of the region. The resulting data will be used for mass-balance estimates, the determination of the sensitivity of the glaciers to force perturbations ranging from tidal to progressive ice-shelf thinning, and to develop models capable of simulating observed changes. The program will give us an exclusive look at the glacier settings before, and perhaps after, iceshelf collapse, providing a wealth of information needed to develop the models needed for reliable studies of future sea-level change.

## Glacier variations in the northern Antarctic Peninsula

(R. Jaña, INACH, UF and CEQUA; F. Rau, J. Arigony, F. Mauz, S. Vogt, H. Saurer, H. Gossmann, UF; H. de Angelis, P. Skvarca, IAA) Variations of glacier frontal positions on the northern Antarctic Peninsula have been studied by analysis of satellite imagery of different sensors and different epochs. Data show substantial retreat of glaciers coincident with large atmospheric warming observed in recent decades. Future field work on glacier mass balance measurements is planned.

#### ABBREVIATIONS

ARMADA: Chilean Navy BGR: Federal Institute for Geosciences and Natural Resources, Hanover, Germany CADIC: Centro Austral de Investigaciones Científicas, Ushuaia, Argentina CEAZA: Centro de Estudios Avanzados de Zonas Aridas, La Serena, Chile CECS: Centro de Estudios Científicos, Valdivia, Chile CEQUA: Centro de Estudios del Cuaternario, Punta Arenas, Chile COWI: Consultancy within Engineering, Environmental Science and Economics, Copenhagen, Denmark DGA: Dirección General de Aguas Ministerio de Obras Públicas, Santiago, Chile DMC: Dirección Meteorológica de Chile, Santiago, Chile DNSC: Danish National Space Center, Copenhagen, Denmark EG&G: Services, NASA Wallops, USA ETH: Swiss Federal Institute of Technology, Zurich, Switzerland GEO: Geoestudios Ltda., Santiago, Chile HU: Hokkaido University, Sapporo, Japan JPL: Jet Propulsion Laboratory, Pasadena, USA IAA: Instituto Antártico Argentino, Buenos Aires, Argentina INACH: Instituto Antártico Chileno, Punta Arenas, Chile IRD: Institute for Research and Development, Montpellier, France KAU: Kanazawa University, Kanazawa, Japan KMS: National Survey and Cadastre, Copenhagen, Denmark KU: University of Kansas, Kansas, USA LDEOCU: Lamont-Doherty Earth Observatory of Columbia University, New York, USA NASAD: NASA Dryden, USA NASAG: NASA Goddard, USA NASAW: NASA Wallops, USA NBI: Niels Bohr Institute, Copenhagen, Denmark OSU: The Ohio State University, Ohio, USA PRF: Patagonia Research Foundation CEQUA, Puerto Williams, Chile PSI: Paul Scherrer Institute, Villigen, Switzerland RU: Rice University, Houston, USA RWTH: RWTH Achen University of Technology, Achen, Germany SERNAGEOMIN: Servicio Nacional de Geología y Minería, Santiago, Chile SFU: Simon Fraser University, Burnaby, British Columbia, Canada SHOA: Servicio Hidrográfico y Oceanográfico de la Armada de Chile, Valparaiso, Chile SU: Stanford University, Stanford, USA TGU: Tokyo Gakugei University

TIT: Tokyo Institute of Technology, Tokyo, Japan TMU: Tokyo Metropolitan University, Tokyo, lapan TST: Terrasat S.A., Santiago, Chile TU: Tsukuba University, Tsukuba, Japan TUD: Technological University of Dresden, Dresden, Germany TUHH: Technological University of Hamburg, Hamburg, Germany UACH: Universidad Austral de Chile, Valdivia, Chile UB: University of Bern, Bern, Switzerland UCB: University of Colorado, Boulder, USA UCI: University of Cincinnati, Cincinnati, Ohio, USA UCH: Universidad de Chile, Santiago, Chile UCW: University College of Wales, Aberystwyth, UK UD: University of Dundee, Dundee, UK UE: University of Exeter, Exeter, UK UF: University of Freiburg, Freiburg, Germany UFRGS: Federal University of Rio Grande do Sul, Porto Alegre, Brazil UH: University of Heidelberg, Heidelberg, Germany UM: University of Maine, Orono, ME 04469, USA UMAG: Universidad de Magallanes, Punta Arenas, Chile UO: University of Oslo, Oslo, Norway UR: University of Rostock, Rostock, Germany US: University of Stockholm, Stockholm, Sweden UT: University of Tsukuba, Ibaraki, Japan UTRIER: University of Trier, Trier, Germany UU: University of Uppsala, Uppsala, Sweden UW: University of Washington, Seattle, USA UWO: University of Western Ontario, London Ontario, Canada Web pages: http://www.glaciologia.cl

http://www.cecs.cl/



### **ANNUAL GENERAL MEETING 2005**

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

8 September 2005, Ningwozhuang Hotel, Lanzhou, China..

The President, Dr Elizabeth Morris, was in the Chair.

20 members from 10 countries were present.

1. **The Minutes of the last Annual General Meeting**, published in *ICE*, 2003, No 135, p. 8–11, were approved on a motion by T.H. Jacka, seconded by F. Ng and signed by the President.

2. The President gave the following report for 2004/05:

#### Ladies and gentlemen,

This is my last report as President and I am pleased to say that after a period of change and difficulty I believe the Society is now in a strong position to move forward and expand its activities. Last year I reported in detail on the program to modernize the equipment and software in the IGS office and overhaul all the electronic production procedures. There have also been staff changes which have brought new skills to our production team.

The staff in the office now numbers six people. The Secretary-General, Magnús Már Magnússon, and Linda Gorman work full time. The Production Manager, Christine Butler, works 20 hours a week and her production assistant Craig Baxter works 15 hours a week. Ali Woollatt works 20 hours per week doing typesetting and page makeup as well as working on the development and maintenance of our 3B2 typesetting program. Ann Leeding works for 5 hours a week. This is the equivalent of approximately one and a half full time positions in production. With this staffing level we are now doing all the work involved in making a volume ready for printing including page makeup, proofing and artwork which used to be done by our printers.

Our main goal over the last year has been to speed up the publication of the *Journal* and *Annals*. I am pleased to say that since the last Council meeting, we have published five issues of the *Journal of Glaciology*, i.e. four issues of Vol. 50 for 2004 and the first issue of Vol. 51. Furthermore the second issue of Vol.51 is being typeset and papers destined for the third issue are being copy-edited. This means that by the end of 2005 we will have published three of the four issues of the 2005 volume. Thus we are almost up to date. Furthermore, the papers we are publishing in 2005 were accepted in 2005, so we have brought the time from submission to publication down to less than a year. However, the Chief Editor has reported a decrease in the number of papers being submitted to the *Journal of Glaciology* so we do need to think of ways to publicize the fact that papers are being processed much faster now.

Annals 38, which contains the proceedings of the Davos Symposium, held in June 2003 was issued in March 2005. Annals 39, which contains the proceedings of the Milan symposium held in August 2003, was mailed out in August 2005 and is the first IGS publication in the new style. It is the second largest IGS publication ever. Although Annals 39 took much too long to reach our readers it is worth considering that it only took 8 months to produce, compared to the 12 months it took to produce Annals 38, which was done entirely in the old way. The editorial and production teams are now working on Vols 40, 41 and 42 of the Annals and hope to issue all of these within the next 6 months.

With regard to the meeting being held here in Lanzhou, the Society would like to commend the local committee and the editors, Ellen Mosley-Thompson and Lonnie Thomson, and their team for their hard work and excellent organization. Most of the papers should be in Cambridge by the beginning of December for publication in 2006, that is, within a year.

So to sum up, I believe we can now say that our team in Cambridge can provide a fast and efficient production service. We must now turn our attention to reducing the remaining sources of delay in the publication process. The time from submission to acceptance is the responsibility of the Chief Scientific Editor and the Editorial Board and last but definitely not least the authors themselves. Council have been discussing ways to encourage authors to respond rapidly to requests from the editors and we believe that an electronic tracking system will help in this regard.

Our second main goal has been to improve management of the IGS finances. Last year the Office began to use a new accounting software package, SAGE. Each expenditure, including staff time, can be assigned to a given task, for example producing a given *Annals* or *Journal* volume. By the end of this financial year we will be able to provide accurate costs for all the Society's present activities and, more importantly, estimate costs for proposed new activities. Furthermore, we will have a rational and easy to follow accounting system that will allow Council to have a clear view of the Society's finances when making strategic decisions.

Members may already have noticed that the Society's website has been redesigned. Web publication of new publications is running smoothly and we have now added older issues of the *Journal*, from issue 152 onwards, and *Annals* volumes back to Volume 33. We are investigating the possibility of going back even further. We need to make sure that all members are aware that they can download papers at no cost. To subscribe, members should email the office (igsoc@igsoc.org).

We have also fully implemented the online abstract submission system that was first introduced at the Portland Symposium last year. It is now a modular system that can easily be adapted for any symposium. The next logical step is to move towards an online paper submission and review system. This is a task that the publication committee is looking into, along with the newly formed Electronic Communications task force.

Planning is well under way for two meetings in 2006. Garry Clarke has agreed to be Chief Scientific Editor of the Iceland Symposium, assisted by John Smellie, and Martin Sharp for the Cambridge meeting. The second circulars should be out before the end of the year. No symposia have been finalized for 2007 but we have agreed to cosponsor the first meeting of the Commission for Cryospheric Sciences, which will take place as part of the IUGG Assembly in Perugia. This is a historic occasion as it will mark the transition of the International Commission on Snow and Ice to full association status within the international scientific union system. The Society wishes to give its full support to this important step forward and has offered the services of the production team for publication of symposium proceedings.

Finally, I have the very pleasant task of announcing that Council has recommended that the Seligman Crystal should be awarded to Professor Richard Alley of Pennsylvania State University for his prodigious contribution to our understanding of the stability of the ice sheets and glaciers of Greenland and Antarctica and of erosion and sedimentation by this moving ice. Through the interpretation of paleoclimatic records from ice cores, Richard has examined the response of these ice sheets 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. I believe Richard will choose to receive his award at the Cambridge symposium next year but I am sure you would like to congratulate him here.

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

R. Braithwaite proposed, and H. Jay Zwally seconded, that the President's report be accepted. This was carried unanimously.

3. The Secretary General, on behalf of the treasurer, Dr. J.A. Heap, presented the following report with the audited Financial Statements for the year ended 31 December 2004.

The Financial Statements for the year ended 31 December 2004 reflect the implementation of our new accounting procedures brought in by the SAGE accounting software. You will see substantial changes between the previous statements and the present one. This is due to the adoption of 'departments' or 'projects' for all activities of the IGS. Also from now on, expenditure and income will be reflected in the year it was incurred. In the past such specific expenditures and income were reflected in the year the relevant volume of either the *Journal* or the *Annals* was due to be published, not the actual year in which the expenditures and incomes were incurred.

The state of the Society's finances is however, best summarised by considering the changes from 31 December 2003 to 31 December 2004 in the following funds, as shown on page 13 of the accounts:

Seligman Fund: increased from £7392 to £7642 as a consequence of accrued interest of £250;

- **Contingencies Fund**: maintained at the same level of £12,684;
- Annals Fund: decreased from £78952 to £67158 as a result of funds set against transfer of expenditure and accrued interest;
- **Publications Fund:** decreased from £25 443 to £21 242, as a consequence of expenditures set against sales, royalties and interest accrual;
- **Future volumes:** increased from £33976 to £51380 reflecting delayed publication of *Annals* 38 and 39 and the resulting saving in printing costs and lack of page charge payments
- Accumulated Fund: increased from £377445 to £397076 consequent upon a gain in that account for the year of £19631; this included a profit of £1917 in the value of investments due to an adjustment to market value (page 12, note 7). Income from memberships increased by £6580 and library sales were down by £346 and that from page charges was down from last year by £28690. This is a considerable decrease from the previous year due to the fact that we only published three Journal issues and only one Annals volume. For the same reason we saw a reduction of printing and publication costs of £87 400. In the 2004 Financial Statement we have only incurred the printing costs for one issue of the *Journal*. This amount also reflects the change

in accounting practices we have adopted as described at the beginning of this report. In 2004 we also received the remainder of the legacy from Loris Seligman and a legacy from Henri Bader, in all totalling £25 605. We also incurred substantial cost in the year due to putting back issues of the *Journal* and the *Annals* on the web and development and software costs due to the reorganizing of our production procedures.

In 2004, the Society published 444 pages in the Journal of Glaciology and 416 pages in the Annals of Glaciology. In 2003 the figures were 618 for the Journal and 716 for the Annals, a year with two issues of the Annals. This of course is a reflection of the reorganization of our production procedures. As the President has indicated in her report we are beginning to catch up and 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 over a thousand pages of the Annals and are planning to publish another 350 pages this year. This will of course be reflected in both page charges received and printing costs, although the latter will be less than previous years because of the fact that we are handling all the artwork and page makeup in-house now and only the actual printing is outsourced.

May I say how particularly grateful we are to all those authors who have been both able and willing to support the Society by the provision of page charges.

May I, again, 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 memberships, these are now balanced by those 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.

John A. Heap, Treasurer

T.H. Jacka proposed, and R. Braithwaite seconded, that the Treasurer's report be accepted. This was carried unanimously.

#### 4. Election of auditors for 2003 accounts

On a motion from the Secretary General, R. Braithwaite proposed, and T.H. Jacka seconded, that Messrs Peters, Elworthy and Moore of Cambridge be elected auditors for the 2005 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.

Presidents:	Atsumu Ohmura
Vice-Presidents:	I. Allison E. Wolff
Elective Members(4):	Richard Hindmarsh Waleed Abdalati Atsushi Sato Gwenn Flowers

These appointments were unanimously approved by the AGM.

The outgoing President E.M. Morris handed the meeting over to the incoming President, A. Ohmura.

The President thanked the immediate past President for her valuable contribution during her term of office.

#### 6. The Society's Constitution

The President reminded the AGM that ballot papers had been sent to all members of the Society asking whether the Society's Constitution dated October 1992 was, in the view of members the version of the Constitution currently in force.

159 properly completed ballot papers were returned to the Society's offices. All of them confirmed that the Society's Constitution dated October 1992 was the version of the Constitution currently in force. The outcome of the ballot is hereby recorded in the minutes of the 2005 Annual General Meeting.

The President thanked members for responding to the ballot request.

#### 7. Other business

The President announced to the AGM that, at its meeting on 5 September 2005, the IGS Council approved unanimously on a motion by the President, following the recommendation of our Awards Committee, to award the Seligman Crystal to Professor Richard Alley. The citation noted the prodigious contribution made by Professor Alley to our understanding 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 he has examined their response to past and future climatic 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.

The AGM discussed the various ways the Society could attract more members and more paper submissions to the *Journal of Glaciology*.

The AGM was adjourned on a motion from A. Rivera, seconded by H. Jay Zwally.

### FROM THE PRESIDENT ELECT

The International Glaciological Society was founded with the simple objective of furthering glaciology, by promoting the exchange of knowledge and experience, publishing research works, and where necessary encouraging and defending the activities of the glaciological community. The society organizes two conferences a year on average covering a range of themes in order to promote this exchange.

Publication of glaciological works has been one of the society's most important tasks since its foundation and is where a great deal of effort has been invested. Major changes in information technology and printing techniques have necessitated a drastic adaptation of publication procedures. The International Glaciological Society has actively coped with these inevitable changes and has used this occasion to serve the society better. The creation of in-house publishing is a direct result and the benefit of these efforts is becoming apparent. By using new IT technology, the *Journal* and *Annals* production processes have been significantly improved compared with earlier procedures.

To take full advantage of these improvements we must cut to a minimum the time between a manuscript's submission and its publication. Members who have accepted the privilege of reviewing a submitted work are encouraged to complete reviewing manuscripts in the shortest time possible. This timely return of the reviewed articles will benefit all members of the society, and encourage more authors to submit their works to the journal for publication.

Another aim of the society is to make our publications accessible to the public as soon as they are scientifically screened. One possibility is to post the print-ready manuscript electronically. Efforts are under way to make previously published works in the older volumes easily accessible. We are hoping to provide electronic access to older back issues and are exploring ways of making these improvements financially possible. This is an on-going effort and can be accelerated with additional funding.

We would be very happy to hear your opinions on the important issues that the Glaciological Society faces. The society exists primarily for the sake of its members. It is important for the headquarters to hear the wishes and desires of its members directly. If you have an idea on how to promote society activities and support its members, please let us know.

Atsumu Ohmura

### SELIGMAN CRYSTAL FOR RICHARD ALLEY

At the recent meeting on High Elevation glaciers and climate change in Lanzhou, China, the President of the International Glaciological Society, Atsumu Ohmura, announced the unanimous decision of the IGS Council to award a Seligman Crystal to award the Seligman Crystal to Professor Richard Alley. The citation noted the prodigious contribution made by Professor Alley to our understanding 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 he has examined their response to past and future climatic 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.

### **IGS STAFF CHANGES**

Last October, the IGS hired Rowena Baxter as a Reference Editor. Rowena previously worked at the Engineering Department of the University of Cambridge, where her responsibilities included managing references for the various academics in the department. Her e-mail is rowena@igsoc.org and if you have any queries regarding references feel free to contact her.

### A REPORT FROM THE LANZHOU SYMPOSIUM

5-9 September 2005, Ningwozhuang Hotel, Lanzhou, China



Figure 1. A panorama of Lanzhou, taken from the summit of Nanshan mountain

On arrival at Gansu airport, Roger Braithwaite and I were surprised to find we were the only symposium participants on that evening flight from Beijing to Lanzhou. Nevertheless a friendly reception committee was already waiting for us, and we were driven to the city in a large jeep. Looking out of the car windows we gained a first impression of loess, definitely the dominant feature of the landscape all around Lanzhou. From the plane we had seen that the whole surface is structured into small chambers that are divided by small and steep loessy hills. The valley floors in between these hills are mostly flat, and although in most cases very narrow, terraced everywhere and used for agriculture. In the car, I found it quite bewildering to drive from one valley into the next almost in the same minute. However, that puzzling landscape soon disappeared in the twilight and when we crossed the Yellow River it was already night. Then we saw the large red 'Welcome to the IGS Symposium' banner fluttering over the gateway of the Ningwozhuang hotel and the next moment we were sitting in the luxurious dining room. I was surprised to see a large, round and revolving glass plate in the centre of the round table. A manifold choice of dishes appeared on this glass plate. To reach the dish of your choice, you simply turn the glass plate - it took us a lot of turns to taste all of



Figure 2. People fishing at a small pond near the Yellow River

the dishes! For dessert delicious melons from the Gansu province were served.

The next morning we went out to explore the city of Lanzhou. Walking through the streets, I was impressed by the large number of skyscrapers and by the loud and restless traffic everywhere. There are many different vehicles rushing along and as a pedestrian, you soon understand that on the local streets the fastest, biggest vehicle always has the right of way. Even the countless cyclist have rights; they ring their bells loudly when pedestrians don't jump out of their way fast enough.



Figure 3. Nicolas, Irmgard and Aurel caught in the middle of a street, trying to cross

After a while we reached the Yellow River and we were surprised and fascinated by how well it lives up to its name. It has a very intense orangebrownish colour which comes from the enormous amount of loess transported in the water. I couldn't suppress my scientific curiosity and measured the clarity of the Yellow River. In hydrology, scientists use the so called Secchi disk to receive a first approximation of the water's clarity. A Secchi disk is all white or black and white and when it is lowered into the water the depth at which the disk disappears from sight is measured. Because I had no Secchi disc to hand, I put a white piece of plastic into the water, which disappeared at a depth of only 5 cm.



Figure 4. The Yellow River flowing through the centre of Lanzhou and thunderstoms over the

The conference started officially on Sunday evening with registration at the Ningwozhuang hotel followed by the ice-breaker. The scientific part began on Monday in a big hall in the hotel. The topics of all the sessions gave a broad overview of the different aspects of research into high-mountain glaciers. Monday was dedicated to ice cores and their climatological interpretation. Tuesday's topic was glacier variations and on Wednesday interactions between snow or ice and the atmosphere were discussed. Thursday was devoted to glacio-hydrological processes and to glacier physics, while the talks on the last day of the symposium were about glacier mass balances and modelling. The symposium's title 'International Symposium on High-Elevation Glaciers and Climate Records' was accurate: speakers from many different countries had come to Lanzhou. Research from numerous different mountain ranges all over the world was presented, with many of the talks reporting on glaciers in altitudes of more than 5000 m. I did not calculate the mean altitude of all the glaciers presented but it must be very high and finally one of the speakers excused himself for his 'high-mountain glaciers' being situated only somewhat above 2000 m!

A little bit more than 2000 m above sea level is also the altitude of Nanshan mountain, to the south of the city. On the midweek excursion we were driven to the top, where we enjoyed a spectacular view of the entire city. Some participants who had been on Nanshan mountain some years ago were amazed at the changes in the city. Countless new skyscrapers had been built and the sea of houses reached right to the very steep flanks of the surrounding loess hills. Looking down at the city, I got the impression that the houses were directly below my feet.



Figure 6. Two Chinese men having bought birds on the local market

In the evenings we split into groups for dinner in Lanzhou. Usually the first thing ordered, simply by pointing at the bottles, was beer. Choosing the dishes always turned out to be difficult; luckily, most restaurants had photos of every dish, but they were not always helpful. Even after a lot of communication by hand signals the dishes often turned out to be a complete surprise.

No guessing was needed on Thursday evening when the banquet took place at the hotel. Again an enormous choice of dishes was served on to the glass plates, along with rice wine, Chinese wine and schnapps. Again, a lot of spinning was needed to taste all the delicious food, and the evening was very lively. Everyone seemed to be in a very good mood. However, at exactly ten o'clock the dishes and even the tables were taken away, and we headed to the city to continue our revelling.



Figure 5. A café on the top of Nanshan mountain and the view down to the city



Figure 7. Roger having his shoes cleaned and discussing the price

On Thursday and especially on Friday the audience was slightly smaller than on the first and second day of the symposium. It felt like the conference was slowly fading away. Some participants left on Friday morning, others went to the city looking for souvenirs or even to a tailor for a custom-made suit. I really enjoyed the time in Lanzhou. I especially enjoyed the friendly atmosphere of the symposium, and the opportunity to make contact with colleagues from so many different countries.

Text and photographs by Horst Machguth



Figure 8. People waiting in a queue in a market

### A REPORT FROM THE LANZHOU POST SYMPOSIUM TOUR

The day after the symposium, we are 14 participants from Austria, Canada, China, Iceland, New Żealand, Switzerland, and the UK, gathered in front of the Ningwozhuang Hotel ready to board the bus that will take us, over the next five days, into the desert of western Gansu Province. Having finished a traditional Lanzhou breakfast of spicy beef noodles, we are set to cross the Yellow River to the left bank and start our westward journey along the Silk Road. The morning sees us winding through valleys cut into the edge of the great loess plateau underlying North-Central China. The valley floor, in fact all the pockets of flat land, is planted with sunflower, corn, melons, and fruit trees. Made up of loess that is 2000 m thick in places, the hills that surround us have been finely ringed with terraces, planted with shrubs, and irrigated in an effort to halt the erosion that colours the Huang He.



Figure 1. Our first encounter with the Great Wall of China and the inevitable street vendors

First stop: Wuwei where the first of many copious meals spins before us at a downtown hotel. An hour later, after dipping our chopsticks into numerous local dishes, we are back on the road. We are now in the desert. Everything is buff-coloured: the sand, the rocks, the hills, the few scattered buildings... some of us are dozing off. Suddenly to our north, not far from the highway, a low, linear, crumbling feature of the same buff colour as everything around appears to be following us. It's a thrill to realize, with certainty, that it can only be the Great Wall of China. We pull into Shuiguazi to have a closer look. A windy and very dusty truck-stop, we are nonetheless pleased to be outside and set about examining the ancient adobe bricks that make up the wall. Too soon, it's back to the bus, local melons bought from a roadside stall in hand, ready to continue our journey westward. On the edge of the Tibet/Qinghai Plateau with the Inner Mongolian Plain to the north, we are hemmed in by mountains; ancient towers look down on us from the summits. We are in the Hexi Corridor.

For the rest of the day, we drive in and out of green, well watered areas with lots of farming and village life. The sharp transition between the



Figure 2. The picturesque view from the bus showed how labour intensive farming in China is

desert and green areas is often striking. We look south, towards the imposing Qilian Mountains, the source of this all important water, straining our eyes to see which white patches are snow and which are glacier. Their importance is not difficult to gauge. Finally, after a very long day, we arrive in Jiayuguan, a planned city with very large avenues and little traffic. Here, as well as in neighbouring Jiuquan, things are hardly different from Lanzhou: the volume of construction under way is staggering.

Sunday we leave our newly built, comfortable hotel and set out for Jiayuguan Fort, westernmost outpost of the Great Wall. Built at the beginning of the Ming Dynasty (1368–1644 AD), the fort, in the Gobi Desert and at the foot of the Oilian Mountains, is an important tourist stop along the Silk Road. Our fearless guide, Yawen (Catherine), vellow flag raised high, leads our little group into the maw of the great brick fort. Curious, distracted, and basically undisciplined, the group immediately disperses, happy for a chance to walk, explore turret and temple, shoot arrows at straw dummies, eat ears of roasted corn, and wander through small, dark shops with the most intriguing and skilfully made curios and antiques. Then it is off to the foot of the wall where camels are mounted for the obligatory 20 minute ride.



Figure 3. Several of the tour participants had their first experience of riding on a camel

We are now settled in our bus seats, staring out windows, discussing, reading, some members of our well knit group falling off to sleep. The four-lane expressway ends. We are now bouncing along a sandy desert track frenetically dodging long trucks, tractors, SUVs, motorcycles, and other buses. Blue sky through trails of dust.

This long day would see us on and off the scattered construction of a very major expressway through very serious desert. Ultimately it will reach the Kazakhstan border, 1700 km to the west. Evidence of flash floods and erosion can be seen everywhere. The embankments of the expressway under construction are being well armoured with stone and concrete. We are now travelling through mostly flat, gravelly desert with the occasional small, tufted patches of vegetation the size of little porcupines. Oil industry installations appear here and there and we also come across an aeolian park; hundreds of huge white windmills producing electricity. Through all this we cross pockets of agriculture. As we go west, cotton predominates, accompanied by onions, red hot peppers, corn and other interesting cultures. As the sun goes down, still on a dirt track and surrounded by highway construction on a grand scale, we reach Dunhuang oasis at the western end of the Hexi Corridor, former outpost on the Silk Road and, as ever, a meeting place of many cultures. This we find is well reflected in its lively night market, where one finds a great variety of roasted meats, exotic sweets, nuts, and dried fruit. Dunhuang has more than likely been an interesting city for a very long time.

The next morning we are off to investigate the local sites. On the very edge of town are the Mingsha Dunes (the Echoing Sand Mountains) and Crescent Moon Spring. Although the dunes are mentioned in all the travel guides, no one is quite prepared for the wall of sand that dwarfs our little group and the city behind us.



Figure 4. The megadunes proved to be quite a challenge to climb but were impressive from every angle

Some dunes are as high as 250 m and the erg covers an area of  $35 \times 20 \text{ km}^2$ . The Mingsha outlier lies at the extreme eastern end of the Kumtag Desert, one of the harshest and least explored area of western China. Souvenir and food stalls, temples, cafés, sand toboggans and hang gliders, hawkers, and camel rides to the top of the dunes; the group will have none of it until it has surveyed the carnival from atop the first dune. That done, we... disperse! The morning is one of the most enjoyable of the trip. Now it's off to visit the magnificent Mogao Grottoes, the Caves of the Thousand Buddhas. The hundreds of rooms carved in the face of a cliff and connected by

ledges and balconies, are filled with polychrome frescoes and carvings representing 900 years of devotion to Buddha. A highly proficient guide leads us through a dozen or so rooms and provides us with explanations and insights at a level well beyond what might be expected. After a stimulating day, we settle into several private dining rooms at a Dunhuang restaurant where a delicious meal is accompanied by many bottles of a truly excellent red wine, made from local grapes.



Figure 5. Massive road construction provided for some very dusty encounters

The morning after, we are faced with the reality of the return trip to Lanzhou: two days, 20odd hours, of Silk Road desert, bringing home the tedium of crossing a large country. The trip is broken up by the pretty and pleasant city of



Figure 6. Countries participating: China, New Zealand, UK, Iceland, Canada, Austria and Switzerland

Zhangye. With only 500km to Lanzhou, and that on a good road, it is announced that tomorrow we may sleep in; we are not setting out until 9:30. Sleep in? The next morning dispersion ensues and by 7:00 am most of us are in taxis headed for the Great Buddha Temple near the centre of town.

The narrow, Qing style, tree-lined street adjacent to the temple is quiet with only the occasional bicycle and practitioner of Tai Chi. We wait for the temple gates to open and visit the sleeping Buddha, its largest indoor likeness in China; Sakyamuni in a state of nirvana.

#### **Dominique Paré and Jocelyne Bourgeois**

### JOURNAL OF GLACIOLOGY

Papers accepted for publication between 1 July 2004 and 15 November 2005. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

Vladimir B. Aizen, Elena Aizen, Koji Fujita, Stanislav A. Nikitin, Karl J. Kreutz, L. DeWayne Cecil, Nozomu Takeuchi Stable-isotope time series and precipitation origin from firn cores and snow samples, Altai glaciers, Siberia

PS Anderson Ice shelf micro-topography observed using satellite thermal imagery

Robert Bindschadler, Patricia Vornberger, Laurence Grey Changes in the ice plain of Whillans Ice Stream, West Antarctica

Xiao Cheng, Guanhua Xu The integration of JERS-1 and ERS SAR in differential interferometry for measurement of complex glacier motion

Olaf Eisen, W.D. Harrison, CF Raymond, KA Echelmeyer, G Bender, JDM Gorda Variegated glacier: a century of surges

Max McGillen, Ian J. Fairchild An experimental study of the controls on incongruent dissolution of CaCo3 under glacialanalogue conditions

Adrian J. Fox, David G. Vaughan The retreat of the Jones Ice Shelf, Antarctic Peninsula

M. Gerbaux, C. Genthon, P. Etchevers, C. Vincent, JP Dedieu Surface mass balance of glaciers in the French Alps: distributed modeling and sensitivity to climate change

Martin Horwath, Reinhard Dietrich, Michael Baessler, Uwe Nixdorf, Daniel Steinhage, Diedrich Fritzsche, Volkmar Damm, Gernot Reitmayr Nivlisen, an Antarctic ice shelf in Dronning Maud Land: geodetic–glaciological results from a combined analysis of ice thickness, ice surface height and ice flow observations

Yoshinori Iizuka, Takeo Hondoh, Yoshiyuki Fujii Na<sub>2</sub>SO<sub>4</sub> and MgSO<sub>4</sub> salts during Holocene period in a Dome Fuji ice core derived by high depth-resolution analysis

Lars Karlof, T.A. Oigard, F. Godtliebsen, M. Kaczmarska, H. Fischer Instruments and Methods: Statistical techniques to select detection thresholds for peak signals in ice core data Lars Karlof, Elisabeth Isaksson, Jan-Gunnar Winther, Niels Gundestrup, Harro A.J. Meijer, Robert Mulvaney, Michel Pourchet, Coen Hofstede, Gaute Lappegard, Rickard Pettersson, Michiel van den Brocke, Roderik S.W. van de Wal Accumulation variability in a 8×8km area in eastern Dronning Maud Land, Antarctica, as determined by shallow firn cores and snow pits: some implications for ice core records

Andrew G. Klein, Joni L. Kincaid Retreat of glaciers on Mt Jaya, Irian Jaya determined from 2000 and 2002 IKONOS satellite images

E.J. Klok, M. Nolan, M.R. van den Broeke Analysis of meteorological data and the surface energy balance of McCall Glacier, Alaska

Bernd Kulessa, Bryn Hubbard, Giles H. Brown Time-lapse imaging of subglacial drainage conditions using 3D inversion of subglacial electrical resistivity data

D. Samyn, S.J. Fitzsimons, R.D. Lorrain Strain-induced phase changes within cold basal ice from Taylor Glacier (Antarctica) indicated by textural and gas analyses

Brett A. Marmo, Jane R. Blackford, Chris E. Jeffree Ice friction, wear features and their dependence on sliding velocity and temperature

Sumio Matsuura, Koji Matsuyama, Shiho Asano, Takashi Okamoto, Yoshitsugu Takeuchi Fluctuation of the seasonal snowpack in a mountainous area of the heavy snow district in the warm-temperate zone of Japan

John C. Moore, Aslak Grinsted Filtering ground penetrating radar data using single spectrum analysis

Fumio Nakazawa, Koji Fujita, Nozomu Takeuchi, Toshiyuki Fujiki, Jan Uetake, Vladimir Aizen, Masayoshi Nakawo Dating of sparse seasonal layers in alpine ice cores using pollen analysis

Francesca Pellicciotti, Ben Brock, Ulrich Strasser, Paolo Burlando, Martin Funk, Javier Corripio An enhanced temperature-index glacier melt model including shortwave radiation balance: development and testing for Haut Glacier D'Arolla, Switzerland

Antoine Pralong, Martin Funk On the instability of avalanching glaciers Antoine Rabatel, Jean-Pierre Dedieu, Christian Vincent

The use of remote sensing data to determine equilibrium line altitude and mass balance time series: validation on three French glaciers for the 1994–2002 period

Antoine Rabatel, Abraham Machac, Bernard Francou, Vincent Jomelli Glacier recession on Cerro Charquini (Bolivia 16'S) since the maximum of the Little Ice Age (17th century)

LA Rasmussen, LM Andreassen Seasonal mass balance gradients in Norway

Charles F Raymond, Ginny A Catania, Nadine Nereson, C.J. van der Veen Bed radar reflectivity across the north margin of

Whillans Ice Stream and implications for margin processes David M. Rippin, Ian C. Willis, Neil S. Arnold, Andrew J. Hodson, Moana Brinkhaus Spatial and temporal variations in surface velocity and basal drag across the tongue of the polythermal Midre Lovenbreen, Svalbard

Rui Jin, Xin Li, Tao Che, Lizong Wu, Pradeep Mool Glacier area changes in the Pumqu River basin, Tibetan Plateau between the 1970s and 2001

Chris R. Stokes, Stephen D. Gurney, Maria Shahgedanova, Victor Popovnin Late 20th century changes in glacier extent in the Caucasus Mountains, Russia

### ANNALS OF GLACIOLOGY, VOLUME 43

The following papers from the International Symposium on High Elevations Glaciers and Climate Records held in Lanzhou, China, 5–9 September 2005, have been accepted for publication in Annals of Glaciology Vol. 43, edited by Ellen Mosley-Thompson and Lonnie Thompson:

Vladimir B. Aizen, Elena M. Aizen, Daniel R. Joswiak, Koji Fujita, Nozomu Takeuchi and Stanislav A. Nikitin

Climatic and atmospheric circulation pattern variability from ice-core isotope/geochemistry records (Altai, Tien Shan and Tibet)

Vladimir B. Aizen, Valeriy A. Kuzmichenok, Arzhan B. Surazakov and Elena M. Aizen Glacier changes in central and northern Tien Shan during the last 150 years based on surface and remote sensing data

D. Bolius, Margit Schwikowski, Theo Jenk, Heinz W. Gäggeler, Gino Casassa and Andres Rivera

A first shallow firn core record from Glacier La Ollada on Cerro Mercedario in the Central Argentinian Andes

Roger J. Braithwaite, Sarah C.B. Raper and Krys Chutko Accumulation at the equilibrium line altitude (ELA) of glaciers inferred from a degree-day

model and tested against field observations

Jorge Luis Ceballos, Christian Euscátegui, Jair Ramírez, Marcela Cañon, Christian Huggel, Wilfried Haeberli and Horst Machguth Fast shrinkage of tropical glaciers in Colombia

Mary E. Davis and Lonnie G. Thompson An Andean ice-core record of a Middle Holocene mega-drought in North Africa and Asia Ding Yongjian, Liu Shiyin, Li Jing and Shangguan Donghui The retreat of glaciers in response to recent climate warming in western China

Kumiko Goto-Azuma, Roy M. Koerner, Michael N. Demuth and Okitsugu Watanabe Seasonal and spatial variations of snow chemistry on Mount Logan, Yukon, Canada

Xiaohua Gou, Fahu Chen, Gordon Jacoby and Meixue Yang

A comparison of tree-ring records and glacier variations over the past 700 years, northeastern Tibetan Plateau

Han Jiankang, Nakawo Masayoshi, Kumiko Goto-Azuma and Chao Lu Impact of fine dust air burden on the mass balance of a high mountain glacier: a case study of the Chongce ice cap, West Kunlun Mts, China

Han Tianding, Ding Yongjian, Ye Baisgheng, Liu Shiyin and Jiao Keqin Characteristics of mass balance of Glacier No.1 at the beadwaters of the Lirumgi River. Tianshan

at the headwaters of the Urumqi River, Tianshan Mountains

He Yuanqing, Pang Hongxi, W.H. Theakstone, Lu Aigang, Zhang Zhonglin, Zhang Dian, Song Bo, Yuan Lingling and Ning Baoying Spatial and temporal variations of oxygen isotopes in snowpacks and glacial runoff in different types of glacial area in western China Zhongqin Li, Ross Edwards, E. Mosley-Thompson, Feiteng Wang, Zhibao Dong, Xiaoni You, Huilin Li, Chuanjin Li and Yuman Zhu Seasonal variability of ionic concentrations in surface snow and elution processes in snow-firn packs at the PGPI site on Glacier No. 1 in eastern Tianshan, China

Liu Shiyin, Shangguan Donghui and Ding Yongjian, Han Haidong, Xie Changwei, Zhang Yong, Li Jing, Wang Jian and Li Gang Glacier changes during the past century in the Gangrigabu Mountains, southeast Qinghai-Xizang (Tibet) Plateau, China

Liu Shiyin, Ding Yongjian Shangguan Donghui, Zhang Yong, Li Jing, Han Haidong, Wang Jian and Xie Changwei

Glacier retreat as a result of climate change due to warming and increased precipitation in the Tarim River Basin, northwest China

Horst Machguth, Frank Paul, Martin Hoelzle and Wilfried Haeberli

Distributed glacier mass balance modelling as an important component of modern multi-level glacier monitoring

Yoshihiro Matsuda, Koji Fujita, Yutaka Ageta and Akiko Sakai

Estimation of atmospheric transmissivity of solar radiation from precipitation in the Himalayas and Tibetan Plateau

Christoph Mayer, Astrid Lambrecht, Marco Belò, Claudio Smiraglia and G. Diolaiuti Glaciological characteristics of the ablation zone of Baltoro Glacier, Karakoram

Claudia Mihalcea, Christoph Mayer, Guglielmina Diolaiuti, Astrid Lambrecht, Claudio Smiraglia and Gianni Tartari Ice ablation and meteorological conditions on the debris covered area of Baltoro Glacier (Karakoram, Pakistan)

Takayuki Miyake, Fumio Nakazawa, Hiroshi Sakugawa, Nozomu Takeuchi, Koji Fujita, Keiichi Ohta and Masayoshi Nakawo Concentrations and source variations of *N*-alkanes in a 21 m ice core and snow samples at Belukha Glacier, Russian Altai Mountains

Ellen Mosley-Thompson, Lonnie G. Thompson and Lin Ping-nan

A multi-century ice core perspective on 20th century climate change with new contributions from high Arctic and Greenland (PARCA) cores Oleg Nagornov, Yuri Konovalov and Vladimir Mikhalenko

Prediction of thermodynamic state of the Gregoriev Ice Cap (Tien Shan, Central Asia) in the future

Fumio Nakazawa and Koji Fujita Use of ice cores from glaciers with melting for reconstructing mean summer temperature variations

Chiyuki Narama and Mitsuru Okuno Record of glacier variations during the last glacial in the Turkestan Range of the Pamir-Alay

Chiyuki Narama, Yuichi Shimamura, Daichi Nakayama and Kanatbek Abdrakhmatov Recent changes of glacier coverage in the western Terskey-Alatoo Range, Kyrgyz Republic, using Corona and Landsat

#### Atsumu Ohmura

Changes in mountain glaciers and ice caps during the 20th century

Andres Rivera, Francisca Bown, Ronald Mella, Jens Wendt, Gino Casassa, César Acuña, Eric Rignot, Jorge Clavero and Benjamin Brock Ice volumetric changes on active volcanoes in southern Chile

Margit Schwikowski, Sabina Brütsch, Gino Casassa and Andrés Rivera A potential high-elevation ice core site at the southern Patagonian icefield

Shangguan Donghui, Liu Shiyin, Ding Yongjian, Ding Lianfu, Xiong Libing, Cai Dihua, Li Gangi, Lu Anxin, Zhang Shiqiang and Zhang Yong Monitoring the glacier changes in the Muztag Ata and Konggur mountains, East Pamirs, based on Chinese Glacier Inventory and recent satellite imagery

Nozomu Takeuchi, Jun Uetake, Koji Fujita, Vladimir Aizen and Stanislav Nikitin A snow algal community on Akkem Glacier in the Russian Altai Mountains

Lonnie G. Thompson, Tangdong Yao, Mary E. Davis, Ellen Mosley-Thimpson, Ping-Nan Lin, Tracy A. Mashiotta, Vladimir N. Mikhalenko and Victor S. Zagorodnov

Holocene climate variability archived in the Puruogangri ice cap from the central Tibetan Plateau

J. Uetake, S. Kohshima, F. Nakazawa, K. Suzuki, M. Kohno, T. Kameda, S. Arkhipov and Y. Fujii Biological ice-core analysis of the Sofiyskiy Glacier in the Russian Altai mountains Wang Feiteng, Li Zhongqin, You Xiaoni, Li Chuanjin, Li Huilin, Li Xiangying, Zhao Zhongping and Zhu Yuman Seasonal evolution of aerosol stratigraphy in Glacier No. 1 percolation zone, eastern Tianshan, China

Vivian Wasiuta, Ann-Lise Norman and Shawn J. Marshall Spatial patterns and seasonal variation of snowpack sulphate isotopes of the Prince of Wales Icefield, Ellesmere Island

Wen Jiahong, Kenneth C. Jezek, Andrew J Monaghan, Sun Bo, Ren Jiawen and Philippe Huybrechts

Accumulation variability and mass budgets of the Lambert Glacier–Amery Ice Shelf system at high elevations

Zhang Xinfang, Yao Tandong, An. Lishe, Tian Lide and Xu Shijian

A study on the vertical profile of bacterial DNA structure in the Puruogangri ice core using denaturing gradient gel electrophoresis

Xu Baiqing, Yao Tandong, Liu Xianqin and Wang Ninglian Elemental carbon and organic carbon measurements with a two-step heating-GC system in snow samples from the Tibetan Plateau

Kaplan Yalcin, Cameron P. Wake, Karl J. Kreutz, Kang Shichang, Karl J. Kreutz and Sallie I. Whitlow Seasonal and spatial variability in snow chemistry at Eclipse Icefield, Yukon Territory, Canada Meixue Yang, Tandong Yao, Xiaohua Gou , Huijun Wang and Thomas Neumann Wavelet analysis reveals periodic oscillations in a 1700 year ice core record from Guliya, China

Meixue Yang, Tandong Yao , Xiaohua Gou and Huijun Wang

Effect of heavy snowfall on ground temperature, northern Tibetan Plateau

Meixue Yang, Tandong Yao, Huijun Wang and Xiaohua Gou

Correlation between precipitation and temperature variations in the past 300 years recorded in Guliya ice core, China

Qinghua Ye, Tandong Yao, Shichang Kang, Feng Chen and Jinghua Wang Glacier variations in the Mt Naimona'Nyi region, western Himalayas, in the last three decades

Zhang Yong, Liu Shiyin, Xie Changwei and Ding Yongjian Application of a degree-day model for the determination of contributions to glacier meltwater and runoff near Keqicar Baqi Glacier, southwestern Tianshan Mountains

Zhang Yong, Liu Shiyin and Ding Yongjian Observed degree-day factors and their spatial variation on glaciers in western China

Yu Wusheng , Yao Tandong, Tian Lide, Wang Yu and Sun Weizhen Oxygen-18 isotopes in precipitation on the eastern Tibetan Plateau

### **BRITISH BRANCH ANNUAL MEETING 2005**

Division of Geography, Northumbria University, 14–15 September 2005

The 30th annual meeting of the British Branch of the International Glaciological Society was hosted by John Woodward at Northumbria University, Newcastle-upon-Tyne on Wednesday 14 and Thursday 15 September 2005. The meeting was attended by over 50 delegates, and included 19 oral and 10 poster presentations covering a large selection of the earth's major glaciated areas. A demonstration of new ground-penetrating radar equipment was made to the meeting by Geomatrix Earth Science Ltd. The social highlight of the meeting was the conference dinner at the Newcastle Hilton in Gateshead. Delegates met on the quayside before enjoying a superb meal and after dinner entertainment.

As in previous years, John Glen judged the competitions for the best student oral and poster

presentations. He presented the John Glen Prize to Suzanne Bevan (University of Wales, Swansea) for the best oral presentation, entitled 'A comparison of remotely sensed surface velocities with balance velocities on two Svalbard ice caps', and to Christina Bell (University of Aberdeen) for the best poster presentation, entitled 'Controls on spatial and temporal variability in the snowpack of a High Arctic ice mass: the Devon Island Ice Cap, Nunavut, Canada'. Congratulations to them and all the postgraduates who presented at the conference for the quality of both their presentations and the science they conveyed to the meeting.

For any queries regarding the conference please contact John Woodward (john.woodward @unn.ac.uk).

### Environmental and Industrial Geophysics Group, The Geological Society GEOPHYSICS OF GLACIAL AND FROZEN MATERIALS

Division of Geography, Northumbria University, 16 September 2005

A conference of the Environmental and Industrial Geophysics Group (EIGG) of the Geological Society followed the British Branch meeting on Friday 16 September 2005. This one-day meeting on the 'Geophysics of glacial and frozen materials' brought together the leading UK near-surface geophysical and glaciological communities, and emphasised state-of-the-science surface and borehole seismic and GPR, GPS, seismoelectric, and electrical self-potential applications in characterizing the properties of and processes in glacial and frozen materials. It is currently planned to publish the conference contributions as full papers in a special issue of the Journal of Environmental and Engineering Geophysics.

For any queries regarding the conference please contact Bernd Kulessa (b.kulessa@swansea.ac.uk).



Unfortunately, on occasion, mistakes creep into our publications. Usually we try to publish corrections in subsequent issues in the case of the *Journal*, but in the case of the *Annals* it is more difficult. Hence we are going to publish all corrections in *ICE* in future and whenever possible in the *Journal* also.

In *Journal* vol. 50, issue 169. Mahoney A., H. Eicken, L. Shapiro and T. C. Grenfell. 2004. Ice motion and driving forces during a spring ice shove on the Alaskan Chukchi Coast. *J.Glaciol.* **50**(169), 195–207, a 'less than' symbol was incorrectly inserted in place of a 'greater than' symbol at two locations:

Page 202, column 1, paragraph 4, line 4:  $<\!0.5\,m$  should be  $>\!0.5\,m$ 

Page 206, column 1, line 2: <1 m should be >1 m

In *Journal* vol. 50, issue 171 the first name of one of the authors was printed incorrectly. The article is Elsberg, D.H. and 6 others. Depth- and time-dependent vertical strain rates at Siple Dome, Antarctica on page 511. E.D. Waddington's first name is Edwin, not Edward.

There was a mistake in *Annals* 39 in the paper by Thomas and others. Force perturbations analysis of Pine Island Glacier, Antarctica, suggests cause for recent acceleration, pages 133–138. The Greek delta symbol  $\Delta$  is missing from several equations, from page 135 onwards. Since this mistake makes the article incomprehensible we have decided to reprint this article and send it to all persons and libraries that received the original copy. We will also make certain that the corrected version of the paper will appear on the Ingenta website.



#### Reminder

When your paper in the *Journal* or *Annals* has been reviewed and accepted, please remember to send the IGS office an electronic version of your final accepted paper (in Word or LaTex) along with your illustrations as eps, ai, ps, tif or psd files. You can send them by e-mail to journal@igsoc.org or annals@igsoc.org; you can mail a CD or disk to us; or you can send them via the IGS ftp site (please contact igsoc@igsoc.org for details).

#### References

If you are using a reference program, such as Reference Manager, EndNote or RefWorks, to produce your reference list, please click on Remove field codes before sending to us. Otherwise, the name and date within the text (i.e. Smith and others, 2001) often disappears during the copy-editing process and has to be rekeyed.

#### **Christine Butler**

**Production Department** 

INTERNATIONAL GLACIOLOGICAL SOCIETY

### International Symposium on Earth and Planetary Ice–Volcano Interactions

Reykjavík, Iceland 19–23 June 2006

Earth & Planetary Ice-volcano interactions

CO-SPONSORED BY: Institute of Earth Sciences, University of Iceland Icelandic Institute of Natural History Icelandic Meteorological Office Icelandic Glaciological Society The National Energy Authority The Icelandic Road Authority Nordic Volcanological Center Landsvirkjun IAVCEI

SECOND CIRCULAR

November 2005

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### INTERNATIONAL GLACIOLOGICAL SOCIETY

PRESIDENT: A. Ohmura VICE PRESIDENTS: E. Brun, E. Wolff, I Allison IMMEDIATE PAST PRESIDENT: E.M. Morris

## SYMPOSIUM ON EARTH AND PLANETARY ICE–VOLCANO INTERACTIONS

The International Glaciological Society will hold an International Symposium on Earth and Planetary Ice–Volcano Interactions in 2006. The symposium will be held in Reykjavík, Iceland, with registration on 18 June and sessions from 19 to 23 June 2006.

#### SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)

#### LOCAL ARRANGEMENTS COMMITTEE

þröstur þorsteinsson (Chairman), Bryndís Brandsdóttir, Freysteinn Sigmundsson, Helgi Björnsson, Hreinn Haraldsson, Magnús T Guðmundsson, Matthew Roberts, Óli Grétar Blöndal Sveinsson, Sveinn Jakobsson, Tómas Jóhannesson, þorsteinn þorsteinsson

### SCIENCE STEERING AND EDITORIAL COMMITTEE

Garry K.C. Clarke, Chief Scientific Editor, John Smellie, Assistant Chief Scientific Editor, Guðfinna Aðalgeirsdóttir, Bryndís Brandsdóttir, Jennie Gilbert, Jim Head, Helmut Rott, Thor Thordarson, Jean-Claude Thouret and Joseph Walder,

### INFORMATION ABOUT THE SYMPOSIUM MAY BE OBTAINED FROM:

International Glaciological Society, Scott Polar Research Institute,

Lensfield Rd, Cambridge CB2 1ER, UK.

Tel: +[44] (0)1223 355 974

Fax: +[44] (0)1223 336 543

Email: igsoc@igsoc.org

Web: http://www.igsoc.org/symposia/ http://www.vedur.is/igs2006/ available 1 January 2006

#### PARTICIPATION

This circular includes forms for registration and instructions for arranging accommodation. These can also be found on the symposium website. The registration form and accompanying payment should be returned by 1 April 2006. There is a surcharge for late registration. The participant's registration fee includes organisation costs, a set of abstracts, the icebreaker function, coffee breaks and lunch, the banquet, and a copy of the *Annals of Glaciology*.

Registration fees	ISK
Participant (IGS member)	38000
Participant (not IGS member)	43 000
Student or retired IGS member	15000
Accompanying person over 18	13000
Late registration surcharge	13000
(after 1 April 06)	
Symposium study tour (estimate)	55000

Registration refunds will be made according to date of notification. Cancellations made before 1 May 2006 will receive a full refund.

Cancellations between 1 May and 3 June 2006 will be eligible for a partial refund. After 3 June it may not be possible to make any refund.

#### THEME

Ice-covered volcanoes pose many interesting challenges to scientists. Numerous interesting phenomena arise from the thermal interaction between hot volcanic materials and ice, here on Earth and elsewhere in the Solar System; examples include the triggering of jökulhlaups, the effect of internal layers of volcanic origin on radar signals, and the relationship between older subglacially erupted volcanoes and the glaciers in which they formed. Furthermore, ice-volcano interactions may cause major hazards such as lahars, jökulhlaups, and explosive eruptions. An improved understanding of these topics can only be advanced through multidisciplinary research, drawing together such diverse fields as remote fieldwork, and modeling. sensing, This symposium provides a forum for researchers from a variety of backgrounds to discuss the science of interactions of volcanoes and ice.

#### TOPICS

The suggested topics include:

- 1. Effects of ice cover on volcanic systems:
  - a. Extraction of heat from magma to meltwater: subglacial and supraglacial melting
  - b. The effect of glacier overburden and water pressure on volcanic activity, seismic activity and subglacial geothermal systems
  - c. Older subglacially formed volcanoes as evidence for past ice cover thickness and extent
- 2. Effects of geothermal and volcanic systems on glaciers and ice caps:
  - a. Mass balance (subglacial melting, the effect of tephra on albedo)
  - b. The effect of subglacial geothermal activity and eruptions on glacier flow
  - c. Effects on the atmosphere and the ocean
  - d. Subglacial lake studies
- 3. Geophysical exploration of ice-covered volcanoes:
  - a. Looking through the ice (radio echo soundings, etc.)

- b. Detection of subglacial geothermal activity (surface depressions; chemicals in meltwater)
- 4. Information from internal acid layers and tephra layers:
  - a. On volcanic activity
  - b. On mass balance
- 5. Volcano-glacier hazards:
  - a. Monitoring of ice-covered volcanoes and geothermal areas (inflation of volcanoes, seismicity, meltwater chemistry, thermal activity, lake levels)
  - b. Jökulhlaups, lahars
- 6. Extraterrestrial ice-volcano interaction

#### SESSIONS AND POSTERS

Oral presentations will be held on four full days and one half-day. There will also be a poster session. The size of poster presentations will be given on the website.

#### 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.

#### PAPERS

#### (1) SUBMISSION OF ABSTRACTS

Participants who want to contribute to the Symposium should submit an abstract of their proposed presentation. This abstract must contain sufficient detail for its scientific merit and relevance to the symposium theme to be judged by the Editorial Board. A web site will be available from December 2005 where authors can upload their abstract and all the relevant contact information. The abstract itself should not exceed 400 words. References and illustrations should not be included.

You will be required to enter all your details with the submission and in particular to state whether you intend to submit a paper for publication in the *Annals of Glaciology*. We will only solicit referees for abstracts that have explicitly stated that they intend to submit a paper. Referees are a scarce commodity and we do not want to trouble them unnecessarily.

Those who are unable to submit their abstract via the internet can submit electronic files on a CD or diskette to the IGS office where a member of staff will upload them on to the web site.

### LAST DATE FOR RECEIPT OF ABSTRACTS: 27 JANUARY 2006

Final versions of papers accepted for publication should not exceed five printed pages in the Annals of Glaciology. Extra pages will be charged at the rate of UK £90 per page. Papers with colour figures will accrue page charges, at the colour rate of UK £150 for all pages. Honouring page charges (also £90 per page) for the first five pages in encouraged.

#### (2) SELECTION OF ABSTRACTS

Each abstract will be assessed on its scientific guality and relevance to the Symposium theme. Authors whose abstracts are accepted will be invited to make either an oral or poster presentation at the Symposium and submit a paper for publication in the Annals of Glaciology (included in the ISI Science Citation Index<sup>®</sup>). First or corresponding authors will be advised by 5 March 2006 of the acceptance or otherwise; other authors will not be informed separately. Authors who have not received notification by that date should contact the IGS office in Cambridge in case their abstract was not received. Acceptance of an abstract means that a paper based on it can be submitted to the Annals of Glaciology. Papers submitted for consideration in the Annals cannot be submitted to another publication as well. Note: abstracts alone will not be published in the Annals of Glaciology.

#### (3) DISTRIBUTION OF ABSTRACTS

A set of the accepted abstracts will be provided to participants upon registration on 18 June 2006.

### (4) SUBMISSION OF PAPERS AND PUBLICATION

Manuscripts should be submitted as a PDF file to the IGS office by e-mail annals@igsoc.org stating clearly the abstract number in the file name and in the subject line of the e-mail. Papers should be prepared in accordance with the instructions sent to authors with the abstract acceptance notification and must be submitted as PDFs (portable document format). Authors who submit in other electronic formats will be asked to re-submit as PDF. All manuscripts should be submitted by 10 May 2006. ALL AUTHORS ARE EXPECTED TO ADHERE TO THIS DEADLINE. Papers will be refereed according to the usual standards of the Society before being accepted for publication. Final papers, based on presentations at the Symposium, which have been submitted and accepted by the Editorial Board following review, will be published in English in the Annals of Glaciology (Vol. 45). Final, revised versions of papers must be submitted by 31 July 2006. Timely publication of the Annals of Glaciology will depend upon strict adherence to deadlines.

## LAST DATE FOR RECEIPT OF PAPERS: 10 May 2006

LAST DATE FOR RECEIPT OF REVISED PAPERS: 31 July 2006

#### **EXCURSIONS**

MID WEEK FIELD TRIP:

Excursion to þingvellir parliament plains, Gullfoss and Geysir. Dinner at Hotel Geysir included. Cost approx. ISK 8000.

Other options: Various short excursions are available from Reykjavík Centre, for instance to the Blue Lagoon. Information will be available at the conference desk.

BANQUET to be held on Thursday evening, 22 June in Viðey.

SYMPOSIUM STUDY TOUR – THREE DAYS 24–26 June 2006: SOUTHERN-ICELAND

Several sites displaying the products and effects of glacio-volcanic interaction will be visited during this trip. Examples include: Mýrdalsjökull ice cap and the Mýrdalssandur outwash plain formed in large jökulhlaups resulting from eruptions in the subglacial volcano Katla; Vatnajökull ice cap, the Skeiðarársandur outwash plain (flooded during the subglacial eruption in Gjálp 1996), the glacier-capped volcano Öræfajökull and the Jökulsárlón (Glacier Lagoon).

Approximate cost is ISK 55 000 per person, including bus transfer, guide, all meals, overnight stays in double rooms at Hvolsvöllur and Skaftafell, admission to visitor centers, flight from Höfn to Reykjavík. Price based on 30 participants.

More details are available at

http://www.vedur.is/igs2006/.

#### ACCOMPANYING PERSONS PROGRAMME

The accompanying person registration fee includes the ice-breaker, city sightseeing tour with lunch, and the banquet. Staff from Iceland Travel will be on the registration/information desk during the conference and will assist with further arrangements.

#### LOCATION AND WEATHER

Iceland is an island of 103 000 km<sup>2</sup> (39 756 sq miles). Its highest peak, Hvannadalshnjúkur, rises to 2111 m and over 11% of the country is covered by glaciers, including Vatnajökull.

Owing to the Gulf Stream the Icelandic climate is mild. The average temperature for January, the coldest month, is  $-0.6^{\circ}$ C (30°F).The summers are fairly cool, with lowland temperatures between 12° and 15°C (54–60°F). The climate is considerably cooler higher up in the mountains.

#### TRAVEL AND ACCOMMODATION

Iceland is a member of the Schengen Treaty. Information about which nationalities need Visa, where and how to apply is to be found at www.utl.is

#### VENUE

The conference is to be held at the Conference and Culture Center, Háskólabíó

The Local Organizing Committee has reserved accommodation at the following hotels, which are situated close to the venue:

#### Radisson SAS Saga Hotel (www.radissonsas.is)

A first class hotel located 10 minutes walk from downtown and 2 minutes from conference venue. All guests have free access to the swimming pools in Reykjavik. Price per night w/breakfast Single room ISK 14 400 Double room ISK 17 600

#### Fosshotel Sudurgata (www.fosshotel.is)

University campus during the winter, used as hotel in the summer. Small apartments with private facilities. Price pr. night w/ breakfast Single room ISK 10 200 Double room ISK 13 600

#### Fosshotel Gardur Inn (www.fosshotel.is)

University campus during the winter, used as hotel in the summer. Rooms without private facilities.

Price per night w/breakfast Single room ISK 6900 Double room ISK 9100

#### B & B

There are several small guesthouses in the centre of town that offer bed & breakfast Prices are from ISK7500 for a single room and ISK9500 for a double room.

For further information and booking of accommodation please contact: Björk Bjarkadóttir Iceland Travel bjorkb@icelandtravel.is Phone +354 585 4374.

#### **IMPORTANT DATES**

Abstracts due	27 Jan 06
Notification of acceptance	28 Feb 06
Pre-registration due	1 April 06
Deadline for full refund	1 May 06
Papers due	10 May 06
Deadline for partial refund	3 Jun 06
Registration	18 Jun 06
Conference starts	19 Jun 06
Post-symposium tour starts	24 Jun 06
Final revised papers due	31 Jul 06

#### REGISTRATION

On the web at http://www.vedur.is/igs2006/ See also the attached form. WCRP CLIMATE AND CRYOSPHERE (CliC), IUGG – COMMISSION FOR CRYOSPHERIC SCIENCES (IUGG – CCS) and INTERNATIONAL GLACIOLOGICAL SOCIETY

## International Symposium on Cryospheric Indicators of Global Climate Change

*Cambridge, England* 21–25 *August* 2006



CO-SPONSORED BY British Antarctic Survey Scott Polar Research Institute

SECOND CIRCULAR

November 2005

Registered Charity

#### INTERNATIONAL GLACIOLOGICAL SOCIETY

PRESIDENT: A. Ohmura VICE PRESIDENTS: E. Brun, E. Wolff, I Allison IMMEDIATE PAST PRESIDENT: E.M. Morris

#### SYMPOSIUM ON CRYOSPHERIC INDICATORS OF GLOBAL CLIMATE CHANGE

The International Glaciological Society will hold an International Symposium on Cryospheric Indicators of Global Climate Change in 2006. The symposium will be held in Cambridge, UK, with registration on 20 August, and sessions from 21 to 25 August.

#### SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)

#### LOCAL ARRANGEMENTS COMMITTEE

Tom Lachlan-Cope (Chairman), Gill Alexander, Liz Crilley, Hilmar Gudmundsson, Glenda Harden, Victoria I. Lytle, Magnús Már Magnússon, Ian Willis, Eric Wolff

### SCIENCE STEERING AND EDITORIAL COMMITTEE

Martin Sharp (Chief Scientific Editor), Maria Ananicheva, Roger Barry, Cecilia Bitz, Ross Brown, Chad Dick, Julian Dowdeswell, Claude Duguay, Greg Flato, Duane Froese, Wouter Greuell, Jon Ove Hagen, Ola Johannesson, Andreas Kääb, Seymour Laxon, Ellsworth LeDrew, Victoria I. Lytle, Vin Morgan, Ellen Mosley-Thompson, Tony Payne, Mark Serreze, Koni Steffen.

### INFORMATION ABOUT THE SYMPOSIUM MAY BE OBTAINED FROM:

International Glaciological Society, Scott Polar Research Institute,

Lensfield Rd, Cambridge CB2 1ER, UK. Tel: +[44] (0)1223 355 974

Fax: +[44] (0)1223 336 543

Email: igsoc@igsoc.org

Web: http://www.igsoc.org/symposia/ http://www.antarctica.ac.uk/igs Available beginning February 2006

#### PARTICIPATION

This circular includes forms for registration and instructions for arranging accommodation. These can also be found on the symposium website. The registration form and accompanying payment should be returned by 27 May2006. There is a surcharge for late registration. The participant's registration fee includes organisation costs, a set of abstracts, the icebreaker function, coffee breaks, the banquet, the mid-week excursion and a copy of the Annals of Glaciology.

Registration fees	UK£
Participant (IGS member)	270
Participant (not IGS member)	320
Student or retired IGS member	100
Accompanying person over 18	80
Late registration surcharge (after 27 May 06)	50
Post-symposium tour (estimate)	450
Registration refunds will be made accordi	ng to
date of notification. Cancellations made b	oefore
27 May 2006 will receive a full refund. Can	cella-
tions between 27 May and 19 July 2006 w	ill be
eligible for a partial refund. After 19 July it	t may
not be possible to make any refund.	

#### THEME

The cryosphere, consisting of snow cover, sea-, lake- and river-ice, glaciers, ice caps and ice sheets, and frozen ground including permafrost, is a fundamentally important part of the global climate system. Many components of the cryosphere respond sensitively and very visibly to climate changes. Cryospheric changes provide important information about past climatic conditions in regions where other climate observations are sparse, and they have significant implications for global sea level, regional water resources and both terrestrial and aquatic ecosystems. Feedbacks between the cryosphere and other components of the climate system play a key role in how the climate system evolves over time. In situ observations, remote sensing, the analysis of proxy records and numerical modeling all contribute to understanding the dynamics of cryospheric change and cryosphere/climate interactions. Building on the foundation laid by the 1st CliC International Science Conference, held in Beijing in April 2005, this symposium will promote discussion of the evidence for changes in all components of the global cryosphere, their interdependence and causes, our current ability to model these changes, and what they tell us about changing global climate.

#### TOPICS

The suggested topics include:

- 1. Observed historical changes in the cryosphere
- Processes that lead to changes in the cryosphere and how these make interpretation difficult
- 3. Actual records of climate in cryospheric regions and their relation to changes in the cryosphere, including statistical/model interpretation
- 4. Extension of climate records back in time, using observations of cryospheric changes
- 5. Synthesis of records by geographical region, and ultimately globally
- 6. Linkage of historical cryospheric records to palaeo-records of climate
- 7. Modeling of all of the above. How well do models capture the observed changes?

#### SESSIONS AND POSTERS

Oral presentations will be held on four full days and one half-day. There will also be a poster session. The poster boards will accommodate A0 size  $(90 \text{ cm} \times 120 \text{ cm})$ .

#### 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.

#### PAPERS

#### (1) SUBMISSION OF ABSTRACTS

Participants who want to contribute to the Symposium should submit an abstract of their proposed presentation. This abstract must contain sufficient detail for its scientific merit and relevance to the symposium theme to be judged by the Editorial Board. A web site will be available at the beginning of 2006 where authors can upload their abstract and all the relevant contact information. The abstract itself should not exceed 400 words. References and illustrations should not be included.

You will be required to enter all your details with the submission and in particular to state whether you intend to submit a paper for publication in the *Annals of Glaciology*. We will only solicit referees for abstracts that have explicitly stated that they intend to submit a paper. Referees are a scarce commodity and we do not want to trouble them unnecessarily.

Those who are unable to submit their abstract via the internet can submit electronic files on a CD or diskette to the IGS office where a member of staff will upload them onto the web site.

### LAST DATE FOR RECEIPT OF ABSTRACTS: 28 FEB 2006

Final versions of papers accepted for publication should not exceed five printed pages in the *Annals of Glaciology*. Extra pages will be charged at the rate of UK £90 per page. Papers with colour figures will accrue page charges, at the colour rate of UK £150 for all pages. Honouring page charges (also £90 per page) for the first five pages is encouraged.

#### (2) SELECTION OF ABSTRACTS

Each abstract will be assessed on its scientific quality and relevance to the Symposium theme. Authors whose abstracts are accepted will be invited to make either an oral or poster presentation at the Symposium and submit a paper for publication in the Annals of Glaciology (included in the ISI Science Citation Index®). First or corresponding authors will be advised by 17 April 2006 of the acceptance or otherwise; other authors will not be informed separately. Authors who have not received notification by that date should contact the IGS office in Cambridge in case their abstract was not received. Acceptance of an abstract means that the paper based on it should be submitted to the *Annals of Glaciology* and not to another publication. Note: abstracts alone will not be published in the *Annals of Glaciology*.

#### (3) DISTRIBUTION OF ABSTRACTS

A set of the accepted abstracts will be provided to participants upon registration on 20 August 2006.

(4) SUBMISSION OF PAPERS AND PUBLICATION Manuscripts should be submitted as a PDF file to the IGS office by e-mail annals@igsoc.org stating clearly the abstract number in the file name and in the subject line of the e-mail. Papers should be prepared in accordance with the instructions sent to authors with the abstract acceptance notification and must be submitted as PDFs (portable document format). Authors who submit in other electronic formats will be asked to re-submit as PDF. All manuscripts should be submitted by 19 June 2006. ALL AUTHORS ARE EXPECTED TO ADHERE TO THIS DEADLINE. Papers will be refereed according to the usual standards of the Society before being accepted for publication. Final papers, based on presentations at the Symposium, which have been submitted and accepted by the Editorial Board following review, will be published in English in the Annals of Glaciology (Vol. 46). Final, revised versions of papers must be submitted by 2 October 2006. Timely publication of the Annals of Glaciology will depend upon strict adherence to deadlines.

### LAST DATE FOR RECEIPT OF PAPERS: 19 June 2006

### LAST DATE FOR RECEIPT OF REVISED PAPERS: 2 October 2006

#### EXCURSIONS

MID WEEK FIELD TRIPS:

Option 1: A walking tour around Cambridge visiting some of the magnificent buildings in this historic city, e.g. Kings College chapel. It may be possible to take in a chauffeured punting trip on the River Cam.

Option 2: Visit to the historic city of Ely. A short coach trip through the Fens, rich in history and folklore, to Ely Cathedral where you will enjoy a guided tour of this historic and beautiful building. Maybe visit to the home of Oliver Cromwell and round off the trip with tea and cakes in the historic Almonry nearby.

BANQUET to be held on Thursday evening, 24 August at St. John's College.

POST-SYMPOSIUM TOUR: THE LAKE DISTRICT, HADRIAN'S WALL, THE PENNINES AND THE YORKSHIRE DALES

This four day tour of the Lake District, Hadrian's Wall, the Pennines and the Yorkshire Dales is based at Penrith, near Ullswater.

Approximate cost is £450 per person, including breakfasts and lunches, luxury bus travel and accommodation on twin share basis.

**25** August: Depart Cambridge for the Lake District – leaving Cambridge at about 5.00pm. The journey will take about 6 hours plus a stop for refreshments en route.

**26 August**: In the footsteps of Beatrix Potter and William Wordsworth – Hawkshead and Grasmere

Drive over the dramatic Kirkstone Pass, the highest road pass in the Lake District, to Windermere and on to Hawkshead. Here you can join an optional walking tour with your guide and explore the hidden alleyways and squares of this historic village where William Wordsworth attended school. There will be time to visit the Beatrix Potter Gallery and view a selection of her original illustrations and enjoy some time at leisure in the village before continuing on to visit Hill Top, Beatrix Potter's farm. Travel on through the heart of the Lake District to Grasmere for Junch on your own and time to wander around this attractive village. Visit the famous Grasmere Gingerbread Shop, the ancient church of St. Oswald and possibly Dove Cottage, the home of William Wordsworth.

This afternoon drive across Dunmail raise to Keswick on Derwentwater. We shall take a short walk along the lakeshore before driving into the beautiful valley of Borrowdale. Stop for a cup of tea before returning to the hotel.

**27 August**: The Eden valley, the Pennines and Hadrian's Wall

Discover the hidden and aptly named Eden valley – an unspoilt area of pretty sandstone villages in the lee of the Pennines. Drive by way of Brampton, an old town associated with Bonnie Prince Charlie, to Lanercost Priory. Here we shall stop to visit the evocative monastic ruins and part of the priory church that is intact and in use today. An exciting and fascinating drive now awaits - along Hadrian's Wall. We shall follow the course of this World Heritage Site just over the border into Northumberland stopping to view a Roman fort nearly 2000 years old. After lunch we shall drive up into the Pennines, stopping at Alston, the highest market town in England before descending back to the Eden valley enjoying spectacular views towards the Solway Firth and Scotland, weather permitting!

28 August: Day at leisure

Day at leisure – guide to be on duty to help with suggestions of things to do, places to see, etc.

An optional walk in the Ullswater valley will be offered.

**29 August**: Dent fault and the Yorkshire Dales National Park

This morning we shall drive through the Yorkshire Dales National Park. We begin with a stop to view the Dent Fault, named after the 19th century geologist Adam Sedgwick, a renowned geologist who attended Cambridge University. We will stop in the market town of Hawes (it is market day) and then drive through Wensleydale, a beautiful limestone valley made famous by the vet James Herriot. This afternoon the journey takes us through Masham and Ripon before joining the A1 and returning to Cambridge for the early evening.

#### ACCOMPANYING PERSONS PROGRAMME

The accompanying persons registration fee includes the icebreaker, the banquet, the midweek field trip and the services of the accompanying persons coordinator. The coordinator will be able to assist accompanying persons to make further arrangements through the local tourist office. Tourist information is available at http://www.cam.ac.uk/cambarea/tourist.html

#### LOCATION AND WEATHER

Cambridge is a city of contrasts – a place where more than 800 years of history are preserved unchanged in stone and brick, but which inspires ideas that have changed the world. The population of this medieval city is around 100 000. Although the area around Cambridge has the lowest rainfall in the UK, these things are relative and you should still pack waterproof clothing. The average temperature during August is 16.3 °C but daytime temperatures are more likely to be around 20°C.

#### TRAVEL AND ACCOMMODATION

Please check with your respective embassies to see if you require a visa to enter the UK. The local organising committee will supply you with an invitational letter if needed.

The Local Organising Committee has reserved accommodation in Downing College (http://www. dow.cam.ac.uk/) at very competitive rates (£48 for a standard room and £57–95 for rooms with ensuite). Those interested MUST confirm their booking by contacting the IGS office BEFORE 10 February. After that date it is not possible to guarantee that rooms will be available. NOTICE that you MUST confirm and pay your deposit for the Downing College accommodation BEFORE the pre-registration deadline.

Alternate accommodation can be found at www.visitcambridge.org/visitors/wheretostay.php

#### **IMPORTANT DATES**

Confirmation for accommodation	10 Feb 06
in Downing College	
Abstracts due	28 Feb 06
Notification of acceptance	17 Apr 06
Pre-registration due	27 May 06
Papers due	19 Jun 06
Deadline for full refund	3 Jul 06
Deadline for partial refund	5 Aug 06
Registration	20 Aug 06
Conference starts	21 Aug 06
Post-symposium tour starts	25 Aug 06
Final revised papers due	2 Oct 06

#### INTERNATIONAL GLACIOLOGICAL SOCIETY SYMPOSIUM ON CRYOSPHERIC INDICATORS OF GLOBAL CLIMATE CHANGE Cambridge, England, 21–25 August 2006

#### **REGISTRATION FORM**

Family Name:														
First Name:														
Address:														
Tel: Fax:						E-r	nail	:						
Accompanied by: Name:										Age (if un	der	21)		_
Name:										Age (if un	der	21)		_
REGISTRATION FEES	£		£			ом	мо	DA	τιο	N				
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Participant (not a member of the IGS)	320	) _		accommodation in Downing College at ver competitive rates (£48 for a standard room £57 to £95 for rooms with en-suite). Those			very om a ose	and and						
Student or retired IGS member	100	) _		i	interested MUST confirm their booking by			by N						
Accompanying person aged 21 or over	80	) _		، ۲	February. After that date it is not possible to guarantee that rooms will be available. No that you MUST confirm and pay your depo for the Downing College accommodation				, e to Noti	ce,				
Late registration surcharge (after 24 April)	50	) _		t f					epos n	it				
Post-symposium tour (estimate)	450	) _		. ,	Alter	nativ	ve a	pre-	mm	odation can	be f	z. Dunc	d at	
TOTAL REGISTRATION FEES www.visitcambridge.org/visitors/wheretostay.php														
Payment of registration fee, in pou	unds s	sterlir	ng dra	wn	on a	UK	bai	nk, r	may	be made by	che	que	to:	
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Account no: 54770084, Sort Code 52- IBAN number: GB83 NWBK 5210 469 (ANY BANK OR TRANSFER CHARGE Mail or fax to: Secretary Genera Institute, Lensfield If payment made after 27 May 2006, a	10-46 54 770 5 MUS I, Inter d Road add £5	ST BE rnatio d, Can	SWI SWI INCLU nal Gla nbridge each p	FT/B JDEI aciol e CB perso	IC co D). ogica 2 1El n	ode: al So R, U	NW ciety K	arew B K( y, Sc	GB 2	reer, Cambridg L olar Research	ge C	BZ 31	DA,	UK.
PLEASE RETURN AS SOON AS POSSI Secretary General, International Glacic Lensfield Road, Cambridge, CB2 1ER, Tel: +44 (0)1223 355 974 Fax: +44	BLE T ologic UK 4 (0)12	O: al Soc 223 35	ciety, S 54 931	cott	Polar E-ma	r Res il: ig	searc	ch In ®igsœ	stitut oc.or	e, g Web: ht	tp://v	vww.	.igso	c.org



C. Bull. 2005. Innocents in the Arctic: the 1951 Spitsbergen expedition. Fairbanks, AK, University of Alaska Press. xviii + 254 pp. (ISBN-10: 1-889963-73-9, ISBN-13: 978-1-889963-73-0, (hardcover), US 34.95.) M. Leppäranta. 2005. *The drift of sea ice*. Berlin and Heidelberg, Springer Verlag. 266 pp. (ISBN 3-540-40881-9 (hardback), £77 (US\$119, €99.95)).





#### Introduction of CRYOblog, a cryospheric discussion forum

Recent discussions on the CRYOLIST e-mail distribution list and website have highlighted the wish within the snow and ice community for a separate medium through which discussions may be pursued without cluttering the inboxes of those with a peripheral interest in particular topics. The general feeling was that a 'blog' (web log) was the most appropriate forum for such discussions. Accordingly, CRYOblog.org (http://www.cryoblog.org/) has been established.

The new website is intended to be complementary to CRYOLIST, the former providing a forum for discussion and the latter focusing on announcements (jobs, conferences etc). As with the existing e-mail distribution list, CRYOblog is targeted at those interested in issues related to snow and ice research. In addition to providing a venue for discussion between scientists, it is anticipated that the site will become a useful resource for groups such as journalists, educators, students and politicians. Everyone is encouraged to visit the new webxsite and peruse the articles. However, its success is dependent on the active participation of the community of cryospheric scientists, so readers are encouraged to register and join the discussions. The administrators will be contacting individuals to invite them to lead the discussions within different thematic realms, but all members of the community are welcome to submit individual articles to the editors for inclusion (via cryoblog@cryoblog.org) and to volunteer to contribute on a more regular basis.

The administrators are grateful for the hosting and support provided by the Department of Geography, Loughborough University, UK.

David Graham and Richard Hodgkins, Loughborough University Todd Albert, Florida State University



# **Recent meetings** (of other organizations)

Report on the 2nd European Conference on Permafrost (EUCOP II) Potsdam, Germany, 12–16 June 2005

The Second European Conference on Permafrost (EUCOP II) was held at the Alfred Wegener Institute, Potsdam, 12-16 June 2005. The conference was organised by the European Science Foundation funded 'Permafrost and Climate in Europe in the 21st Century' (PACE21) Network, under the auspices of the International Permafrost Association (IPA). The local organising committee was led by Prof. Hans Hubberten of the Alfred Wegener Institute in Potsdam. The conference followed the First European Conference on Permafrost that was held in Rome in 2001. Over 250 delegates attended the Potsdam meeting, from 22 countries in Europe, Asia, North and South America and from New Zealand. The main themes of the conference were

- permafrost records of past climates,
- permafrost soils and microbiology,
- periglacial landforms and cryogenic processes,
- permafrost as an analogue for extraterrestrial systems,
- hydrology and sediment fluxes,
- permafrost geochemistry,
- permafrost modelling in the context of climate change,
- coastal and offshore permafrost, and
- engineering, geohazards and land-use planning in permafrost regions.

Papers were presented orally and as posters, and a volume of abstracts was published for the meeting by the Alfred Wegener Institute (Terra Nostra Heft 2005/2, 224 p. ISSN 0946-8978). The main paper sessions are outlined below.

*Permafrost Records of Past Climates.* Chair Bernd Diekmann (Potsdam, Germany) and Julian Murton (Brighton, UK). 13 papers discussed Pleistocene permafrost conditions in Siberia, Alaska, northern Canada and Europe, plus the evolution of arctic lake basins, lacustrine palaeoenvironmental records and modelling of Pleistocene permafrost and permafrost interactions with groundwater.

*Permafrost soils and microbiology.* Chair Liza Rivkina (Puschino, Russia) and Eva-Maria Pfeiffer (Hamburg, Germany). 11 papers. The keynote paper by E. Rivkina explored methane generation under subzero temperatures. Other papers discussed microbial communities in relation to permafrost organic content, methane fluxes and

the carbon balance in the Arctic and in Antarctica, plus climatic and anthropogenic forcing of permafrost ecosystems, and the geocryology of arctic soils.

Periglacial landforms and cryogenic processes. Chair Matti Seppälä (Helsinki, Finland) and Ole Humlum (Oslo, Norway). 15 papers. The keynote by J. Murton (Sussex, UK) presented physical modelling of bedrock fracture by ice segregation. Other papers presented results of laboratory physical modelling, field studies and geophysical investigations targeted at a range of periglacial processes and ground ice phenomena. Detailed acoustic monitoring of Svalbard ice-wedges provided new information on cracking and wedge evolution, and the distribution of periglacial landforms in various mountain regions was described, including the relation between glacier retreat and the development of cryogenic geomorphic systems.

Permafrost as an analogue for extraterrestrial systems. Chair Dirk Wagner (Potsdam, Germany) and David Gilichinsky (Pushchino, Russia). 8 papers. The keynote talk by D. Gilichinsky explored the possibility of water as cryopeg lenses within the permafrost on Mars. Papers were presented describing the nature and origin of Martian permafrost including surface polygonal patterns. A second theme was microbiology at low temperatures, including resistance of terrestrial bacteria to solar UV and desiccation in the context of potential extra terrestrial life forms.

Hydrology and sediment fluxes in permafrost regions. Chair Achim Beylich (Trondheim, Norway), Bernd Etzelmüller (Oslo, Norway). 8 papers The sensitivity of the arctic land surface to climate forcing was discussed, with papers focusing on the effects of permafrost degradation on soils, hydrology and ecosystems together with glacier-permafrost interactions and the nature, formation and present-day dynamics of rock glaciers.

*Permafrost geochemistry*. Chair Hanno Meyer (Potsdam, Germany) and Ron Sletten (Washington, USA). 7 papers included presentations on geochemical investigations of Antarctic ice wedges, tabular ground ice and coastal sediments in Siberia, cosmogenic dating of permafrost and a new glacial oxygen isotope record from the Italian Alps. Permafrost modelling in the context of climate change. Chair Charles Harris (Cardiff, UK) and Lorenz King (Giessen, Germany). 23 papers. The keynote paper by M Hoelzle, (Zurich Switzerland) discussed recent progress in modelling mountain permafrost distribution. Papers discussed borehole and active-layer monitoring in North America, Europe, Siberia and the Tibetan Plateau, and impacts of climate, including extreme events, on permafrost thermal conditions and slope stability. Papers also described ground-ice and related landform investigations, and geophysical surveys in both continuous and discontinuous permafrost.

*Coastal and offshore permafrost.* ChairVolker Rachold (Potsdam, Germany) and Mikhail Grigoriev (Yakutsk, Russia). 7 papers included presentations on climate fluctuation and coastal dynamics, application of GIS techniques, seismic investigations of sub-sea permafrost, complex coastal ground ice sequences and the dynamics of gas hydrate systems.

Engineering, geohazards and land-use planning in permafrost regions. Chair Michael Davies (Dundee, UK), Andreas Kääb (Zurich, Switzerland) and Martin Gude (Jena, Germany). 14 papers were presented. Guidelines for construction in permafrost was the theme of the keynote talk by D. Hayley (Canada). Papers discussed monitoring and modelling of permafrost stability in northern Russia, Qinghai-Tibet Plateau, the Mackenzie Valley Canada, and the south-western Barents Sea, the role of permafrost in avalanche initiation and laboratory physical modelling of soil-structure interactions and the stability of scree slopes.

Poster sessions were an important feature of the conference, and generated much lively discussion. 20 posters were presented on permafrost palaeoenvironments, 19 posters on permafrost soils and microbiology, 32 posters on periglacial landforms and cryogenic processes, 6 posters on permafrost geochemistry, 16 posters on coastal and offshore permafrost, 11 posters on hydrology and sediment fluxes, 44 on permafrost monitoring and modelling in the context of global change and 33 posters on permafrost engineering and geohazards.

In addition to the excellent science presented at the conference, the local organisers provided a first rate social programme that was thoroughly enjoyed by delegates, and Professor Hubberten and his team at the Alfred Wegener Institute are to be congratulated on the outstanding success of the meeting.

During the conference two International Permafrost Association Council meetings were held to discuss IPA constitutional changes, and to inform delegates on planning for the next International Conference on Permafrost to be held in Fairbanks USA in 2008.

**Charles Harris** Cardiff



# Future meetings (of other organizations)

International Workshop on Antarctic Sea Ice Thickness Hobart, Tasmania, Australia, 5–7 July 2006 (in conjunction with the SCAR Open Science Conference)

#### Objectives

The aim of the workshop is to bring together members of the Antarctic sea ice community who have an active interest in measuring sea ice (and snow cover) thickness, or using sea ice thickness data. This will cover all disciplines of field science, remote sensing and modelling, and provide and opportunity to discuss recent results and plan future research.

#### Workshop goals:

- Review recent results in the field of Antarctic sea ice and snow cover thickness.
- Identify and synthesise the available data sets on sea ice and snow cover thickness from various measurement programs, including upward-looking sonar, electro-magenetic induction, in situ data, satellite altimetry and gravimetry, and other remote sensing products.

- Identify key inter-comparison projects between the available data sets to determine improvements that can be made to sea ice thickness measurements, and identify gaps in our current knowledge.
- Identify future requirements for field programs for validation of model, instrument and satellite programs (e.g., validation of satellite altimetry products), especially during IPY.
- Explore opportunities for creating a data portal to sea ice data sets through an international data centre, to facilitate easier access by the broader scientific community.
- Identify key users of sea ice thickness data and initiate cross-disciplinary studies.
- Conduct a training course in ship-based sea ice observations, and encourage maximum participation in the ASPeCt ice observation scheme during IPY and beyond.

#### **Registration and Presentations:**

Online registration will be available from February 2006 at the address listed below.

Oral and poster presentations will be welcome, and a series of invited talks will be publicised via the website. The registration fee will be AU\$100 (approx. US\$75) and will cover refreshments and lunch each day. The registration fee is waived for students. Limited travel funds are available to support international participants, please contact Tony Worby for further information.

#### Polar dynamics: Monitoring, understanding and prediction Open scheme conference August 29–31 2007, Bergen, Norway.

The conference will commemorate the 90-year anniversary of the Geophysical Institute inBergen and of the Norwegian Geophysical Society, both founded in 1917. Among the many world-known scientists working at the institute during the first decades were V. Bjerknes with his young assistants including J. Bjerknes, H. Solberg, C. G. Rossby, T. Bergeron, the group known as the Bergen School in Meteorology, and also the oceanographers B. Helland-Hansen, H. U. Sverdrup, and J. E. Fjeldstad. Many of the same scientists were also founders of the Norwegian Geophysical Society. Much of the research at the institute was from the beginning tightly connected to the high latitudes in both hemispheres, a tradition that has persevered until present. Despite numerousfield campaigns, and the developments of satellite sensors and high-speed computers, many of the questions that puzzled the scientists 90 or more years ago, are still unresolved. Paleorecords reveal rapid changes in climate in the past that most likely were linked to air/sea/ice processes taking place in the high north. Furthermore, climate models show that the largest response to anthropogenic climate forcing will likely occur in this sensitive region. In order to improve our knowledge about the many processes

#### **Convenors:**

Dr Tony Worby, Australian Antarctic Division, Hobart. Email: A.Worby@utas.edu.au

Prof Steve Ackley, Clarkson University, New York. Email: sackley@pol.net

#### Website:

http://www.aspect.aq/workshop2006.html.

taking place in the high latitudes, with the aims to improve regional weather forecasts on daily to seasonal scales, to quantify the consequences of anthropogenic forcing on decadal to centennial scales, and to assess the likelihood of unpleasant climate surprises in the future, a strategic combination of observations, process studies and numerical models are needed.

The aim of the conference is to provide an overview of ongoing and emerging monitoring programs; recent advances in process studies and understanding, and new opportunities for prediction based on state-of-the-art regional or general circulation models of the high-latitude systems.

We aim for a target of 300 participants or more. Excellent conference facilities in the city of Bergen with capacity well exceeding this number have been secured. A professional conference organiser deals with all practical aspects. Participation in this conference will also give excellent opportunities for exploring the historic city as well as the surrounding fjord district.

#### **Conference website:**

www.gfi.uib.no/conference2007/info.htm

#### **Conference email:**

http://www.conference2007@gfi.uib.no



# **Glaciological diary**

\*\* IGS sponsored

\* IGS co-sponsored

#### 2005

#### 2–11 August

### IAMAS General Assembly. Beijing, China Web: http://www.iamas.org/

Workshop on Glacier Mass Balance and its Coupling to Atmospheric Circulation *Principal Convener*: Prof. Peter Jansson, University of Stockholm, Sweden; Secretary of ICSI. E-mail: peter.jansson@natgeo.su.se

Workshop on Mountain Snow and Ice Cover *Principal Convener*: Paul Foehn, Swiss Federal Institute for Snow and Avalanche Research SLF E-mail: foehn@slf.ch

Workshop on Modelling Forest Snow Processes

Principal Convener: Richard Essery, Centre for Glaciology, Institute of Geography and Earth Sciences, University of Wales, Aberystwyth E-mail: rie@aber.ac.uk

23–27 August

- \*Conference on Glacial Sedimentary Processes and Products, Aberystwyth, UK Centre for Glaciology, Institute of Geography and Earth Sciences, University of Wales, Aberystwyth SY23 3DB, UK Email: Michael Hambrey mjh@aber.ac.uk, Neil Glasser nfg@aber.ac.uk, Bryn Hubbard byh@aber.ac.uk
- 1-10 September

The 11th International Conference and Field Trip on Landslides (CFL), Norway E-mail: icfl05@ivt.ntnu.no Web: www.ivt.ntnu.no/ICFL05

#### 5-9 September

\*\*International Symposium on Highelevation Glaciers and Climate Records, Lanzhou, People's Republic of China Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK

Web: http://www.igsoc.org/symposia/

14-15 September

#### \*IGS British Branch Annual Meeting 2005, Division of Geography, Northumbria University

Web:http://northumbria.ac.uk/sd/academic/sas/ gem/bbgis/ 16 September

Environmental and Industrial Geophysics Group, The Geological Society: Geophysics of Glacial and Frozen Materials, Division of Geography, Northumbria University Web:

http://northumbria.ac.uk/sd/academic/sas/ gem/bbgis/

#### 13-24 September

5th Karthaus Summer Shool on Ice Sheets and Glaciers in the Climate System. Karthaus, northern Italy Contact: Johannes Oerlemans E-mail: j.oerlemans@phys.uu.nl Web: http://www.phys.uu.nl/%7Ewwwimau/ education/summer school/

#### 24-29 September

#### Polar Regions and Quaternary Climate EuroConference toward an Integrative View of Climate in Antarctica and Circum-Antarctic Regions

An ESF Research Conference held at Acquafredda di Maratea (near Naples), Italy. Contact: Ms. Anne-Sophie Gablin E-mail: asgablin@esf.org Web: http://www.esf.org/conferences/lc05115

#### 1-5 October

Open Science Conference: Global Change in Mountain Regions, Perth, Scotland, UK Web: http://www.mountain.conf.uhi.ac.uk/

#### 10–14 October

#### Third International Conference on the Oceanography of the Ross Sea, Antarctica, Venice, Italy

Jane Frankenfield Zanin, CNR-ISMAR (Istituto di Scienze Marine), San Polo 1364, 30125 Venezia, Italy E-mail: RossSea@ismar.cnr.it Web: http://www.ross-sea.org/

#### 17-18 October

## Evolution of the Antarctic ice sheet: new understanding and new challenges

A Discussion Meeting organised by the Royal Society.

The meeting will be held at the Society's London offices at Carlton House Terrace Web: http://www.royalsoc.ac.uk/event.asp

#### 21-22 October

#### The Northwest Glaciology Meeting, University of British Columbia, Vancouver Web:

http://www.eos.ubc.ca/research/glaciology/N WG2005/index.html

#### 3-5 November 2005

\*IGS Nordic Branch Annual Meeting 2005, Geocenter Copenhagen, Denmark Contact: Andreas Ahlstrøm E-mail: aa@oersted.dtu.dk Web: http://server.oersted.dtu.dk/igsnb/

#### 5-9 December 2005

## \*\*International Symposium on Sea Ice, New Zealand

Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK

Web: http://www.igsoc.org/symposia/

#### 5-9 December 2005

#### AGU Fall Meeting – several cryospheric sessions are planned American Geophysical Union, San Francisco, CA. USA

E-mail: fm-help@agu.org (subject: 2005 Fall Meeting)

Web: http://www.agu.org/meetings/fm05/

#### 12-13 December

#### 6th International Conference on Global Change: connection to the Arctic (GCCA-6), Tokyo, Japan

International Arctic Research Center (IARC) at the University of Alaska Fairbanks (UAF) and member universities of the University Consortium for GCCA in Japan Web: http://www.stelab.nagoya-u.ac.jp/stewww1/div1/GCCA6/

#### 2006

30 January-3 February

International Arctic Science Committee, IASC, Working Group on Arctic Glaciology Workshop on the mass budget of Arctic glaciers and the first planning meeting of GLACIODYN (IPY) Universitätszentrum Obergurgl, Austria

Contact Carleen Tijm-Reijmer E–mail: c.h.tijm-reijmer@phys.uu.nl

#### 6–10 February

#### GLIMS workshop, Twizel, New Zealand Contact: Shulamit Gordon, s.gordon@antarcticanz.govt.nz AND Jeff Kargel, kargel@hwr.arizona.edu)

16–18 March **The 36th Annual Arctic Workshop**, **INSTAAR, University of Colorado, Boulder**, **CO, USA** Web: http://instaar.colorado.odu/montings/AW/2000/

http://instaar.colorado.edu/meetings/AW2006 E-mail: ArcticWS@colorado.edu

#### 2–7 April

#### European Geosciences Union meeting, cryospheric sessions, Vienna, Austria Web:

http://www.cosis.net/members/meetings/progr amme/view.php and http://meetings.copernicus.org/egu2006

#### 19–23 June 2006

#### \*\*International Symposium on Earth and Planetary Ice-Volcano interactions, Revkjavík, Iceland

Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK

Web: http://www.igsoc.org/symposia/

#### 28–30 June

#### Geomorphology and Earth System Science British Geomorphological Research Group 2006 annual conference, Loughborough University, UK

Web:

http://www.lboro.ac.uk/departments/gy/gess/ index.htm

#### 5–7 July

#### \* International Workshop on Antarctic Sea Ice Thickness, Hobart, Australia

In conjunction with the SCAR Open Science Conference

*Convenors*: Dr Tony Worby (Australian Antarctic Division), A.Worby@utas.edu.au; Professor Steve Ackley (Clarkson University, USA), sackley@pol.net

#### 12-14 July

#### Second SCAR (Scientific Committee on Antarctic Research) Open Science Conference on 'Antarctica in the Earth System'

Hotel Grand Chancellor, Hobart, Australia Web:

http://www.scarcomnap2006.org/scarosc.php

#### 23-28 July

#### International Conference on the Physics and Chemistry of Ice (PCI-2006), Bremerhaven, Germany

Open Session on Glacier and Ice Sheet Research Web: http://www.pcice2006.de

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#### 7-9 August

Asian Permafrost Conference, Lanzhou, China

Web: http://www.casnw.net/permafrost/

21-25 August

\*International Symposium on Cryospheric Indicators of Global Climate Change A joint CliC/IGS/ICSI Symposium Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER,

UK

Web: http://www.igsoc.org/symposia/

#### 4-8 September

\*III International Symposium on Avalanches and Related subjects. The contribution of theory and practice to avalanche safety, Kirovsk, Murmansk region, Russia Contact: Pavel Chernous at

PChernous@apatit.com Web: http://www.cas.kirovsk.ru/ Register after 1 June 2005

#### 13-14 September

\* IGS British Branch Annual Meeting 2006, Keele University, UK. Contact: Zoe Robinson, atz.p.robinson@keele.ac.uk

#### 14-22 September

9th International Symposium on High Mountain Remote Sensing Cartography (HMRSC-IX), University of Graz, Austria Contact: Wolfgang Sulzer, wolfgang.sulzer@uni-graz.at

Web:

http://www.kfunigraz.ac.at/geowww/hmrsc/ hmrsc\_9/

#### 9-15 October

#### Water, Ecosystems and Sustainable Development in Arid and Semi-arid Zones, Urumqi, China

Organized by Ecole Pratique des Hautes Etudes (EPHE, France), Xinjiang University (China) and University of Tehran Contact: +33 (0)1.53.63.61.63 (Béatrice Argant) Watarid@ephe.sorbonne.fr Web:

http://www.ephe.sorbonne.fr/watarid.htm

#### 2007

2–13 July

24th General Assembly of the International Union of Geodesy and Geophysics: 'Earth, Our Changing Planet', Perugia, Italy. Web: http://www.iugg2007perugia.it/

veb: http://www.lugg200/pe

#### August

#### \*\*International Symposium on Snow Science, Moscow, Russia

Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK

Web: http://www.igsoc.org/symposia

#### 29-31 August

Polar Dynamics: Monitoring, Understanding, and Prediction

#### Open science conference, Bergen, Norway

Geophysical Institute, University of Bergen. Allegt 70, N-5007 Bergen, Norway E-mail: conference2007@gfi.uib.no Web:

http://www.gfi.uib.no/conference2007/info.ht m

#### 2008

23-27 June

9th International Conference on Permafrost Celebrating the 25th Anniversary of the formation of the International Permafrost Association, University of Alaska Fairbanks, Fairbanks, Alaska, USA Web: http://www.nicop.org/



# New members

#### Andy Aschwonden,

Institute for Atmospheric & Climate Science, ETH Zürich, Universitätsstrasse 16, CH-8092 Zürich, Switzerland Tel [41](44) 632-7387; andy@env.ethz.ch

#### Dr. Jocelyne C. Bourgeois,

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