

# NEWS BULLETIN OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

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# News Bulletin of the International Glaciological Society

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*Cover picture*: Dobrowolskibreen, part of the surging Nathorstbreen system, Svalbard. Photograph by Jakub Małecki.

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

# From the Editor

### Dear IGS member

As this is the last issue of ICE for 2014 it is appropriate to look ahead to 2015 (especially since it is February already). 2015 will be an interesting year for our Society, with a lot of changes especially on the publication side. So let me start.

For 2015, we have eliminated the mandatory charges of £450 in the *Journal* and £350 in the *Annals* for papers containing colour illustrations. This has been partially offset in the Annals by a small increase in the per page charge to £80. We have kept the per page charge at £90 for the *Journal*. I trust this overall reduction in page charges (at least for those of you using colour) will be appreciated

Rowena Baxter, who has been our reference editor for nearly 10 years, is going to retire on 1 April. This will actually be her second retirement as she previously retired from the Department of Engineering at the University of Cambridge. It was her diligence and careful attention to detail that made her ideal for the post of reference editor, and we were able to coax her out of retirement to join the IGS production team in 2006. Ever since then she has carefully checked every single reference in papers accepted for publication in IGS journals. Her accuracy and attention to detail will be greatly missed.

One of the last jobs Rowena is undertaking before retirement is to migrate our database from 'Reference Manager' to 'EndNote', which I believe is the most commonly used reference database. In future we will be relving on authors much more to check their own references more carefully and to submit them in a standard format. Our database presently has in excess of 110000 references. We are planning to upload it to the Cloud so you can all benefit more directly from it. Similarly, we are creating an IGS EndNote template for authors to use for submissions and we will be producing information about this on the 'Instructions for authors' pages of our website in due course. Our Chief Editor, Jo Jacka, will also be carefully scouring submissions for incomplete and erroneous references. Non-compliant papers will be returned to authors for reference correction before being sent out for review. It may be possible to automate some of this process through our online submission systems and we are currently investigating this.

References are the lifeblood of scientific writers. It is extremely important to get the information correct so that citations are picked up by all the metrics systems like Thomson, Scopus, Google Scholar, etc., and authors are credited correctly.

The new arrangements for references is part of the overall new business plan for the IGS we are implementing in anticipation of going Open Access (OA) Gold. The move to OA Gold will inevitably result in a loss of revenue for the Society, as our library and institutional subscribers that only have online subscription will not need to renew next time around. We are hoping that at least some of our current hard-copy subscribers will want to continue to receive a paper copy.

As the emphasis in the future will be on online publication we will move away from 'page charges' and towards 'author processing charges' (APCs). We plan to create a pricing structure based on 'units', similar to that used by JGR, where a figure, a table and so many words or characters make up publishing units and authors are charged depending on the number of units into which their paper breaks down.

Also, it will become necessary to start charging authors of the less well produced papers for certain of the various administrative, editorial and production procedures we have up till now performed for free. This practice is in line with the approach taken by other publishers and, as the publications will have to be self-sustaining, it is only fair that those authors who prepare their manuscripts thoroughly should not be subsidizing those who do not. So, if it proves necessary to spend more time editing some papers to bring them to a publishable standard, then we will have to charge the authors for the additional time and effort.

In addition, we are working on a tender to have our website redesigned and restructured. It was clear from the results of the recent survey we carried out (the results of which will be published in ICE) that members want more exposure for accepted papers. This will be one of the priorities of the new website. We have not

yet finalized how and where the hosting of IGS publications will be. Right now we are with IngentaConnect. My personal feeling is that we should not take on too much in one go and that it will be best to get the OA up and running before tackling the next phase. But wherever the hosting ends up being, we will move all our publications to a single site to improve access to articles. Although we do have a single access point for all articles at present through the IGS members' site, clearly this is not working for many of you. For example, many of you use Google to search for a reference and, once you find it, you simply want to click on it for it to appear on your screen. That is not how it works at the moment. You must log into the members' site and then navigate to the article. We are looking at ways of improving this situation for you.

As part of improving the access to our publications, we are converting all our archive articles to XML format and we will be creating IGS templates for our XML files so they can be displayed in various styles and optimized for whatever platform you are using. We are also working on a new version of *ICE*, designed specifically for more agreeable online viewing than the current flip-through PDF file.

To finish off, I note that the first issue of the *Journal* for 2015, issue 225, is now published. We are now assigning papers to the third issue of 2015. *Annals* volume 55 is now complete and work is progressing nicely on *Annals* issues for 2015. So we continue to work hard on getting your papers out there as quickly as possible.



### Russia

#### Geophysical studies in Antarctica

Recent aerial geophysical studies have been carried out in Princess Elizabeth Land. They include airborne geophysical surveys on a scale 1:500 000 together with magnetic and radar measurements. Results of these observations are used to construct maps and schemes showing the glacier structure, the subglacial landscape and features of the deep structure of the region under investigation. In particular, it had been discovered that, in the area of the Westfol oasis, 300 km inland, there is a wide 50 km trough up to 400 m deep.

Ground-based radar investigations in recent years have been concentrated along a route between Progress and Vostok stations. Here, the glacier structure and subglacial landscape were studied, and geo-radar investigations of the upper parts of the snow-and-firn thickness and a geological cross-section of the Larsemann hills were performed. Near Vostok station, the wavelike (undulating) occurrence of layers inside the snow depth was revealed, with wave amplitude up to 2 m. In the area of the Larsemann hills, the basic features of the glacier structure and the near-bottom part of the fresh-water water bodies were also revealed.

Seismic studies by means of refraction shooting have been carried out around Subglacial Lake Vostok since 2008. It was determined during these works that in the near-bottom part of the lake depression there are sedimentary deposits at depths varying from 400 m in the north to 1200 m in the southern one. A crystalline basement underlies them.

S.V. Popov, Marine Geological Expedition, St. Petersburg

# Fluctuations of the Antarctic ice sheet surface altitude

Satellite lidar altimeter (ICESat, accuracy of measurements 3–5 cm) obtained at intervals of 4 months during 2003–08 revealed a new phenomenon: periodic fluctuations of altitude of the Antarctic ice-sheet surface. It is supposed that this phenomenon is related to the behaviour of subglacial lakes. The motion of subglacial water is reflected in changes in the surface altitude above subglacial lakes. Interrupted equilibrium in subglacial lakes, in particular Lake Vostok, appears to cause abrupt changes in glacier surface altitude. Cascades in subglacial lakes were also

found. Shifting of phases of vertical motions of glacier surface in the cascades may be interpreted as a result of the influence of subglacial runoff. These researches are continuing with the use of the new space system CRYOSat 2 equipped with radar (frequency 2.5 cm), measuring the height of the Antarctic ice-sheet surface.

L.N. Vasiliev, V.M. Kotlyakov, M.Yu. Moskalevsky, Institute of Geography RAS, Moscow).

#### Studies of glaciers on Svalbard

Begun in 2010, studies of glaciers Eastern Grønfjordbreen and Fridtjovbreen on the Nordenskiöld Land have continued in subsequent years. Data obtained by ground-based radar sounding (20 MHz frequency) and thermal sounding of boreholes 10-20 m deep indicated that both these glaciers are polythermal. In Eastern Grønfjordbreen the proportions of cold and warm ice are respectively 83% and 17%; for Fridtjovbreen they are 26% and 74%. According to the rate of radiowave propagation, the water content of warm ice amounts to 2-5%. Over the last 30 years, the average thickness of cold ice in Eastern Grønfjordbreen has decreased by 34 m, while that of warm ice has only decreased by 9 m. In Fritjovbreen, cold ice thinned by 87 m, but in contrast warm ice thickened by 48 m. These differences in changes in the hydrothermal structure of adjacent glaciers, in which the loss of thickness (35–45 m) is similar, can be related to the fact that changes in Eastern Grønfjordbreen took place against the background of its shortening under conditions of climate warming. At the same time, similar changes in Fridtjovbreen were complicated by its surge in 1991-97.

N.F. Glazovsky, I.I. Lavrientjev, Yu.Ya. Macheret, Institute of Geography RAS)

# Investigation of palaeoclimate variations at the millennium scale

These studies were based on isotope analysis of carbon (carbonate of hydroxylapatite) contained in the bones of plant-eating animals, mainly mammoths; the isotope composition was used as a palaeoclimatic indicator for the polar regions. For this purpose the bones were taken from animals belonging to the late Pleistocene era that were found at the mouth of the the river Lena. The isotope composition of the bone carbonate was examined by the radiocarbon method, allowing reliable dating. These analyses revealed instability in the late Pleistocene climate that manifested itself in drastic, brief (500–2000 years), irregular episodes of mild climate, i.e. interstadials. Both the causes of this and the changes induced in the mammoths themselves in Arctic regions were studied for the time between the Pleistocene and the Holocene.

V.I. Nikolaev, Institute of Geography RAS

Garabashi Glacier (central Caucasus) massbalance reconstructions inferred from tree rings The main goal of this research was to explore whether tree-ring data can be efficiently used to reconstruct glacier mass-balance in the Caucasus. Tree-ring width and maximum density chronologies of pine (Pinus sylvestris L.) at seven high-elevation sites in the northern Caucasus were explored for this purpose. Tree-ring maximum density in the Caucasus showed a clear climate response to summer temperatures and allowed the reconstruction of April-September temperatures since the 19th century. Instrumental mass-balance records of Garabashi Glacier began in 1983. Maximum-density chronology has a statistically significant correlation with mass-balance variations becausee of the sensitivity of tree growth to summer temperature and the significant contribution of ablation to total mass-balance variation. To incorporate different climatically sensitive parameters into the reconstruction, a stepwise multiple regression model was used. The strongest correlation was identified between two ring-width chronology and one maximumdensity chronology. A cross-validation test confirmed model adequacy and this made it possible to reconstruct Garabashi Glacier massbalance changes for 1800–2005. Reconstructed and instrumental mass balance values coincide well except for the most recent period in the present century, when the reconstructed mass balancesslightly exceeds its real values. However, even in this period it remained negative similar to the instrumental records. Both reconstructions show good interannual agreement, particularly for the period between 1975 and 2005. According to the reconstruction, two distinct periods of positive mass balance occurred in the 1830s and the 1860s. O.N. Solomina, E.A. Dolgova, Institute of Geography RAS

#### Potential impact of methane emission from thawing terrestrial and subaquatic permafrost on global climate: synthesis of observations and modelling for the Russian Arctic

A research group from the Russian State Hydrological Institute studied the potential impact of methane emission from thawing terrestrial and subaquatic permafrost on global climate using synthesis of observations and modelling for the Russian Arctic. We used numerical modelling to calculate the past, present and future state of the north Eurasian terrestrial and subaquatic permafrost, quantify its contribution to the global methane balance and evaluate the climate feedback. GIS analysis of smallscale digital topographic maps indicated that the total area of Siberian wetlands was approximately  $0.7 \times 10^6$  km<sup>2</sup>, of which  $0.35 \times 10^6$  km<sup>2</sup> was located in permafrost regions. The estimated net flux of methane from the frozen wetlands under current climatic conditions amounts to almost 28.5 Mt a<sup>-1</sup>. According to our model results, projected to the mid-21st century, changes in the volume of the seasonally thawing organic-rich soils and higher soil temperatures can increase the methane flux from Siberian frozen wetlands by 6-10 Mt a<sup>-1</sup> and thus increase the atmospheric concentration by 100 Mt and lead to a ~0.01 °C global temperature rise. We also used a comprehensive dynamical permafrost model forced with the transient regional climatic scenario to calculate the state of permafrost and the depth to the boundary of the hydrate stability zone (HSZ) at ESAS over the period from the last glacial maximum 18-20 ka BP up to the end of the millennium. The model is based on the heat transfer equation and explicitly accounts for the effect of salt diffusion in the bottom sediments by coupling thermal and mass fluxes. We used a climate scenario suggesting that, at the time of inundation (ca 8 ka BP), the top sediment layer warmed by ~12°C from -13.5°C (mean annual air temperature) to -1.5°C (bottom water temperature). Temperature was set to this constant value until 1985. Since then, in accordance with modern observations, we applied a 0.09°C a<sup>-1</sup> trend until 2100, and afterwards set the temperature to a constant value of 11.5°C. The rate of temperature change in the 21st century according to this schematic scenario by far exceeds all IPCC projections. This has been done intentionally to explore the likelihood of the so-called 'methane bomb' concept under the most favourable, although highly unrealistic, climate conditions.

Oleg Anisimov, Hydrological Institute, St. Petersburg

#### Investigation of the evolution of the mountain glacier systems of north Eurasia under presentday climate conditions

Within the framework of the GLIMS project, we estimated the current state of the glacier systems of north Eurasian mountain regions as well as changes that have occurred since compilation of the USSR Glacier Inventory. Satellite ASTER surveys were used as the main source of new data. The general tendency towards reduction in glacier areas for recent decades is as follows: polar Urals 23.5%; Caucasus 17.7%; Tien Shan 12.6%; Altai

19.7%; Suntar-Khayata 27%; Sredinny (Central) Ridge in Kamchatka 16.6%. Almost everywhere this reduction took place against a background of a rise in summer temperature of 1.5-2°C

G.A. Nosenko, T.E. Khromova, Institute of Geography RAS

#### Study of glaciarization of Suntar-Khayata Mountains, Siberia

Glacial-cryogenic complexes In the Suntar Khayata Mountains were studied, and this work continued explorations of local glaciers started in 1957–59 (IGY). The degree of glacierization of the northern mass of the Suntar Khayata Mountains for the last 60–80 years was estimated by comparing the following information: data from the USSR Glacier Inventory; the aerial photographic survey of 1945; satellite pictures obtained by Landsat in 2010; Bing Maps 2011; and the digital surface of relief AsterDEM. In 2012 and 2013, the Institute of Permafrost of the Siberian Branch (SB) of the Russian Academy of Sciences (RAS), together with the Japanese Institute of Global Changes and the Institute of Geography RAS, carried out field explorations on some reference glaciers from the Mus-Khaya mountain massif. These works included a GPS survey of the presentday boundaries of glaciers, investigation of their morphology, measurements of thawing on the glacier surfaces, and ice sampling for analysis of their isotope composition. This complex of investigations made it possible to estimate the reduction of glaciated areas in the region, changes in their altitudes, and the rising of equilibrium line in comparison with the middle of the last century. To estimate the moraine age, starting from the Little Ice Age, the moraine complexes were investigated; series of lichenometric dating results and tests of residual strength of the surface were obtained. The main conclusion is that the glaciers of the Suntar-Khayata Mountains are degrading. During last summer they were entirely located in the area of ablation.

A.A. Galanin, Institute of Permafrost, SB RAS, Yakutsk; M.D. Ananicheva, Institute of Geography RAS

Glaciation changes in the northern part of Sredinny (Central) Ridge on the Kamchatka Peninsula in the second half of the 20th century Changes in area of the glaciers in the northern Sredinny Ridge (Kamchatka Peninsula) occurring from the 1950s to the present time were examined. For this purpose, ASTER satellite imageries (2002), data from the USSR Glacier Inventory and aerial photographs of 1950 were used. Vector boundaries of the glacier maps were constructed by decoding ASTER images. The estimates obtained demonstrate degradation of glaciers in this area of Kamchatka. The glacier area of this ridge, as presented in the USSR Glacier Inventory, has decreased by16.6%. The reduced glacier area is subject to major climatic change factors. During this period the average summer air temperatures rose and the amount of solid precipitation was less.

A.Ya. Muraviev, G.A. Nosenko, Institute of Geography RAS

#### Investigations into the Caucasus glaciers

The objective of these investigations is to extend the long-term series of annual mass-balance measurements at two reference glaciers in the Caucasus: Garabashi, on the southern slope of Elbrus (since 1982), and Djankuat, in the Baksan river basin (since 1968). The data have been published in bulletins of the International Service of glacier monitoring. Ground-based radar measurements of ice thickness and surveys of the glacier surfaces by means of dual-frequency differential GPS-receiver were performed on Garabashi and Marukh glaciers (in the western Caucasus). Laboratory analysis of the dust particles, abundantly precipitated in some years onto the snow slope of Elbrus, together with data from synchronous space surveys established the sources of the transported dust: western regions of the Sahara Desert and the Arabian Peninsula. (This work was performed jointly with the Reading University.) Equilibrium lines are integral indicators of the conditions of glacier existence. Accordingly, a map of the present-day boundaries of equilibrium lines has been created for comparison with their positions in the middle of the 20th century taken from the USSR Glacier Inventory. Analysis of parameters and times of mud-flow occurrences for the last 50 years in the glacial zone of Kabardino-Balkaria indicated an empirical relationship between mud-flow activity and the morphometric characteristics of river basins.

O.V. Rototaeva, G.A. Nosenko, S.S. Kutuzov, Institute of Geography RAS

**Dynamics of glacier terminuses in the Caucasus** Monitoring of terminuses and changes in the surface and deep structures of glaciers in the central and west Caucasus, including the ice sheet of the Elbrus volcanic cluster, is continuing, using both ground-based methods and remote sensing. Images from satellites ASTER and Landsat taken in 2001–13, materials from aerial photographic surveys in 1953 and 1987, a DGPS-survey, and mass-balance measurements on the reference glaciers were used for this study. To define presentday glacier boundaries in areas of alimentation, digital models of relief GDEM, built from stereopairs (double images) from ASTER, were used. It has been found that catastrophic melting over the last decade has resulted in serious changes to the parameters of almost all Elbrus glaciers, manifested by lower surfaces and glacier-tongue retreat. Changes in glacier boundaries for two periods, 1987–99 and 2000–13, were compared. The rate of tongue retreat is now almost twice as great and glacier area has reduced by 5%; this correlates well with rising summer temperatures in the region and is supported by mass-balance observations on Garabashi glacier. Currently, the intensity of Caucasus glacier melting has reached record levels for the whole period of direct in situ observations and reconstructions (1905–2013). G.A. Nosenko, Institute of Geography RAS

#### Study of surging Kolka glacier in the Caucasus

In September 2002, the small glacier Kolka, located on the northern slope of the Kazbek-Djmaray massif was completely 'thrown out' of its bed. As a consequence, a huge mass of ice, stones and water, immediately turning into a high-speed destructive stream, rushed for several minutes 16 km down the valley and created a gigantic ice/stone obstruction 4 km long in the Karmadon valley. Over the next 12 years, a great volume of data from geological, geophysical and glaciological explorations was obtained, together with space surveys from various dates. All this has made it possible to corroborate the theory of the Institute of Geography RAS that the breakdown of the Kolka glacier resulted from a combination of simultaneously acting extreme factors. Of these the most important were the intensification of tectonic and volcanogenic processes in the region and the large volume of accumulated water under the glacier, which was responsible for the magnitude of the catastrophe. Observations of the course of regeneration in the empty circue of the Kolka glacier have established that a new glacier body has formed in the rear part of the cirque due to active avalanche alimentation and partial movement of former hanging tributaries of this glacier. By the end of 2012, its area had reached 0.6 km<sup>2</sup>. During the last 3 years its front has became stable.

O.V. Rototaeva, Institute of Geography RAS

#### Climatic characteristics of the snow cover of northern Eurasia and their variation during recent decades

A statistical analysis was made of the characteristics of snow cover in north Eurasia for the base climatic period 1951–80 and during recent climate warming in 1989–2006. Changes in the snow cover over the subcontinent are related to the mechanisms of atmospheric circulation revealed earlier. Maximum snow accumulation occurs in the east of the Kamchatka peninsula. According

to indirect data, resources of solid precipitation are even greater on the mountain ranges near the Black Sea, in the Krasnava Polyana area. In the continental part of north Eurasia, maximum snow depth is in the middle of the Yenisey basin. Snow accumulation maxima in the east European plain are located near the Urals and in the Mezen river basin. Minima for the entire subcontinent are located in the trans-Baikal region and in the south of the east European plain. During recent decades, snow accumulation in north Eurasia has increased overall. The largest increase has occurred in southern Kamchatka, southern Sakhalin, the east of European Russia and western Siberia. The seasonal dynamics of the snow depth from the end of October until the end of April were analysed. A significant increase in the frequency of weather situations favourable to fast snowmelt and a sharp runoff peak has occurred in the Pechora river basin and, according to some estimates, in the upper parts of the Vychegda and Kama basins, near the Gulf of Finland, in the middle of the Ob basin, and in the Anabar river basin.

A.B. Shmakin, Institute of Geography RAS

#### Mt Elbrus ice core studies

An intermediate-depth ice core (181.8 m) was recovered from the western plateau of Elbrus (43°20′53.9″ N, 42°25′36.0″ E; 5150 m a.s.l.) in the Caucasus, Russia, in 2009. The ice core has been partly analysed for stable isotopes  $(d^{18}O \text{ and } \delta D)$ , microparticle concentration, major ions (K<sup>+</sup>, Na<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, NH<sub>4</sub><sup>+</sup>, SO<sub>4</sub><sup>2-</sup>,  $NO_{2}^{-}$ , Cl<sup>-</sup>), black carbon (BC), methane (CH<sub>4</sub>) concentration and tritium content. The mean annual net accumulation derived from distinct annual oscillations of  $d^{18}O$ ,  $\delta D$ , and  $NH_{+}^{+}$  is 1200 mm w.e. Records of desert dust deposition events were also analysed. On average, dust deposition events occur in the Elbrus area three to six times a year. Major dust sources were the deserts of the northern Sahara and the Middle East. Temperatures were measured in the boreholes on the western Elbrus plateau in 2009 and ranged from -17°C at 10 m depth to -2.4°C at 182 m. According to radar measurements the glacier thickness ranged from 45 m near the marginal zone of the plateau to 255 m in the middle. An age-depth relationship has been constructed for the upper 100 m of the ice core on the basis of simple annual layer counting, the 1963 tritium peak and a good dated known volcanic eruption (Katmai, 1912). Preliminary dating of basal glacier layers using a 2-D ice-flow model indicates 400-450 years.

V.N. Mikhalenko, Institute of Geography, RAS

#### Studies of snow avalanches

Since 1968, the scientific–educational Elbrus station has carried out regular stationary observations of snow cover, avalanches, heavy snowfalls, catastrophic natural events and their dynamics with respect to present-day climate change in the Caucasus region. As has been discovered, the period of abundant snow at the end of the 20th century has changed during the last two decades, with noticeable decreases in snowfall and accumulation and a rise in winter temperature. The winter of 2012/13 saw the least snow of the whole period of observation here.

The Research Laboratory of Snow Avalanches and Mudflows (Lomonosov MSU) supplies the electronic base by means of additional data on the occurrence of avalanches and conditions of their formation throughout Russia. Modelling of snow avalanches and calculations of their dynamic characteristics were performed on the key sites in the Khibiny Mountains, near Elbrus, and on Krasnaya Polyana; the Swiss software RAMMS was used for this purpose. We have shown the influence of avalanche-model parameters prescribed by climatic factors upon the dynamic characteristics and magnitude of avalanche deposits. A model has been developed for shortterm forecasting of snowstorm avalanches for the Khibiny region.

In June 2013, a school seminar was held together with the Swiss Federal Institute of Avalanche Research at which participants presented principles of work and the possibilities of the RAMMS software for 2-D dynamic modelling of snow avalanches and mudflows under conditions of 3-D relief. Procedures for predicting avalanche risks at the mountain ski resorts of the northern Caucasus are in progress; they are being developed on a large-scale using geoinformatic modeling.

N.V. Volodicheva, Lomonosov State University

# Studies of avalanche and snow processes in Sakhalin Island

In 2010–13, avalanche processes were observed and investigated in Sakhalin Island, Kuril isles, Transbaikalia, and in the west Caucasus (Krasnaya Polyana). It was established on the basis of these observations that velocity and the distance of run-out, as well as specific features of avalanche motion, depend much more on the generic type of an avalanche than on its volume. Seven generic types of avalanche distinguished by their dynamics were isolated. From the results of investigations into avalanche complexes on the marine terraces of south Sakhalin and avalanche processes in flat areas, it was determined that avalanche complexes on marine terraces had a number of features that allowed them to be considered a specific class. Eight types of terrace avalanche complex were isolated, and regularities in their structure were identified for the purpose of calculating parameters for the avalanche processes on marine terraces and on plains in cases where observation data are insufficient.

In winter 2013, changes in the rate of structure and the texture of the generically homogeneous snow layer were studied in southern Sakhalin. It was determined that ice crystals in the stage of constructive metamorphism can appear in the snow layer as early as 3 days after it had formed during a snowfall. Crystals of skeleton class can be formed in as little as 8 days while the bar texture can appear a mere 9 days after formation of the layer. In this way it was determined that avalanche-generating layers can exist in a snow layer 8–10 days after snowfall.

Investigations' were continued into the electric properties of snow. It was revealed that the electric charge of an ice crystal depends on its size and form (i.e. on the stage of its metamorphism), and the charge of a snow layer depends on its structure and texture. Ice crystals placed in an artificial electric field arrange themselves into vertical clusters similar to those observed in snow layers with a filamentary texture. This indicates that a separation of surface charges takes place on the crystals while the crystal itself in such cases should be characterized as a dipole. A model has been developed that presents snow cover in its natural state as an electrodynamic system.

N.A. Kazakov, Far-Eastern Geological Institute, Far-East Branch of RAS

The Glaciology Association, uniting specialists in the field of snow-ice studies from Former Soviet Union countries, is located in Moscow. Glaciological symposiums are held every two years; the last one took place in January 2013 in Novosibirsk. Since 2010, the Russian Academy of Sciences has published the journal Ice and Snow which is a continuation of Materials of Glaciological Sudies (published since 1961).

#### Vladimir Kotlyakov

Honorary Member of the IGS, President of the Glaciological Association, Editor-in-Chief of Ice and Snow



# **International Glaciological Society**

## JOURNAL OF GLACIOLOGY

Papers accepted for publication between 1 September and 31 December 2014. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

#### Timothy I. Brox, Mark L. Skidmore, Jennifer R. Brown

Characterizing the internal structure of laboratory ice samples with nuclear magnetic resonance

#### J.R. Carr, A. Vieli, C.R. Stokes, S.S.R. Jamieson, S.J. Palmer, P. Christoffersen, J.A. Dowdeswell, F.M. Nick, D.D. Blankenship, D.A. Young Basal topographic controls on rapid retreat of Humboldt Glacier, northern Greenland

#### Ryan Cassotto, Mark Fahnestock,

Jason M. Amundson, Martin Truffer, Ian Joughin Seasonal and interannual variations in ice melange and its impact on terminus stability, Jakobshavn Isbræ, Greenland

#### Joan J. Fitzpatrick, Donald E. Voigt, John M. Fegyveresi, Nathan T. Stevens, Matthew K. Spencer, Jihong Cole-Dai, Richard B. Alley, Gabriella E. Jardine, Eric D. Cravens, Lawrence A. Wilen, T.J. Fudge, Joseph R. McConnell Physical properties of the WAIS Divide ice core

S. Gogineni, J.B. Yan, J. Paden, C. Leuschen, J. Li, F. Rodriguez-Morales, D. Braaten, K. Purdon, Z. Wang, W. Liu, J. Gauch Bed topography of Jakobshavn Isbræ, Greenland, and Byrd Glacier, Antarctica

#### Joshua King, Richard Kelly, Andrew Kasurak, Claude Duguay, Grant Gunn, Nick Rutter, Tom Watts, Chris Derksen

Spatiotemporal influence of tundra snow properties on Ku-band (17.2 GHz) backscatter

Jonathan Kingslake, Felix S.L. Ng, Andrew Sole Modelling channelized surface drainage of supraglacial lakes

#### Kristine M. Larson, John Wahr, Peter Kuipers Munneke

Constraints on snow accumulation and firn density in Greenland using GPS receivers

#### L. Leppänen, A. Kontu, J. Vehviläinen, J. Lemmetyinen, J. Pulliainen

Comparison of traditional and optical grain size field measurements with SNOWPACK simulations in a taiga snowpack

#### Cameron Lewis, Sivaprasad Gogineni, Fernando Rodriguez-Morales, Ben Panzer, Theresa Stumpf, John Paden, Carl Leuschen Airborne fine-resolution UHF radar: an approach

to the study of englacial reflections, firn compaction and ice attenuation rates

#### A. Martín-Español, F.J. Navarro, J. Otero, J.J. Lapazaran, M. BŁAszczyk

Estimate of the total volume of Svalbard glaciers, and their potential contribution to sea-level rise, using new regionally based scaling relationships

#### Brent Minchew, Mark Simons, Scott Hensley, Helgi Björnsson, Finnur Pálsson

Early melt-season velocity fields of Langjokull and Hofsjokull ice caps, central Iceland

#### Francesca Pellicciotti, Christa Stephan, Evan Miles, Sam Herreid, Walter W. Immerzeel, Tobias Bolch

Mass-balance changes of the debris-covered glaciers in the Langtang Himal, Nepal, 1974–99

#### J.L. Riedel, Steve Wilson, William Baccus, Michael Larrabee, T.J. Fudge, Andrew Fountain Glacier status and contribution to streamflow in the Olympic Mountains, Washington, USA

#### Summer Rupper, William F. Christensen, Barry R. Bickmore, Landon Burgener, Lora Koenig, Michelle Koutnik, Clément Miège, Richard R. Forster

The effects of dating uncertainties on net accumulation estimates from firn cores

#### Meiping Sun, Zhongqin Li, Xiaojun Yao, Mingjun Zhang, Shuang Jin

Modeling of the hydrological response to climate change in a glacierized high mountain region, northwest China

#### Barbara L. Trüssel, Martin Truffer, Regine Hock, Roman J. Motyka, Matthias Huss, Jing Zhang Runaway thinning of the low-elevation Yakutat Glacier, Alaska, USA, and its sensitivity to climate change

Victor C. Tsai, G. Hilmar Gudmundsson An improved model for tidally modulated grounding-line migration

#### Cesar Vera Valero, Katreen Wikstroem Jones, Yves Bühler, Perry Bartelt

Release temperature, snowcover entrainment and the thermal flow regime of snow avalanches

#### Denis Voytenko, Timothy H. Dixon, Ian M. Howat, Noel Gourmelen, Chad Lembke, Charles L. Werner, Santiago De La Peña, Björn Oddsson

Multi-year observations of Breiðamerkurjökull, a marine-terminating glacier in southeastern Iceland, using terrestrial radar interferometry

#### C.C. Walker, J.N. Bassis, H.A. Fricker, R.J. Czerwinski

Observations of interannual and spatial variability in rift propagation in the Amery Ice Shelf, 2002–14

#### Wang Shijin, Qin Dahe, Xiao Cunde

Moraine-dammed lake distribution and outburst flood disaster risk in the Chinese Himalaya

#### Faye R. Wyatt, Martin J. Sharp

Linking surface hydrology to flow regimes and patterns of velocity variability of the Devon Ice Cap, Nunavut

#### Duncan A. Young, Laura E. Lindzey, Donald D. Blankenship, Jamin S. Greenbaum, Alvaro Garcia De Gorordo, Scott D. Kempf, Jason L. Roberts, Roland C. Warner, Tas Van Ommen, Martin J. Siegert, Emmanuel Le Meur Land-Ice Elevation Changes From Photon Counting Swath altimetry: first applications over the Antarctic ice sheet

#### Lucas K. Zoet, Neal R. Iverson

Experimental determination of a double-valued drag relationship for glacier sliding

## ANNALS OF GLACIOLOGY 55(68)

The following papers have been selected for publication in Annals of Glaciology 55(68) (thematic issue on Ice drilling technology), edited by Frank Wilhelms

Olivier Alemany, Jérôme Chappellaz, Jack Triest, Michel Calzas, Olivier Cattani, Jean-François Chemin, Quentin Desbois, Thibault Desbois, Romain Duphil, Sonia Falourd, Roberto Grilli, Christophe Guillerme, Erik Kerstel, Benoit Laurent, Eric Lefebvre, Nicolas Marrocco, Olivier Pascual, Luc Piard, Philippe Possenti, Daniel Romanini, Vincent Thiebaut, Radouane Yamani The SUBGLACIOR drilling probe: concept and design

T. Benson, J. Cherwinka, M. Duvernois, A. Elcheikh, F. Feyzi, L. Greenler, J. Haugen, A. Karle, M. Mulligan, R. Paulos IceCube Enhanced Hot Water Drill functional description

**Daren Blythe, Dennis Duling, Dar E. Gibson** Developing a hot-water drill system for the WISSARD project. Part 2: In situ water production for hot-water drilling in Antarctica

#### Justin Burnett, Frank R. Rack, Daren Blythe, Pat Swanson, Dennis Duling, Dar Gibson, Chad Carpenter, Graham Roberts, Jeff Lemery, Steve Fischbein, Adam Melby

Developing a hot-water drill system for the WISSARD project: 3. Instrumentation and control systems

K.A. Casey, T.J. Fudge, T.A. Neumann, E. J. Steig, M.G.P. Cavitte, D.D. Blankenship The 1500 m South Pole ice core: recovering a 40 ka environmental record

**Romain Duphil, Philippe Possenti, Luc Piard** A new leak-tight borehole casing at Dome Concordia station, Antarctica, for the SUBGLACIOR project

Dmitry Eliseev, Dirk Heinen, Klaus Helbing, Ruth Hoffmann, Uwe Naumann, Franziska Scholz, Christopher Wiebusch, Simon Zierke Acoustic in-ice positioning in the Enceladus Explorer project

#### Christopher J. Gibson, Jay A. Johnson, Alexander J. Shturmakov, Nicolai B. Mortensen, Joshua J. Goetz Replicate ice-coring system architecture:

mechanical design

Leland Greenler, T. Benson, J. Cherwinka, Alan Elcheikh, F. Feyzi, A. Karle, R. Paulos Modeling hole size, lifetime and fuel consumption in hot-water ice drilling

J. Hong, P. Talalay, M. Sysoev, X. Fan DEM modeling of ice cuttings transportation by electromechanical auger core drills Jay A. Johnson, Nicolai B. Mortensen, Christopher J. Gibson, Joshua J. Goetz, Alexander J. Shturmakov Replicate ice-coring system testing

V.S. Litvinenko, N.I. Vasiliev, V.Ya. Lipenkov, A.N. Dmitriev, A.V. Podoliak Special aspects of ice drilling and results of 5G hole drilling at Vostok station, Antarctica

Keith Makinson, Paul G.D. Anker The BAS ice-shelf hot-water drill: design, methods and tools

Sumito Matoba, Kunio Shimbori, Takayuki Shiraiwa Alpine ice-core drilling in the North Pacific region

Nicolai B. Mortensen, Joshua J. Goetz, Chris J. Gibson, Jay A. Johnson, Alexander J. Shturmakov Replicate ice-coring system architecture: electrical, electronic and software design

Nicolai B. Mortensen, Jay A. Johnson, Alexander J. Shturmakov Precision cable winch level wind for deep icecoring systems

**Robert Mulvaney, Jack Triest, Olivier Alemany** The James Ross Island and the Fletcher Promontory ice-core drilling projects

**Peter D. Neff** A review of the brittle ice zone in polar ice cores

**Trevor J. Popp, Steffen B. Hansen, Simon G. Sheldon, Christian Panton** Deep ice-core drilling performance and experience at NEEM, Greenland

Trevor J. Popp, Steffen B. Hansen, Simon G. Sheldon, Jakob Schwander, Jay A. Johnson Drilling into debris-rich basal ice at the l

Drilling into debris-rich basal ice at the bottom of the NEEM (Greenland) borehole

Frank R. Rack, Dennis Duling, Daren Blythe, Justin Burnett, Dar Gibson, Graham Roberts, Chad Carpenter, Jeff Lemery, Steve Fischbein Developing a hot-water drill system for the WISSARD Project: 1. Basic drill-system components and design

#### Margit Schwikowski, T.M. Jenk, Dieter Stampfli, Felix Stampfli

A new thermal drilling system for high-altitude or temperate glaciers

Simon G. Sheldon, Trevor J. Popp, Steffen B. Hansen, Thomas M. Hedegaard, Carsten Mortensen

A new intermediate-depth ice-core drilling system

Simon G. Sheldon, Jørgen P. Steffensen, Steffen B. Hansen, Trevor J. Popp, Sigfús J. Johnsen

The investigation and experience of using ESTISOL<sup>™</sup> 240 and COASOL<sup>™</sup> for ice-core drilling

Simon G. Sheldon, Trevor J. Popp, Steffen B. Hansen, Jørgen P. Steffensen Promising new borehole liquids for ice-core drilling on the East Antarctic high plateau

Kristina R. Slawny, Jay A. Johnson, Nicolai B. Mortensen, Christopher J. Gibson, Joshua J. Goetz, Alexander J. Shturmakov, Donald A. Lebar, Anthony W. Wendricks Production drilling at WAIS Divide

#### **Pavel Talalay**

Perspectives for development of ice-core drilling technology: a discussion

Pavel Talalay, Xiaopeng Fan, Zhichuan Zheng, Jun Xue, Pinlu Cao, Nan Zhang, Rusheng Wang, Dahui Yu, Chengfeng Yu, Yunlong Zhang, Qi Zhang, Kai Su, Dongdong Yang, Jiewei Zhan Anti-torque systems of electromechanical cablesuspended drills and test results

#### J. Triest, O. Alemany

Drill fluid selection for the SUBGLACIOR probe: a review of silicone oil as a drill fluid

Jack Triest, Robert Mulvaney, Olivier Alemany Technical innovations and optimisations for intermediate ice core drilling operations

Frank Wilhelms, Heinrich Miller,

Michael D. Gerasimoff, Andreas Frenzel, Diedrich Fritzsche, Hannes Grobe, Steffen Bo Hansen, Sverrir Æ. Hilmarsson, Kerstin Hörnby, Andrea Jaeschke, Steinunn S. Jakobsdóttir, Paul Juckschat, Achim Karsten, Lorenz Karsten, Patrik Kaufmann, Torbjörn Karlin, Eberhard Kohlberg, Guido Kleffel, Anja Lambrecht, Astrid Lambrecht, Gunther Lawer, Jochen Schmitt, Simon G. Sheldon, Morimasa Takata, Marcus Trenke, Birthe Twarloh, Fernando Valero-Delgado, Dorothee Wilhelms-Dick

The EPICA Dronning Maud Land deep drilling operation

#### V. Zagorodnov, L.G. Thompson

Thermal electric ice-core drills: history and new design options for intermediate-depth drilling

Annals 55(68) is now complete

## ANNALS OF GLACIOLOGY 56(69)

The following papers have been selected for publication in Annals of Glaciology 56(69) (thematic issue on Sea ice in a changing environment), edited by Petra Heil

Stephen F. Ackley, Hongjie Xie, Elizabeth Tichenor Ocean heat flux under Antarctic sea ice in the Bellingshausen and Amundsen Seas: two case studies

Justin F. Beckers, Angelika H.H. Renner, Gunnar Spreen, Sebastian Gerland, Christian Haas Sea-ice surface roughness estimates from

airborne laser scanner and laser altimeter observations in Fram Strait and north of Svalbard

#### Luke G Bennetts, Siobhan P. O'Farrell, Petteri Uotila, Vernon Squire

An idealised wave-ice interaction model without subgrid spatial or temporal discretisations

#### E. Rachel Bernstein, Cathleen A. Geiger, Tracy L. Deliberty, Mary Stampone

Antarctic sea-ice thickness and volume estimates from ice charts between 1995 and 1998

**R. Bintanja, G.J. Van Oldenborgh, C.A. Katsman** The effect of increased fresh water from Antarctic ice shelves on future trends in Antarctic sea ice

#### Sinéad L. Farrell, Kelly M. Brunt, Julia Ruth, John M. Kuhn, Laurence Connor, Kaitlin Walsh Sea-ice freeboard retrieval using digital photon-

counting laser altimetry

Mario Hoppmann, Marcel Nicolaus, Stephan Paul, Priska A. Hunkeler, Günther Heinemann, Sascha Willmes, Ralph Timmermann, Olaf Boebel, Thomas Schmidt, Meike Kühnel, Gert König-Langlo, Rüdiger Gerdes Ice platelets below Weddell Sea landfast sea ice

#### Priska A. Hunkeler, Stefan Hendricks, Mario Hoppmann, Stephan Paul, Rüdiger Gerdes

Towards an estimation of sub-sea-ice platelet-layer volume with multi-frequency electromagnetic induction sounding

#### Stefanie Linow, Thomas Hollands, Wolfgang Dierking

An assessment of the reliability of sea ice motion and deformation retrieval using SAR images

### Shaun McDonald, Theodoro Koulis, Jens Ehn,

Karley Campbell, Michel Gosselin, C.J. Mundy A functional regression model for predicting optical depth and estimating attenuation coefficients in sea-ice covers near Resolute Passage, Canada

Mari-Ann Moen, Torbjørn Eltoft, Stian N. Anfinsen, Anthony P. Doulgeris, Angelika H.H. Renner, Sebastian Gerland Assessing polarimetric SAR sea ice classification using consecutive day images

#### Stephan Paul, Sascha Willmes, Mario Hoppmann, Priska A. Hunkeler, Christine Wesche, Marcel Nicolaus, Günther Heinemann, Ralph Timmermann

The impact of early summer snow properties on Antarctic landfast sea-ice X-band backscatter

#### Andrew Roberts, Anthony Craig, Wieslaw Maslowski, Robert Osinski, Alice DuVivier, Mimi Hughes, Bart Nijssen, John Cassano, Michael Brunke

Simulating transient ice–ocean Ekman transport in the Regional Arctic System Model and Community Earth System Model

#### M. Wiese, P.. Griewank, D. Notz

On the thermodynamics of melting sea ice versus melting freshwater ice

#### Mengxi Zhai, Xinqing Li, Fengming Hui, Xiao Cheng, Petra Heil, Tiancheng Zhao, Tianyu Jiang, Cheng Cheng, Tianyu Ci, Yan Liu, Zhaohui Chi, Jian Liu

Sea-ice conditions in the Adélie Depression, Antarctica, during besetment of the Chinese icebreaker RV Xuelong

More papers for Annals 56(69) will be listed in the next issue

## ANNALS OF GLACIOLOGY 56(70)

The following papers have been selected for publication in Annals of Glaciology 56(70) (thematic issue on Contribution of Glaciers and Ice Sheets to Sea Level Change), edited by Richard Hindmarsh and Frank Pattyn

#### Denis Callens, Nicolas Thonnard, Jan T.M. Lenaerts, Jan M. Van Wessem, Willem J. Van De Berg, Kenichi Matsuoka, Frank Pattyn

Mass balance of the Sør Rondane Glacial System, East Antarctica

#### Markus Engelhardt, Thomas Vikhamar Schuler, Liss M. Andreassen

Sensitivities of glacier mass balance and runoff to climate perturbations in Norway

#### **Geoff Evatt**

Rothlisberger channels with finite ice depth and open channel flow

#### Joel Harrington, Neil F. Humphrey, Joel T. Harper

Temperature distribution and thermal anomalies along a flowline of the Greenland Ice Sheet

### Pierre-Marie Lefeuvre, Miriam Jackson,

**Gaute Lappegard, Jon Ove M. Hagen** Inter-annual variability of glacier basal pressure from a 20 year record

#### Masahiro Minowa, Shin Sugiyama, Daiki Sakakibara, Takanobu Sawagaki

Contrasting glacier variations of Glaciar Perito Moreno and Glaciar Ameghino, Southern Patagonia Icefield

#### Peter Kuipers Munneke, Stefan R.M. Ligtenberg, Eric A. Suder, Michiel R. van den Broeke

A model study of the response of dry and wet firn to climate change

#### Lisbeth T. Nielsen, Nanna B. Karlsson, Christine S. Hvidberg

Large-scale reconstruction of accumulation rates in Northern Greenland from radar data

#### Bhanu Pratap, D.P. Dobhal, Manish Mehta, Rakesh Bhambri

Influence of debris cover and altitude on glacier surface melting: a case study on Dokriani Glacier, central Himalaya, India

#### Marion Reveillet, Antoine Rabatel, Fabien Gillet-Chaulet, Alvaro Soruco

Simulations of changes in Glaciar Zongo (Bolivia, 16°S) over the 21st century using a 3-D full-Stokes model and CMIP5 climate projections

#### Harry Zekollari, Philippe Huybrechts

On the climate-geometry imbalance, response time and volume-area scaling of an alpine glacier: insights from a 3-D flow model applied to Vadret da Morteratsch

More papers for Annals 56(70) will be listed in the next issue

# **Diary of a Symposium**

A report on the IGS symposium on 'The Contribution of Glaciers and Ice-Sheets to Sea Level Change'

Chamonix-Mont-Blanc, France, 26-30 May 2014

#### DAY 1: 26 MAY 2014

Where can you randomly meet Tavi Murray, Jonathan Bamber, Neil Ross, Bethan Davies (from Antarcticglacier.org) and Ruth Mottram by just walking in town? In Chamonix since yesterday, as they are all here for the IGS Chamonix 2014 Symposium on Glaciers and ice sheets contribution to sea-level change.

So after a pleasant icebreaker (quite ironic for a glaciology conference) yesterday, with good food and good wine, today was the first day of talks.

Tony Payne gave the first keynote presentation of the week with an overview of the contribution of Greenland and Antarctica to sea-level from the IPCC Assessment Report 5. After the morning coffee break Regine Hock gave a really enthusiastic presentation on modelling Juneau Icefield (Alaska) using the Brian Anderson flow model over a short/medium time and space scale.

Another enthusiastic talk was the one by Ruth Mottram presenting some results on Greenland Ice Sheet modelling. After the afternoon coffee break came the ice rheology session, with two excellent talks by Jeremy Bassis and Brad Lipovsky

This first day ended in apotheosis with the award to Paul Duval of the Seligman Crystal (**see** p. 20). In the history of the IGS, very few recipients have received their Crystal 'at home' but Paul did. After a fascinating lecture highlighting the outstanding contribution of Paul to ice rheology and its impact on ice-sheet flow, his colleagues from



The IGS Chief Editor fortifying himself at a convenient pavement cafe in anticipation of a taxing week.

LGGE celebrated the event with testimonies and the presentation of images from old times. They supplied touching evidence of the Paul's unique human and scientific qualities. Surely every retired or retiring glaciologist now dreams of such a tribute from the younger generation!



The location....



... had a stunning view



The Icebreaker was extremely well attended and copiously supplied with delicious food and drink.



During coffee breaks participants were able to study the Mont Blanc massif on a small scale.

#### DAY 2: 27 MAY 2014

After a 'not that good' night weatherwise and a foggy breakfast, the first session started at 8:30 with a keynote presentation from Michiel van den Broeke on evaluating the RACMO model of surface mass balance and discharge of ice sheets. And of course one of the key points is to get data from an automatic weather station such as the iW5 AWS, which can be deployed in 30 minutes. During the second session, Roberta Sciascia presented modelling on submarine melting of glacier front. Later that day I had a nice chat with Roberta and it seems that it is great to work at MIT!

In the afternoon Peter Kuipers Munneke gave a great talk on modelling the process of creating an aquifer in the Greenland firn. Really cool and simple modelling with a comprehensible interpretation.

Big glaciers, big proglacial lakes? Don't look for them, they're in Patagonia. Shin Sugiyama presented the first results of his (Southern Hemisphere) summer fieldwork. Good work and a good place to work! For your information, in Patagonian proglacial lakes, stratification of waters is controlled by the sediment load and notby temperature or salinity as in marine fjords.



The main auditorium was often full to capacity – here for the welcome from IGS President Doug MacAyeal....



... so the organizers had provided an overflow room, which was also usually pretty busy.

And here comes the poster session... my poster session! Still surprised how many people came to have a look to my poster and talked to me. Among them, Gwenn Flowers from Simon Fraser University, BC, Canada.

I talked to Deborah Verfaillie about her poster on the mass balance of the Kerguelen Island icecap.



The Secretary General was on hand to sell you a tie, a hat or a T-shirt should you not have one already.



The poster session: the calm ....



Gwenn Flowers giving an expert demonstration of the use of the hands to illustrate complex ideas.



... before the arrival of the hordes.

I also talked to Lionel Benoit (former colleague from IGN) about the use of Geocube to track the movement of Glacier d'Argentière. And to finish, I got a full explanation from Marius Schafer's poster on the mass balance of the Patagonian icefields.

#### DAY 3: 28 MAY 2014

All today's sessions were about basal processes and the first session concentrated on glacial hydrology. The keynote presentation was given by Gwenn Flowers. It was a really great and motivating talk about the history and evolution of glacial hydrology modelling. Just before the coffee break Tessa Kyrke-Smith gave a great talk on the initiation of ice streams by subglacial water and their simulations. Really visual and impressive. Then after the coffee break, Marion Bougamont talked about soft bed sediment and ice flow in Greenland. She has some famous collaborators (if an appearance on the BBC's Frozen Planet makes you famous) from Aberystwyth: Allun Hubbard and Sam Doyle.

After this really interesting morning, it was time for the midweek excursion. Participants had three choices:



The weather for the midweek excursions did not show the Mer de Glace at its best.



The Mer de Glace excursions started from Montenvers train station.

- Taking the cable car to Aiguille du Midi at 3842 m
- Taking the train to Montenvers and visiting the museum and gems gallery of the Mer de Glace
- Taking the train to Montenvers and going for a walk on the Mer de Glace

I chose the last option, which involved the descned of a chain of ladder (around 200 m) from Montenvers station). Before taking the Montenvers train, there was some hope of sun but by the time we arrived at the Mer de Glace the rain had set in. Anyway it was a great excursion: it was good to be outside after 2.5 days of talks.

The Aiguille du Midi ('Noon's needle' in French), located 3842 m a.s.l at the very top of an impressive granite peak, is supposed to be one of the most scenic place in the world and many delegates chose this option. As with the rest of the Symposium, the local organizing Committee had organized the excursion perfectly, except that they had proved unable to blow away the convective clouds covering the peak. What a pity in these modern times, when a very slight change of a few coefficients in the parameterization of convection would be sufficient to turn a forecast cloudy day into perfect sunshine! So no way to see the top of the Mont-Blanc, which was so close to us.

Taking advantage of the IGS symposium, the LGGE had organized an after-dinner public lecture entitled 'The glaciers in abeyance?'. The speakers were Delphine Six, Christian Vincent (LGGE), Eric Rignot (NASA JPL), Frank Pattyn (ULB) and Isabella Zin (LTHE). It was a relaxing evening after more than two days of high-level glaciology.

#### DAY 4: 29 MAY 2014

After poor weather for the excursion, this morning was sunny and we could see the summits all around the conference site.

After a keynote talk by Eric Rignot, Martin O'Leary gave a really enjoyable presentation on a method of reconstructing bed topography from various datasets. He succeed in making the maths involved in 'hardcore' modelling easy. Then Mathieu Morlighem talked about his work on the bed map of Greenland using mass conservation method: really interesting and impressive.

After the coffee break, Lauren Andrews presented her work based (for a change) on observations and not modelling. It was a nice talk on hydrolic head measurements in moulins in Greenland.

The afternoon sessions focused on radar and analysis of radargram with talks from:

 Neil Ross about a series of impressive radargrams in Antarctica and their interpretation



Some participants went on an excursion that took them under the Mer de Glace via the EDF gallery.



The descent to the Mer de Glace is not for the faint-hearted.



But glaciologists are made of stern stuff and everyone made it to the bottom....



The banquet was held in splendid surroundings.



Everyone had a very good time!



Olivier Gagliardini, Chairman of the Organizing Committee, was in charge of the microphone.



Here, Olivier is chatting to IGS Secretary General Magnús Magnússon and Serge Martinot, president of the French Fondation Eau, Neige et Glace.

- Dustin Schroeder on what information is present in radargrams
- Joseph MacGregor with a MATLAB package (PickGUI) to analyse radargrams, the stratigraphy of the Greenland Ice Sheet and how to follow isochrones for hundreds of kilometres.

And here came the second poster session. It was really interesting to be on the other side of the session, looking at work from far away and asking questions. With more than 50 posters, it was difficult to go through all of them but here is my top poster list:

- Ilaria Clemenzi, on the implication of blowing snow on seasonal mass balance in the Alps (Haut Glacier d'Arolla)
- Martin O'Leary, with an open source Javascript Ice Sheet Model for education. Really cool, a must try



Richard Hindmarsh and Frank Pattyn, joint Chief Editors of the *Annals* issue associated with the symposium, addressed the banqueters.



After the banquet, a group of revellers about to hit the town took the opportunity to pose in a huge empty picture frame that just happened to be leaning against the wall.



Richard Hindmarsh attracts random admirers wherever he goes.

- Clément Miège, with IceBridge data and snow accumulation in SE Greenland
- Sophie Berger, on ice rise, pinning point and ice shelf velocity in Dronning Maud Land.

Then came the banquet... just three words: excellent French food!

#### DAY 5: 30 MAY 2014

After an excellent banquet, tiredness and a lot of varied talk were on the agenda for the last day of the conference. And some sun too.

The keynote talk of the day was given by Terry Wilson, on the GPS/Seismograph network deployed in Antarctica to evaluate the Glacial Isostatic Adjustment (GIA).



Who needs 3-D television when you can watch glacier sliding in 3-D at an IGS symposium?

In the second session of the morning, Neal Iverson presented some glacial geomorphological features left by the Laurentide Ice Sheet at the Des Moines Lobe (Idaho, USA). Using mechanic tests on tills, magnetic analysis and high-resolution Lidar, these features have been identified as crevasses–squeeze ridges, which changes the the interpretation of the retreat rate of the Des Moines Lobe. A really interesting talk, especially for glacial geomorphologists!

In the same session, Mac Cathles talked about glacial earthquakes as a way to measure calving events. He used a physical model (water tank and plastic block) to determine the aspect of the seismic signal.

After lunch, Tavi Murray presented the work of her group on Helheim Glacier in Greenland. In the last session (there were still a lot of participants left), we got a surprising talk on mountain glacier flow modelling in a special context: finding where corpses had been buried on the Aletschgletscher. Guillaume Jouvet told us an interesting story: you can find more detail in his paper (doi:10.3189/2014JoG13J156). And finally Erin Pettit presented her work on the Antarctic Peninsula, which presents an east/west divide due to orographic precipitation and the acceleration of the SCAR inlet ice shelf.

The IGS Chamonix 2014 Symposium was really a great conference for me: broadening my vision of glaciology and talking to a lot of interesting people!

Thank you IGS and all participants!

Pierre Lardeux Eric Brun

### Presentation of the Seligman Crystal to Paul Duval

On the Monday evening of the Chamonix Symposium, a presentation was made to Paul Duval of the Seligman Crystal, which he had been awarded in 2013 (see ICE 161, pp. 34–35). Maurine Montagnat read the citation for the award, which was as follows:

Paul Duval has been at the forefront of international research to understand the physics of ice flow for 40 years. Many would say that he is still the leading researcher in microscale ice physics. He has made outstanding contributions to our understanding of ice flow with regard to the effects of impurities, including water, the impact of crystal size variations, and the ratecontrolling processes of the deformation of ice. He characterized ice creep and unveiled the micromechanisms underlying the process. In addition, he championed modern modelling of the depth evolution of crystallographic texture and of the attendant development of plasticly anisotropic viscoplastic flow within both the Greenland and the Antarctic ice covers. Computational glaciologists continue to incorporate these effects into refined interpretations of ice core data and GCM models, much to the benefit of future climate predictions.

Early in his career, Paul published three papers that stand out as fundamental building blocks in glaciology. 'Fluage et recrystallisation dynamique de la glace polycristalline' (Duval (1972) *C. R. Acad. Sci. (Paris)*, **275**, 337–339) made clear for the first time that dynamic recrystallization contributes significantly to the acceleration of creep following the secondary stage. 'Anelastic behavior of polycrystalline ice' (Duval (1978), *J. Glaciol.*, **21**(85), 621–628) showed that, when load is removed, anelastic or recoverable strain accounts for a significant fraction of primary



Paul with his family - grandsons and grad students.



Paul Duval with his Seligman Crystal.

creep, an observation he explained in terms of dislocation back-slip. 'Rate-controlling processes in the creep of polycrystalline ice' (Duval and others (1983) J. Phys. Chem., 87, 4066-4074) established not only that plastic strain of relatively warm material (-10°C) compressed under intermediate-to-high deviatoric stress (0.1–10 MPa) results principally from basal slip, but also that the rate of deformation is governed by a non-basal process. Most importantly, this paper showed that creepstrengthening (i.e. the reduction by a factor of 100 or more of the deformation rate upon transition from primary to secondary creep) is caused by the development of long-range interactions among the stress field of dislocations. This result laid the foundation for the understanding of the a later discovery that dislocations in ice move cooperatively and intermittently rather than individually and continuously, in the form of 'avalanches' or microbursts (Weiss and Grasso (1997) J. Phys. Chem. B, 101, 6113-6117).

As Paul continued to explore the nature of creep, including, for instance, the study of creepinduced grain growth in polar ice (Montagnat

and Duval (2000) Earth Planet. Sci. Lett., 183. 179-186), he also initiated a novel study on the modelling of inelastic deformation within glaciers and polar ice sheets. He realized early on that in such work it is critical, particularly in relation to the dating of ice cores, to take into account the plastic anisotropy that develops through the evolution of crystallographic texture: otherwise, predictions of ice age can be in error by thousands of years. Therefore, he incorporated not only an understanding of the physics of deformation but also new developments in materials mechanics on viscoplastic self-consistency (Hutchinson (1976) Proc. R. Soc. London Ser. A, 348, 101-127; Hutchinson (1977) Metal. Trans. A, 8, 1465–1469). This approach led to several excellent papers. For instance, 'Modelling fabric development along the GRIP ice core, central Greenland' (Castelnau, Duval and others (1996) Ann. Glaciol., 23. 194-201), 'Viscoplastic modeling of texture development in polycrystalline ice with a self consistent approach' (Castelnau, Duval and others (1996) J. Geophys. Res., 101, 13851-13878) and 'Modelling viscoplastic behavior of anisotropic polycrystalline ice' (Castelnau and others (1997) Acta Mater., 45, 4823-4834) all showed very good agreement with observation, thereby establishing the power of the combined physics-mechanics approach. A later paper, Elastoviscoplastic micromechanical modelling of the transient creep of ice' (Castelnau and others (2008) J. Geophys. Res., 113, B11203), accounted (in terms of the rheology of single crystals) for the permanent creep rate of several highly anisotropic samples harvested from Greenland.

More recent developments in which Paul is playing an important role include the study of dislocation 'avalanches'. The observation (Weiss and Grasso (1997) J. Phys. Chem. B, 101, 6113-6117) that dislocations in ice move cooperatively and intermittently rather than individually and continuously is now attributed to the kind of long-range interactions among dislocations that Paul described in his 1983 paper (Duval and others (1983) J. Phys. Chem., 87, 4066-4074). Among others, notably Weiss and others (e.g. Weiss and others (2007) Phys. Rev. B, 76, 224110), Paul and his collaborators (e.g. Montagnat and others (2006) Phil. Mag., 86, 4259; Chevy and others (2010) Acta Mater., 58, 1837–1849) have added to this evolving story by showing that the dislocation arrangement in deformed ice exhibits invariance of spatial scale and is therefore fractal in character. Another development, published in 'On the role of long range internal stresses on grain nucleation during discontinuous recrystallization' (Duval and others (2012) Mater. Sci. Eng. A, 546, 207–211) is the idea that long-range dislocation interactions can eliminate the need for a critical nucleus, leading to the possibility of spontaneous nucleation not only in ice but also in other plasticly anisotropic materials such as zirconium. These developments in dislocation avalanches and barrier-free nucleation will inspire fundamental research on the plasticity of ice and other materials for years to come.

Paul's book, co-authored with Erland Shulson, *Creep and Fracture of Ice* (Cambridge University Press, 2009) is the first reasonably complete account of the physical mechanisms underlying the inelastic deformation of ice on scales small and large. Throughout the book, mechanisms that govern the behaviour of ice are related to mechanisms that control the behaviour of other materials, in support of the a view that Paul has held for many years (expressed directly in 'Creep and plasticity of glacier ice: a materials science perspective'; Duval and others (2010) *J. Glaciol.*, **56**(200), 1059–1068) that ice is a model material.

Paul is a humble person, with little to be humble about. He has served his profession well, with integrity and vigour and with clarity of thought. He has always been a keen teacher and communicator of his knowledge, keen to discuss research projects with others. He has inspired many students, several of whom are now recognized as excellent scientists in their own right. In November 2011, an international symposium (linked with the new ESF MicroDICE project) was held at Grenoble in his honour. That this symposium was instigated and organized by his current and past students demonstrates their admiration for his contribution to their own successes, and is a credit to him and to this work over the past 40 years.

Paul Duval has made a superb contribution to glaciology over the years, and the Awards Committee feel that the award of the Seligman Crystal is a fitting acknowledgement of his achievements.



Paul's presentation to the symposium audience.

Paul was then presented with the Seligman Crystal by IGS President Doug MacAyeal. After the presentation, Paul gave the following address:

I am very honoured to receive the Seligman crystal during this symposium and grateful to the IGS Awards Committee for this recognition of my work in the physics and the rheology of ice flow. I think of the contribution made by Gerald Seligman to the development of studies on the physics of snow and ice and, obviously, to his initiative in launching the *Journal of Glaciology* in 1947. I also think of his efforts to make the connection between ice physics and metallurgy.

I began my research work at the University of Grenoble by studying colour centres, point defects introduced by exposing alkaline halide crystals to light. A friend, working in the Laboratoire de Glaciologie of Grenoble, convinced me to visit this laboratory. After a short discussion with L. Lliboutry, I accepted to begin PhD thesis work on the physics of ice flow in 1969.

<sup>'</sup>Following the advice' of Lliboutry, my first work was to read the book *Dislocations* by J. Friedel (Fig. 1)! The role of dislocations in the plasticity of ice had been addressed during the joint meeting of the British Glaciological Society and the Institute of Metals held in Cambridge on 29 April 1948

I was lucky to work in the field in the Alps and Antarctica. I remember ice core drilling on the upper plateau of the Vallée Blanche (Massif du Mont-Blanc) during summer 1971. Measurements of the water content were made with a calorimeter by Jean-Robert Petit (Fig. 2).

In East Antarctica, a first deep drilling at Dome C (East Antarctica) reached a depth of about 900 m in January 1978. These three months in the field remain engraved in my memory. The observed decrease of the crystal growth rate below 400 m, associated with the transition between the Holocene and the last glacial period, gave a tremendous boost to the drilling team and to Claude Lorius, very anxious about the progress of the drilling and the possibility of reaching the glacial period. I would like here to thank the drilling team for their expertise and the good atmosphere during these three months at Dome C (Fig. 3).

I would also like to thank N. Barkov and V. Lipenkov (AARI, St Petersburg) for the first studies of the ice structure of the Vostok ice core, for many nice and fruitful discussions and for their friendship.

# The long history of the value of the stress exponent n

The behaviour of ice at low stresses has been under discussion for many years! Colleagues and friends in LGGE (Grenoble) often say in the cafeteria 'what



Fig. 1.

is the value of the stress exponent?' I recognize that I have spent 'some' time on this study!

A value of n higher than 4 has 'recently' been deduced from flow modelling and radar measurements near ice divides by colleagues in Cambridge and Grenoble. New results given by Fabien Gillet-Chaulet during this symposium confirm this behaviour at very low stresses.

An important point is the occurrence of diffusion creep, often introduced in flow models, at very low stresses. It should not be invoked at low stresses in ice! Stresses are too low to induce the concentration gradient of point defects required to induced deformation.

<sup>1</sup> In this context, it is important to say some words on solid-state convection in icy satellites. For Europa, Callisto and other icy satellites, convection stresses could be lower than 10<sup>-3</sup> MPa. Convection should not occur if the strongly non-linear behaviour at low stresses has been confirmed.



Fig. 2



Fig. 3

## Long-range internal stresses; why are they so important? are they so important?

In single ice crystals, plastic flow is characterized by intermittent strain bursts (dislocation avalanches), as shown by acoustic emission experiments. The size distribution of energy bursts follows a power law over several decades, indicating a selforganized critical state. The individual motion of dislocations would not represent the real situation! These results were obtained by Jerome Weiss and colleagues in LGGE.

Dislocation density deduced from the observation of basal slip lines in ice is correlated on a large scale. These results also indicate longrange elastic interactions between dislocations in different slip lines.

Transient creep is associated with the development of a long-range internal stress field and dislocation avalanches also mainly produce deformation.



Paul's supporters had T-shirts specially printed for the occasion.

The driving force for embryo formation during dynamic recrystallization is induced by the energy of dislocations within the embryo and probably also by the relaxation of internal stresses at a scale much larger than grain size. The 'classical' grain nucleation theory could be not applicable as soon as long-range internal stresses are present in the polycrystal! 'Concerning laboratory creep experiments and the study of dynamic recrystallization, I must mention how much I have been impressed by the high quality of experimental data obtained by the Australian group in Melbourne and Hobart'. Thanks to Jo Jacka for his friendship and nice discussions.

I hope I have convinced you that ice is a very nice model material.

I wish to thank IGS, the IGS Awards Committee, the International and local organizing committees of this symposium.

There are many people to whom I owe the Seligman crystal. I have already mentioned some colleagues. I have surely been influenced by several researchers. Allow me to mention J.W. Glen, J. Weertman, L. LLiboutry, M.F. Ashby, G. Canova, R. Lebensohn, K. Hutter, Y. Bréchet... and colleagues and friends in LGGE. Many thanks to Catherine, Maurine, Olivier, Jerome, Fabien, Gaël .... I have realized for many years, how lucky I have been to work in this laboratory! Perhaps, it is one reason for my 'many' stays in other laboratories!

I am very happy to receive the Seligman crystal in Chamonix in the presence of my wife Marie-Thérèse, my daughter Christine, my grandchildren, Victor and Etienne, my brother, Jean and my son-in-law Jean-François.

Lastly, I would like to say I have begun my field work with the ice core drilling on the upper plateau of the Vallée Blanche (close to l'Aiguille du Midi and Mont-Blanc) and I will be leaving LGGE just after this symposium in Chamonix.

Just before finishing, I would like to mention the interest of Doug and Magnus in metal-forging, cutleries and the associated physical processes that occur during heat-treatments! I am not sure that ice can be considered as a model material for these processes!

Thank you for your patience!

Paul Duval



The 39th Annual Meeting of the International Glaciological Society British Branch was hosted by the Bristol Glaciology Centre at the University of Bristol, between 8 and 9 September 2014. We were warmly welcomed to the historic university buildings by Martin Siegert, ahead of two days of presentations on all aspects of glaciology. This included 37 talks, with 11 delivered by postgraduate students, and 33 poster presentations.

Day 1 kicked off with a session on remote sensing, which used a wide variety of data sources to understand glacier behaviour. This ranged all the way from unmanned aerial vehicles through to the remains of Viking settlements. Next, we moved to a much smaller scale for a series of talks on the interactions between microbes and glacier ice. During the lunch break, the younger participants benefited from the expertise of the UK Polar Network Panel on opportunities outside academia after the PhD. The afternoon session focused on glacier hydrology, which really highlighted the importance of subglacial melt water plumes, but also the limitations to our understanding of them.

After the presentations, we were privileged to listen to a captivating talk by John Nye, entitled 'Glaciology 65 years ago'. He took us back to the world of glaciology at the start of his career, when he and John Glen were the entire UK glaciology community, and made us realize just how much the field has grown in recent decades. However, it was nice to see that some things have not changed, particularly the principle of observing glaciers and explaining their behaviour. As Professor Nye eloquently put it, 'You don't need to go there, just to think, but there is something about being there that really concentrates the mind'. He then told us about some of his early fieldwork experiences, including measuring strain rates for the first time and using time-lapse photography to determine glacier velocities. As with fieldwork today, there were anecdotes of near-misses, including camping on unstable moraines and tunnelling to the bed of glaciers (!) and just about making it out before the tunnels closed.

John Nye's talk was followed by a lively poster session, which was made all the more lively by the provision of vodka in glasses made of ice. As it turned out, these were rather difficult to hold once they began to warm up, but certainly helped promote an excellent environment for the discussion of all things glacial. Conversations were then transferred onto a boat, for a water-borne tour of Bristol harbour and Brunel's famous ship, the S.S. Great Eastern. The nautical theme continued and the Annual Dinner was held aboard the floating restaurant Spyglass, which was moored up at



Question: Why is there a mystery chair at the front of the lecture theatre?



Answer: for our special guest, John Nye.



The position of the screen over the splendid heraldic fireplace inspired some artistic gestures..

Welsh Back. David Sugden provided an entertaining speech during dinner and demonstrated his talents as an impressionist, aided by his hat. The night ended with the opportunity to sample the excellent beers available in Bristol's public houses.

Day 2 began bright and early with an informative session on palaeoglaciology, which was followed by talks on geophysics. Lunch time was devoted to the Annual General Meeting, where it was confirmed that the next meeting would be held in Durham. Next came a series of talks on the ice sheets, which presented research from across Antarctic and Greenland, and the talks were rounded off by the second remote sensing session.

The British Branch Meeting finished with the customary awarding of the John Glen prizes for student presentations, which were presented by David Sugden (as himself). The winners were Emma Smith for the best talk, entitled 'Mapping the ice-bed interface characteristics of Rutford Ice Stream, West Antarctica using micro seismicity'



Vodka served in glasses made of ice added an extra dimension to the poster session....



... which was as lively and well attended as ever.



Here, John Hillier and Eleanor Darlington are obviously enjoying looking round the posters.



... although it looks as if Ian Hewitt and Rob Arendt may have discovered an error somewhere!



Students look younger and younger these days: school children from a local primary school enjoy the outreach activities associated with the meeting.



The children also judged the polar photo prize and took part in an art competition.



David Sugden and Martin Siegert present Emma Smith with the John Glen Prize for best student talk.

and Sammie Buzzard for her poster on 'Mathematical modelling of melt lake formation on an ice shelf'.

In addition to the presentation awards, the long-awaited results of the polar photo prize were announced. This formed part of an outreach programme with a local school, Hareclive Primary, who were asked to judge photographs submitted by the meeting participants on the themes of polar science and glaciology. The pupils also took part in an art competition as part of the meeting and visited during the UK Antarctic Research Symposium, which followed the British Branch Meeting.

All that remains is to thank the local organizing committee for an interesting and productive meeting and to also tothank everyone for presenting their work. We can all look forward to the next meeting in Durham in September 2015.

#### **Rachel Carr**

## New Zealand Branch Meeting 2014 Aoraki-Mount Cook Village, 2–4 July 2014

The New Zealand branch of the IGS is the Snow and Ice Research Group (SIRG). This year SIRG held its annual workshop at Aoraki–Mt Cook Village in the heart of the Southern Alps. Attendance was strong for the 11th annual workshop, with 40 participants from New Zealand's universities and research institutes and beyond. The setting was appropriate, with the mid-winter workshop held in the New Zealand Alpine Club's Unwin Lodge just downvalley from Tasman Glacier and surrounded by the high peaks of the central Southern Alps.

Presentations were wide-ranging, with new results from the recently acquired Roosevelt Island ice core, studies of sea-ice-ice-shelf interaction, and New Zealand glacier and climate work. As always, this year's SIRG emphasized student participation with the majority of presentations given by students and sponsorship covering all student fees.

The programme included an evening of public talks during which Brian Anderson entertained and depressed the audience with his future simulations of ice volume in the Southern Alps. This was followed by Pascal Sirguey's presentation of a recent resurvey of the elevation of New Zealand's highest peak (Mount Cook). The new estimate knocks 30 m off the top of the mountain as a result of ablation following a rock and ice collapse in 1991. Local climber and guide Jane Morris concluded the evening with a presentation of some awe-inspiring mountaineering trips in the surrounding peaks.

Awards were a little thin on the ground at this year's workshop due to an apparent Southern Hemisphere shortage of IGS paraphernalia.



The New Zealand Alpine Club's Unwin Lodge at Aoraki–Mt Cook, which served as the venue for SIRG 2014. Photo: Jeff Welter.



The view from Unwin Lodge.



Brian Anderson presents some recent results from his time-lapse photography campaign on Fox Glacier documenting glacier and landslide speed-up events in response to rainfall. Photo: Jeff Welter.



SIRG 2014 participants help install a long-term GPS station on the debris-covered portion of Tasman Glacier. Photo: Jeff Welter.

However, a special mention was given to University of Otago PhD candidate Pat Wongpan for the quality of his presentation (Simulation of the crystal growth of platelet sea ice with diffusive heat and mass transfer) and his unique ability to correctly complete the conference abstract template.



Kat and Georgina Lilly and Christina Hulbe in the Hooker Valley on a field trip after the conference. Georgina (aged 4 months) was the youngest person to take the podium, while her mum presented 'Mapping ice microstructure using electron backscatter diffraction'.



Tasman Lake and the terminus of Tasman Glacier as seen from the air. Tasman Glacier last underwent a major calving event in February 2013. Photo: Jeff Welter.

Conference excursions took place on the last day in the surrounding valleys and ridges, with Trevor Chinn leading a trip up Hooker Valley while two student parties were co-opted to assist with maintaining glacier monitoring equipment on Tasman Glacier and its surrounding ridges.

#### Huw Horgan



A party from Otago went up to check on a camera perched above the Tasman. Photo: Prisco.



The President, Douglas R. MacAyeal, was in the Chair.

51 persons, from 13 countries, attended, of whom 39 were members.

#### 1. The previous AGM's minutes

<u>The Minutes</u> of the last Annual General Meeting, published in *ICE*, 2013, No 162, p. 25–31, were approved on a motion by L. Stearns, seconded by R. Alley and signed by the President.

#### 2. The President's report

The President gave the following report for 2013–14:

Dear Fellow Members:

#### Overview of 2014:

Over the calendar year now just closing, the IGS has held two major international symposiums, sponsored four branch meetings, published three issues of the Annals of Glaciology, published six issues of the Journal of Glaciology, presented one Seligman Crystal, conducted its first major member survey, and has continued a major self-evaluation process to determine what steps can be taken both to modernize its services to the community and to ensure that it remains a useful and vibrant entity supporting the overall purposes of its constitution. During this same time period, both of most important peers of the IGS, the EGU and AGU, have completed converting their operations to a commercial publisher (EGU as originally created, and now AGU with the partnership with Willey Blackwell Co.). This leaves IGS as a unique entity in the world of scientific societies that support publication and conferences: the IGS is the only non-commercial. member-driven. charitable organization constitutionally dedicated to the support of research and knowledge dissemination in glaciology and related fields. Indeed, the IGS is probably the smallest scientific society in the Earth Sciences that still retains a staff, a full-time secretary general, a dedicated headquarters, and still publishes over 2500 pages a year. Despite our small size, we have continued to produce a quality product: the impact factors of the Journal and Annals rose significantly in 2014. The Journal broke the 3.0 barrier, rising to above 3.2, and the Annals rose 35% to above 2.5.

What is most important for members to realize is that the IGS faces many hard challenges as a result of the rapid evolution of the scientific publishing community expressed in terms of (a) increased pressure for open access publishing models, (b) greater emphasis on author and article citation metrics, and (c) the commercialization of our peer societies (EGU and AGU) with large volume, high tech, publishing houses.

To address these challenges, the IGS under-took a member survey to enquire of both members and recent authors of IGS publications what they regard as the 'core values' that are most important for the IGS to embody. The most widespread opinion was that the independent, non-commercial status of the IGS should be maintained. The survey also revealed that the majority of the 1080 respondents are mid-career and younger scientists who embrace the notion of strong citation metrics, fair and constructive scientific editing, and a preference for paperless media and for open access.

The IGS Council responded to these survey results with several charges to the officers, com-mittees and staff, as well as making two statements of principle. The statements of principle were (a) that IGS publication should transform to Open Access, either Gold or Green, but preferably Gold, and (b) that modernizing steps should be taken to emphasize on-line presentation of articles published, and that the publication of paper journal issues should be phased out.

Efforts to respond to the Council's wishes have been undertaken, following the symposium held in Chamonix in June. Starting in 2015, individual memberships will be entirely on line. Authors will no longer be charged surcharges to support colour printing. Because colour charges are now supported by those who actually want paper issues, page charges are reduced by £450 and £350 on typical Journal and Annals papers. For 2015, paper volumes will only be available to institutional subscribers, or to individuals willing to pay for the printing and mailing fees. There has been some dismay expressed by some of our more senior members about these changes, and this is understandable, given the relatively recent evolution of internet access to and presentation of scientific publications. We respond compassionately to these cases, and point out that we would be virtually alone in the publishing industry if we were to retain an emphasis only on the production of printed volumes.

The Secretary General and I have further started an evaluation of our web presentation of published articles. We happily note the fact that Ingenta, our web provider, has undertaken modernization that we are now able to benefit from. But we are also engaged in looking at alternatives to Ingenta, including OJS and commercial systems.

With regard to open access, the IGS remains roughly in the same place as when it started the year: the IGS offers OA Gold for a fixed price, but all other articles published are supported by the combination of page charges (sans colour fees), subscription income and member dues. Going beyond this mode of offering Open Access is not yet possible, as the dues and subscription income are essential in supporting the core activity of our small scientific society such as retaining our independent staff, headquarters and Secretary General.

#### Prospects and challenges ahead:

The primary challenge the IGS faces is how to retain enough income to support core expenses (the independent Headquarters and professional full time Secretary General, among other things) under an Open Access business plan. For the IGS to successfully transition to Open Access Gold, approximately 50% of the estimated £2500 author processing fee on 150 papers per year would be necessary to support core expenses. Copernicus, I have been told by reliable sources, provides only ~10% of the author processing fees to the EGU to support its core activity. So this means that we cannot yet go Open Access Gold until our papers can be edited (both scientific review expenses and post-acceptance expenses), typeset, converted to a pleasing web format and presented on line for < 50% of author processing fees.

The idea of shifting to an Open Access Green model is also being considered. But here the model demands reduced fees for authors who are relying on subscriptions to cover production expenses. So many of the business challenges are the same.

In the meantime, while the IGS contemplates these difficulties, we are focussing on making prudent changes that are beneficial to modernization regardless of the business model to be eventually developed for the future. An example of this is our move to the reduction and eventual elimination of paper printing.

#### The importance of membership involvement:

Above all other considerations in the effort to modernize the IGS is the importance of having both a large, and an active (in the volunteer sense), membership base. With only one full-time employee, the IGS depends on the generosity of the scientific community, both in time and in continuing to publish with us, to support our core activity and to remain the community's one remaining independent publisher.

This, your participation as members and supporters of the IGS, remains our most promising means of meeting future challenges.

I would now like to close my report and ask the Secretary General to assist me in answering your questions.

Respectfully submitted, Douglas R. MacAyeal, President

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

M. Siegert asked whether IGS membership was now included in the registration fee for IGS symposia. The SG responded that the non-member registration fee did and that IGS members got a discount. H. Conway asked whether the IGS newsletter ICE was available online and the President responded that it was. The SG further added that there were plans to make it online-only and redesign to make it a fully interactive online publication rather than a simply a viewable PDF. L. Stearns asked about the difference between Open Access Green and Gold, which the President explained. Following up on that, C. Shuman asked whether there was legislation in place requiring scientific papers to be Open Access. The SG responded by explaining that there was no legislation in place but some funding agencies and institutes make it a requirement.

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

#### 3. The Treasurer's report

The IGS Secretary General presented the following report with the audited Financial Statements for the year ended 31 December 2013 on behalf of the Treasurer, Dr I.C. Willis.

Dear fellow members, ladies and gentlemen

As our turnover in 2013 was close to the £500k threshold, our accountants undertook a full Audit this year.

The Society's finances are summarized by considering the changes from 1 January 2013 to 31 December 2013, as shown on page 11 of the accounts. In the table, the Restricted Fund is money associated specifically with the Seligman Crystal and the Richardson Medal. The Unrestricted Funds is everything else.

*Restricted Funds*: decreased by £38 from £7000 to £6962 as a result of the difference between interest payment income and expenditure on

engraving the two Richardson Medals that were awarded in 2013.

Unrestricted Funds: increased by £8515 from £384 063 to £392 578 showing that the income to the IGS largely from membership, sales of the Journal and Annals, page charges and symposia attendance slightly exceeded expenditure associated with Journal and Annals printing, publication and associated office support, and office support for activities related to organizing symposia and running the Society.

*Total*: The Society had net resources accrued before revaluation of £5457, resulting in the positive movement in the Society's funds of £8477 in 2013, compared to the bigger gain of £28 092 in 2012, losses between 2008 and 2011, and a small profit of £11 327 in 2007.

Thus, I am pleased to report that the Society's finances are once more in the black, although it is slightly disappointing that we did not turn in a slightly bigger profit (comparable or bigger than last year) to help offset the periods of loss between 2008 and 2011. Since 2007 we still have a cumulative deficit of £169 212 and I believe the Society should continue to try to reduce that over the next few years by continuing to turn in a modest profit each year. Our total funds at the end of the year were £399 540 and yet our average annual expenditure for the last 3 years has been £526 390. I would like to see our total funds equal to our annual expenditure.

In more detail, income is itemized in notes 2-6, and expenditure is listed in notes 3 and 7–11 on pages 15–19. The accounts are presented under the headings '*Journal*, *ICE* & Books', '*Annals*', and 'Meetings/Symposia' to reflect the three main activities of the Society.

#### Income:

*Note 2.* Voluntary income was £2048 in 2013 compared to £737 in 2012. This reflects a greater number of royalties associated with sales of individual articles through Ingenta and licensing fees (for copying individual articles) collected by the Publishers Licensing Society Ltd (PLS).

Note 3. Trading activities associated with the sale of IGS merchandise turned in a small profit of £632 in 2013 compared to a small loss of £365 in 2012. Over the last few years, income and expenditure associated with T-shirts, fleeces, hats, etc. have approximately matched. It would be nice if this item could be guaranteed to turn in a small profit in the future.

*Note 4.* Income from interest on investments fell slightly in 2013 compared to 2012: down £2448 from £9832 to £7384. This reflects the lower

interest rates given generally by the banks. A few higher interest investments mature in 2014 and the Society should look to reinvest some of its reserves in higher-interest but low-risk accounts. But the market is such that we may be hard pushed to find better than 1.5% p.a. return. The Society has suffered since the financial crash of 2008, when interest income was close to £30000!

*Note 5.* Income associated with *Journal, ICE* & Books (this includes membership subscriptions, sales to non-members, libraries and other organizations, and page charges) was up by £14 194 from £276 661 in 2012 to £290 855 in 2013. Similarly, income associated with *Annals* was also up by £45 979 from £79 354 in 2012 to £125 333 in 2013. I discuss both these items further below with respect to Note 6. Conversely, income from Meetings & Symposia was down by £192 902 from £265 523 in 2012 to £72 621 in 2012. This reflects the fact that three symposia were held in 2012, including the large SCAR meeting, whereas two took place in 2013.

Note 6. Journal sales to libraries and other organizations were down by £8199 from £98 107 (2012) to £89 908 (2013). This reflects a small drop in the number of libraries taking the *Journal* and an increase in the percentage taking online-only (which is cheaper than paper copy). This needs to be monitored. Conversely, income from page charges rose by £21 831 from £112 735 (2012) to £134 566 (2013). Most authors now honour page charges (quite rightly) and the rise in this item reflects that fact and the greater number of Journal pages published in 2013 compared to 2012. The Open Access Fee is a new heading. One author paid this in 2013. Income in this form is likely to increase in the future. The changing balance between income from libraries, regular page charges and the Open Access Fee needs to be monitored and ideally anticipated and budgeted for.

*Note 6.* As mentioned above, total income from *Annals* is up by £45 979 from £79 354 in 2012 to £125 333 in 2013. The increase in *Annals* income largely reflects the greater number of *Annals* issues published in 2013 compared to 2012 (five issues in 2013 – one single and two double; three issues in 2012 – all single).

#### **Expenditure:**

*Note 8.* The direct costs associated with editing, printing, publishing and distributing the *Journal* and *Annals* and material for Meetings / Symposia increased slightly by £8753 from £128 964 (2012) to £137 717 (2013). This compares to a comparable increase of £6533 (2011–12). Printing costs are generally dropping as more and more members and libraries are subscribing

to online only. An increase in the cost of printing more Annals volumes in 2013 compared to 2012 is offset in part by reduced costs associated with printing and posting fewer copies of the *Journal*. Wages and salaries associated with these activities increased slightly by £3080 due to the overall increase in the number of *Journal/Annals* pages produced. [Pension costs feature here this year. They are spread, together with the salaries and NI contributions, across the three headings Direct Costs, Support Costs and Governance Costs, whereas last year pension costs were all put in the Support Costs category].

*Note 9.* The Society did not receive financial requests to sponsor workshops / meetings in 2013 with the result that no grants were awarded.

Note 10. The total support costs associated with Journal, Annals and Meetings/Symposia activity fell by £126275 from £428098 (2012) to £301823 (2013). This is largely made up of the reduced costs associated with running two symposia rather than three (a decrease of £95202). Encouragingly, many other items are less costly this year than last year, including Computer costs, Office equipment, and Travel and subsistence costs (largely the costs of our Secretary General representing the Society at Meetings (not Symposia, which are accounted for elsewhere)).

The lower bank changes in 2013 compared to 2012 (a fall of £4171) is largely associated with the decreased costs of credit card transactions. These were high in 2012, associated mostly with the SCAR meeting.

The provision for doubtful debts is now a trivial amount compared to the situation several years ago. In fact, the Society received  $\pm 131$  of the  $\pm 361$  of debt it has provided for in 2012!

Note 11. Governance costs associated with running the Society increased by  $\pm 10\ 008$  in 2013 compared to 2012. This is largely a result of increased salary costs (see Note 14) and the inclusion of a portion of total pension costs under this heading.

Note 14. Overall staff costs went up by £17 983 in 2013 versus 2012. This compares with a fall in staff costs of £11 107 (2011–12) and a fall of £38 817 (2010–11). [But note that the 2010 figure includes a ~£11 000 sum associated with a redundancy payment, so the 2010–11 fall should more realistically read £27 817]. Overall, therefore, the IGS office is running more smoothly and efficiently. The increased staff costs in 2013 over 2012 are due partly to extra time spent working on five Annals volumes in 2013 as opposed to three in 2012, and partly to the pay rise for the Secretary General in recognition of his 10 years of

service to the IGS. This was implemented by the President as instructed by Council at its meeting in Fairbanks in 2012.

#### Summary

The Society's finances are in reasonable shape and much better than they have been in recent years although it is a shame we did not at least match the small surplus we had last year. We ran a very small surplus in 2013 (2% of funds). This compares to the slightly bigger surplus in 2012 (~7% of funds), a small deficit in 2011 (~5% of funds), a bigger deficit in 2010 (~18% of funds) a much bigger deficit in 2009 (~27% of funds), a small deficit in 2008 (<1% of funds), a small surplus in 2007 (~2% of total funds) and a bigger surplus in 2006 (~5.5% of total funds). The net result over the past 8 years is that we have been accumulating a deficit. We should continue to strive to ensure that the small surpluses in 2013 and 2012 continue and ideally grow in future years. The Society is now setting a budget on all key items of income and expenditure and is more closely monitoring each item on a weekly to monthly basis. This seems to have gone some way towards helping us achieve our small surplus but more could be done.

On the income side, it is good that the Society's membership is now stable and has been at the ~950 level for 2 years in a row. There are certainly more potential members out there but, no doubt for several reasons, they are not joining. Perhaps the recent questionnaire survey of members and non-members may shed some light on how the Society may encourage greater membership and increase its income from this source. It is also good news that library subscriptions to the Journal and Annals are being maintained. Despite stable membership and library subscriptions, 'income per volume' is dropping, on average, due to increased take up of online-only copies. This reduced income is currently slightly more than offset by reduced printing and posting expenditure. The effects on the Society's budget as more members and libraries take online-only will have to be managed carefully. Income from page charges is now also stable but income from the Open Access Fee is likely to increase in future as more authors are able to pay for this. Again, the effects on the Society's budget of this will have to be managed carefully. The Society should continue to invest some of its assets in highinterest, low-risk, medium-term (1-2 years) bank accounts.

On the expenditure side, the Society's costs have stabilized and been brought under control in recent years. It is encouraging that big items of expenditure – computing, proof reading and editing – are now rising by modest amounts or even falling slightly. Wages rose faster in 2013 than in 2012 but this partly represents a one off change to the Secretary General's salary. Printing is another substantial cost and moving to onlineonly would lead to savings. This option should be discussed further by Council. Organizing Symposia for related organizations (e.g. SCAR) is another potential income stream to the Society although there are associated costs of course. The pros and cons of trying to run more symposia for related organizations should also be discussed.

lan C. Willis, Treasurer 22nd May 2014

The SG invited members to discuss the Treasurer's report.

R. Hock proposed, and M. Siegert seconded, that the Treasurer's report be accepted. This was carried unanimously.

#### 4. Election of auditors for 2013 accounts

On a motion from the Secretary General, G. Aðalgeirsdóttir proposed, and C. Shuman seconded, that Messrs Peters Elworthy and Moore of Cambridge be elected 'Independent Inspectors or Auditors', whichever is appropriate for the 2014 accounts. This was carried unanimously.

#### 5. Elections to Council

After circulation to members of the Society the Council's suggested list of nominees for 2014–17, no further nominations were received, and the following members were therefore elected unanimously.

President: Douglas R. MacAyeal Vice-Presidents: Frank Pattyn Shin Sugiyama

Elective Members:	Gwenn Flowers
	Maurine Montagnat
	Barbara Stenni
	Andres Rivera

These appointments were unanimously approved by the AGM.

The President thanked the outgoing Council members and welcomed the newly elected members.

#### 6. Other business:

The President and the Secretary General then responded to a period of open questions and discussion covering a variety of topics. Topics discussed included: the need for IGS investments to be ethical and environmentally sound, the status of IGS membership, is it healthy and how can we make it more attractive to early career glaciologists? The progress towards Open Access was discussed, as was the availability of back issues of IGS publications. Members discussed and emphasized the historical legacy of the Society. Several members raised the question of the possibility of having some or all presentations at various IGS symposia broadcast as videos and e-posters. The discussion also touched on how the IGS could interact with other organizations in the future, such as jointly sponsoring Chapman Conferences with the AGU and bundling memberships with APECS. A question was raised as to whether it might be possible to get subsidises from agencies and possibly companies. The decision to offer only 'online-only' membership was also discussed.

The AGM was adjourned on a motion from J. Shea and seconded by T. Scambos at 19:00 local time.



### 100 years of glacier-climate studies at Claridenfirn

#### Zürich, Switzerland, 22-24 August 2014

The mass balance measurement series on Claridenfirn saw its 100th year this summer. This mass balance series is the worlds longest unbroken measurement of the seasonal mass balance, and contains rare and valuable information on melt and precipitation at high altitudes. To celebrate the centenary, an event was organized at ETH Zürich, Switzerland. Under the title '100 years of glacier-climate studies at Claridenfirn' a symposium was held on 22 August 2014. Nine invited presentations covered the whole range from mass-balance measurements through global sea level to extrusion flow and a karst-cave system under the glacier.

About 80 participants from different related fields of science and of practice, and lay people, attended this interesting and stimulting event. Over the weekend 23/24 August some 25 people climbed to the Clariden hut for the celebration. An apero was sponsored by the hut guardian, and an official 'uniform' (in the shape of T-shirts) was handed over to Giovanni Kappenberger and Urs Steinegger, who have performed these measurements in their leisure time for the last 35 and 20 years respectively. The celebration and the excursion on the following day were accompanied by a member of the science department of the Swiss Radio Broadcasting Network SRF2.

Despite dense fog and snow fall on Sunday the whole group climbed up the glacier to visit the lower stake, which has been maintained for 100 years in the same location and the balance



Excursion to the lower stake on Claridenfirn with its youngest 'stake-holder' balancing on a glaciologist's shoulders.

of which has been measured twice a year. Due to the bad weather conditions the upper stake was not visited. During the descent some sunshine permitted views of the beautiful landscape, and rendered the memory of the whole excursion a pleasant one for all participants.

This event raised awareness of this unique glacier mass balance series, and we hope that in the future it will receive the attention and the support it deserves.

Atsumo Ohmura Martin Lüthi



INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on

# Hydrology of Glaciers and Ice Sheets



Höfn in Hornafjörður, Iceland, 22-26 June 2015

Co-sponsored by: \* University of Iceland Institute of Earth Sciences, University of Iceland Icelandic Meteorological Office National Power Company of Iceland Icelandic Road Administration Iceland Glaciological Society Geoscience Society of Iceland

SECOND CIRCULAR December 2014 http://www.igsoc.org/symposia/2015/iceland



The International Glaciological Society will hold an International Symposium on 'Hydrology of glaciers and ice sheets' in 2015. The symposium will be held in Hornafjörður, Iceland, from 22–26 June 2015, with a welcome reception and registration in the evening of Sunday 21 June.

#### THEME

Glaciers and ice sheets store vast quantities of fresh water, and their hydrology is of wide-ranging importance. The hydrology of mountain glaciers has direct implications for water resources, flood risks, hydro-power, ice dynamics and erosion. The hydrology of larger ice sheets plays a critical role in their dynamics and mass balance, and consequently is important for oceanography, biology and climate science.

This symposium will provide a forum to discuss all aspects of glacier and ice sheet hydrology and their connections both with other areas of the cryosphere and with climate sciences. It will provide an opportunity to present advances in ground-based measurements, remote sensing and modelling to stimulate discussions on their interpretation and implications. The meeting seeks to bring together scientists from around the world, to provide an overview of the current state of knowledge of glacier and ice-sheet hydrology and to provide a focus on key areas for future research.





#### TOPICS

The following list of topics defines the focus of this upcoming symposium:

- 1. **Glacier catchment hydrology** (timing and magnitude of runoff, floods and droughts, influence of climate change, subdaily variations, applications to stakeholders, future water availability)
- 2. **Supraglacial and firn hydrology** (surface mass balance, meltwater retention in firn, percolation, ice lensing, supraglacial streams, lakes, influence on albedo, aquatic biological communities, ice–dust interaction, supraglacial systems on ice shelves and ice tongues)
- 3. **Englacial and subglacial hydrology** (crevassing and moulins, influence on thermal structure, basal melting/freezing, englacial and subglacial channels, subglacial lakes, thermodynamics at meltwater–ice interface, biology)
- 4. **Basal sliding and ice dynamics** (sliding speed, dependence on effective pressure, cavitation, sediment strength, hydrology of ice streams, calving processes)
- 5. **Jökulhlaups and hazards** (subglacial lakes and outburst floods, marginal lakes, moraine-dammed lakes, timing and magnitude of discharge)
- 6. **Erosion and landforms** (role in quarrying, deformation and transport of sediments, eskers, drumlins, MSGL)
- 7. **Hydrology of subglacial eruptions** (meltwater production and pathways, eruption site water retention, steam and ash, floods, subglacial geothermal areas, porous media hydrology and thermodynamics)
- 8. **Instrumentation and methods** (remote sensing, field techniques, new technologies, geochemistry).





#### PROGRAMME

A mixture of oral and poster sessions, interlaced with ample free time, forms the general framework of the symposium, which is intended to facilitate exchange of scientific information between participants in an informal manner. Additional activities include the customary icebreaker, a symposium banquet and pre-, midand post-symposium field excursions to specifically selected, stellar locations at and around Vatnajökull and south Iceland. The venue is close to the Vatnajökull ice cap, the largest glacier in Europe (see location map at mapsengine.google. com/map/edit?mid=zsO15Ms1AhZM.kc\_fkL4y3nsI). The location is stunning and ideal for a symposium such as this one.

#### **REGISTRATION FEES**

All fees are in Euros, €

<ul> <li>Participant (current IGS member):</li> </ul>	500€
– Participant (not IGS member):	640€
- Student or retired (current IGS member):	350€
- Student or retired (not IGS member):	420€
– Accompanying person (18+):	100€
– Accompanying person (<18):	50€
- Late registration surcharge (after 31 May 2015):	€08
– Earlybird discount (before 16 March 2015):	40€

The fees include the icebreaker, the symposium banquet, lunch (Mon–Fri), daily morning/afternoon coffee and the midweek excursion. Because of the limited size of the Hotel Lindarbakki conference room (130 seats), late registrations may not be accepted, so book early so the organizers can best manage the event. Fees for non-members include online membership of the IGS for 2015.

Please register for the symposium through the IGS website, where you can pay by credit card or request an invoice for payment by bank transfer. **The 'Earlybird' deadline for registration is 16 March 2015. After 16 March the registration fee** will be as indicated in the table above. A late registration surcharge of 80€ will be added after 31 May 2015.





ACCOMPANYING PERSONS: The accompanying person's registration fee includes the icebreaker, midweek excursion and symposium banquet. It does not include tea/coffee, lunch **nor attendance at symposium sessions**.

STUDENT SUPPORT: Students who are listed as presenting authors are encouraged to apply for financial support at the time of abstract submission. Only presenting authors will be supported, and support levels will depend on the number of applications received. Please email all information (2 pages maximum) in a single PDF file to Tómas Jóhannesson (tj@vedur.is). Follow the filename convention: 'IGS2015\_Ice\_TravelSupport\_LASTNAME\_FIRSTNAME.pdf'.

Please note that the abstract submission system is separate from the student travel support application and including your abstract on the support application does NOT constitute an abstract submission. You must submit an abstract through the online abstract submission system for you to be considered for support.

#### VENUE

The symposium will take place at Hotel Vatnajökull at Lindarbakki, 13 km from the village of Höfn in Hornafjörður, southeast Iceland. The hotel is new and provides excellent conference facilities. Transport from the international airport in Keflavík/Reykjavík is provided by domestic flights and buses.

#### LOCATION

The Hornafjörður area in southeast Iceland is shaped by glaciers and glacier rivers. The inhabitants of the settlements south of Vatnajökull have witnessed advance and retreat of glaciers, jökulhlaups and subglacial eruptions that have made their mark on the history of the area since the settlement of Iceland more than 1000 years ago. The area is famous in the history of glaciological research. To list a few examples, observations of outlet glaciers from Öræfajökull in the nearby Skaftafell National Park led the late 18th-century naturalist Sveinn Pálsson to the conclusion that ice flows as a very viscous fluid, the glaciologists Hans W:son Ahlmann, Sigurður Þórarinsson and their colleagues made pioneering mass-balance observations of Vatnajökull in the early 20th century, and in the 1970s, observations of jökulhlaups on Skeiðarársandur from Grímsvötn led to the first insights into the dynamics of glacier floods.





#### ACCOMMODATION

Because of limited resources in the area we have reserved accommodation for symposium delegates at various locations in the Hornafjörður area. A block of 40 rooms has been reserved at the symposium venue at Hotel Vatnajökull at Lindarbakki, several more rooms at Hotel Jökull midway between Lindarbakki and Höfn, and 11 four-person cabins at the campsite in Höfn (see location map). A minibus service will be organized between the symposium venue and the various accommodation sites. Accommodation can be reserved and paid for through the IGS website at the same time as registering for the symposium (see below).

#### **REGISTRATION AND RECEPTION**

There will be a welcome reception at Hotel Vatnajökull at Lindarbakki at 19:30 on Sunday 21 June, sponsored by Jökulsárlón glacier lagoon (http://icelagoon.is). Registration will start at 17:00 at the same location. It will also be possible to register on Monday morning.

#### MIDWEEK EXCURSION

A half-day midweek excursion will be organized on Wednesday afternoon to Hoffellsjökull and Lambatungnajökull outlet glaciers. There will be a hike to a newly formed terminus lake at the tongue of Hoffellsjökull where recent retreat of the terminus has led to extensive break-up of the ice front and rapid thinning of the neighbouring glacier.

#### BANQUET

The banquet will be held on Thursday evening. More information will become available on the symposium homepage.

#### PRE-SYMPOSIUM EXCURSION

An afternoon snowmobile excursion will be offered on Sunday 21 June from Jöklasel by Skálafellsjökull outlet glacier (see location map). Members of the Iceland Glaciological Society will guide the group to some of the premier locations to observe beautiful outlet glaciers of southeast Vatnajökull (see http://www.glacierjeeps.is/?s=joklasel).





#### POST-SYMPOSIUM EXCURSION

A two-day excursion in the south of Iceland will be offered after the symposium. The main focus will be on glaciology, glaciohydrology and subglacial volcanism. Sights during the tour include the outwash plains affected by jökulhlaups from the Vatnajökull and Mýrdalsjökull ice caps, including those caused by eruptions of Grímsvötn and Katla. There will be an opportunity to visit the glacial lagoon in front of the Breiðamerkurjökull outlet glacier and observe the calving front. The route passes by the Eyjafjallajökull stratovolcano, where lahars and meltwater floods descended downslope during the 2010 eruption while volcanic ash was thrown into the atmosphere, disrupting air travel. The trip includes a one-night stay at a hotel in south Iceland. Arrival in Reykjavík Sunday evening.

#### OTHER SIGHTSEEING

Some delegates may wish to combine the symposium with other sightseeing in the area. The options include a climb of the highest peak in Iceland (2110 m a.s.l.), which can be arranged through local trekking companies (see mountainguides. is/day-tours/mountain-climbing/icelands-highest-summit/ and adventures.is/ summertours/summerdaytours/hikingdaytours/whitegiantdaytourfromskaftafell/). More details will be announced on the symposium homepage.

#### ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper at the symposium are required to submit an abstract, and there will be both oral and poster presentations. A programme and collection of submitted abstracts will be provided for all participants at the symposium. The Council of the International Glaciological Society has decided to publish a thematic issue of the *Annals of Glaciology* on topics consistent with the symposium themes. Submissions to this issue will not be contingent on presentation at the symposium, and material presented at the symposium is not necessarily affirmed as being suitable for consideration for this issue of the *Annals*. Participants are encouraged, however, to submit manuscripts for this *Annals* volume. The deadline for receiving *Annals* papers is 7 May 2015. The editorial board requests strict adherence to review and publication deadlines to facilitate timely publication of the *Annals of Glaciology* issue.





#### SYMPOSIUM ORGANIZATION Magnús Már Magnússon (International Glaciological Society)

SCIENTIFIC STEERING AND EDITORIAL COMMITTEE Alexander H. Jarosch and Ian Hewitt (Chief Editors), Guðfinna Aðalgeirsdóttir, Gwenn Flowers, Helen A. Fricker, Joel Harper, Matt Hoffman, Bryn Hubbard, Tómas Jóhannesson, Doug Mair, Christian Schoof, Thomas Schuler, Chris Stokes

LOCAL ORGANIZING COMMITTEE Tómas Jóhannesson (Chair), Bergur Einarsson, Andri Gunnarsson, Magnús Tumi Guðmundsson, Sigurlaug María Hreinsdóttir, Eyjólfur Magnússon, Finnur Pálsson, Þorsteinn Þorsteinsson

CONTACTS FOR FURTHER INFORMATION Magnús Már Magnússon International Glaciological Society Scott Polar Research Institute Lensfield Road, Cambridge, CB2 1ER, UK Tel: +44 (0)1223 355 974 / Fax: +44 (0)1223 354 931 Email: igsoc@igsoc.org / Web: http://www.igsoc.org/symposia/2015/iceland/

Tómas Jóhannesson Local Organizing Committee Email: tj@vedur.is

#### FURTHER INFORMATION

If you wish to attend the symposium log onto the IGS website at www.igsoc.org/ symposia/2015/iceland/ and register your details and interest in attending. This will ensure you receive any relevant information and updates. Formal registration will open on 1 March 2015.

### IMPORTANT DATES

International Symposium on Hydrology of Glaciers	and Ice Sheets
Abstract submission deadline:	21 February 2015
Student travel support application deadline:	21 February 2015
Notification of acceptance:	8 March 2015
Early registration deadline:	16 March 2015
Venue hotel booking deadline:	15 April 2015
Deadline for full refund:	15 April 2015
Deadline for partial refund:	31 May 2015
Late fee payable from:	31 May 2015
Welcome/reception dinner	,
(sponsored by Jökulsárlón glacier lagoon):	21 June 2015
Symposium starts:	22 June 2015
Annals of Glaciology volume 57, issue 72	
Paper submission deadline:	7 May 2015
Final revised papers deadline:	9 August 2015



### INTERNATIONAL GLACIOLOGICAL SOCIETY

# International Symposium on Contemporary ice-sheet dynamics

Ocean interaction, meltwater and non-linear effects





Cambridge, UK 16–21 August 2015

> SECOND CIRCULAR November 2014 http://www.igsoc.org/symposia/2015/cambridge http://igs-2015.bas.ac.uk



The International Glaciological Society will hold an International Symposium on 'Contemporary ice-sheet dynamics: ocean interaction, meltwater and non-linear effects' in 2015. The symposium will be held in Cambridge, UK, from 16–21 August 2015.

#### THEME

Over the last 15 years remarkable progress has been made in understanding the processes affecting Earth's great ice sheets. At both poles, observations increasingly show the sensitivity of grounded ice to changes in the ocean, prompting a gathering pace in research into how ice sheets change in response to variations in ocean climate.

The processes controlling grounded ice's response to ocean changes are an intimately interrelated sequence. The open ocean delivers heat into the coastal seas, coastal seas transfer it to ice fronts via proglacial fjords and to the ice shelf cavities, processes at the ice–ocean interface melt the ice and affect behaviour in the inland ice streams, and the ice stream dynamics finally transmit changes across the drainage basins from which they are nourished. In this way, the ocean is intimately linked to ice-stream and drainage-basin changes; every process along this sequence is important, and changes to any of these stages can affect the whole system.

The meeting will bring together researchers from the oceanographic and glaciological communities who use observational and modelling tools in the study of ice-sheet stability, surface mass balance and its influence on glacier dynamics, ice stream–ice shelf interaction, ice-sheet basal properties, subglacial hydrology, tidewater glaciers and ocean interactions, ice-shelf mass balance, ice-shelf stability, iceberg calving, oceanographic circulation and processes within sub-ice-shelf cavities, circulation and ocean heat transfer through fjord systems, continental shelf processes that modify oceanographic conditions and processes beneath ice shelves, and teleconnections that influence shelf seas. By bringing all these communities together, the aim of the meeting is to establish an integrated understanding of this interrelated sequence of processes that ultimately links open-ocean variations with changes in the inland ice sheet, and to provide an overview of the current state of knowledge in this rapidly moving field of research.



### TOPICS

Following on from the discussion above, topic areas will cover the sequence of environments and disciplines from the open ocean to the inland ice sheet, and include observations and modelling of:

- 1. **Transport of ocean heat across the continental shelf break** (oceanographic mechanisms that allow heat onto the continental shelf, influence of teleconnections, shelf break ocean dynamics)
- 2. **Continental shelf ocean processes** (processes influencing shelf conditions, circulation in proglacial fjords, impacts on the ice-shelf cavity and tidewater glacier calving fronts, air–sea exchange, sea-ice formation, coastal polynyas)
- 3. **Sub-ice-shelf processes and environment** (ice-shelf basal mass balance, ice- ocean boundary layer, sub-ice-shelf heat transport)
- 4. **Tidewater glacier and ice-shelf stability** (iceberg calving processes, impact of subglacial drainage on ice front processes, ice-shelf disintegration, structure of ice shelves)
- 5. **Ice sheet-stream-shelf glaciology** (impact of ice shelves on ice streams, grounding line dynamics, upstream propagation of grounding line changes, ice stream dynamics, ice stream basal conditions, sub-ice stream hydrology, ice sheet and ice stream mass balance)
- 6. **Dynamics and stability of ice sheets** (evidence of past ice sheet instability from proxies, observed state of the great ice sheets, non-linear dynamical processes)
- 7. Integrated understanding of the processes linking oceans and ice sheets, and changes therein (external drivers and internal instabilities, interactions between these, model predictions of future behaviour and implications thereof, overall effect of ocean and atmosphere on changes in the great ice sheets)

Potential participants are encouraged to contact the Chief Editor if they feel additional topics would be appropriate.



#### PROGRAMME

A mixture of oral and poster sessions, interlaced with ample free time, forms the general framework of the symposium, which is intended to facilitate the exchange of scientific information between participants in an informal manner. Additional activities will include the customary icebreaker and symposium banquet. There will be no separate annual FRISP meeting in 2015, so members of that community are encouraged to attend this symposium (co-sponsored by FRISP).

#### ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper at the symposium are required to submit an abstract by 19 April 2015. A programme and collection of submitted abstracts will be provided for all participants at the symposium. The Council of the International Glaciological Society has decided that the IGS will publish a related thematic issue of the *Annals of Glaciology*. Submissions to this issue will not be contingent on presentation at the symposium, and material presented at the symposium is not necessarily affirmed as being suitable for consideration for this issue of the *Annals*. Participants are encouraged, however, to submit manuscripts for this *Annals* volume. The deadline for receiving *Annals* papers is 3 July 2015. For key dates, see end of Circular.



Scott Polar Research Institute University of Cambridge

# British Antarctic Survey

STAR





REGISTRATION FEES All fees are in Sterling, £

- Participant (current IGS member):	£445
– Participant (non-member):	£545
- Student or retired (current IGS member):	£295
- Student or retired (non-member):	£395
– Accompanying person (18+):	£160
– Accompanying person (12–17):	£125
– Accompanying person (<12):	Free
– Late registration surcharge (after 27 July 2015):	+£100
– Early-bird discount (before 20 May 2015):	-£30

The fees include the icebreaker, the symposium banquet, lunch (Mon–Fri) daily morning/afternoon coffee and biscuits and the mid-week excursion. The fees for non-members include online membership of the IGS for 2015.

Please register for the symposium through the IGS website. If you cannot do this, contact the IGS office directly. If payment by credit card is not possible, contact the IGS office to arrange for a bank transfer. **The 'Early-bird' deadline for registration is 20 May 2015. After 20 May the registration fee will be as indicated in the table above. A late registration surcharge of £100 will be added after 27 July 2015.** 

ACCOMPANYING PERSONS: The accompanying person's registration fee includes the icebreaker, the mid-week excursion and symposium banquet. It does not include tea/coffee, lunch **nor attendance at symposium sessions**.

EARLY CAREER SCIENTIST SUPPORT: Funding is available to partially support student and early career scientist attendance at this symposium. Application details will be posted on the symposium homepage in January 2015 at the latest.





#### VENUE

The symposium will be held in Cambridge, UK. Cambridge has a strong glaciological heritage, which continues today. The British Antarctic Survey has been based here since 1975; the Scott Polar Research Institute, part of the University of Cambridge, was founded in 1920 and houses a unique polar museum; Cambridge is also home to the International Glaciological Society.

The venue for the symposium will be Churchill College, University of Cambridge. Churchill College is the largest college campus in Cambridge, set in a 42acre (17ha) site on the edge of the city centre. It is one of the newer colleges of the University, receiving its Royal Charter in 1960, and is the national and Commonwealth memorial to Sir Winston Churchill. Churchill College has a Foundation that specifies a focus on science, mathematics and technology.

Wifi is available across the campus and is available free to use. The College and University are also part of the eduroam system.

#### ACCOMMODATION

Accommodation has been reserved for conference participants in Churchill College. This can be booked separately from the registration. There are ensuite rooms available, which will be allocated on a first-come-first-served basis, the remainder standard single rooms have a wash basin in the room and share a bathroom with four or five others. Please note these are student rooms within the College.

Room costs include room, breakfast and dinner (in the college). Wifi is also available (with eduroam or unsecured). Additional facilities available include use of the College grounds, including tennis courts (availability to be confirmed), use of a gym (subject to signing of a health declaration) and squash courts.





#### REGISTRATION AND ICEBREAKER

A welcome reception barbecue will be held in the grounds of Churchill College on Sunday 16 August 2015 from 7:30 pm. Indoor space is available if the weather is inclement. Registration will start at 17:30 at the same location. It will also be possible to register on Monday morning

#### BANQUET

The symposium banquet will be held on Wednesday 19 August 2015 in the Great Hall of Homerton College, University of Cambridge. This venue is a splendid gothic hall built in 1890 and retains an atmosphere of history, grandeur and academia.

#### SYMPOSIUM EXCURSION

We have arranged a walking tour of the historic Cambridge city centre, which will take in many of the University Colleges. Entry into Kings College Chapel is included. King's College Chapel is a splendid example of late Gothic (Perpendicular) architecture. It was begun in 1446 by Henry VI (1421–71) and took over a century to build. It has the largest fan vault in the world and some of the finest medieval stained glass. It is also the venue for the Christmas Eve service *A Festival of Nine Lessons and Carols,* which is broadcast to millions around the world.

The tour will be of two hours duration, and is included in the symposium registration fees.





#### VENUE

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# **Glaciological diary**

\*\* IGS sponsored

\* IGS co-sponsored

#### 2015

#### 2–4 February 2015 CESM Land Ice and Polar Climate Working Group Winter Meetings Boulder, Colorado, USA Websites: https://www2.cesm.ucar.edu/ working-groups/pcwg and https://www2. cesm.ucar.edu/working-groups/liwg

#### 4-7 February 2015

# Symposium: The evolution of mountain permafrost

Sion, Switzerland Website: http://www.temps-symposium.ch/ program.php?language=en

#### 8–14 February 2015

**1st European Snow Science Winter School** Sodankylä, Finland Website: http://www.slf.ch/dienstleistungen/ events/snowschool/index\_EN

#### 13-20 February 2015

#### Arctic Science Partnership: Field course on Snow Covered Sea Ice

(GEOG 7400 Field Topics in Arctic System) Nuuk, Greenland Contact John Iacozza [john.iacozza@ umanitoba.ca] Website: http://www.asp-net.org/content/fieldschools

#### 23–27 February 2015

International Snow and Avalanche Course Davos, Switzerland Contact: Stephan Harvey <harvey@slf.ch> Website: http://www.igsoc.org:8000/ symposia/www.slf.ch/more/training/ symposia/2015/kathmandu/

#### 23-27 February 2015

#### Workshop: Measurements of ice structures by means of image analysis Bremerhavn, Germany Website: http://www.awi.de/index.

php?id=7415

#### 2–6 March 2015 \*\*International Symposium on Himalayan glaciology

Kathmandu, Nepal Contact: Secretary General, International Glaciological Society Website: http://www.igsoc.org:8000/ symposia/2015/kathmandu/

#### 23-26 March 2015

Workshop on the Dynamics and Mass Budget of Arctic Glaciers/IASC Network on Arctic Glaciology Annual Meeting Obergurgl, Austria Website: http://www.iasc.info/nag/

#### 23-27 March 2015

Workshop: Dynamics of Atmosphere–Ice– Ocean Interactions in the High Latitudes Rosendal, Norway Website: http://highlatdynamics.b.uib.no/ www.iasc.info/nag/

#### 23-27 March 2015

Deutsche Physicalisches Gesellschaft: DPG Spring Meeting Heidelberg, Germany Website: http://www.dpg-physik.de/ veranstaltungen/tagungen/

#### 12-17 April 2015

European Geosciences Union: General Assembly 2015 Vienna, Austria Website: http://www.egu2015.eu/

#### 21–25 April 2015

Annual Meeting of the Association of American Geographers Chicago, Illinois, USA Website: http://www.aag.org/cs/ annualmeeting

23–30 April 2015 Arctic Science Summit Week, ASSW 2015 Toyama, Japan 23–25 April: ASSW Business Meetings 27–30 April: ISAR-4 and ICARP III Symposium Website: http://www.assw2015.org/

### 27–9 May 2015

Alpine Glaciology Meeting Milan, Italy Contact: Claudio Smiraglia/ Guglielmina Diolaiuti/Roberto Azzoni <alpglaciomeet2015@gmail.com>

31 May-4 June 2015 **Creep 2015 conference** Toulouse, France Contact: Maurine Montagnat <montagnat@ lgge.obs.ujf-grenoble.fr> 2–5 June 2015 Workshop: Ilulissat Climate Days Ilulissat, Greenland Website: http://www.polar.dtu.dk/english/ Ilulissat-Climate-Days

#### 21-26 June 2015

#### \*\*International Symposium on the Hydrology of Glaciers and Ice Sheets Iceland Contact: Secretary General, International Glaciological Society

Website: http://www.igsoc.org:8000/ symposia/2015/iceland

#### 22 June-2 July 2015

26th Union of Geodesy and Geophysics (IUGG) General Assembly Prague, Czech Republic Website: http://www.iugg2015prague.com/

#### 13-17 July 2015

#### SCAR: XII International Symposium on Antarctic Earth Sciences Goa, India Website: http://www.isaes2015goa.in/

#### 22-25 July 2015

PALSEA2 2015 Workshop: Data-Model Integration and Comparison Tokyo, Japan Contact Glenn Milne [gamilne@uottawa.ca]

#### 16-21 August 2015

#### \*\*International Symposium on Contemporary Ice-Sheet Dynamics: ocean interaction, meltwater and non-linear effects

Cambridge, UK Contact: Secretary General, International Glaciological Society Website: http://www.igsoc.org:8000/ symposia/2015/cambridge/

#### 23-29 August 2015

#### Innsbruck Summer School of Alpine Research (InnSAR) on Surface-Atmosphere Exchange over Mountainous Terrain

Innsbruck, Austria Website: http://www.uibk.ac.at/congress/ innsar/

#### 2–3 September 2015 \*International Glaciological Society British Branch Meeting 2015

Department of Geography, Durham University,UK Contact: C.R. Stokes <c.r.stokes@durham. ac.uk>

#### 2–4 September 2015 World Symposium on Climate Change Adaptation: special session on 'Arctic climate change' Manchester, UK Website: http://www.haw-hamburg.de/en/ wscca-2015.html

#### 2016

20–24 June 2016 Eleventh International Conference on Permafrost (ICOP 2016) Potsdam, Germany Website: http://icop2016.org

#### June/July 2016

\*\*International Symposium on Interactions of Ice Sheets and Glaciers with the Ocean La Jolla, California, USA Contact: Secretary General, International Glaciological Society

#### 2017

13–17 February, 2017 International Symposium on the Southern Cryosphere: Climate Drivers and Global Connections

Wellington, New Zealand Contacts: Secretary General, International Glaciological Society (IGS); Secretary General, International Association of Cryospheric Sciences (IACS) (Chair of Local Organizing Committee); Director, Climate and Cryosphere (CliC)

#### August/September 2017

#### \*\*International Symposium on Polar Sea Ice, Polar Climate and Polar Change Boulder, Colorado, USA Contact: Secretary General, International

Glaciological Society

#### 2018

15-27 June 2018 SCAR/IASC Conference Davos, Switzerland Contact: SCAR Secretariat [info@scar.org]



# New members

#### Dr Katsuhiko Asahi

Institute of Mountain Science, Shinshu University Asahi 3-1-1, Matsumoto 390-8621, Japan asahi@shinshu-u.ac.jp

#### Mr Pascal Buri

Institute of Environmental Engineering, ETH Zürich HIF CO 46.4, Stefano-Franscini-Platz 3, CH-8093, Zürich, Switzerland Tel +41 44 633 42 07 buri@ifu.baug.ethz.ch

#### Ms Julie E. Coryell

Seattle Washington 98105, USA julie.coryell@gmail.com

#### Mr Anders Damsgaard

Department of Geoscience, Aarhus University Hoegh-Guldbergs Gade 2, DK-8000 Aarhus C, Denmark Tel +45 61 27 42 66 anders.damsgaard@geo.au.dk

#### Ms Doris Duethmann

Hydrology, GFZ German Research Centre For Geosciences Telegrafenberg, DE-14473 Potsdam, Germany Tel +49 (0)331 288 1721 doris.duethmann@gfz-potsdam.de

#### **Mr Denis Felikson**

Aerospace Engineering, University of Texas at Austin 3305B Hampton Rd., Austin, TX 78705, USA denis.felikson@utexas.edu

#### **Mr Mauro Fischer**

Department of Geosciences, Geography Unit, University of Fribourg Route Wilhelm-Kaiser 11, C520, CH-1700 Fribourg, Switzerland Tel +41 26 300 90 09 mauro.fischer@unifr.ch

#### Dr David B. Fissel

ASL Environmental Sciences, Inc. 1081 Clarke Road, Brentwood Bay BC V8M 1C7, Canada Tel +1 250 589 7112 dfissel@aslenv.com

#### **Ms Caitlyn Florentine**

Geosciences Department, University of Montana 32 Campus Drive #1296, Missoula MT 59812, USA Tel +1 303-548-7693 caitlyn.florentine@gmail.com

#### Dr Noel Gourmelen

University of Edinburgh, Edinburgh, UK ngourme2@staffmail.ed.ac.uk

#### Mr Jack Hutton

Geography, Trent University 561 Homewood Ave, Peterborough ON K9H2N4, Canada Tel 705-313-2503 jackhutton@trentu.ca

#### Professor Frank Lehmkuhl

Department of Geography, RWTH Aachen University Templergraben 55, D-52056 Aachen, Germany flehmkuhl@geo.rwth-aachen.de

#### Mrs Maria F. Lopez Ornela

University of San Francisco Berkeley, CA 94709, USA ferlopezornelas@gmail.com

#### Mr Felix Matt

Department of Geosciences, University of Oslo Postboks 1047 Blindern, NO-0316 Oslo, Norway f.n.matt@geo.uio.no

#### Mr Michael J. McCarthy

Geography, University of Cambridge Cambridge, UK mchl.mccrthy@gmail.com

#### **Dr Philip Porter**

School of Life and Medical Sciences, University of Hertfordshire College Lane, Hatfield, Herts AL10 9AB, UK Tel 01707 285091 p.r.porter@herts.ac.uk

#### Professor David J. Prior

Department of Geology, University of Otago Leith Walk, Dunedin 9054, New Zealand Tel +6421790458 david.prior@otago.ac.nz

#### Ms Yvonne Margaret Smith

Earth and Environmental Sciences, University of Leeds Leeds, UK eeyms@leeds.ac.uk

#### **Dr Andrew Stumpf**

Prairie Research Institute, University of Illinois Champaign, IL USA astumpf@illinois.edu **Mr Paul Tepes** Environment, Earth & Ecosystems, The Open University paul.tepes@gmail.com

Mr Patrick Wright Geosciences, University of Montana 32 Campus Dr. #1296, Missoula, MT 59812-1296, USA patrick.wright@umontana.edu

# **International Glaciological Society**

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Editor: M.M. Magnússon (Secretary General)

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All enquiries about the International Glaciological Society should be addressed to: Secretary General, International Glaciological Society, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, UK Tel: +44 (1223) 355 974 Fax: +44 (1223) 354 931 E-mail: igsoc@igsoc.org Web: http://www.igsoc.org/