



***NEWS BULLETIN  
OF THE INTERNATIONAL  
GLACIOLOGICAL  
SOCIETY***





# Ice

## News Bulletin of the International Glaciological Society

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Number 170

1st Issue 2016

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*Cover picture:* A classic view of beautiful ogives on the Juneau Icefield, Alaska, USA. Photograph by Twila Moon.

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

Welcome to the first issue of ICE for 2016. Several important changes have occurred over the past 6 months that need mention in this report. First, the search for a new Chief Editor, and for four Associate Chief Editors, is now complete. Second, the editorial team is very busy coming to grips with the ScholarOne editing system used by Cambridge University Press. This system is significantly different from the editing software we are used to. Finally, with the reduction in staff at IGS, we will be moving our office over the next few months, into the British Antarctic Survey (BAS) offices. On top of these changes, we need to think carefully about the most efficient and beneficial ways for our Council to meet and to function.

The big news at the moment is the new IGS editorial team. Acting on the recommendations of the publications committee we have worked on the transition of the IGS Chief Editorship from the retiring CE, Jo Jacka, to a team of a Chief Editor and four Associate CEs. After the initial call for applications, uptake was slow, so at the Council meeting held during the AGU Fall meeting in San Francisco it was decided to proactively seek applicants. A list of potential applicants was drawn up and we sent out invitations to apply to several people, which resulted in several highly qualified applications. An ad hoc committee was formed for the selection process. Selection was difficult but we believe we now have a strong team leading the IGS editorial board. I would like to take this opportunity to thank our retiring CE, Jo Jacka, for a very enjoyable and fruitful collaboration. Without him the IGS would have been in a very different situation.

The new IGS Chief Editor is Graham Cogley. Graham is an Emeritus Professor of Geography, Trent University. He has substantial experience in editorial matters: most recently he was the Chief Editor for the thematic *Annals of Glaciology* volume 'Glaciology in High-Mountain Asia'.

The four Associate Chief Editors are:

- Hester Jiskoot: Hester is an Associate Professor of Physical Geography & Glaciology at the University of Lethbridge, Canada.
- Frank Pattyn: Frank is a Professor at the Université Libre de Bruxelles, Belgium.
- Perry Bartelt: Perry is head of the research unit Snow Avalanches, Debris Flows and Rockfalls of the Swiss Federal Institute for Forest, Snow and Landscape (WSL), Davos.
- And last but not least, Sérgio Faria: Sergio is Ikerbasque Research Professor at the Basque Centre for Climate Change (BC3), Bilbao, the Basque Country, Spain and an Adjoint Presidential Professor at Nagaoka University of Technology (NUT), Nagaoka, Japan.

All have substantial experience in matters relating to scientific publishing. Our publishing partner, Cambridge University Press, is running a blog series on the new team over the next few weeks. Please visit the blog at <http://blog.journals.cambridge.org/tag/igs-journals/>.

One issue that IGS needs to address is the effectiveness of the Council and its meetings. Actually, this is not a recent concern: our late treasurer, John Heap wrote a memorandum to Council just after the turn of the century, expressing



his concerns on the issue. The fact is that over the years it has become increasingly difficult to form a quorum for IGS Council meetings, resulting in us having to co-opt council members on a regular basis. This sometimes results in only three active Council members being present at a meeting while the further three needed to form a quorum have been co-opted.

In the past, IGS symposia were fairly general, resulting in the attendance of several Council members at each one. More recently, our symposia have become more and more specialized, resulting in Council members not attending them. We do try to select Council members with diverse scientific expertise, so it is to be expected that only those who are interested in the theme of a particular symposium will attend.

A point supporting my argument is that next year we are holding a joint meeting with IACS and CliC. The theme of the symposium is very broad, 'The Cryosphere in a Changing Climate'. And, sure enough, seven Council members have already indicated their intention of attending. So we should not have any problem with the quorum for the Council meeting.

We have thus increasingly resorted to holding Council meetings during events that are all-encompassing, resulting in several IGS members and in particular IGS Council members being present. I am specifically referring to the AGU Fall meeting, held in December in the USA and the EGU meeting, held in Europe in April.

'Unfortunately', the UK Charity Commission requires us to hold at least one 'face to face' Council meeting per year. It is possible for Council to hold discussions using audio-visual means, teleconferencing and e-mail. But decisions thus made need to be confirmed at a face

to face Council meeting. It is possible to hold these face to face meetings using electronic means 'provided that the means used allows all Council members to both hear and see each other, for example, using video conferencing or internet video facilities', to quote the Charity Commission. It is normally not a problem to hold such 'electronic' meetings if the number of persons taking part is not excessive. As the IGS Council consists of at least 18 members, the system required to host such a meeting needs to be substantial. We are exploring the possibility of teleconferencing and with our move to BAS we should be able to make use of the facilities they have for smaller meetings. When asked, the BAS IT people said their system could handle six to eight participants, but no more. And each participant would have to have similar equipment. And if we only have access to a system that can cope with six to eight participants, how will we determine who should be asked to participate? This raises again the question of whether it would be a good idea to establish a smaller 'executive' committee that could 'meet' using electronic means.

At the risk of sounding repetitive I would like to repeat what I said in my last ICE editorial. 'Only by retaining our membership will we be able to provide you with our continued service as a prestigious learned society, organizing the various symposia, meetings and workshops, collating the *ICE* newsletter and continuing with the prestigious Seligman Crystal and Richardson Medal awards. As an IGS member you have access to a wide network of glaciologists within which you can share your ideas and establish contacts.'

We look forward to receiving your membership renewals.



# Recent work

## New Zealand

### *ALPINE GLACIERS*

#### **The mass balance programme on Brewster Glacier**

Nicolas Cullen (UoOtago), Brian Anderson (VUW), Pascal Sirguey (UoOtago), Dorothea Stumm (ICIMOD), Andrew Mackintosh (VUW), Jonathan Conway (Bodeker Scientific), Huw Horgan (VUW), Ruzica Dadic (VUW), Sean Fitzsimons (UoOtago) and Andrew Lorrey (NIWA) A traditional mass balance programme has been maintained on Brewster Glacier since 2004. It is the longest in situ record of a glacier's mass ever obtained in the Southern Alps and as a result, has become an important benchmark for a range of glaciological and climatological studies. The efforts to gather direct measurements of accumulation and ablation have been considerable, with a large number of people contributing in different ways over the last decade. Field measurements have been conducted at the end of winter (snow probing, snow density and drilling of ablation stakes) and end of summer (ablation stake measurements), enabling winter, summer and annual balances to be determined. Recently, the glaciological measurements used to reconstruct mass balance have been consolidated to help reconcile differences in historical data acquisition. As part of this effort, a new, geostatistical method to calculate mass balance has been developed.

Contact: Nicolas Cullen [nicolas.cullen@otago.ac.nz](mailto:nicolas.cullen@otago.ac.nz) and/or Brian Anderson [brian.anderson@vuw.ac.nz](mailto:brian.anderson@vuw.ac.nz)

#### **Surface climate and energy balance on Brewster Glacier**

Nicolas Cullen (UoOtago), Jonathan Conway (Bodeker Scientific), Rachel Spronken-Smith (UoOtago) and Sean Fitzsimons (UoOtago) The sensitivity of Brewster Glacier to atmospheric forcing has been investigated in an effort to unravel the chain of physical processes that link the climate system to glacier mass balance. An automatic weather station has been maintained next to the terminus since the beginning of the mass balance programme, while meteorological data from the ablation zone of the glacier have been obtained using a range of instrumentation. The uncertainties associated with modelling turbulent heat fluxes have been assessed using eddy correlation data, while high-quality radiation

measurements have been used to optimize parameterizations to separate cloud and air mass influences on all-sky radiation. Recently, a novel analysis to assess the influence of clouds on mass-balance sensitivity to air temperature has been completed, as well as a seasonal analysis of the surface meteorology and energy balance. The next logical step is to assess in detail how fluctuations in large-scale atmospheric circulation translate to changes in glacier surface layer processes.

Contact: Nicolas Cullen [nicolas.cullen@otago.ac.nz](mailto:nicolas.cullen@otago.ac.nz)

#### **Rolleston Glacier mass balance programme**

Tim Kerr (Aqualinc) Heather Purdie (UoCanterbury) Wolfgang Rack (UoCanterbury)

Although New Zealand has over 3100 glaciers, very few are monitored on a regular basis. Rolleston Glacier is a small cirque glacier in the Arthurs Pass region, situated on the south-eastern flank of Mt Philistine. Since 2010 our mass-balance programme has involved a combination of direct measurement (e.g. snowpits, probing and stakes), with remote surveying techniques (e.g. ground-penetrating radar, oblique repeat photography) and modelling, to develop a better understanding of how a small alpine glacier responds to changing climate and the role that avalanche deposition has in overall glacier health.

Contact: Tim Kerr [t.kerr@aqualic.co.nz](mailto:t.kerr@aqualic.co.nz)

#### **Sliding and cavitation in response to high rain rates: Tasman Glacier, New Zealand**

Huw Horgan and Brian Anderson (VUW) Tasman Glacier, which is estimated to contain one-third of New Zealand's ice, has demonstrated a remarkable response to the heavy rainfall events that occur in the central Southern Alps. An observation campaign that has been ongoing since November 2012 has recorded short-term (less than 24-hour) accelerations to up 36-times the glacier's background velocity. Vertical uplift of over 50 cm has been observed in association with the largest of the speed-up events. For the past year an expanded network of six GNSS sensors has been deployed on the lower 4 km of the glacier; these will now be joined by a seismometer deployment with the aim of further examining sliding processes.

Contact: [huw.horgan@vuw.ac.nz](mailto:huw.horgan@vuw.ac.nz)

## **Subaqueous terminus evolution and calving glacier dynamics at Tasman Glacier, New Zealand**

Heather Purdie, Paul Bealing, Justin Harrison (UoCanterbury), Emily Tidey (UoOtago), with support from Glacier Explorers

Global glacier recession is increasing the number of glaciers that terminate in proglacial lakes, yet the processes that drive iceberg calving are still poorly understood. This knowledge gap is in part due to the challenge of obtaining good datasets in a highly dynamic and dangerous environment. We are using traditional vessel-mounted survey techniques in combination with a remote-controlled jet boat to survey bathymetry and subaqueous morphology at the Tasman Glacier terminus. A number of submerged ice ramps (aka ice-feet) have been mapped, some extending out into the lake by as much as 200 m. Ongoing monitoring of the ice ramps in combination with limnological monitoring will improve understanding of the processes controlling ramp development and subsequent disintegration.

Contact: Heather Purdie [heather.purdie@canterbury.ac.nz](mailto:heather.purdie@canterbury.ac.nz)

## **Relating glacier surface albedo variations to mass balance variability**

Pascal Sirguey (UoOtago), Nicolas Cullen (UoOtago), Todd Redpath (UoOtago), Angus Dawson (UoOtago), Marie Dumont (CEN, France) In relation to potential mass-balance proxies, previous studies have reported on linkages between satellite-derived measurements of surface albedo and annual glacier mass balance. Although albedo minima are not regarded as a 'conventional' proxy for mass balance, the annual minimum glacier-wide albedo (reached at the end of the ablation season) is of significance because it measures the relative share of exposed ice in the ablation area and snow and firn in the accumulation area. It is thus closely related to the accumulation area ratio (AAR), itself being related to annual balance. This method has been used successfully to reconstruct mass balance on Brewster Glacier, providing a platform from which to explore and assess the spatio-temporal variability in surface albedo and mass balance of other glaciers in the Southern Alps of New Zealand.

Contact: [pascal.sirguey@otago.ac.nz](mailto:pascal.sirguey@otago.ac.nz)

## **Southern Alps end of summer snowline survey**

Team members (in alphabetical order): Brian Anderson, Trevor Chinn, Nicolas Cullen, Nava Fedaeff, Huw Horgan, Andrew Lorrey, Gregor Macara, Andrew Mackintosh, Andrew Willsman, Andy Woods

The NZ end of summer snowline (EOSS) survey is one of the longest-running observation

programmes in the Southern Hemisphere to document glacier activity. For more than 40 years, low-level oblique aerial photographs have been captured for a set of index glaciers for the Southern Alps, an effort initiated and led by Trevor Chinn since the 1970s. Repeated estimates of the change in altitude of the snowlines tell us about the overall health of the glaciers and how they responded to the climate from one year to the next. These measurements based on the extensive EOSS photo archive are also being connected to regional climate processes and also to glacier mass-balance modelling. We are also recovering and digitizing all the historic glacier photos from aerial flights going back into the 1960s. The development of the photo archive is also assisting with a update of the New Zealand glacier inventory and an effort to employ Structure from Motion to gain more detailed information about Southern Alps glacier changes.

Funded by the NIWA project Climate Present and Past

Contact Andrew Lorrey, Climate Scientist at NIWA for more details. <https://www.niwa.co.nz/climate/research-projects/climate-present-and-past>

## **Implications of rapid glacial retreat for glacier tourism at Fox Glacier**

Heather Purdie, Christopher Gomez (UoCanterbury) Brian Anderson (VUW) with support from Fox Glacier Guides

Current rapid glacial recession is changing the hazard-scape at the popular tourist destination of Fox Glacier. Shrinking ice volume is destabilizing the surrounding valley slopes and feedbacks associated with ablation suppression under debris aprons are changing the glacier surface morphology, resulting in an exacerbation of rockfall hazard. We are using time-lapse cameras and unmanned aerial vehicles to photograph the glacier and surrounding slopes as input into structure from motion modelling to create a series of digital elevation models. These models are then used to assess slope dynamics and changing rockfall run-out distances.

Contact: Heather Purdie [heather.purdie@canterbury.ac.nz](mailto:heather.purdie@canterbury.ac.nz)

## **NZ Snow and Ice Research Group on-line**

The New Zealand IGS chapter website is maintained by Tim Kerr (Aqualinc)

[sirg.org.nz](http://sirg.org.nz) received over 1600 visitors throughout 2015. The SIRG website is the primary resource for finding out about past and future annual meetings <http://sirg.org.nz/about/workshop-proceedings/> and details of New Zealand representatives in international cryospheric organizations <http://sirg.org.nz/international-representatives/>. The site also provides links to popular media articles

about New Zealand snow and ice: <http://sirg.org.nz/about/media/>, provides information about funding sources: <http://sirg.org.nz/research-fundingjob-opportunities/> and keeps an update of recent relevant papers [sirg.org.nz/about/bibliography/](http://sirg.org.nz/about/bibliography/). 18 papers were listed for 2015, with eight being specifically about New Zealand snow and ice. A full list of NZ Snow and Ice publications is available from the bibliographic database at <http://www.zotero.org/groups/sirg>. There are currently 601 articles referenced in this database from the 1862 'Notes on the geology of the province of Canterbury, NZ' by Julius von Haast, to the 2016 'Estimating permafrost distribution in the maritime Southern Alps, New Zealand' by Katrin Sattler and others. Contact: Tim Kerr [t.kerr@aqualic.co.nz](mailto:t.kerr@aqualic.co.nz)

## ANTARCTICA–ICE–OCEAN INTERACTIONS

### **Vulnerability of the Ross Ice Shelf in a warming world**

Christina Hulbe (UoOtago)

The rate at which West Antarctic ice responds to climate forcing depends on a set of processes involving ice, ocean, atmosphere and the terrestrial subglacial environment. Previous work has led to the understanding that rapid change is most likely to be driven from the sea and focused at the ice-shelf grounding line. We seek here to identify the key process interactions and to reduce uncertainty in future change projections via a coordinated set of investigations centred on two hot-water drilling field hubs on the Ross Ice Shelf (RIS). Field camps at each site will support interdisciplinary studies of both modern processes and ice and geological records of past states. The hubs will be connected regionally via satellite remote sensing, airborne geophysics and numerical modeling. Our programme embraces the surface interface with the atmosphere, and the calving front, but emphasizes the grounding line and sub-ice-shelf cavity. We will retrieve sea-floor sediments for paleoclimate and ice-sheet history studies, measure ocean properties, and conduct novel glaciological research at both sites. A mooring will be left in the ocean cavity nearly 200 km upstream of the ice shelf front. Single-season oceanographic observations will be made near the grounding line. When connected with existing observations on the RIS, the new sites yield an effective transect that allows us to consider the coupled system from grounded ice sheet to open ocean.

Contact [christina.hulbe@otago.ac.nz](mailto:christina.hulbe@otago.ac.nz)

### **Tidal flexure at Antarctic grounding zones**

Oliver Marsh (UoCanterbury); Wolfgang Rack (UoCanterbury)

Ice in the grounding zone bends continuously due to ocean tides and new high-resolution SAR satellites (TerraSAR-X, Sentinel-1, ALOS-2) can be used to precisely map this bending, providing spatially complete and high resolution information on ice deformation parameters and thickness. We are using differential interferometry from multiple satellites to map temporal changes in flexure patterns in different grounding zone configurations. This will provide new insight into the causes of short-term glacier velocity fluctuations and the differences in apparent ice viscosity and stiffness observed over these time periods. Combined with an inverse finite element model, this technique will improve our understanding of grounding zone ice properties in remote areas, and pave the way for improved monitoring of grounding zone change and measurement of ice thickness in this region.

Contact [oliver.marsh@canterbury.ac.nz](mailto:oliver.marsh@canterbury.ac.nz)

### **Application of ice shelf processes to icy worlds**

Jacob Buffo (Georgia Institute of Technology); Natalie Robinson (NIWA); Britney Schmidt (Georgia Institute of Technology)

The presence of platelet ice at the ice–ocean boundary will be represented in a finite difference model that incorporates multi-phase physics and accretion/ablation dynamics. This model seeks first to improve numerical representation of Antarctic sea ice and ice shelves, before being applied to the ice shell of Jupiter's moon, Europa. The goal is to produce computationally inexpensive, yet accurate, thermohaline multiphase simulations of basal ice that can accurately model the ice–ocean interface of polar ice and icy moons, as well as be incorporated into a wide variety of geophysical models that rely heavily on floating ice dynamics and processes to simulate a broad spectrum of Earth systems.

Contact [Natalie.Robinson@niwa.co.nz](mailto:Natalie.Robinson@niwa.co.nz)

### **Electromagnetic sounding of sea ice**

Pat Langhorne (UoOtago); Wolfgang Rack (UoCanterbury); Christian Haas (York University, Canada)

Continent-wide satellite estimates of Antarctic sea-ice thickness are now becoming available but need to be validated by sea-ice transects and ice–ocean and oceanographic observations relating to heat transfer in ice-shelf-affected waters. Electromagnetic (EM) induction techniques are the only reliable method of determining sea-ice thickness from the air. The technique also shows promise for detecting the sub-ice platelet layer. In 2016, EM induction flights will be based out



of McMurdo Sound and extend outward into the Ross Sea along new-generation satellite altimeter tracks. These will be combined with on-ice surveys to map the geographic extent of the influence of ice-shelf meltwater on sea ice.

Contact [pat.langhorne@otago.ac.nz](mailto:pat.langhorne@otago.ac.nz) or [wolfgang.rack@canterbury.ac.nz](mailto:wolfgang.rack@canterbury.ac.nz)

### **Influence of glacial melt input on sea ice processes**

Pat Langhorne (UoOtago); Wolfgang Rack (UoCanterbury); Craig Stevens (NIWA)

The geographic extent of the sea-ice response to changing freshwater fluxes (such as from ice-shelf meltwater) introduced artificially to the Southern Ocean is being mapped using a global ESM (CESM1 – CAM5) with an existing sea-ice module (the Community Ice CodE, CICE). The outcome of this study will be an improved understanding of the pathways of heat exchange between the ocean and sea ice. This insight will be useful with regard to the influence of ocean stability and heat transfer on the large-scale sea-ice thickness distribution. Modelling will be supplemented by new-generation satellite altimeter measurements (CryoSat-2, Sentinel-3 and ICESat-2). These data will reveal basin-wide spatial sea-ice characteristics and their temporal variability, while snow on sea ice will be studied using radar imagery.

The instrumented moorings currently deployed near the Drygalski Ice Tongue will be retrieved and re-deployed in order to continue long-term monitoring of the ice-shelf-derived plume at the point where it enters the Terra Nova Bay Polynya system. The ice tongue can be considered a proxy for an ice shelf, at a scale that allows for substantial influence on water properties and behaviour while remaining quantifiable. In addition, direct measurements of ice–ocean interactions along the flow path of ice-affected melt water will be conducted from the fast ice of western McMurdo Sound.

Contact [pat.langhorne@otago.ac.nz](mailto:pat.langhorne@otago.ac.nz); [wolfgang.rack@canterbury.ac.nz](mailto:wolfgang.rack@canterbury.ac.nz) or [Craig.Stevens@niwa.co.nz](mailto:Craig.Stevens@niwa.co.nz)

### **Platelet ice influence on ocean boundary layer**

Natalie Robinson (NIWA); Craig Stevens (NIWA)

Ice-shelf basal melting can drive seawater temperatures below the surface freezing point. Ice crystals persist in this water and are buoyantly deposited beneath coastal sea ice. There, the crystals may form a porous and friable ‘sub-ice platelet layer’ which may be several metres thick. Therefore it not only causes sea ice to be thicker than it would otherwise be but also alters the hydrostatic relationship between sea-ice elevation and thickness, and the hydrodynamic operation of the ocean boundary layer. The same mechanism

results in the accretion of marine ice beneath ice shelves, with potential implications for the long-term stability of cold-cavity ice shelves. An observational study of these effects in the upper ocean boundary layer will be linked into existing ice–ocean modelling to assess the potential effects on a regional scale. Approximately five fast-ice sites in Southern McMurdo Sound will be visited during the study, allowing a consistent approach to observation of boundary-layer interactions along a gradient in properties of both ocean water and sub-ice platelet layer.

Contact [Natalie.Robinson@niwa.co.nz](mailto:Natalie.Robinson@niwa.co.nz) or [Craig.Stevens@niwa.co.nz](mailto:Craig.Stevens@niwa.co.nz)

### **Wave–ice interaction**

Alison Kohout (NIWA); Mike Williams (NIWA)

Ocean waves break up sea ice with trends in the retreat and expansion of the sea-ice edge correlated with trends in mean significant wave height. The key to interpreting this correlation lies in understanding wave attenuation in the marginal ice zone, an area of broken ice floes, potentially hundreds of kilometres wide, near the sea-ice edge. We plan to deploy up to 20 NIWA-funded second-generation waves-in-ice buoys across the marginal ice zone from the Nathaniel B. Palmer PIPERS cruise in the Ross Sea, 2017. Several instruments will be deployed well into the pack ice to ensure we fully capture the propagation of large wave events. The focus of the experiment is the energy decay and change of angular spread of the penetrating directional wave spectra. We will also run an experiment to capture wave-induced ice-floe breakup, an area where there is a critical knowledge gap. Subsequent experiments are planned for locations with high wave exposure, for example in the marginal ice zone or in coastal locations such as Casey Station, Sea of Okhotsk or Alaska.

Contact [Alison.Kohout@niwa.co.nz](mailto:Alison.Kohout@niwa.co.nz) or [Mike.Williams@niwa.co.nz](mailto:Mike.Williams@niwa.co.nz)

### **Interannual variability in the Ross Sea**

Alena Malyarenko (NIWA); Mike Williams (NIWA)

Multiple drivers contribute to the thermohaline and momentum-driven circulation in the Ross Sea. In recent years massive icebergs, variable polynya activity, changing fast-ice conditions and a long-term trend towards lower-salinity deep water have all contributed to high interannual variability in oceanic properties on the Ross Sea continental shelf – including within the Ross Ice Shelf cavity. This project will combine moored and profiled data from a variety of sources with seal-tag temperature/salinity data to improve understanding of the year-to-year variability in ocean properties.

Contact [Mike.Williams@niwa.co.nz](mailto:Mike.Williams@niwa.co.nz)

### **Control of Ross Sea dynamics by competing seasonal processes**

Stefan Jendersie (NIWA); Mike Williams (NIWA)

An application of the Regional Ocean Modeling System (ROMS) to the shallow Ross Sea continental shelf, including the ice-shelf cavity, has identified a system of three anticyclonic and one cyclonic circulation cells that facilitate the water mass transports in the region. Constrained by the banks and depressions, the cells are spatially persistent but experience different individual temporal changes. The main control of their dynamics is the horizontal differences in density that drive three mechanisms: baroclinic pressure gradients, gravity-driven bottom flows and barotropic pressure gradients through sea-surface height gradients. (1) Circumpolar deep water resupply events seem to be triggered by a zonal shift of the Antarctic Slope Current (ASC) in the order of  $\sim 10$  km that occurs at different times along the shelf break; (2) density gradients are strengthened via high-salinity shelf water production during intense winter sea-ice formation the southwestern Ross Sea; (3) Local horizontal differences in density are enhanced by ice shelf water (ISW) supplied by ice-shelf basal melt. The model predicts phase lags of up to 1.5

years between heat import events to the cavity and the subsequent ISW pulse leaving the cavity. Thus the seasonality of flow dynamics in the Ross Sea is a superposition of the ASC variability, the atmospheric cycle and the heat import signal to the cavity.

Contact [Mike.Williams@niwa.co.nz](mailto:Mike.Williams@niwa.co.nz)

### *ABBREVIATIONS*

CEN	Conservatoires d'espaces naturels
ICIMOD	International Centre for Integrated Mountain Development (Kathmandu, Nepal)
NIWA	New Zealand National Institute of Water and Atmospheric Research
UoOtago	University of Otago
UoCanterbury	University of Canterbury
VUW	Victoria University of Wellington

**Heather Purdie**



# International Glaciological Society

## *JOURNAL OF GLACIOLOGY*

Papers accepted for publication between 1 January and 30 April 2016. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

**Elena M. Aizen, Vladimir B. Aizen, Nozomu Takeuchi, Paul A. Mayewski, Bjorn Grigholm, Daniel R. Joswiak, Stanislav A. Nikitin, Koji Fujita, Masayoshi Nakawo, Alexander Zapf, Margit Schwikowski**

Abrupt and moderate climate changes in the mid-latitudes of Asia during the Holocene

**W.H. Armstrong, R.S. Anderson, Jeffery Allen, H. Rajaram**

Seasonal evolution of glacier speedup measured from correlation of high-resolution satellite imagery and modeled using a two-dimensional cross-sectional flow model

**Katherine Boldt Love, Bernard Hallet, Thomas L. Pratt, Shad O'Neel**

Observations and modeling of fjord sedimentation during the 30-year retreat of Columbia Glacier, AK

**M. Capt, J.-B. Bosson, M. Fischer, N. Micheletti, C. Lambiel**

Decadal evolution of a very small heavily debris-covered glacier in an Alpine permafrost environment

**Fanny Brun, Pascal Buri, Evan S. Miles, Patrick Wagnon, Jakob Steiner, Etienne Berthier, Silvan Ragettli, Philip Kraaijenbrink, Walter W. Immerzeel, Francesca Pellicciotti**

Quantifying volume loss from ice cliffs on debris-covered glaciers using high resolution terrestrial and aerial photogrammetry

**Denis Callens, Reinhard Drews, Emmanuel Witrant, Morgane Philippe, Frank Pattyn**

Temporally stable surface mass balance asymmetry across an ice rise derived from radar internal reflection horizons through inverse modeling

**Tom Cowton, Peter Nienow, Andrew Sole, Ian Bartholomew, Douglas Mair**

Variability in ice motion at a land-terminating Greenlandic outlet glacier: the role of channelized and distributed drainage systems

**Stephen A. Drake, Hendrik Huwald, Marc B. Parlange, John S. Selker, Anne W. Nolin, Chad W. Higgins**

Attenuation of wind-induced pressure perturbations in Alpine snow

**Philomène Favier, Nicolas Eckert, Thierry Faug, David Bertrand, Mohamed Naaim**

Avalanche risk evaluation and protective dam optimal design using extreme value statistics

**Linghong Ke, Xiaoli Ding, Lei Zhang, Jun Hu, C.K. Shum, Zhong Lu**

Compiling a new glacier inventory for Southeastern Qinghai-Tibet Plateau from Landsat and PALSAR data

**Martin P. Luthi, Andreas Vieli, Luc Moreau, Ian Joughin, Moritz Reisser, David Small, Manfred Stober**

A century of geometry and velocity evolution at Equip Sermia, West Greenland

**Lv Mingyang, Lu Xiancai, Guo Huadong, Liu Guang, Ding Yixing, Ruan Zhixing, Ren Yuanzhen, Yan Shiyong**

Investigation of an extremely rapid glacier surge on Mt Tobe Feng, western China, 2015

**Shelley MacDonell, Martin Sharp, Sean Fitzsimons**

Cryoconite hole connectivity on the Wright Lower Glacier, McMurdo Dry Valleys, Antarctica

**Jeppe K. Malmros, Sebastian H. Mernild, Ryan Wilson, Rasmus Fensholt, Jacob C. Yde**

Glacier area changes in the central Chilean and Argentinean Andes 1955–2013/14

**Colin R. Meyer, Matheus C. Fernandes, Timothy T. Creyts, James R. Rice**

Effects of ice deformation on Röthlisberger channels and implications for transitions in subglacial hydrology

**Mostafa E. Mobasher, Ravindra Duddu, Jeremy N. Bassis, Haim Waisman**

Modeling hydraulic fracture of glaciers using continuum damage mechanics

**Isabel J. Nias, Stephen L. Cornford,  
Antony J. Payne**

Contrasting the modelled sensitivity of the  
Amundsen Sea Embayment ice streams

**M.K. Obryk, P.T. Doran, J.A. Hicks, C.P. McKay,  
J.C. Priscu**

Modeling the thickness of perennial ice covers  
on stratified lakes of the Taylor Valley, Antarctica

**Yu Ohata, Takenobu Toyota, Takayuki Shiraiwa**

Lake ice formation processes and thickness  
evolution at Lake Abashiri, Hokkaido, Japan

**Sunal Ojha, Koji Fujita, Katsuhiko Asahi,  
Akiko Sakai, Damodar Lamsal,  
Takayuki Nuimura, Hiroto Nagai**

Glacier area shrinkage in eastern Nepal  
Himalaya since 1992 using high-resolution  
inventories from aerial photographs and ALOS  
satellite images

**C. Papasodoro, A. Royer, A. Langlois, E. Berthier**  
Potential of RADARSAT-2 stereo radargrammetry  
for the generation of glacier digital elevation  
models

**Allen Pope, Ian C. Willis, Finnur Pálsson,  
Neil S. Arnold, W. Gareth Rees, Helgi Björnsson,  
Lauren Grey**

Elevation change, mass balance, dynamics, and  
surging of Langjökull, Iceland from 1997 to 2007

**Pamela A. Santibáñez, Joseph R. McConnell,  
John C. Priscu**

A flow cytometric method to measure  
prokaryotic records in ice cores: an example  
from the WAIS Divide drilling site

**Chris R Stokes, Martin Margold,  
Timothy T. Creyts**

Ribbed bedforms on palaeo-ice stream beds  
resemble regular patterns of basal shear stress  
('traction ribs') inferred from modern ice streams

**Sarah Thompson, Douglas I. Benn,  
Jordan Mertes, Adrian Luckman**

Stagnation and mass loss on a himalayan  
debris-covered glacier: processes, patterns and  
rates

**John Wahr, Evan Burgess, Sean Swenson**

Using GRACE and climate model simulations  
to predict mass loss of Alaskan glaciers through  
2100

**Claudia Wekerle, Florence Colleoni,  
Jens-Ove Näslund, Jenny Brandefelt,  
Simona Masina**

Numerical reconstructions of the penultimate  
glacial maximum Northern Hemisphere ice  
sheets: sensitivity to climate forcing and model  
parameters

## **ANNALS OF GLACIOLOGY 57(72)**

*The following papers have been selected for publication in Annals of Glaciology 57(72) (thematic  
issue on Hydrology of glaciers and ice sheets), edited by Alexander H. Jarosch and Ian Hewitt*

**Douglas J. Brinkerhoff, Colin R. Meyer,  
Ed Bueler, Martin Truffer,  
Timothy C. Bartholomäus**

Inversion of a glacier hydrology model

**Sebastian Goeller, Daniel Steinhage,  
Malte Thoma, Klaus Grosfeld**

Assessing the subglacial lake coverage of  
Antarctica

**Matti Leppäranta, Elisa Lindgren, Lauri Arvola**  
Heat balance of supraglacial lakes in western  
Dronning Maud Land

**A.M. MacDonald, A.R. Black,  
B.É. Ó Dochartaigh, J. Everest, W.G. Darling,  
V. Flett, D.W. Peach**

Using stable isotopes and continuous meltwater  
river monitoring to investigate the hydrology of a  
rapidly retreating Icelandic outlet glacier

**Łukasz Stachnik, Jacob C. Yde,  
Marta Kondracka, Dariusz Ignatiuk,  
Magdalena Grzesik**

Glacier naled evolution and relation to the  
subglacial drainage system based on water  
chemistry and GPR surveys (Werenskiöldbreen,  
SW Svalbard)

**Sarah L. St Germain, Brian J. Moorman**

The development of a pulsating supraglacial  
stream

**Ian C. Willis, Ed L. Pope,  
Gwendolyn J.M.C. Leysinger Vieli,  
Neil S. Arnold, Sylvan Long**

Drainage networks, lakes and water fluxes  
beneath the Antarctic ice sheet

Annals 57(72) is now complete



## ANNALS OF GLACIOLOGY 57(73)

*The following papers have been selected for publication in Annals of Glaciology 57(73) (thematic issue on Contemporary ice-sheet dynamics), edited by Tony Payne*

**Timothy C. Bartholomaus, Leigh A. Stearns, David A. Sutherland, Emily L. Shroyer, Jonathan D. Nash, Ryan T. Walker, Ginny Catania, Denis Felikson, Dustin Carrol, Mason J. Fried, Brice Noël, Michiel van den Broeke**

Contrasts in the response of adjacent fjords and glaciers to ice sheet surface melt in West Greenland

**Julia Christmann, Carolin Plate, Ralf Müller, Angelika Humbert**

Viscous and viscoelastic stress states at the calving front of Antarctic ice shelves

**S. L. Cornford, D.F. Martin, V. Lee, A.J. Payne, E.G. Ng**

Adaptive mesh refinement versus sub-grid friction interpolation in simulations of Antarctic ice dynamics

**Richard Hodgkins, Robert Bryant, Eleanor Darlington, Mark Brandon**

Pre-melt-season sediment plume variability at Jökulsárlón, Iceland, a preliminary evaluation using in-situ spectroradiometry and satellite imagery

**Martin J. Siegert, Neil Ross, Jilu Li, Dustin M. Schroeder, David Rippin, David Ashmore, Robert Bingham, Prasad Gogineni**

Subglacial controls on the flow of Institute Ice Stream, West Antarctica

**William A. Sneed, Gordon S. Hamilton**

Recent changes in the Norske Øer Ice Barrier, coastal Northeast Greenland

More papers for Annals 57(73) will be listed in the next issue

# Alpine Glaciology Meeting 2016

Munich, Germany, 25–26 February 2016

On 25 and 26 February 2016 the 20th Alpine Glaciology Meeting was held in the wonderful premises of the Carl Friedrich von Siemen Foundation near the Nymphenburg castle in Munich, Germany. A total of 60 participants from six different nations (Germany 24, Austria 14, Switzerland 12, Italy 4, UK 4 and France 2) listened to 22 oral presentations and discussed presentations at a lively poster session with 20 contributions. The meeting started with Magnus M. Magnusson's speech on the latest developments at the International Glaciological Society, which now has nearly 1100 members. During the first session on Glacier Monitoring, chaired by



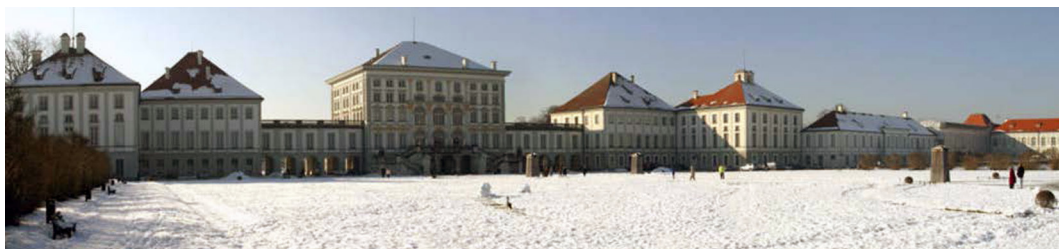
The Carl Friedrich von Siemens Foundation building, where AGM 2016 was held.



Magnús M. Magnússon, IGS Secretary General, giving the introduction to the meeting.



Claudio Smiraglia speaking on 'Present extent and features of the Italian glaciers: results from the new Italian Glacier Inventory'.



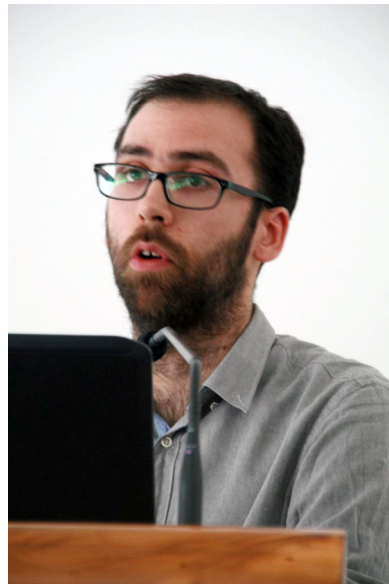
Nymphenburg Castle, photographed by Markus Weber.



Roberto Azzoni speaking on 'The dark side of the ice: new method to describe fine debris effects on the ice albedo and the composition of microbial communities on Alpine glaciers' and Ludwig Braun on 'Half a century of direct glacier mass balances of Vernagtferner, Eastern Alps: how can they be interpreted?'

Christoph Mayer, a total of 10 contributions were presented on topics concerning the Alps (8), Africa (1) and Central Asia (1). In session 2 (Geophysical Methods), chaired by Frank Paul, Martin Funk reported on the glacier instabilities

of the northwest face of Weissmies, Switzerland, and further contributions were given by two Swiss colleagues on the disastrous ice avalanches in Langtang following the Nepalese earthquake of 25 April 2015.



Eva Gleisberg presenting her BSc thesis, entitled 'Calculation of the annual water balance components for the Vernagtferner basin between 1845–2013 using a conceptual runoff model' and Davide Fugazza speaking on 'Areal and volumetric variations of the Lex Blanche Glacier (Mont Blanc Massif, Italy) from historical cartography and remote sensing sources'.





Kay Hefricht presenting Andrea Fischer's contribution, 'A decade of research on snow farming in glacier ski resorts: any ice left?'

Federico Covi speaking on 'Assessing potential reasons for different accumulation patterns on Mount Kenya and Kilimanjaro'.

On the second day, during the session on Glaciers and Climate, Christian Vincent honoured our deceased French colleague Louis Reynaud (1942–2016) who made substantial contributions to knowledge of glacier dynamics and worldwide variations in glacier mass balance. A total of five presentations were made in this session (three on the European Alps and two on the Himalaya–Hindu-kush (HKH) region). It was followed by the

last session, on Geodesy and Glacier Modelling, with three contributions (one on the Alps, two on the HKH).



Melanie Rankl, with her presentation 'Multi-mission satellite analysis of glaciers in High Asia' and Frank Paul with 'Glacier mapping with Sentinel 2 MSI & Landsat 8 OLI: exciting perspectives and new challenges'.

Emmanuel Thibert presenting 'An analysis of extreme mass balance values recorded at Sarennes Glacier over seven decades'.



Coffee break.



Lunch being served.



Informal gathering after lunch.



Martin Funk giving his talk on 'Monitoring glacier instabilities in the ice-covered Weissmies northwest face'.

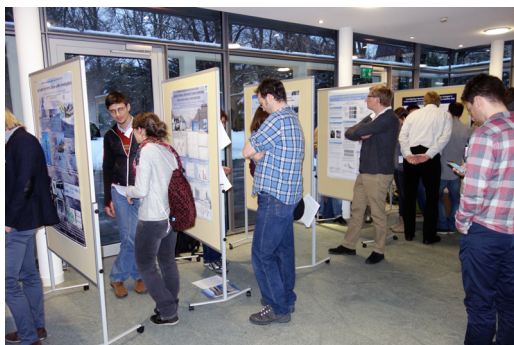
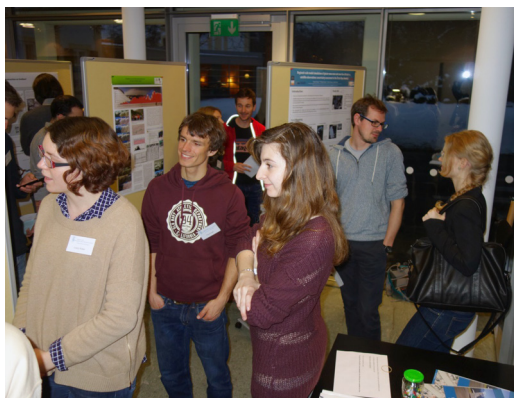


Two presentations on the release of ice avalanches in the Langtang area, Nepal: Jakob Steiner, 'Traces of the Gorkha earthquake in April 2015 on Langtang's glaciers', and Giovanni Kappenberger, 'The exceptional ice avalanche of Langtang Lirung released by the earthquake of 25 April 2015'.





Evening dinner at the Hirschgarten Restaurant.



The poster session. A total of 20 posters were introduced with a 2-minute talk each and then discussed at the stands.

#### *Poster contributions*

Azzoni, R.S. Identification of recent glacier evolution and ice-related landforms of the Ararat/ Ağrı Dağı Mount (Eastern Turkey) through SPOT and PLEIADES images

Barandun, M. Glacier-wide mass balance on four Kyrgyz glaciers from 2003 to 2015

Compostella, Ch. Ice to water: the Forni glacier under investigation

Feiger, N. Two new bedrock topographies for Gries- and Findelenglacier

Fischer, A. The glacier survey of the Austrian Alpine Club: 125 years of citizen science

Hanzer, F. Regional-scale model simulations of glacier snow cover and snow line altitude vs satellite observations: uncertainty assessment in the Ötztal Alps (Austria)

Hartl, L. Can a simple numerical model help to fine-tune the analysis of ground penetrating radar data? Hochebenkar rock glacier as a case study

Lambrech, A. Accumulation distribution in the upper Fedchenko Glacier, Pamir

Landmann, J. Obstacles on the way to a consistent global glaciological database

Marke, T. Past and potential future changes in the Austrian snow cover

McCarthy, M. Using ground-penetrating radar to study debris-covered glaciers in the Himalaya

Naegeli, K. Landsat based spectral albedo of glacier surfaces in the Western Swiss Alps

Prinz, R. Scale effects impeding paleoclimate reconstructions from mountain glaciers: impacts on the vertical mass balance profile

Vezzola, L. Assessing glacier features supporting supraglacial trees: the case study of the Miage debris-covered Glacier (Italian Alps)

Vijay, S. Investigating seasonal and long-term glacier changes in Alaska and Western Himalaya (India) using multi-mission satellite data

Fürst, J.J. Modelling present glacier dynamics on Svalbard - from inferring surface velocities to computing a flow-consistent bedrock map

Lindner, F. Monitoring of outburst floods using seismology

Bollmann, E. State-of-the art airborne photogrammetry for glacier monitoring

Wendt, A. A glacier surge of Bivachny Glacier in the Pamir Mountains, by means of repeated high-resolution interferometric digital elevation models



Christian Vincent giving his presentation on 'Sliding velocity fluctuations and subglacial hydrology over the last two decades on Argentière glacier, Mont Blanc area' and Pascal Egli on 'A dynamic energy balance model to compute supra glacial debris thickness using thermal satellite images on a glacier in Langtang valley, Nepal Himalaya'.

Hamish Pritchard speaking on 'Why do Asia's mountain glaciers matter?'

Meals and refreshments were served on both days by the friendly staff of the Siemens Stiftung, which offered not only a pleasant lecture hall and a poster exhibition area, but also cosy meeting rooms for informal get-togethers and discussions. A bouquet of flowers and a sincere 'Thank you' was given to Mrs Kresnik and her staff by Ludwig Braun, who closed the meeting with an invitation to everyone to attend the next AGM, which will take place in Zurich on 16–17 February 2017. In this way, the tradition of meeting annually in an informal and friendly atmosphere will continue, giving young scientists in the field of glaciology the chance to present their work in progress to a larger scientific community.



Lunch break before the last session.



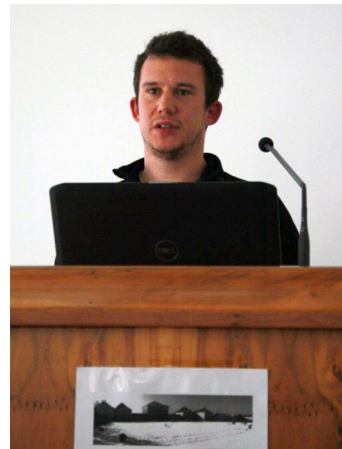
Tobias Zolles presenting 'Uncertainty estimation on energy balance models' and Achim Heilig 'The temporal firn line evolution for glaciers in the Rofental, based on C- and X-band remote sensing SAR data'.





Henry Nwachukwu presenting the material of his MSc thesis entitled 'Mass loss and mass distribution of alpine glaciers using terrestrial gravimetry' and Pascal Buri talking on '3-D modelling of ice-cliff evolution on a debris-covered glacier, Nepalese Himalayas'.

The final talk was by Alexander Groos on his MSc topic 'Investigating mass balance processes for glaciers in the Karakoram based on enhanced degree day modelling', which was followed by Ludwig Braun's closing remarks.



Lecture hall with flowers.



Hostess Dr Gudrun Kresink shutting down the computer.

### **Ludwig Braun & colleagues**

Commission for Geodesy and Glaciology,  
Bavarian Academy of Sciences, Munich  
[www.glaziologie.de](http://www.glaziologie.de)





INTERNATIONAL GLACIOLOGICAL SOCIETY

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



Scripps Institution of Oceanography,  
La Jolla, California, USA  
10–15 July 2016

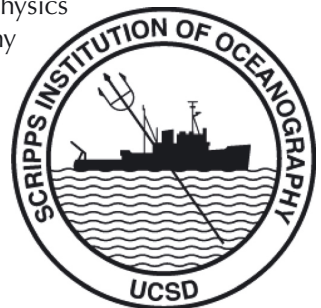
*Co-sponsored by:*

- ❄ Forum for Research into Ice Shelf Processes (FRISP)
- ❄ Greenland Ice Sheet Ocean network (GRISO)
- ❄ Institute of Geophysics and Planetary Physics
  - ❄ Scripps Institution of Oceanography
  - ❄ National Science Foundation
  - ❄ NASA

SECOND CIRCULAR

February 2016

<http://www.igsoc.org/symposia/>





The International Glaciological Society will hold a second International Symposium on ‘Interactions of Ice Sheets and Glaciers with the Ocean’ in 2016. The symposium will be held on the oceanfront in La Jolla, California, USA, from 10–15 July 2016. It is a follow-on to the successful 2011 IGS symposium on the same theme, which brought together 194 delegates from nearly 20 countries and resulted in the publication of 36 peer-reviewed research articles cited over 650 times since 2012.

The Symposium will also serve as the first of two annual Forum for Research into Ice Shelf Processes (FRISP) meetings to be held in 2016. FRISP (<http://folk.uib.no/ngfso/FRISP/index.html>) originated as a subcommittee of the Scientific Committee on Antarctic Research (SCAR) Working Group of Glaciology.

#### THEME

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

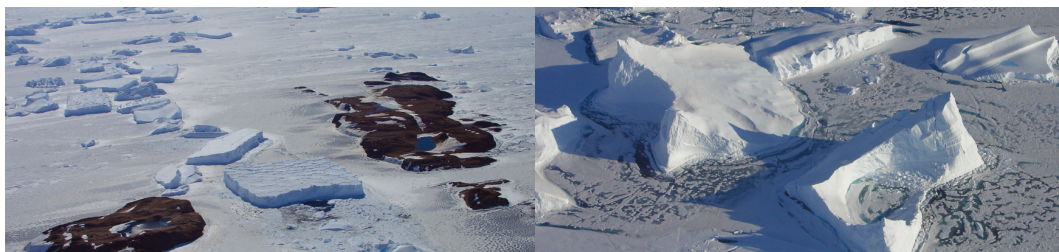
We expect that this symposium will attract experts in ice-sheet, ice-shelf, glacier, ocean and climate studies whose research addresses interactions of the ocean (including sea ice) and land ice in the global climate system using in situ observations, remote sensing and/or modeling. While we expect most contributions to be related to the Greenland and Antarctic ice sheets, we encourage contributions on all aspects of interactions between ice sheets, glaciers and the ocean, towards achieving the symposium goals. Come and attend what we believe will be a stimulating and productive symposium in a beautiful setting in Southern California.



## SUGGESTED TOPICS

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

1. Mass balance of ice shelves and tidewater glaciers, including the physics of melting and freezing at the ice–ocean interface and iceberg calving, forcing from ocean and atmosphere, and sensitivity to climate change
2. Dynamics of ice shelves and tidewater glaciers, including the response to changes in surface and basal mass balance, response to ocean variability (e.g. tides, sea ice, ice melange, storm events and tsunamis), impact of calving events, and processes influencing ice rheology and susceptibility to fracture
3. Coupling between grounded and floating ice, including controls on the location and evolution of grounding lines, response of inland ice to thinning and breakup of ice shelves and termini of tidewater glaciers, and the inland transmission of ocean forcing
4. Oceanic response to the input of ice, including the impacts of meltwater and icebergs on regional and global ocean circulation and sea level
5. Role of atmosphere/sea-ice/ocean processes in delivering ocean heat to glaciated coastlines, including the impact of past, present and future climate variability
6. Records of change in ice shelves and tidewater glaciers, including time series derived from direct observation and studies of the past impacts of ice sheet–ocean interaction preserved in the ice core and marine geological record





7. Observational and modeling techniques that advance our understanding of ice sheet–ocean interaction, including strategies for understanding processes, and instrumental monitoring, of ocean forcing and ice sheet/glacier response.

#### REGISTRATION FEES

All fees are in US Dollars, USD

Early registration until 26 April 2016

– Participant (IGS member):	\$595
– Participant (not IGS member):	\$695
– Student or retired (IGS member):	\$375
– Student or retired (not IGS member):	\$445
– Accompanying person (18+):	\$175
– Accompanying person (12–17):	\$95
– Accompanying person (<12):	Free
– Delegate registration after 26 April 2016:	+\$50
– Delegate late registration surcharge (after 27 June 2016):	\$100

The fees include the Icebreaker, the Tuesday evening reception at Professor Walter Munk's La Jolla home, 'Seiche', the Symposium Banquet, lunch (Mon–Fri) and daily morning/afternoon refreshments. Wednesday afternoon activities are not included.

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.

**ACCOMPANYING PERSONS:** The accompanying person's registration fee includes the Icebreaker, the Tuesday evening reception and the symposium banquet. It does not include attendance at the presentation sessions.







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

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

**GETTING TO SAN DIEGO:** San Diego Airport is conveniently located right in the city center, which is about 14 miles from La Jolla. Transfer from the airport is an easy 25-minute journey by taxi, Cloud 9 Shuttle or rental car. The airport is served by most of the major airlines and has direct flights to





most US cities including Denver, Dulles, BWI, New York and Chicago. For European attendees, British Airways operates a non-stop, daily flight from London Heathrow to San Diego; if you travel on another airline from Europe you will need to connect in a US hub, most likely on the East coast of the USA or at LAX or SFO. Flying to LAX and then surface transport to La Jolla is another feasible option.

**ACCOMMODATION:** Rooms have been booked at the UCSD Revelle Apartments. The rates are very favorable (\$100 Single and \$80 Double, which includes breakfast and dinner). There are a limited number of rooms available and they will be allocated on a 'first come, first served' basis. We have also booked a block of rooms (at \$239+tax for a single) at the Hotel La Jolla (see [www.igs.co.uk/symposia/2016/lajolla/](http://www.igs.co.uk/symposia/2016/lajolla/)). The hotel has a shuttle and is located an easy 20 minute walk along the beach from the conference venue. For those who prefer to stay elsewhere, the venue is on the Bus Route 30, which passes through downtown La Jolla and Pacific Beach, so you can seek accommodation in those places. There are also vacation rentals in La Jolla for larger groups or families (AirBnB or VRBO).

**PARKING:** Parking is available near the conference venue, but if you require it please let us know in advance so that we can make sure we have enough daily permits available. The cost is \$8 a day, cash only.

**MIDWEEK ACTIVITIES:** After the first couple of days looking wistfully at the beach during breaks, you will finally get the chance to spend some time there midweek. In keeping with IGS tradition, Wednesday afternoon will be reserved for recreation, and we will offer a selection of waterfront activities for your enjoyment and relaxation: surfing, sea-kayaking, stand-up paddle-boarding, beach volleyball and walking. If you wish to take part in any of these activities (cost is extra), just tell us when you arrive on site which you would prefer.





**RECEPTIONS:** There will be an early-evening Icebreaker reception at 'Surfside' next to the Scripps Forum on Sunday 10 July. Come along to meet your fellow delegates, get orientated at the conference site and pick up your registration package. Scripps Emeritus Professor Walter Munk has generously offered his La Jolla home 'Seiche' to the conference for a reception on the Tuesday evening – this is an occasion not to be missed!

**BANQUET:** The banquet will be held on Thursday evening on a Hornblower cruise boat on the beautiful San Diego bay. This promises to be a memorable evening with your colleagues and friends.

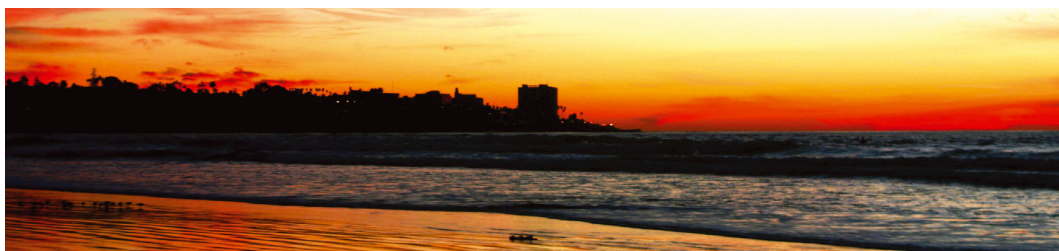
The receptions, banquet and all luncheons are included in the cost of registration.

**STUDENT/POSTDOC SUPPORT:** We have approached NSF and NASA to request funds to partially support student and postdoc attendance at this symposium. If this funding eventuates we will send out a separate notification in the next month.

#### ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper (either oral or poster) at the Symposium must submit an abstract by 15 March 2016. A collection of submitted abstracts will be provided for all participants at the Symposium.

The Council of the International Glaciological Society will also publish a thematic issue of the *Annals of Glaciology* on 'Ice–ocean interaction', consistent with the Symposium themes. Symposium participants are encouraged to submit manuscripts for this peer-reviewed *Annals* volume, with a deadline of 15 June 2016 to allow time for review before the Symposium. Submissions to this issue are not contingent on presentation at the Symposium. Note that acceptance of a Symposium abstract does







not necessarily affirm that the material to be presented is suitable for consideration as part of this issue of the *Annals*; please contact the Chief Editor if you have any questions about this.

#### SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)

#### LOCAL ORGANIZING COMMITTEE

Helen Amanda Fricker (Chair), Donna Shabkie, Matthew Siegfried

#### ANNALS OF GLACIOLOGY EDITORIAL COMMITTEE

Chief Editor: Helen Amanda Fricker. Associate Editors will include Adrian Jenkins, Laurie Padman, Eric Rignot, Ted Scambos and Fiamma Straneo.

Information will be updated on the conference website, <http://www.igsoc.org/symposia/2016/lajolla/> as it becomes available.



#### IMPORTANT DATES

##### *Interactions of Glaciers and Ice Sheets with the Ocean*

Abstract submission deadline:	Tuesday 15 March 2016
Notification of acceptance:	Tuesday 29 March 2016
Opening of online registration:	Monday 21 March 2016
Early registration deadline:	Tuesday 26 April 2016
Deadline for full refund:	Thursday 27 May 2016
Deadline for refund on a sliding scale:	Friday 17 June 2016
Late registration surcharge:	Monday 27 June 2016
Registration and Icebreaker:	Sunday 10 July 2016
Symposium starts:	Monday 11 July 2016

##### *Annals of Glaciology volume 58, issue 74*

Paper submission deadline:	Wednesday 15 June 2016
Final revised papers deadline:	Wednesday 31 August 2016





INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on

## Polar Ice, Polar Climate, Polar Change

Remote sensing and modeling advances in understanding the cryosphere



University Memorial Center, University of Colorado at Boulder,  
Boulder, Colorado, USA, 14–19 August 2017

*Co-sponsored by:*

- ❄ National Snow and Ice Data Center
- ❄ Cooperative Institute for Research in Environmental Sciences
- ❄ Institute of Arctic and Alpine Research
- ❄ National Center for Atmospheric Research

FIRST CIRCULAR

April 2016

<http://www.igsoc.org/symposia/2017/boulder>

The International Glaciological Society will hold an International Symposium on 'Polar Ice, Polar Climate, Polar Change' in 2017. The symposium will be held on the University of Colorado Boulder campus at the University Memorial Center and other campus venues on 14–19 August 2017.

## THEMES

The changes of the past 15 years in Arctic and Antarctic sea ice and the ice sheets appear to be a prelude to new levels of impact of the polar regions on global climate and sea level. The single-year ice system is expanding in the Arctic, with processes comparable to those of Antarctic sea ice. Antarctic sea ice extent is highly variable, and is responding to shifts in ocean circulation and wind patterns. Both polar sea ice systems interact in important ways with climate and with the adjacent ice sheets.

Much of this growing awareness and understanding has come from the tremendous success of satellite and airborne remote sensing, supporting both process studies and modeling of the geophysical basis for observed changes. The proposed symposium would both summarize new, high-profile results from the international research communities and provide a synthesis of current understanding as climate change impacts continue.

The goals of this symposium are:

- (1) to provide a forum for presenting the current best observational data of all aspects of sea ice and polar ice sheets in both hemispheres, and their ongoing changes
- (2) to present and discuss results from models of ongoing polar climate and cryosphere processes, and interactions between sea ice and the climate system
- (3) to examine the likely future course of the sea ice, ice sheet and polar climate systems as revealed by coupled models
- (4) to entrain the global polar science community, at all stages of career development, in discussing the state and direction of the Earth's polar regions

## SUGGESTED TOPICS

We welcome all submissions for presentations under the broad topics of polar remote sensing and polar cryospheric and climate system modeling. The key focus areas are:

1. Sea ice mapping and observations of sea-ice–climate–ocean processes and interactions; remote determination of snow cover on sea ice or sea-ice thickness; sea-ice models; past, present and future evolution of the Arctic or Antarctic sea-ice system; studies combining field and remote observations
2. Satellite or airborne observations of ice-sheet mass balance, glacier flow, ice-sheet accumulation, surface melting, melt ponds and streams; remote sensing of ice–ocean interaction and ocean circulation near the ice front; new observational techniques; historical records of ice flow and thickness

3. Model studies of ice-sheet and ice–ocean processes; polar climate models; coupled models of the polar atmosphere–ice–ocean–land system; predictive models of the evolution of the ice-sheet system or ice–ocean system over the next few decades to centuries
4. Trends in snow cover over the Northern Hemisphere; snow albedo, dust and soot in snow; new technologies for mapping snow cover; remote sensing (satellite and airborne) studies of permafrost, new methods of observation of permafrost
5. Calibration and validation studies of polar remote sensing data
6. Information on the polar cryosphere, especially sea ice extents, from early satellite or other remote sensing records; data rescue
7. Data management and informatics as they apply to polar remote sensing data, calibration–validation data sets

## PROGRAM

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 an opening icebreaker, a symposium banquet and a selection of activities during a Thursday (16 August) afternoon mid-symposium break. There is a pre-symposium geology and landscape excursion planned, and a post-symposium excursion to the path of a solar eclipse on Monday 21 August.

## ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper (either oral or poster) at the symposium will be required to submit an abstract by 1 April 2017. A collection of submitted abstracts will be provided for all participants at the symposium. The Council of the International Glaciological Society has decided to publish a thematic issue of the *Annals of Glaciology* on 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 submission of *Annals* papers will be published at a later date.

## LOCAL ORGANIZING COMMITTEE

Ted Scambos, Tad Pfeffer, John Cassano; additional members may be appointed.

## SCIENCE STEERING AND EDITORIAL COMMITTEE

Mark Serreze, University of Colorado at Boulder (chair), Ted Scambos, Allen Pope, Sharon Stammerjohn, Walt Meier, Marijke Holland, Noah Molotch.

## VENUE

The symposium will be held at the University Memorial Center, located near the center of the Boulder Campus, with dining facilities just a short walk away and a large patio area with a view of the famous Flatiron mountain ridge. A number of hotels are within reasonable walking distance, and Boulder has an excellent bus system and bike path network for getting around.

## LOCATION

Late summer in the Colorado Rockies is spectacular, with reliably warm, generally dry weather, magnificent mountains, awe-inspiring evening thunderstorms and excellent hiking and climbing possibilities. Boulder is a city of about 100 000 people, renowned for its restaurants, walking mall and biking- and walking-friendly layout, and its beautiful University campus. Nearby is Denver, a city of 2 million inhabitants, with sports, museums and other points of interest. Boulder is about 90 minutes' drive from Rocky Mountain National Park, or 45 minutes from trails that lead to the Continental Divide in the Indian Peaks Wilderness. Microbreweries abound

## FURTHER INFORMATION

If you wish to attend the symposium please register your interest online at <http://www.igsoc.org/symposia/2017/boulder/>. The Second Circular will give further information about accommodation, the general scientific programme, additional activities, preparation of abstracts and final papers. Members of the International Glaciological Society will automatically receive one, as will all those who have pre-registered. Information will also be updated on the IGS conference website, <http://www.igsoc.org/symposia/2017/boulder/> as it becomes available. A local website will open later in 2016.



# Glaciological diary

\*\* IGS sponsored

\* IGS co-sponsored

## 2016

9–13 May 2016

### **European Space Agency Earth Observation and Cryosphere Science conference 2016**

hosted during the ESA Living Planet

Symposium 2016

Prague, Czech Republic

Website: <http://lps16.esa.int/>

9–13 May 2016

### **4th CryoSat User Workshop**

hosted during the ESA Living Planet

Symposium 2016

Prague, Czech Republic

Website: <https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/cryosat/news/-/article/cryosat-4th-user-workshop>

22–23 May 2016

### **Subglacial Access Drilling: IDPO Science Planning Workshop**

Herndon, Virginia, USA

Website: <http://icedrill.org/2016-subglacial-planning-workshop/index.shtml>

23–27 May 2016

### **PAST Gateways International Conference**

Trondheim, Norway

Website: <http://www.ngu.no/en/activities/past-gateways-4th-international-conference>

24–29 May 2016

### **XVI Glaciological Symposium: Past, present, and future of the Earth cryosphere**

St Petersburg, Russia

Website: <http://www.glac2016.igras.ru/>

31 May–3 June 2016

### **23rd IAHR International Symposium on Ice 2016: Research and Application of Ice Dynamics and Thermodynamics in Engineering, Ecology and Climate Change**

Ann Arbor, Michigan, USA

Website: <http://www.iahr-ice2016.org/>

1–3 June 2016

### **Workshop: Observing and modelling meltwater retention processes on ice sheets and glaciers**

Copenhagen, Denmark

Contact Robert Fausto <[rsf@geus.dk](mailto:rsf@geus.dk)>

6–10 June 2016

### **Conference on Mathematical Geophysics**

Paris, France

Website: <http://cmg2016.sciencesconf.org/>

13–24 June 2016

### **Workshop: Polar Geospatial Center Boot Camp**

St Paul, Minnesota, USA

Website: <http://bootcamp.pgc.umn.edu/>

14–16 June 2016

### **73rd Eastern Snow Conference**

Columbus, Ohio, USA

Website: [http://www.easternsnow.org/annual\\_meeting.html](http://www.easternsnow.org/annual_meeting.html)

14–17 June 2016

### **Snow Engineering VIII (8th International Conference on Snow Engineering)**

Nantes, France

Website: <http://www.snoweng2016.org/cop2016.org/>

20–24 June 2016

### **Eleventh International Conference on Permafrost (ICOP 2016)**

Potsdam, Germany

Website: <http://icop2016.org>

21–23 June 2016

### **2016 Ice Sheet System Model Workshop**

La Jolla, California, USA

Website: <http://issm.jpl.nasa.gov/issmworkshop2015/>

26 June–1 July 2016

### **Goldschmidt conference**

Yokohama, Japan

Session 12f: Elemental and Isotopic Marine Biogeochemistry at a Range of Scales

Website: <http://goldschmidt.info/2016/program/programViewThemes#theme12>

28–29 June 2016

### **Conference: Small Unmanned Aerial Systems for Environmental Research**

Worcester, UK

Website: <http://www.worcester.ac.uk/discover/uav-conference.html>

5–7 July 2016

### **UK Antarctic Science Conference**

Norwich, UK

Website: [http://store.uea.ac.uk/browse/extra\\_info.asp?compid=1&modid=2&deptid=28&catid=17&prodid=53](http://store.uea.ac.uk/browse/extra_info.asp?compid=1&modid=2&deptid=28&catid=17&prodid=53)

10–15 July 2016

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

La Jolla, California, USA

Contact: Secretary General, International Glaciological Society

30 July–15 August 2016

**41th Scientific Assembly of the Committee on Space Research (COSPAR)**

Istanbul, Turkey

Session COSPAR-16-A2.1: Scientific exploitation of new missions and heritage data sets in oceanography and cryosphere

Website: [https://www.cospar-assembly.org/admin/session\\_cospar.php?session=524](https://www.cospar-assembly.org/admin/session_cospar.php?session=524)

20–30 August 2016

**SCAR Open Science Conference: Antarctica in the Global Earth System – from the Poles to the Tropics**

Kuala Lumpur, Malaysia

Session: Remote sensing of the Antarctic environment: Multi-disciplinary advances.

Conveners Ewe Hong Tat, Hans-Ulrich Peter, Rob Massom, Oscar Schofield, Shridhar Jawak <[shridhar.jawak@gmail.com](mailto:shridhar.jawak@gmail.com)>

Website: <http://scar2016.com/index.php>

24–25 August 2016

**Workshop: In-situ snow albedo measurements: toward a snow albedo intercomparison experiment**

Helsinki, Finland

Website: <http://harmosnow.eu/index.php?page=24%20-%2025.08.2016,%20Helsinki>

5–7 September 2016

**Annual Meeting of the British Society for Geomorphology**

Plymouth, UK

Website: <https://www.plymouth.ac.uk/whatson/bsg-2016>

5–9 September 2016

**6th International Conference on Mars Polar Science and Exploration**

Reykjavík, Iceland

Website: <http://www.hou.usra.edu/meetings/marspolar2016/>

7–8 September 2016

**International Glaciological Society British Branch Meeting**

Southampton, UK

Contact: Jane Hart [jhart@soton.ac.uk](mailto:jhart@soton.ac.uk)

7–8 September 2016

**Workshop: Understanding the fundamental processes controlling the surface mass balance of the Greenland ice sheet and improving estimates**

Palisades, New York, USA

Website: <http://www.cryocity.org/greenland-smb-workshop.html>

9–12 September 2016

**Third Arctic-FROST network meeting and Early Career Scholars Workshop on Arctic Sustainability in the Global Context**

Vienna, Austria

Website: <http://www.uni.edu/arctic/frost>

12–16 September 2016

**European Conference on Applied Climatology**  
Trieste, Italy

Session UC4: The cryosphere and its interactions with the climate system

Website: <http://meetingorganizer.copernicus.org/EMS2016/session/22051>

12–16 September 2016

**ESA Remote Sensing of the Cryosphere Advanced Training Course 2016**

Leeds, UK

Website: <http://seom.esa.int/cryotraining2016/index.php>

13–24 September 2016

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

Karthaus, Italy

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

3 October 2016

**Workshop: NECKLACE, an international programme to acquire time series of melt rates from Antarctic ice shelves**

Gothenburg, Sweden

Contact Anna Wåhlin

<[anna.wahlin@marine.gu.se](mailto:anna.wahlin@marine.gu.se)>

1–6 October 2016

**30th Forum for Research into Ice Shelf Processes (FRISP)**

Gothenburg, Sweden

Website: <http://folk.uib.no/ngfso/FRISP/>

17–20 October 2016

**5th International Geo-hazards Research Symposium – in memory of Prof. Tsanyao Frank Yang (IGRS 2016)**

Taipei, Taiwan

Contact: organizing committee at [igrs2016@gmail.com](mailto:igrs2016@gmail.com)

21–22 October 2016

**International Symposium on Polar Environmental Change and Public Governance**

Wuhan, China

Website: <http://2016.chinare.cn/>

12–16 December 2016

**AGU 2016 Fall Meeting**

San Francisco, California, USA

Website: <http://fallmeeting.agu.org/2015/>

**2017**

22–26 January 2017

14th Conference on Polar Meteorology and Oceanography

held as part of the 97th Annual Meeting of the American Meteorological Society

Seattle, WA

Website: <https://annual.ametsoc.org/2017/index.cfm/programs/conferences-and-symposia/14th-conference-on-polar-meteorology-and-oceanography/>

12–17 February, 2017

**\*\*International Symposium on the Southern Cryosphere: Climate Drivers and Global Connections**

Wellington, New Zealand

Contact: Secretary General, International Glaciological Society

20–24 February 2017

**Practice meets science: International Advanced Training Course on ‘Snow and Avalanches’ 2017**

Davos, Switzerland

Website: [http://www.slf.ch/dienstleistungen/events/practice\\_meets\\_science/index\\_EN](http://www.slf.ch/dienstleistungen/events/practice_meets_science/index_EN)

27–29 March 2017

**4th Polar Prediction Workshop**

Bremerhaven, Germany

Contact Betsy Turner-Bogren <betsy@arcus.org>

22–25 May 2017

**International Conference on High Latitude Dust 2017**

Reykjavík, Iceland

Website: <http://www.geomorphology.org.uk/meetings/international-conference-high-latitude-dust-2017>

14–19 August 2017

**\*\*International Symposium on Polar Ice, Polar Climate and Polar Change: Remote sensing advances in understanding the cryosphere**

Boulder, Colorado, USA

Contact: Secretary General, International Glaciological Society

**2018**

4–9 March 2018

**\*\*International Symposium on Cryosphere and Biosphere**

Kyoto, Japan

Contacts: Secretary General, International Glaciological Society

Professor Nozomu Takeuchi, Chiba

University, Chiba, Japan <ntakeuch@faculty.chiba-u.jp>

15–27 June 2018

**SCAR/IASC Conference**

Davos, Switzerland

Contact: SCAR Secretariat [info@scar.org]





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# International Glaciological Society

Secretary General M.M. Magnússon

	<b>Council Members</b>	<b>Concurrent service on Council, from</b>
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Vice-Presidents	G. Flowers	2015–2018
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	S. Sugiyama	2014–2017
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	*W. Colgan	2013–2016
	*H.A. Fricker	2015–2018
	*J.K. Hutchings	2015–2018
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	*M. Montagnat	2014–2017
	A. Rivera	2014–2017
	*B. Stenni	2014–2017
	*C. Tijm-Reijmer	2015–2018
	*Y. Zaika	2013–2016
Co-opted	E.M. Morris	
	F. Navarro	
	E. Wolff	

\*First term of service on the Council

## IGS Committees

Awards	M. Tranter (Chairman)
Nominations	E. Brun (Chairman)
Publications	C.L. Hulbe (Chairman)

## Correspondents

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## Seligman Crystal

1963 G. Seligman	1989 H. Oeschger	2001 G.K.C. Clarke
1967 H. Bader	1989 W.F. Weeks	2003 K. Hutter
1969 J.F. Nye	1990 C.R. Bentley	2005 R.B. Alley
1972 J.W. Glen	1990 A. Higashi	2007 L.G. Thompson
1972 B.L. Hansen	1992 H. Röthlisberger	2009 P.A. Mayewski
1974 S. Evans	1993 L. Lliboutry	2011 A. Iken
1976 W. Dansgaard	1995 A.J. Gow	2012 D.E. Sugden
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1982 M. de Quervain	1997 S.J. Johnsen	
1983 W.O. Field	1998 C. Lorius	
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1985 M.F. Meier	2000 S.C. Colbeck	
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G.K.C. Clarke	J.W. Glen
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## Richardson Medal

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1997 D.R. MacAyeal	2012 W.S.B. Paterson
1998 G.K.C. Clarke	2013 J.W. Glen
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2003 C.S.L. Ommanney	

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# International Glaciological Society

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## MEMBERSHIP

Membership is open to all individuals who have a scientific, practical or general interest in any aspect of snow and ice and benefits include online access to the *Journal* and *Annals of Glaciology* and *ICE*. To join please see our website at <http://www.igsoc.org/membership>.

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Contributing members	£137
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Student members (under 30 years or studying for PhD/MSc)	£37

Payment may be made on line using MasterCard, AmEx or VISA/Delta.

## ICE

Editor: M.M. Magnússon (Secretary General)

This news bulletin is issued to members of the International Glaciological Society and is published three times a year. Contributions should be sent to your National Correspondent or to the Secretary General, International Glaciological Society, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, UK.

Annual cost for libraries, etc., and for individuals who are not members of the Society:

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