ISSN 0019–1043

Ice

News Bulletin of the International Glaciological Society

Number 163 3rd Issue 2013

Contents

Cover picture: Landsat image from Antarctica. Photography by Pablo Zenteno.

From the Editor

Dear IGS member

As Secretary General, I go to all IGS symposia and workshops and several other meetings as well. During the course of this, I listen to a lot of presentations from the whole spectrum of scientists, young and old, well known and not so well known. And I always sit near the front of the auditorium so as to be better able to follow what is being said and to be able to see the content of the presenters' slides. I have heard some great presentations; presentations that made me understand what the talk was about, although I had no previous knowledge of the subject. I could hear every word the presenter said and I felt s/he was talking directly to me. Unfortunately this experience represents the minority of cases. All too often I am looking at the back of the presenter's neck and really struggling to hear what they are saying because the microphone is in the podium (i.e. behind the presenter). And frequently it strikes me that it is as if the presenter has never had a lesson in how to give a good presentation.

In addition, during question time following a presentation, most venues have people running around with microphones for the questioners to use. The purpose of using microphones is to ensure that the whole audience can hear both the question and the answer. However, when prompted by the session chair to wait for the microphone, some questioners declare proudly that 'I don't need a microphone, I'm loud enough'. What these individuals have not considered is that there are several people *behind* them. As an experiment, try holding a conversation with someone walking in front of you who is looking straight ahead.

A great may questioners do not wait for the microphone to arrive before starting to ask their question. Once the microphone arrives, they continue with their question so the audience only gets to hear the second half of the question. That is assuming the questioner actually speaks into the microphone. Sadly, many people hold the microphone at waist level so no-one can hear the second half of their question anyway. A former IGS President taught me a good technique: 'rest the microphone on your chin' (known as the 'ice cream licking technique'). Ideally, in this situation, the presenter (or a good session chair) will repeat the question for the benefit of the audience, but this often seems to be forgotten. I rest my case. For the benefit of all delegates at presentations, I suggest that all of us need to wait for, and effectively use, the microphone.

Another thing worth remembering by all people giving presentations is that the quality of the slide is inversely proportional to the number of words on the slide. I should know, I am one of the very few presenters who has received an award for 'the most number of words in a slide that no-one was able to read'. The prize I received was a knife to cut up my overheads into manageable units. My excuse at the time was that I was showing

the shape of a flow chart and the audience was not supposed or expected to read what was in the individual boxes. However, 'Not supposed to' is not a good defence; the audience, while trying to read the text in my boxes, missed what I was saying and did not get the message. I learned my lesson: I should have left the boxes blank.

Remember: a simple diagram is worth a thousand words. Stick to a simple font and do not go crazy on the colours. The psychedelic era passed a few decades ago, before PowerPoint was invented.

You will have noticed that we are looking towards making some changes to the way the IGS operates in light of the coming of Open Access. As part of that we would like to solicit our members' opinion on various related issues via a survey. I do not know exactly when we will launch the survey but it will be done online and possibly on the IGS members' site. What I would like to ask you all is to please respond to our request to participate. It is important for Council to know what the membership is thinking so it can make properly informed decisions.

To finish off, I note that the second issue of the *Journal* for 2014, issue 220, is now complete online. The third issue of the *Journal* is well on its way to completion. *Annals* 55(66) has gone to the printers, and work is progressing on other *Annals* issues for 2014.

So far, almost 900 members have renewed. The total tally for 2013 was 956 members, 4 down from the previous year. I trust that we will reach the 1000 mark in 2014.

Magnús Már Magnússon
Secretary General

Recent work

Switzerland

SNOW

Snow cover and micrometeorology
Project lead: Charles Fierz and Michael Lehning (SLF); funded by SNF, CCES, WSL, Swiss cantons; partners: see webpages
SLF stands traditionally for all aspects of snow and avalanche research. Within this context, the research unit Snow and Permafrost covers the topics of Snow Physics, Permafrost and Snow Climatology, Snow Sports, and Snow cover and Micrometeorology (SMM). More info about the research unit and all its research projects can be found on its webpage (see below). SMM collaborators developed over many years the snow-cover model SNOWPACK and the land surface scheme Alpine3D. The models allow for improving avalanche warning tools or studying snow hydrology and climatology particularly in cold and mountainous regions. The input data to these models are provided by MeteoIO. All codes are open source and downloadable from https://models.slf.ch. Snow–atmosphere interaction is another important aspect of SMM research: sublimation of snow on the ground and in suspension, drifting and blowing snow, and turbulent fluxes over patchy alpine snow covers are studied by modelling and experimenting both in the field and in a cold wind tunnel. In addition, SMM developed with its partners the Swiss Experiment Platform that provides an entry point to many data sets for environmental research but also provides links to advanced processing tools. The expertise gained by the SMM scientists often leads to collaborations not only with the other research groups based at SLF but also in fields less in their focus such as orographic precipitation or ecology.
Duration: ongoing
Webpages: http://www.slf.ch/ueber/organisation/schnee_permafrost/Mikrometeorologie/index_EN; http://www.slf.ch/ueber/organisation/schnee_permafrost/index_EN; E-mail: fierz@slf.ch

Snow ventilation
Project lead: Hendrik Huwald (EPFL); funded by SNF; partners: SLF, OSU, UU
This project addresses snow pack ventilation and possibly associated heat and moisture transport with the goal of better understanding and quantifying the energy balance and snow-atmosphere exchange processes. Field experiments are designed and conducted to measure and relate near-surface atmospheric turbulence with barometric pressure fluctuations at various levels within the snow pack, and to investigate their impact on the snow temperature profile and interstitial gas dynamics.
Duration: 2010–13
Webpage: http://cryos.epfl.ch;
E-mail: hendrik.huwald@epfl.ch

SnowDTS
Project lead: Hendrik Huwald (EPFL); funded by SNF; partner: OSU
Fibre Optic Distributed Temperature Sensing (FO-DTS) is used to measure and quantify spatial and temporal variability in a snow pack. To this end optical fibres are deployed in various configurations in the snow pack and the observed temperature distributions are analysed. Combined with snow density data from collocated snow pits these data also allow for computation of distributed subsurface heat flux in the snow pack and thus constitute a valuable contribution to snow energy balance calculations.
Duration: 2009–13
Webpage: http://cryos.epfl.ch/; E-mail: hendrik.huwald@epfl.ch

GLACIERS AND ICE SHEETS – GENERAL

Glacier variations in the Western and Central Alps: Reconstruction of the LIA-glacier history by historical documents, connection to climate variability, art and perception (1. Mer de Glace – Art & Science)
Samuel Nussbaumer (GIUZ), Philip Deline (EDYTEM/USCA), Christian Vincent (LGGE/UJFG), Heinz J. Zumbühl (GIUB); funded (partially) by SNF, CNRS
This interdisciplinary project (13 collaborators) tries to give an overview of the actual state of knowledge of the Mer de Glace, the largest glacier in France and the Western Alps. Geomorphological and dendrogeomorphic studies allow the reconstruction of the palaeogeography (e.g. the last maximal glaciation). A great number of historical documents results in a concise LIA-history of the Mer de Glace. The recent fluctuations of the glacier facing climate change are shown, ending in the scenarios of the future (changing surface cover, reduced attractiveness of the landscape, growing natural hazards, big change of public perception of the glaciers).

Duration: 2008–13
E-mail: Heinz J. Zumbühl (zumbuehl@giub.unibe.ch)

Glacier variations in the Western and Central Alps: Reconstruction of the LIA-glacier history by historical documents, connection to climate variability, art and perception (2. The two Grindelwald glaciers – Art & Science)
Heinz J. Zumbühl (GIUB), Samuel Nussbaumer (GIUZ), Hanspeter Holzhauser; Matthias Huss (GIUF), Horst Machguth (GIUZ), Hans Kienholz (GIUB), Heinz Wanner (GIUB), Martin Funk (VAW/ETHZ), Daniel Steiner (PHZ), Marc Luetscher (UIBK), Nils Hählen (TBKB), Daniel Tobler (GEOT), Richard Wolf, Rémi Fontaine, Robert Bösch
This interdisciplinary project (15 collaborators) tries to reconstruct history of two Grindelwald glaciers in the Holocene using different methods (e.g. historical documents, dendrochronology, speleothems). The great number of visually rich historical documents (with a lot of newly discovered mid-19th century photographs) allows detailed results of the LIA frontal fluctuations. The impact of climate change on the future glacier extension until the end of the 21st century is estimated by model calculations. The huge ice loss in the last years resulted not only in a dramatic change of landscape, but also in a growing number of natural hazards. The change of the public perception of the famous two glaciers, especially in the last 200 years, is discussed.
Duration: 2012–14/15
E-mail: Heinz J. Zumbühl (zumbuehl@giub.unibe.ch)

Morphological characteristics of glacial overdeepenings
Project lead: Urs H. Fischer (Nagra); funded by: Nagra; partners: GIUZ, GeoSheffield, SSE MMU
This study aims to elucidate the controls on overdeepening location and evolution of overdeepening geometry by (1) undertaking morphometric analyses of a statistically robust sample of overdeepenings located beneath the Antarctic and Greenland ice sheets and in suitable palaeo-ice sheet settings (e.g. Swiss Alpine foreland), (2) elucidating and assessing the presence of stabilising feedbacks in overdeepening erosion using analyses of overdeepening morphometry and ice sheet geometry, and (3) investigating climatic, glaciological and geological controls on overdeepening location and evolution using information on ice sheet thermal regime, topographic context and bedrock geology.
Duration: 2013–14
E-mail: urs.fischer@nagra.ch

GlaciArch
Project lead: Claude Collet (GIUF); funded by SNF; partners: Archéologie cantonale (Canton of Valais), ARIA S.A., Musée d'Histoire (Sion, Valais)
Recent climate changes have led to an increase in the exposure of archaeological remains in frozen environments due to melting on a global scale. In order to avoid the risk of losing exceptional cultural remains due to decomposition, predictive methodologies should be employed to locate areas of high archaeological potential. Here, we merge existing glaciological knowledge and methodologies with archaeological and historical information in GIS to gain a better understanding about how people interacted with frozen environments in the recent past, as well as to create a model to determine areas of high archaeological potential for the future based on glacier melting rates. Glacier outlines from the years 1850, 1973 and 2010, as well as topographic properties such as slope and aspect, will be compared to archaeological and historical databases to validate the relationship between artefact discoveries and glacial extents over time. Also, broad-scale (hypsometric modelling) and local-scale (mass balance modelling) approaches will be used to predict future glacial extents in order to specify locations where archaeological investigations should be conducted first.
Duration: 2011–14
Webpage: http://www.glacialarchaeology.com;
E-mail: Claude.Collet@unifr.ch, Stephanie.Rogers@unifr.ch

ICE SHEET MODELLING

Ice flow dynamics over Switzerland around the Last Glacial Maximum (LGM)
Project lead: Urs H. Fischer (Nagra); funded by Nagra; partners: IES UniGe, CoSci LLC
This modelling project involves the numerical reconstruction of the geometry and flow field of the Rhine Glacier during the last ice age (including LGM) as a basis for studying the influence of the ice thickness distribution in the Alps on local ice flow directions in the Alpine foreland. This is expected to enable a meaningful prediction of locations in northern Switzerland that are most likely to be occupied by concentrated flows of ice during future glaciations and hence most likely to be affected by glacial erosion.
Duration: 2011–14
E-mail: urs.fischer@nagra.ch

Modelling isochrone architecture
The aim of this project is to understand the influence of changes in ice flow and subglacial processes, in particular major subglacial melt or drainage events, upon englacial layer structure in

the Antarctic ice-sheet, as observed in RES data and thereby quantify former basal processes. To this aim, englacial layer architecture are simulated using numerical modelling and then compared with observed internal layers over regions where changing subglacial conditions are known to occur. Although ice dynamics has been recognised to be crucial for the ice loss from Antarctica (e.g. IPCC report 2007), there is still a lack of understanding of the role of subglacial melt, freeze-on and drainage on the flow of ice-sheets. The findings from this project will provide an important step forward towards understanding ice-sheet dynamics.
Duration: 2008–14
Project lead: Gwendolyn Leysinger Vieli (GIUZ); originally funded by Royal Society BP Dorothy Hodgkin Fellowship, now by MNF, UZH; partner: BAS
E-mail: gwendolyn.leysinger@geo.uzh.ch

GLACIER MONITORING AND MODELLING

Indian Himalayas Climate Adaptation Program (IHCAP)
Project lead: UNIGE; funded by Swiss Development and Cooperation Agency, Swiss Federal Ministry of Foreign Affairs; partners/collaborators Christian Huggel (UZH), Nadine Salzmann (GIUF), Fritz Schlunegger (UNIBE), Mario Rohrer (Meteodat GmbH)
The Indian Himalayan Climate Adaptation Program combines advanced scientific research, traditional and innovative knowledge of communities and action, and policy articulation at multiple levels with the objective of adding value by addressing climate change impacts and adaptation in the Indian Himalayas in a holistic manner. It responds to a Government of India dialogue with the Government of Switzerland for collaboration to promote climate resilient development in the Indian Himalayan Region by strengthening scientific capacity in India, both at the individual and institutional levels, and through land-use based community adaptation measures. The programme is designed to build resilience to climate change impacts at the community level in Indian Himalayan Region by focusing on innovative climate adaptation solutions integrated with indigenous knowledge and practices, with a focus on water-livelihood-food security for poverty reduction and on risk reduction to extreme events in the Indian Himalayan Region. The programme will also, at India's domestic policy level (state and national), enrich climate change policy dialogue and implementation focusing on adaptation, and work towards strengthening institutions and enhancing knowledge through networked solutions.
Duration: 2012–2015
Webpage: http://ihcap.in/;
E-mail: Markus Stoffel (markus.stoffel@unige.ch)

Modelling the response of seasonal snow cover to a changing climate: a study based on field observations and modelling in the arid and semi arid Andes of central Chile
Project lead: Hydrology and Water Resources Management, Institute of Environmental Engineering, ETHZ, funded by State Secretariat for Education and Research SWISS-CHILE Scientific & Technology Cooperation Fund; partners/collaborators: James McPhee, Gonzalo Cortes (University of Chile), Silvan Ragettli
In the arid and semi arid Andes of Central Chile, seasonal snow covers are the main source of summer streamflow, which originates from the interaction between snow and climate, the resulting melt and the process of runoff generation in the headwater catchments. The main objectives of this project are: (1) to understand the processes governing the accumulation of seasonal snowpack above 2500 m a.s.l. and its summer depletion caused by interaction with the climate forcing, and to model the two processes above as well as the formation of surface runoff; (2) to project variations in seasonal snow cover and runoff associated with a changing climate.
Duration: since 2011
Webpage: http://www.ifu.ethz.ch/hydrologie/research/research_projects/SER_Chile; E-mail: Francesca Pellicciotti (pellicciotti@ifu.baug.ethz.ch)

New monitoring techniques for understanding the response of very small glaciers to climate change
Very small glaciers (<0.5 km^2), often account for 80–90% of the number of glaciers within a mountain range. Although their total area and ice volume is comparably small, they significantly affect the hydrological cycle of poorly glacierized basins. There is yet a large uncertainty regarding the mass balance response, typical ice thickness, the dynamics and englacial temperatures of small glaciers.
We address the response of very small glaciers in the Swiss Alps to climate change. A main objective is testing, application and further development of new monitoring techniques. The potential of repeated terrestrial laser scanning to determine the annual ice volume change of small glaciers is investigated. On seven selected glaciers the ice thickness, seasonal surface mass balance, ice movement and ice temperatures will be monitored. These comprehensive field studies will provide a strengthened process understanding regarding the climate response of very small glaciers. The knowledge gained from

the field surveys will be used to enhance existing models for predicting future glacier evolution and assessing the impact of the likely disappearance of small glaciers on the alpine environment.
Duration: 2012–15
Project lead: Martin Hoelzle/Matthias Huss (GIUF); funded by: SNF
Webpage: http://www.unifr.ch/geoscience/geographie/en/research;
E-mail: matthias.huss@unifr.ch

Helicopter-borne GPR for mapping snow accumulation distribution
In high-alpine terrain snow depth can vary by one order of magnitude over distances of a few meters. This variability cannot yet be adequately captured by numerical models, and measurements of snow depth distribution in the field are laborious. Therefore, tools for easily identifying snow depth are required for a better understanding of the high spatial snow accumulation variability.
This project applies and further develops ground penetrating radar (GPR) techniques for detecting the snow depth distribution on glaciers. The GPR system is based on a helicopter thus allowing a fast, remote and reliable monitoring of snow accumulation in high alpine terrain providing an accurate mapping of the pattern of spatial variability in the snow cover. The helicopter-borne GPR technology is applied at two glacierized test sites (Findelengletscher and Colle Gnifetti, Switzerland). GPR measurement campaigns are accompanied by extensive ground-based validation (GPR, snow density, firn cores) for assessing the uncertainties. We investigate the potential of helicopter-borne GPR to detect firn layers of previous years, and thus past accumulation rates on alpine glaciers. In addition, new modelling approaches to calculate the spatial distribution of snow accumulation on glaciers are developed based on the process understanding gained from the high-resolution field data.
Duration: 2011–14
Project lead: Martin Hoelzle/Matthias Huss (GIUF; funded by: SNF; Partners: PSI, AWI
Webpage: http://www.unifr.ch/geoscience/geographie/en/research;
E-mail: matthias.huss@unifr.ch

SEON (Swiss Earth Observatory Network)
Project lead: M. Schaepmann (UZH); funded by State Secretariat for Education, Research and Innovation and ETH-Board; partners: UZH, ETHZ, EAWAG-AR, EMPA, Agroscope
The Swiss Earth Observatory Network is a competence centre to monitor status and functioning of Swiss ecosystems in a changing environment. An increasing demand for natural resources impacts important biotic and physical processes within the Earth system and causes complex interactions within terrestrial ecosystems. SEON pursues a holistic Earth system science approach to assess environmental change impacts on ecosystem functioning and considers complex feedback mechanisms between the Earth spheres, including the human impact.
The contribution of the University of Fribourg focuses on the use of albedo products from the air-borne multispectral imagery for glacier melt modelling and process understanding. In particular, the reasons for the presently observed darkening of alpine glacier surfaces, i.e. its components and drivers, will be investigated on several Swiss glaciers.
Duration: 2013–16
Webpage: http://www.seon.uzh.ch;
E-mail: matthias.huss@unifr.ch

Capacity Building and Twinning for Climate Observing Systems (CATCOS)
Project lead: M. Hoelzle (GIUF); funded by SDC (Swiss Agency for Development and Cooperation); partners: UZH, PSI, EMPA, MeteoSwiss
CATCOS is supported by the Swiss Agency for Development and Cooperation (SDC) with MeteoSwiss as the coordinating partner. In the context of the Global Climate Observing System (GCOS) and WMO Global Atmosphere Watch (GAW), the project stresses the need for improving climate observations world-wide, but particularly in developing countries and countries in transition. The University of Fribourg puts the main focus on the re-establishment glacier monitoring series at selected glaciers in the countries Kyrgyzstan and Uzbekistan. Glacier mass balance is determined using the conventional glaciological method, supported by new innovative approaches such as snowline cameras and modelling. Measurements and evaluations are performed in close collaboration with local scientists to allow knowledge transfer and capacity building.
Duration: 2011–13
Webpage: http://www.meteoschweiz.admin.ch/web/de/meteoschweiz/internationales/Internationale_Projekte/catcos.html;
E-mail: martin.hoelzle@unifr.ch

Glacier variations in southern South America: extension of the historical glacier record and connection to climate variability
Project lead: Samuel Nussbaumer (GIUZ); funded by SNF; partners: Mariano Masiokas (IANIGLA), Brian Luckman (UWO)
This interdisciplinary project provides new evidence to the South American glacier history and contributes to the PAGES (Past Global Changes) 2k Network on the reconstruction of

climate variability of the last two millennia. New, detailed and highly resolved glacier records, based on historical material, complemented with dendrogeomorphic studies are produced for selected study sites in southern South America. Observed glacier changes are analysed and interpreted regarding climate dynamics. This allows an assessment of the spatial pattern of glacier changes in southern South America, differentiating local effects from regional or larger-scale climate dynamics. Glaciers are excellent indicators for the public perception of climate change in mountainous areas, and information about ongoing glacier changes and related consequences are provided.
Duration: 2012–13
Webpage: http://www.geo.uzh.ch/~snus/research.htm; E-mail: samuel.nussbaumer@geo.uzh.ch

PERMAFROST

TEMPS (The temporal evolution of mountain permafrost in Switzerland)
Project lead: Christian Hauck, GIUF; funded by SNF; partners: UZH, ETHZ, UL, SLF Davos
Permafrost, defined as lithospheric material whose temperature remains below 0°C for two or more consecutive years, occurs in many high-mountain regions of the European Alps. To evaluate the sensitivity of mountain permafrost to climatic changes and to assess its future evolution, not only climatic variables such as air temperature, radiation and timing and duration of snow cover have to be considered, but also subsurface characteristics such as ground temperature, ice content, porosity and thermal and hydraulic properties. Permafrost monitoring in the Swiss Alps started only 1–2 decades ago, but currently comprises a large set of meteorological, geophysical, kinematic and ground thermal parameters, e.g. within the PERMOS network. The project TEMPS will integrate these data with model simulations using a dynamic process-oriented permafrost model. In combination with results from RCM simulations, TEMPS aims to create plausible evolution scenarios of mountain permafrost at specific sites and will investigate the interactions between atmosphere and permafrost focusing on the evolution of ground temperature, ice content and related degradation and creep processes. The overall objective of TEMPS is to improve the understanding of the vulnerability of mountain permafrost regions to climate changes and assess the potential impact at different field sites in the Swiss Alps. The project includes collaborations between atmospheric and cryospheric sciences, geomorphology, geophysics, geography and remote sensing.
Duration: 2011–15
Webpage: http://www.unifr.ch/geoscience/geographie/en/research;
E-mail: Christian.Hauck@unifr.ch

SOMOMOUNT (Soil moisture in mountainous terrain and its influence on the thermal regime in seasonal and permanently frozen terrain)
Project lead: Christian Hauck, GIUF; funded by: SNF
The water content of the near subsurface plays a major role not only regarding the energy and water budget of the soils and at the atmosphere-subsurface interface, but also regarding stability issues on sloping mountainous terrain. This includes the influence of water content on the thermal and hydraulic conductivity of frozen soil as well as the influence of latent heat during freeze and thaw processes. In spite of this importance, soil moisture is currently not measured operationally at middle or high altitudes, where a seasonally and perennially frozen subsurface (permafrost) prevails. The SOMOMOUNT project will close this gap regarding data availability and process understanding about the influence of spatially and temporally variable water content on the ground thermal regime in the context of freezing and thawing processes. The project aims at: 1) setting up a network of soil moisture monitoring stations at middle and high altitudes in Switzerland 2) applying innovative geophysical approaches to determine the 2-dimensional distribution of liquid water and ice content 3) using the coupled heat and mass transfer subsurface model COUP to estimate the influence of temporally and spatially changing soil moisture on the thermal regime of partly and permanently frozen ground.
Duration: 2013–16
Webpage: http://www.unifr.ch/geoscience/geographie/en/research;
E-mail: Christian.Hauck@unifr.ch

PERMASENSE: wireless sensing in high Alpine environments
L. Thiele, J. Beutel (ETHZ), S. Gruber (UZH), C. Tschudin (UBasel); funded by NCCR MICS (SNF) and FOEN; partners: see webpage
Permasense is a consortium of several individual projects linking electronic engineering and high-mountain research. In this project, wireless sensing infrastructure suitable for autonomous long-term operation in high-mountain environments is developed, tested, deployed and operated. Geo-science research addresses cryogenic rock movement, temperature and moisture dynamics in rock, weathering and fracturing of rock and its spatio-temporal patterns, and the understanding of snow cover variability.
Duration: 2006–13

Webpage: http://www.permasense.ch/home/about.html; E-mail: Stephan Gruber (stephan.gruber@geo.uzh.ch)

X-Sense/X-Sense2
Project lead: Lothar Thiele (ETHZ), Geoscience part: Andreas Vieli (UZH); funded by: nano-tera.ch (SNF); partners: ETHZ, FOEN, GAMMA
X-Sense/X-Sense2 is a large interdisciplinary project that focuses on the issue of slope stability in high mountain permafrost and combines geoscience with sensing system engineering. Within the project dependable wireless sensing technology is developed as a new scientific instrument for environmental sensing under extreme conditions. This includes continuous monitoring of surface movement and deformation, temperatures, seismic/acoustic signals and other environmental variables. Whereas X-Sense has mostly been focused on surface movement and the development of a robust wireless monitoring system, the follow-on project X-Sense2, will exploit MEMS technology in order to detect failure events.
Duration: X-Sense 2010–13, X-Sense2: 2013–17
Webpage: http://www.permasense.ch/projects/x-sense.html;
E-mail: Andreas Vieli, andreas.vieli@geo.uzh.ch

PERMOS: Swiss Permafrost Monitoring Network
Project lead: Jeannette Nötzli (GIUZ); funded by FOEN, MeteoSwiss, SCNAT; partners: see webpage
The Swiss network for permafrost monitoring documents the status and long-term variations of permafrost in the Swiss Alps. Three main elements are observed at sites on different landforms in varying topographic settings for a comprehensive analysis: (1) ground temperatures measured in boreholes and at the surface near to the drill site, (2) changes in subsurface ice and unfrozen water content at the drill sites by geo-electrical surveys, and (3) velocities of permafrost creep determined by geodetic surveys and photogrammetry.
Duration: Since 2000
Webpage: http://www.permos.ch;
E-mail: jeannette.noetzli@geo.uzh.ch)

TEMPS-B: Ground ice and water content estimation and integrative analysis of mountain permafrost monitoring elements (Subproject of TEMPS)
Project lead: C. Hilbich (GIUZ/UNIFR), J. Noetzli (GIUZ); funded by SNF Sinergia; partners: see webpage
Subproject B of the SNF-Sinergia project TEMPS 'The Evolution of Mountain Permafrost in Switzerland' aims at a process-oriented understanding of the landform-specific sensitivity of mountain permafrost (bedrock terrain, talus slopes, rock glaciers and ice-cored moraines) to climate anomalies by performing a joint analysis of a comprehensive set of surface and sub-surface temperature, geophysical, meteorological and kinematic monitoring data from already established permafrost sites in the Swiss Alps.
Duration: 2011–14
Webpage: http://www.unifr.ch/geoscience/geographie/en/research/cryosphere-and-geomorphology-project/temps;
E-mail: christin.hilbich@geo.uzh.ch, jeannette.noetzli@geo.uzh.ch

TEMPS-C
Project Lead: I. Gärtner-Roer (GIUZ), M. Philips (SLF), M. Schaepman (GIUZ); funded by SCNAT (Sinergia); partners: GIUF, UL, ETHZ, GIUO
The Project TEMPS-C is entitled: From kinematics to dynamics: geomorphic and physical controls of permafrost creep derived from airborne digital sensors and terrestrial surveys. The project includes field work (e.g. terrestrial geodetic survey, laser scanning), as well as data processing of remote sensing data and related accuracy analyses. Field work comprises a kinematic monitoring (using terrestrial surveys) conducted on different rock glaciers in the Alps. Data processing includes the analysis of aerial imagery, laser scanning and kinematic data from terrestrial surveys, as well as and the processing of stereoscopic high resolution imagery for the generation of elevation models and orthophotos. In addition thermal borehole data from different rock glaciers are analysed. Further work comprises the conceptualization of an adapted sediment budget approach describing sediment transfer rates using the multisensoral digital elevation data and field observations. The applied combination of laser scanning, stereophotogrammetry and geodetic survey calls for a systematic data assimilation and accuracy assessment. Finally, given findings should be included in an improved 1-D thermo-mechanically coupled model.
Duration: 2/2012-1/2015
Webpage: http://www.geo.uzh.ch/microsite/temps-c/; E-mail: isabelle.roer@geo.uzh.ch, Johann Müller (johann.mueller@geo.uzh.ch)

PermaWeather
Project lead: Markus Egli (UZH); funded by Germany/Austria/Switzerland; partners: University of Würzburg (Germany), ETHZ, University of Basel, Northern Arizona University
The investigations aim at estimating short- and long-term erosion/weathering of high Alpine soils. Two types of sites are considered: a) with and b) without permafrost. The following research question arose: (1) Are different erosion effects (short- to long-term) recognizable at sites with or

without permafrost? (2) Do chemical weathering processes differ? (3) Are the soil organic matter (SOM) stocks at sites that are influenced by permafrost really higher? (4) Are the SOM characteristics and ages of fractions at such sites different from sites having no permafrost? (5) What could be the effects of climate warming?
Chemical weathering and erosion rates are characterized using a multi-method approach. A cross-check of all the methods used will allow an extended interpretation and mutual control of the results. Novel or very recently developed methods (long-term erosion rates derived from meteoric ^{10}Be; short-term erosion rates determined using ^{137}Cs and Pu isotopes, spatial on-site detection of permafrost using a three-dimensional geophysical approach, ^{14}C dating of stable SOM are applied for the first time in high Alpine regions. The expected insights will lead to a better understanding of the processes of high mountain soils and are a further step towards deciphering processes at increasing system disequilibria.
Duration: 2011–15
Webpage: http://www.forschungsportal.ch/unizh/p13995.htm;
E-mail: Markus Egli (markus.egli@geo.uzh.ch)

ColdWeather
Large parts of the European Alps and Russia were glaciated during the last ice age and/or still show permafrost conditions. A main gap in knowledge exists about the velocity of mineral transformations and formation of soils in high alpine and arctic climate zones often having permafrost. A main aim of the project is to compare existing and new datasets on weathering and soil evolution in the Alps (Swiss and Italian Alps), the Altai mountains (Siberia, Russian Altai) and the Polar Urals (Russia). In addition, datasets from the Wind River Range (Rocky Mountains, USA) will be available. A main focus is given on soil and landscape evolution covering decades to millennia (Holocene/Pleistocene) to derive weathering rates and mineralogical transformations under different environmental settings in cold regions (cold/humid to cold/arid). The Altai mountains and partially the Wind River Range occupy a bioclimatic niche between a humid and cryoarid tundra. In contrast, the Alps and the Ural have a more humid climate. Due to climate change (warmer/drier climate in many northern regions), a hypothesis is, among others, that soils of northern areas of Eurasia would tend to change and become similar to the Altai/Wind River Range mountains soils.
Duration: 2011–14
Project lead: Markus Egli (UZH), funded by ERA.Net-RUS (Scientific & Technological Cooperation Programme Switzerland–Russia), partner: St Petersburg State University (Russia)
Webpage: http://www.forschungsportal.ch/unizh/p16071.htm;
E-mail: Markus Egli (markus.egli@geo.uzh.ch)

HYDROLOGY

Influence of hydrologic transients on glacial erosion
Project lead: Urs H. Fischer (Nagra); funded by Nagra; partners: ES SFU
The objective of this project is to make a robust model-based assessment of whether it is important to include sub-annual transient behaviour in the glacier drainage system to accurately model glacial erosion rates; specifically (1) to assess the significance of diurnal to seasonal variations in basal water pressure on sliding rates integrated over long time scales, (2) to examine how the representation of hydrology and sliding within an ice-flow model influences integrated sliding rates, and (3) to explore the combined influences of the above (transient hydrology and process representation) on calculated erosion rates.
Duration: 2013
E-mail: urs.fischer@nagra.ch

MONTANAQUA (Approaching water stress in the Alps – water management options in the Crans–Montana–Sierre Region, Valais)
Climate change as well as societal and economic development will significantly modify the offer and consumption of water, and consequently fuel conflicts of interest. Dry valleys in the Alps will be particularly affected, as water will become even scarcer in these regions. In close collaboration with local authorities and stakeholders involved in the water sector of the study area, the Crans–Montana–Sierre region, the project aims at developing solutions required for a more sustainable and balanced water management and distribution. Specific goals are: (1) evaluation of present/future water availability – in particular, the Plaine Morte Glacier and water diversion systems are examined; (2) evaluation of water use by different user groups taking societal and economic changes into consideration – thus possible areas of conflict are identified; (3) evaluation of practical organization of water management and development of options for a more adequate water distribution.
The cooperation of specialists from different disciplines and universities help to better understand the involved processes and to develop new knowledge in the field of water management. The collaboration with local and regional authorities and stakeholders provides solutions that are practicable and acceptable.
Duration: 2010–13

Project lead: R. Weingartner (UNIBE; funded by: SNF; partners: UNIBE, UL, SISKA
Webpage: http://www.nfp61.ch;
E-mail: matthias.huss@unifr.ch

ASG Rhein: Abflussanteile Schnee und Gletscher
Project lead: Kerstin Stahl (GIUF); funded by KHR; partners: Markus Weiler (GIUF), Jan Seibert (UZH), Kai Gerlinger (HYDRON GmbH Karlsruhe), Jörg Belz (BfG, Koblenz), David Finger (UZH), Mario Böhm (HYDRON, Karlsruhe), Daphné Freudiger, Andreas Steinbrich (GIUF)
Snow and glacier melt have different impacts on river flow dynamics. The ice-melt component holds the river regime relatively constant, while snow and rain components cause higher interannual variability. As a consequence of climate change the fraction of ice and snowmelt in river flows have changed and will further change in the future. In this project, the snow and glacier melt contribution to the discharge of the river Rhine and its tributaries will be estimated with a combination of different meteorological, glaciological and hydrological data analysis and model simulations at different scales. The headwater basins will be modelled with a transient semi-distributed coupled glacier–snow–hydrology-model based on HBV. These modelled discharge components are then used as input to the large-scale hydrological water balance model LARSIM, which is already used operationally to predict discharge in the Rhine. The climatic variability of the last 100 years will be used to quantify the discharge components and to correctly identify the driving parameters. The model includes reservoirs and partly regulated lakes, since a complex hydraulic system with lakes reacts differently when the discharge dynamics change as a result of climate change.
Duration: 2012–14
Webpage: http://ihf-projektplattform.uni-freiburg.de/asgrhein;
Contact: Jan Seibert (UZH)

ACQWA
Project Lead: Martin Beniston (UNIGE); funded by EU FP7; 30 academic partners in Europe, Chile, Argentina and Kyrgyzstan, including: UNIGE, ETHZ, UNIBE, Agroscope-Reckenholz, Max-Planck-Institute for Meteorology (Hamburg), CNRS (Grenoble and Paris), LSCE-Paris, University of Birmingham, University of Dundee, University of l'Aquila, ICTP-Trieste, ISAC-Turin, ENEL-Rome, University of Graz, BOKU-Vienna. Full list at webpage
Future shifts in temperature and precipitation patterns, and changes in the behaviour of snow and ice in many mountain regions will change the quantity, seasonality, and possibly also the quality of water originating in mountains and uplands. As a result, changing water availability will affect both upland and populated lowland areas. Economic sectors such as agriculture, tourism or hydropower may enter into rivalries if water is no longer available in sufficient quantities or at the right time of the year. The challenge is thus to estimate as accurately as possible future changes in order to prepare the way for appropriate adaptation strategies and improved water governance. The project seeks to assess the vulnerability of water resources in mountain regions such as the European Alps, the Central Chilean Andes, and Central Asia, where declining snow and ice are likely to strongly affect hydrological regimes in a warmer climate. Model results are then used to quantify the environmental, economic and social impacts of changing water resources in order to assess how robust current water governance strategies are and what adaptations may be needed in order to alleviate the most negative impacts of climate change on water resources and water use.
Duration: 2008–13
Webpage: www.acqwa.ch;
E-mail: Martin.Beniston@unige.ch, Markus.Stoffel@unige.ch

ICE CORES

Accelerated release of persistent organic pollutants (POPs) from Alpine glaciers
Project lead: Konrad Hungerbühler (ETHZ); funded by SNF, BAFU; partners: S&E ETHZ, VAW/ETHZ, EMPA, EAWAG-SG, PSI
Melting Alpine glaciers represent an important secondary source of persistent organic pollutants that were previously deposited to and incorporated into glaciers and are now released to the environment due to the rapid melting. In the frame of an interdisciplinary project, including the fields of glaciology, analytical chemistry, sedimentology, and environmental fate modelling, the complete chain of processes affecting these hazardous chemicals in temperate Alpine glaciers is investigated.
Duration: 2010–14
Webpage: http://www.sust-chem.ethz.ch/research/groups/prod_assessment/Projects/GlazioPOP;
E-mail: Margit Schwikowski (margit.schwikowski@psi.ch)

Radiocarbon dating of ice from a Kilimanjaro plateau glacier
Palaeoclimate reconstructions based on six ice cores assigned a basal age of 11'700 years to the Northern Icefield on Kilimanjaro. Another study claims that plateau glaciers on Kilimanjaro are subject to recurring cycles of waxing and waning controlled primarily by atmospheric moisture. An

absence of the ice bodies was reconstructed for the period around 850 years ago. In this project we aim to apply a novel approach using carbonaceous aerosols contained in the ice for radiocarbon dating to help resolving the current debate about the age of the Kilimanjaro plateau glaciers.
Duration: 2013–14
Project lead: Margit Schwikowski (PSI); funded by: SNF
Webpage: http://p3.snf.ch/Project-144388;
E-mail: margit.schwikowski@psi.ch

Palaeo climate reconstruction from Tsambagarav ice core, Mongolian Altai
In order to place recent climate change in a longer term context the reconstruction of climatic variations on annual, interannual, and decadal time scales of the last 1000 years is a priority target in current climate research. This project aims to reconstruct different climate parameters using an ice core from a high-alpine glacier at a very continental site with low data coverage, the Tsambagarav massif in the Altai mountain range in Central Asia.
Duration: 2010–13
Project lead: Margit Schwikowski (PSI); funded by SNF; partners: Department of Geosciences of the University of Fribourg, Institute for Water and Environmental Problems SB RAS, Barnaul, Russia
Webpage: http://p3.snf.ch/Project-134564;
E-mail: margit.schwikowski@psi.ch

REMOTE SENSING

CryoLand
Project lead: Thomas Nagler (ENVEO), Andreas Wiesmann (GAMMA); funded by EU FP7; partners: see webpage
CryoLand is aimed at developing, implementing and validating a standardized and sustainable service on snow and land ice monitoring as a Downstream Service within GMES in a value added chain with the Land Monitoring Core Services. The contribution of GAMMA () is related to the improvement and validation of products on glaciers surface velocity and on glacial lakes outlines and the development of tools for the use of Sentinel-1 for the derivation of snow products.
Duration: 2011–15
Webpage: http://www.cryoland.eu/; E-mail: thomas.nagler@enveo.at; wiesmann@gamma-rs.ch

Accelerated release of persistent organic pollutants (POPs) from Alpine glaciers
Project lead: Martin Lüthi (ETHZ); funded by SNF; partners: Safety & Environmental Technology Group, ETH Zurich; Laboratory for Radiochemistry & Environmental Chemistry, PSI; Laboratory for Analytical Chemistry, EMPA; Institute of Geological Sciences, Bern
In this project the transport of water within temperate ice and processes affecting the fate of POPs, including deposition on, incorporation into, transport within, and release from glaciers, is investigated and quantified.
Duration: 2011–14
Webpage: http://www.vaw.ethz.ch/people/gz/luethim/projects/data/gz_pop;
E-mail: martin.luethi@geo.uzh.ch

Future glacier evolution and consequences for the hydrology (FUGE)
Project lead: Martin Funk (ETHZ); funded by SNF ; partners: IfU/ETHZ, UNIGE
The expected reduction of ice volume in the Alps will lead to higher or reduced annual runoff depending on the time scale considered and the glacierized area of the drainage basin. Changes in runoff characteristics of high mountain catchments will pose a new challenge to water resource management. The productivity of hydropower systems relying on winter accumulation and summer melt will be affected by these changes and adaptive measures will be necessary for the management of the hydro installations. This project will address these questions in close collaboration with some hydropower companies in Switzerland.
Duration: 2011–14
Webpage: http://www.vaw.ethz.ch/people/gz/funk/projects/data/gz_fuge;
E-mail: funk@vaw.baug.ethz.ch

Subglacial controls on the short term dynamics at the margins of the Greenland Ice Sheet
Project lead: Martin Lüthi (ETHZ); funded by SNF; partners: UTA; DC; NASA-G; LANL
The aim of this project is a better understanding of the processes responsible for peripheral thinning and seasonal flow velocity variations of the marginal areas of the Greenland Ice Sheet. In a coordinated international and interdisciplinary effort we collected a unique body of in situ measurements along a flow line in the ablation area downstream of Swiss Camp (West Greenland). Boreholes to the bedrock were instrumented to obtain information on processes at the ice–bedrock interface, the thermal structure, internal deformation and layering within the ice body. These data sets were complemented by high-time-resolution measurements of surface motion, climate parameters and seismicity.
Duration: 2011–14
Webpage: http://www.vaw.ethz.ch/people/gz/luethim/projects/data/gz_rogue;
E-mail: martin.luethi@geo.uzh.ch

Subglacial controls on the short term dynamics at the margins of the Greenland Ice Sheet: seismic experiments
Project lead: Martin Lüthi (ETHZ); funded by ETH research grant; partners: UTA, DC, NASA-G; LANL; SED
This project includes the deployment of a high-density seismic network in Greenland's ablation zone The seismic analysis consists of performing a seismic noise tomography and determining icequake source mechanisms. This provides valuable information about englacial water flow, basal and englacial shear motion in response to changes in englacial water storage in response to basal water pressure fluctuations.
Duration: 2011–14
Webpage: http://www.vaw.ethz.ch/people/gz/luethim/projects/data/gz_rogue_seismic;
E-mail: martin.luethi@geo.uzh.ch

ESA DUE GlobSnow 1 and 2
Project lead: Jouni Pulliainen (FMI); funded by ESA; partners: ENVEO, GAMMA, UNIBE, SYKE, NR, Meteoschweiz, Environment Canada, FMI, Norut, ZAMG
The aim of the ESA DUE GlobSnow project is the production of global long term records of snow parameters intended for climate research purposes on hemispherical scale. The GlobSnow snow datasets contain satellite-retrieved information on snow extent (SE featuring Fractional Snow Cover, FSC) and snow water equivalent (SWE) extending as far to the past as feasible using the selected sensor-families. The current SE dataset is based on optical data from Envisat AATSR and ERS-2 ATSR-2 sensors covering the Northern Hemisphere between 1995 and 2012. The SWE record is based on the time series of measurements by two different space-borne passive microwave sensors (SMMR and SSM/I) spanning 1979 to 2012. The objective of the GlobSnow-2 project is further enhancement of the retrieval methodologies for SE and SWE products and a re-processing of the long-term datasets utilizing the improved retrieval algorithms. In addition to the further development of methodologies for the legacy sensor families of GlobSnow-1, the consortium will investigate the utilization of AVHRR and NPP Suomi VIIRS data as gap fillers before the launch of the Sentinel-3 SLSTR-sensor. Also the development of a new product combining the high resolution SE data with the lower resolution SWE product will be an area of focus for GlobSnow-2.
Duration: 2008–14
Webpage: http://www.globsnow.info/;
E-mail: Jouni.Pulliainen@fmi.fi

Glaciers_cci
Project lead: Frank Paul, GIUZ, frank.paul@geo.uzh.ch; funded by: ESA; partners: ENVEO, GAMMA, GUIO, SEEL
During the 3-year phase 1 of the ESA CCI project, the major goal of the Glaciers_cci sub-project is to develop and implement automated algorithms for generation of the three products glacier outlines, elevation changes and velocity fields. These activities will be performed in close collaboration with a dedicated climate research group and a climate modelling user group (CMUG). Special emphasis will be on quality assessment and definition of data standards to enhance the integrity of existing datasets by round-robin experiments. Product generation will focus on key regions which are given by current data demands (e.g. existing gaps in the world glacier inventory).
Duration: 2011–13
Webpage: http://www.esa-glaciers-cci.org/;
E-mail: frank.paul@geo.uzh.ch)

ice2sea
Project lead: David Vaughan (BAS); funded by: EU FP7; partners: see webpage
The contribution of UZH is mainly related to two sub-workpacks, WP3.3 and WP 5.3. WP3.3. is related to the generation of an improved database of glaciers and icecaps for global scale calculations (led by T. Bolch). In WP 5.3 distributed glacier mass balance models that operate on a regional scale and that can be driven by climate model output are used to improve projections of future glacier change (led by H. Machguth). The ultimate goal is to couple the datasets generated in WP 3.3 to the results of WP 5.3 for improved global scale assessments of future glacier evolution and melt.
Duration: 2009–13
Webpage: http://www.ice2sea.eu/; E-mail: david.vaughan@bas.ac.uk; contact at GIUZ: Frank Paul (frank.paul@geo.uzh.ch)

CLIMATE CHANGE ADAPTATION

CCA-DRR Peru
Project lead: Christian Huggel, Nadine Salzmann (GIUZ); funded by SDC; partners: Meteodat GmbH, EPFL, CARE Peru
Local Andean communities are especially vulnerable to, and affected by climate change impacts and related hazardous processes such as lake outburst floods, mud/debris flows, or large rock/ice avalanches. The project aims at supporting communities and institutions to adapt to new situations beyond historical experience and follows a three-level strategy:
Local level: Case study at the glacier lake Laguna 513 in the Cordillera Blanca focusing on glacial

risks and setting up an early warning system and a feasibility study for a multi-purpose project (e.g. water management, risk reduction of natural hazards, power generation).
Academic level: Enforcement of academic capacity building by new postgraduate/master courses in glaciology, climate change and high-mountain risk management in collaboration with three Peruvian universities.
Institutional level: Strengthening of glaciology in Peru by supporting key institutions in terms technologies and methodologies of climate change-related glacier and integral high-mountain monitoring and by a constant exchange through international networks.
The three-year project consists of a Peruvian part, coordinated by the local NGO 'CARE', and including local, regional and national authorities; and of a Swiss part, led by the University of Zurich.
Duration: 2011–14
E-mail: Christian Huggel
(christian.huggel@geo.uzh.ch)

NELAK
Project lead: Wilfried Haeberli (GIUZ); funded by SNF (NFP61); partners: see webpage
As a consequence of rapid glacier vanishing, an increasing number of smaller and larger lakes are forming in high-mountain regions worldwide. Such new lakes can be tourist attractions and may also represent interesting potentials for hydropower production. However, they more and more often come into existence at the foot of very large and steep icy mountain walls, which are progressively destabilizing due to changing surface and subsurface ice conditions. The probability of large flood and debris flow catastrophes caused by impact waves from large rock/ice avalanches into lakes may still appear to be small now but steadily increases for long time periods to come. Based on a DEM 'without glaciers' and a corresponding map of potential future lake sites, the interdisciplinary project NELAK attempts at establishing a knowledge basis for planning the sustainable use of the new lakes in the Swiss Alps. Aspects of hazard prevention, hydraulic engineering, landscape protection, tourism as well as of legal questions are investigated. A concept for integral risk assessment is developed and the corresponding tools examined.
Duration: 2010–13
Webpage: www.nfp61.ch/E/projects/cluster-hydrology/lakes_melting_glaciers/Pages/default.aspx;
E-mail: Wilfried Haeberli (wilfried.haeberli@geo.uzh.ch)

Frank Paul

ABBREVIATIONS

ACQWA	Assessing climate impacts on the quantity and quality of water
ARIA S.A.	Archéologie et Recherches Interdisciplinaries dans les Alpes
AWI	Alfred Wegener Institute
BAFU	Federal Office for the Environment
BAS	British Antarctic Survey, Cambridge
BOKU	Universität für Bodenkultur, Vienna
CCA-DRR Peru	Climate Change Adaptation and Disaster Risk Reduction related to deglaciation in the Andes of Cusco and Ancash, Peru
CCES	Competence Center Environment and Sustainability
CCI	Climate Change initiative
CNRS	Centre National de la Recherche Scientifique, France
CoSci LLC	Cohen Scientific LLC, Shorewood, WI
D-A-CH	Germany-Austria-Switzerland
DC	Dartmouth College, Hanover, NH
DUE	Data User Element
EAWAG-AR	Aquatic Research
EAWAG-SG	Sedimentology Group
EDYTEM	Environnements, Dynamiques et Territoires de la Montagne, France
EMPA	Swiss Federal Laboratories for Material Science and Technology
ENEL	Ente Nazionale dell' Electricità (Italian Public Electricity Utility)
ENVEO	ENVEO IT GmbH, Innsbruck, Austria
EPFL	École Polytechnique Fédérale de Lausanne
ERA.Net-RUS	Scientific & Technological Cooperation Programme Switzerland-Russia
ES SFU	Department of Earth Sciences, Simon Fraser University
ESA	European Space Agency
ETHZ	Swiss Federal Institute of Technology, Zurich
EU FP7	European Union 7th Framework Programme
FMI	Finnish Meteorological Institute
FO-DTS	Fibre Optic Distributed Temperature Sensing
FOEN	Federal Office of the Environment, Bern
GAMMA	Gamma Remote Sensing and Consulting AG, Gümligen
GeoSheffield	Department of Geography, University of Sheffield
GEOT	Geotest, Bern
GIUB	Institute of Geography, University of Berne

GIUF	Department of Geosciences, University of Fribourg
GIUZ	Department of Geography, University of Zurich
GPR	Ground Penetrating Radar
GUIO	Department of Geosciences, University of Oslo
IANIGLA	Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales
ICTP	International Centre for Theoretical Physics
IES UniGe	Institute of Environmental Sciences, University of Geneva
IPCC	Intergovernmental Panel on Climate Change
ISAC	Institute for the Study of the Atmosphere and Climate
KHR	Internationale Kommission für die Hydrologie des Rheingebietes
LANL	Los Alamos National Laboratories, Los Alamos, NM
LGGE	Laboratoire de Glaciologie et Géophysique de l'Environnement, Grenoble
LSCE	Laboratoire pour les Sciences du Climat et de l'Environnement
MeteoSwiss	Federal Office of Meteorology and Climatology, Zurich
MICS	Mobile Information and Communication Systems
MNF	Faculty of Science
Nagra	National Cooperative for the Disposal of Radioactive Waste
NASA-G	NASA Goddard SFC, Greenbelt, MD
NCCR	National Centres of Competence in Research
NELAK	New Lakes in Deglaciating High-Mountain Regions – Climate-Related Development and Challenges for Sustainable Use
NR	Norwegian Computing Centre
OSU	Oregon State University
PERMOS	Permafrost Monitoring Switzerland
PHZ	Pädagogische Hochschule Zürich
POP	persistent organic pollutants
PSI	Laboratory of Radiochemistry and Environmental Chemistry, Paul Scherrer Institut
RCM	Regional Climate Models
RES	Radio Echo Sounding
ROGUE	Real-time Observation of the Greenland Under-ice Environment
S&E ETHZ	Safety & Environmental Technology Group, ETH Zurich
SCNAT	Swiss Academy of Sciences
SDC	Swiss Agency for Development and Cooperation
SED	Swiss Seismological Service
SEEL	School of Earth and Environment, University of Leeds
SEON	Swiss Earth Observatory Network
SISKA	Swiss Institute for Speleology and Karst Studies
SLF	WSL Institute for Snow and Avalanche Research
SNF	Swiss National Science Foundation
SSE MMU	School of Science and Environment, Manchester Metropolitan University
SYKE	Finnish Environment Institute
TBKB	Tiefbauamt des Kantons Bern
TEMPS	The Evolution of Mountain Permafrost in Switzerland
UIBK	Institute of Geology, University of Innsbruck
UJFG	Université Joseph Fourier, Grenoble
UL	University of Lausanne
UNIBE	University of Bern
UNIGE	University of Geneva
USCA	Université de Savoie, Chambéry, Annecy
UTA	University of Texas, Austin, TX
UU	University of Utah
UWO	University of Western Ontario
UZH	University of Zurich
VAW/ETHZ	Laboratory of Hydraulics, Hydrology and Glaciology, ETH Zurich
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
ZAMG	Zentralanstalt für Meteorologie und Geodynamik

International Glaciological Society

JOURNAL OF GLACIOLOGY

Papers accepted for publication between 1 October and 31 December 2013. The papers are listed in alphabetical order by first author. Some of these papers have already been published.

Jakob Abermann, Christophe Kinnard, Shelley MacDonell
Albedo variations and the impact of clouds on glaciers in the Chilean semi-arid Andes

Matthew J. Beedle, Brian Menounos, Roger Wheate
An evaluation of mass-balance methods applied to Castle Creek Glacier, British Columbia, Canada

Alexandre Bevington, Luke Copland
Characteristics of the last five surges of Lowell Glacier, Yukon, Canada, since 1948

J. Rachel Carr, Chris R. Stokes, Andreas Vieli
Recent retreat of major outlet glaciers on Novaya Zemlya, Russian Arctic, influenced by fjord geometry and sea-ice conditions

L. Maclagan Cathles, Dorian S. Abbot, Douglas R. MacAyeal
Intra-surface radiative transfer limits the geographic extent of snow penitents on horizontal snowfields

M. Craven, R.C. Warner, B.K. Galton-Fenzi, L. Herraiz-Borreguero, S.W. Vogel, I. Allison
Platelet ice attachment to instrument strings beneath the Amery Ice Shelf

Indrani Das, Regine Hock, Etienne Berthier, Craig S. Lingle
21st-century increase in glacier mass loss in the Wrangell Mountains, Alaska, USA, from airborne laser altimetry and satellite stereo-imagery

Hernán de Angelis
Hypsometry and sensitivity of the mass balance to changes in equilibrium-line altitude: the case of the Southern Patagonia Icefield

Thomas Feistl, Peter Bebi, Michaela Teich, Yves Bühler, Marc Christen, Kurosch Thuro, Perry Bartelt
Observations and modeling of the braking effect of forests on small and medium avalanches

Prateek Gantayat, Anil V. Kulkarni, J. Srinivasan
Estimation of ice thickness using surface velocities and slope: case study at Gangotri glacier, India

Rianne H. Giesen, Liss M. Andreassen, Johannes Oerlemans, Michiel R. van ven Broeke
Surface energy balance in the ablation zone of Langfjordjøkelen, an arctic maritime glacier in northern Norway

Robert L. Hawley, Zoe R. Courville, Laura M. Kehrl, Eric R. Lutz, Erich C. Osterberg, Thomas B. Overly, Gifford J. Wong
Recent accumulation variability in northwest Greenland from ground-penetrating radar and shallow cores along the Greenland inland traverse

Guillaume Jouvet, Martin Funk
Modelling the trajectory of the corpses of mountaineers who disappeared in 1926 on Aletschgletscher, Switzerland

Laura M. Kehrl, Robert L. Hawley, Erich C. Osterberg, Dominic A. Winski, Alexander P. Lee
Volume loss from lower Peyto Glacier, Alberta, Canada, between 1966 and 2010

Thomas Kleiner, Angelika Humbert
Numerical simulations of major ice streams in western Dronning Maud Land, Antarctica, under wet and dry basal conditions

Bess G. Koffman, Michael J. Handley, Erich C. Osterberg, Mark L. Wells, Karl J. Kreutz
Dependence of ice-core relative trace-element concentration on acidification

Peter Kuipers Munneke, Stefan R.M. Ligtenberg, Michiel R. van den Broeke, David G. Vaughan
Firn air depletion as a precursor of Antarctic ice-shelf collapse

Astrid Lambrecht, Christoph Mayer, Vladimir Aizen, Dana Floricioiu, Arzhan Surazakov
The evolution of Fedchenko glacier in the Pamir, Tajikistan, during the past eight decades

Adrian McCallum
Cone penetration testing (CPT) in Antarctic firn: an introduction to interpretation

Carlos Martín, G. Hilmar Gudmundsson, Edward C. King
Modelling of Kealey Ice Rise, Antarctica, reveals stable ice-flow conditions in East Ellsworth Land over millennia

D. Samyn, N. Azuma, I. Matsuda, Y. Osabe
Novel shearing apparatuses in confined flow for investigating recrystallization and fabric evolution processes in mono- and polycrystalline ice

Stefan Schleef, Matthias Jaggi, Henning Löwe, Martin Schneebeli
An improved machine to produce nature-identical snow in the laboratory

Dirk van As, Morten Langer Andersen, Dorte Petersen, Xavier Fettweis, Jan H. van Angelen, Jan T. M. Lenaerts, Michiel R. van den Broeke, James M. Lea, Carl E. Bøggild, Andreas P. Ahlstrøm, Konrad Steffen
Increasing meltwater discharge from the Nuuk region of the Greenland ice sheet and implications for mass balance (1960–2012)

Lin Wang, Zhongqin Li, Feiteng Wang, Ross Edwards
Glacier shrinkage in the Ebinur Lake Basin, Tien Shan, China, during the last 40 years

C. Rosie Williams, Richard C. A. Hindmarsh, Robert J. Arthern
Calculating balance velocities with a membrane stress correction

Ming-Ko Woo, Kathy L. Young
Disappearing semi-permanent snow in the High Arctic and its consequences

A.P. Wright, D.A. Young, J.L. Bamber, J.A. Dowdeswell, A.J. Payne, D.D. Blankenship, M.J. Siegert
Subglacial hydrological connectivity within the Byrd Glacier catchment, Antarctica

Liyun Zhao, Lide Tian, Thomas Zwinger, Ran Ding, Jibiao Zong, Qinghua Ye, John C. Moore
Numerical simulations of Gurenhekou glacier on the Tibetan Plateau

ANNALS OF GLACIOLOGY 55(65)

The following paper has been selected for publication in Annals of Glaciology *55(65) (thematic issue on Advancing clean technologies for exploration of glacial aquatic ecosystems), edited by Peter Doran*

W.C. Stone, B. Hogan, V. Siegel, S. Lelievre, C. Flesher
Progress towards an optically powered cryobot

More papers for *Annals* 55(65) will be listed in the next issue

ANNALS OF GLACIOLOGY 55(67)

The following papers have been selected for publication in Annals of Glaciology *55(67) (thematic issue on Radioglaciology), edited by David Braaten*

David Bekaert, Nicolas Gebert, Chung-Chi Lin, Florence Hélière, Jørgen Dall, Anders Kusk, Steen Savstrup Kristensen
Multi-channel surface clutter suppression: East Antarctica P-band SAR ice sounding in the presence of grating lobes

Daniel Farinotti, Edward C. King, Anika Albrecht, Matthias Huss, G. Hilmar Gudmundsson
The bedrock topography of Starbuck Glacier, Antarctic Peninsula, as determined by radio-echo soundings and flow modeling

Robert W. Jacobel, Knut Christianson, Adam Wood, Kevin Dallasanta, Rebecca Gobel
Morphology of basal crevasses at the grounding zone of Whillans Ice Stream, West Antarctica

More papers for *Annals* 55(67) will be listed in the next issue

ANNALS OF GLACIOLOGY 55(66)

The following papers have been selected for publication in Annals of Glaciology *55(66) (thematic issue on Changes in glaciers and ice sheets: observations, modelling and environmental interactions), edited by Douglas R. MacAyeal and Weili Wang*

Eleanor A. Bash, Shawn J. Marshall
Estimation of glacial melt contributions to the Bow River, Alberta, Canada, using a radiation–temperature melt model

Alexey A. Ekaykin, Anna Kozachek, Vladimir Ya. Lipenkov, Yu. A. Shibaev
Multiple climate shifts in the Southern Hemisphere over the past three centuries based on glaciological and geochemical investigations in central Antarctic snow pits and ice cores

M.J. Fried, C.L. Hulbe, M.A. Fahnestock
Grounding-line dynamics and margin lakes

Jing Gao, Tandong Yao, Daniel Joswiak
Variations of water stable isotopes ($\delta^{18}O$) in two lake basins, southern Tibetan Plateau

Fengming Hui, Tianyu Ci, Xiao Cheng, Ted A. Scambos, Yan Liu, Yanmei Zhang, Zhaohui Chi, Huabing Huang, Xianwei Wang, Fang Wang, Chen Zhao, Zhenyu Jin, Kun Wang
Mapping blue-ice areas in Antarctica using ETM+ and MODIS data

Shangguan Donghui, Liu Shiyin, Ding Yongjian, Wu Lizong, Deng Wei, Guo Wanqin, Wang Yuan, Xun Junli, Yao Xiaojun, Guo Zhilong, Zhu Wanwan
Glacier changes in the Koshi River basin, central Himalaya, from 1976 to 2009, derived from remote-sensing imagery

Liqiong Shi, Zhijun Li, Fujun Niu, Wenfeng Huang, Peng Lu, Enmin Feng, Hongwei Han
Thermal diffusivity of thermokarst lake ice in the Beiluhe basin of the Qinghai–Tibetan Plateau

Weijun Sun, Xiang Qin, Wentao Du, Weigang Liu, Yushuo Liu, Tong Zhang, Yuetong Xu, Qiudong Zhao, Jinkui Wu, Jiawen Ren
Ablation modeling and surface energy budget in the ablation zone of Laohugou Glacier No. 12, western Qilian Mountains, China

Hongzhen Tian, Tiabao Yang, Qinping Liu
Climate change and glacier area shrinkage in the Qilian Mountains, China, from 1956 to 2010

C. Vincent, M. Harter, A. Gilbert, E. Berthier, D. Six
Future fluctuations of Mer de Glace, French Alps, assessed using a parameterized model calibrated with past thickness changes

Chaomin Wang, Shugui Hou, Hongxi Pang, Yaping Liu, Heinz W. Gäggeler, Leonhard Tobler, Sönke Szidat, Edith Vogel
210Pb dating of the Miaoergou ice core from the eastern Tien Shan Mountains, China

Jiahong Wen, Long Huang, Weili Wang, T.H. Jacka, Volkmar Damm, Yan Liu
Ice thickness over the southern limit of the Amery Ice Shelf and reassessment of the mass balance of the central portion of the Lambert Glacier–Amery Ice Shelf system

Hongbo Wu, Ninglian Wang, Xi Jiang, Zhongming Guo
Variations in water level and glacier mass balance in Nam Co lake, Nyainqentanglha Range, Tibetan Plateau, based on ICESat data for 2003-09

Hao Xu, Shugui Hou, Hongxi Pang
Asian–Pacific Oscillation signal from a Qomolangma (Mount Everest) ice-core chemical record

Annals 55(66) is now complete

Radioglaciology in Kansas

A report on the IGS conference on 'Radioglaciology'

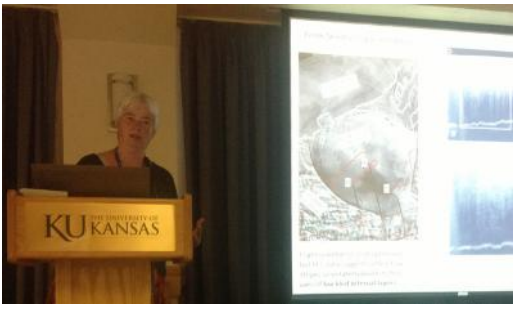
Lawrence, Kansas, USA, 9–13 September 2013

The symposium on Radioglaciology held in Lawrence, Kansas, in September 2013, came together on a hot but breezy day atop the distinguished Oread Hotel in the center of campus on Sunday evening, with the opening of the Icebreaker and registration. Delegates from 15 countries converged on this spot for four days of exchange followed by a half-day workshop on polar aircraft (manned and unmanned) technology for use in glaciological research. The symposium formally started with an inspiring keynote address by Richard Alley on 'Ice sheets and sea level: data, models and ways forward.' This kicked off 11 oral sessions and one poster session on a variety of topics that are touched by the powers of radioglaciology: Instruments and Methods, Data and Signal Processing, Ice Physical and Chemical Properties, Internal Layers, Basal Conditions, Modeling, Bed Maps and Accumulation. In addition to Alley's keynote presentation, there were invited talks by David Crandall (Automatic identification of ice layers in radar echograms), Richard Hindmarsh (Using radar layer data in ice-sheet models) and Jay Zwally (Antarctic ice-sheet mass gains exceeded losses: by how much and why?). The poster session, held on Tuesday afternoon, featured detailed presentations on new techniques, reports on projects in progress and visions of how ice-sheet flow dynamics may be creating the complex layers routinely observed in modern radioglaciology. As is now commonplace at IGS symposia, a meeting of APECS was held, featuring the sage advice of David Braaten, Doug MacAyeal, Magnús Magnússon, Kenichi Matsuoka, Wolfgang Rack and Leigh Stearns.

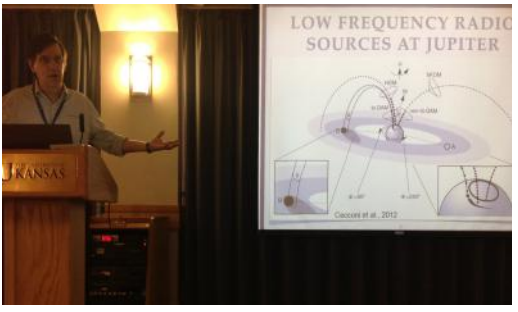
The symposium was well attended.

In addition to a full, intriguing program of talks and posters, the week's symposium also featured chances for glaciologists to socialize and share informal conversations. In addition to various private evening meals and pub visits, we enjoyed a pair of mid-week symposium excursions, a barbecue at Haskell Indian Nations University was savored, and we participated in an interesting banquet featuring a fascinating historical perspective on the events in Lawrence that preceded the American Civil War of the 1860s.

One of the two excursions was to the Flinthills of Kansas to visit a working ranch and the Tallgrass Prairie National Preserve. If you ask yourself what a busload of glaciologists is doing on a 100°F day tumbling through America's mid-west – well, we were learning what you need to know to become



Dorthe Dahl-Jensen's invited presentation was on the subject of 'Tracing internal radio-echo sounding layers' ...



.... while Don Blankenship gave an account of the information gathering Europa Clipper mission to Jupiter's frozen moon.

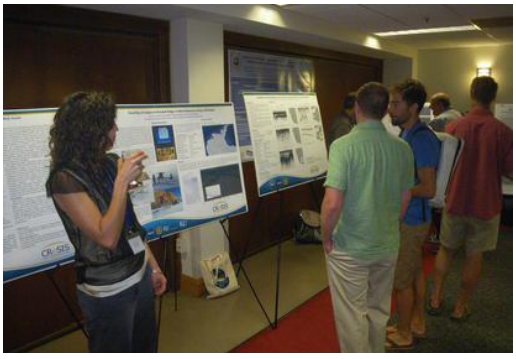
One of the highlights of the week for participants from further afield was a buffet meal hosted in his own home by Chair of the Local Organizing Committee Prasad Gogineni. Here a group of them are savouring the excellent food and putting the world of Radioglaciology to rights.

Also making good use of the social networking opportunities on offer at Prasad's party were Richard Alley, Richard Hindmarsh, Andy Aschwanden, Heinz Müller, Dorthe Dahl-Jensen and her daughter, Nanna Steffensen.

The poster session on Tuesday was as lively as ever.

a cowboy in the Flint Hills. For that purpose we went to see the cattle ranch of Kent and Rose Bacon. They gave us a friendly welcome on our arrival and showed us around their ranch in the Flint Hills where they raise calves all year long.

The Flint Hills are one of the last large areas of Tallgrass Prairie in the USA. Composed of limestone and shale, they are home to different grass species such as blustem, switchgrass and Indian grass. While the region is unsuited to growing wheat, it turned out that cattle love the prairie grasses and grow to be good, strong animals. Aware of the uniqueness of the area they live in, Kent and Rose take part in the Kansas Land Trust Projects. This means, for example, that they have to burn their land at regular intervals to prevent trees and shrubs from destroying the grass hills and thus keep the Tallgrass Prairie alive.



Some of the people looking at some of the posters.

The poster session was accompanied by excellent food and drink.

The Tallgrass Prairie provided some splendid views.

During our stay Rose showed us pictures so that we could get an impression of how it looks when they burn the land or when they move the cattle. Sadly, our visit was during a time when no cattle were on the farm. They normally get new calves twice a year and then raise them. The next load arrived just hours after we had left the farm. Thus, instead of showing us how they move the cattle through the working stations where they are branded and vaccinated, we were moved ourselves.

Nevertheless, there were of course animals on the farm. As well as the dog, who is the by far the best cowboy, they keep Quarter Horses for their work with the cattle. Rose gave us a demon-

The finer points of cattle handling were an interesting addition to the week's tally of new scientific information.

However, there were no cattle on the ranch on the day we were there, so in default of cattle, Rose demonstrated how to lassoo a Secretary General...

Rose Bacon gave a demonstration of lassoo technique, which everyone then had a chance to try their hand at.

... and then how to weigh him!

The visit to the ranch was very popular. Here, inspecting the weighing equipment and watching the weighing process, are tireless local organizer Sorcha Hyland and a number of the delegates.

Haskell Indian Nations University staged a spectacular display of Native American dance...

The other excursion visited the Nelson–Atkins Museum of Art, where Tim Creyts was given a valuable opportunity to contemplate snow from the artist's perspective.

...accompanied by a powwow drum circle in less traditional costume....

stration of how easily she can handle her horse, moving it back and forth, while the horse reacted immediately. Afterwards, we went for a short hike, crossing the river and going up the hill to get a good view of the vicinity. At the top, Kent awaited us with cold water for a refreshing break.

Back at the ranch we tried our luck branding – just on wooden plates – and throwing the lasso. But, at the end of the day we had to accept that it's best to leave that sort of thing to the experts.

The other excursion was as unlike a cowboy/girl experience as you could get in Kansas, and featured a visit to two museums: the Nelson–Atkins Museum of Art in Kansas City (featuring world-class collections, including works by Thomas Benton and a collection of Native American art), and the US National World War One Museum.

... which several of the party, including esteemed President, Doug MacAyeal, were keen to try themselves.

The Secretary General, however, managed to stay out of the dancing until railroaded into it by a very persuasive lady.

The traditional banquet was enhanced by a talk about the role of the state of Kansas in the events leading up to the American Civil War. Here, diners are giving Dr Earle their full attention.

The two excursions converged at the end of the day on Haskell Indian Nations University where a famous Kansas-City-style barbeque was enjoyed and where delegates had a chance to learn about Native American cultures. Among the most rousing cultural lessons was the chance to learn to perform Native American dance to the drumbeat and song of a powwow drum circle.

The traditional IGS Symposium Banquet was held Thursday night at the University of Kansas Alumni Center and featured a fascinating lecture by KU professor of history Dr Jonathan Earle on 'Ad Astra Per Aspera: Kansas's all true (and slightly bizarre) origins'. The lecture recounted how in the late 1850s and early 1860s Kansas became the focus of the struggle between slavery and abolition in the antebellum USA. Lawrence, Kansas, was a bastion of abolition, which attracted a great deal of ill-fortune during the Civil War, including a bloody and destructive raid by Confederate guerrilla raider William Quantrill.

The symposium closed its formal oral and poster presentations on Thursday so that Friday could be devoted to a workshop on polar aircraft and their use in conducting glaciological research. Several panels contributed to the discussion in this workshop: Doug MacAyeal and Hugh Corr discussed Science Elements and Objectives; Mark Ewing, Shawn Keshmiri, Carl Leuschen, Stephan Yan, Bruno Camps-Raga, Daniel Steinhage and Sun Bo discussed Platforms and Radar Systems for Manned and Unmanned Aircraft; and there was a group discussion on the topic of Missions and Maximizing Platforms.

Overall, the conduct of radioglaciology over the past 5 years has produced extraordinary advances in glaciology and has benefited the ultimate aim of glaciology to inform the world about how ice on this planet (and others) behaves in response to various forcings. This achievement was easily recognized by delegates who have attended both the IGS symposia on radioglaciology during the past 5 years. Undoubtedly there will be a strong case for holding another symposium on radioglaciology in another 5 years time (or sooner). The symposium in Kansas was extremely successful, and this success was attributed in large part to the flawless performance of the local organizing committee and the people who shouldered the responsibility of taking care of meeting logistics and details. Jennifer Laverentz, Sorcha Hyland and Jenna Collins were instrumental in making the meeting enjoyable for all participants, as were Riley Epperson with his IT help in the lecture hall and a team of KU graduate and undergraduate students who volunteered their time with poster setup and general conference logistics, including Alexandra Dewitt, Boyu Feng, Elizabeth Post, Jose Velez, Katharine Doyen, Konstantinos Petrakopoulos, Kyle Purdon, Logan Byers, Sarah Child, Souroush Rezvanbehbahani, Steve Foga and, last but by no means least, Trey Stafford.

Doug MacAyeal, Jenna Collins and Anja Diez

Nordic Branch Meeting 2013

Lammi, Finland, 31 October–2 November 2013

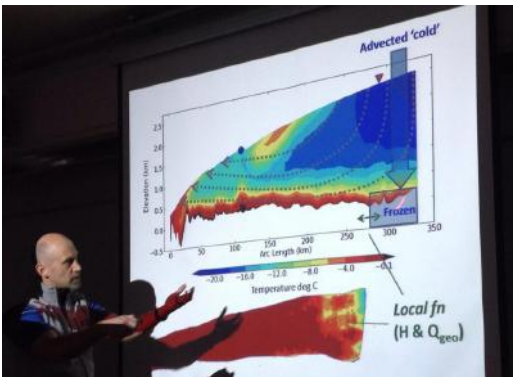
The Nordic Branch of the IGS meets once a year so that researchers of the 'northern countries' (Finland, Sweden, Norway, Denmark, Iceland, with the participation of scientists from many other countries of Europe and the world) can discuss current research with peers. This year's meeting was held over three days at the well-appointed Lammi Biological Station operated by the University of Helsinki. In addition to providing comfortable dormitory accommodation and delicious meals for the meeting participants, the venue also provided a first-class sauna located on the shore of one of Finland's most studied lakes.

A total of 23 oral and 25 poster presentations were given at the meeting on a variety of glaciological research ranging from theoretical to applied, and covering a geographical range extending from the two polar regions to the local glaciers in Scandinavia. As is the tradition at branch meetings, a significant number of oral and poster presentations were given by students. Focusing particularly on effectiveness of presentation, the 'Ymir Award' committee, consisting of Peter Jansson, Tómas Jóhannesson, Caroline Clason and Doug MacAyeal, chose Ward van Pelt and Joaquin Belart as this year's Ymir Award recipients in the oral and poster categories respectively.

In addition to presentations on glaciological research, there were three special presentations. At the start of the meeting, John Loehr of the Lammi Biological Station gave an enjoyable overview of the kinds of environmental and biological research conducted at the station. Making note of the various wild animals routinely sighted in the vicinity of the station, and particularly near the station's lakeside sauna complex, the Secretary General advised that wearing a traditional Finnish pukko on a lanyard around the neck would be a good way to ward off saunatonttu (Finnish sauna elves). (He then presented a brief overview of the new IGS field knife available for order from the IGS merchandise collection.) A second special talk was given before dinner on the first day by Hanna Johansson, an art historian, on the subject of 'winter art'. The third special presentation was made after the first day's dinner by Anker Weidick, a long-time member of the IGS, on his 60 years of research directed to the ice of Greenland. Immediately prior to Anker's presentation, he was surprised by a brief ceremony at which he was awarded the IGS's Richardson Medal in recognition of his long service and contribution to the understanding of Greenland's glaciers and ice sheet. Jason Box, who recently moved from North America to Denmark, gave the citation for the medal as well as an informative introduction to Anker's life and work.

Possibly the most difficult aspect of the meeting that future Nordic Branch meetings will strive to match was the outstanding evening of sauna activity at the lakeside sauna complex during the first evening of the meeting. Although the participants had to segregate into women's and men's groups (each had an hour and a half to enjoy the sauna), no other activity of the meeting (with the possible exception of the APECS activities conducted the

The meeting provided three days of presentations and was as busy as always.



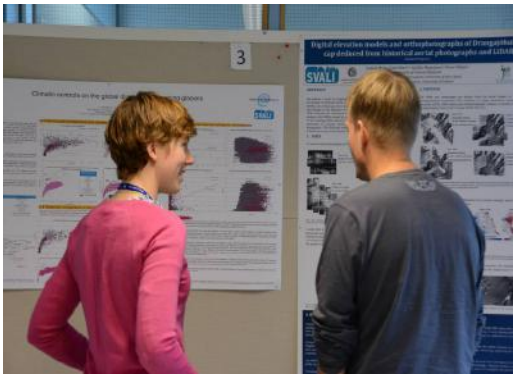
Joel Harper described his (colourful) transect of the bed of the Greenland ice sheet.

A highlight of the meeting was an invited talk by art historian Hanna Johansson on 'Winter Art'.

second evening) facilitated so much interaction between participants. The sauna featured a spread of delicious Finnish snack food (various mustards, cheeses, breads, pickles and sausages) and drink (ranging from water to the local brew: Lammin Sahtia) in a comfortable anteroom where towel clad glaciologists could compare notes on their research. Within the sauna itself, there was plenty of Hyvää Löyly, and the pleasure of the steam was heightened by quick dips in the cold lake immediately adjacent to the sauna.

This year's Nordic Branch was an extremely successful meeting, not only because of its pleasant location and the intriguing research presented, but because it gave participants the chance to experience the hospitality and culture of Finland. With most sincere appreciation, Onni Järvinen and his team of helpers are acknowledged for their hard work in making the Branch Meeting in Lammi happen.

Richard Hodgkins



The posters evoked much animated discussion.

Anker Weidick had been invited to share his incredible knowledge of the glaciers of Greenland...

... but was not expecting IGS President Doug MacAyeal to present him with the Society's Richardson Medal – closely supervised by Jason Box and the Secretary General.

The Ýmir award for the best student oral presentation went to Ward van Pelt and the award for the best poster to Joaquín Belart.

Annual call for nominations for awards

The Awards Committee is inaugurating an annual call for nominations for Honorary Membership of the IGS, the Richardson Medal and the Seligman Crystal.

Honorary Membership is *in recognition of eminent contributions to the objectives of the Society. Honorary Members shall not exceed twelve in number at any time.* Currently, there are seven. These are G.K.C. Clarke, J.W. Glen, V.M. Kotlyakov, G. Østrem, C.W.M. Swithinbank, G. Wakahama and Yang Zhenniang.

The Richardson Medal is *awarded in recognition of outstanding service contributions to the International Glaciological Society and to glaciology.* The term 'service' is to be interpreted broadly and is not exclusively restricted to service to the Society, although such service should receive greatest weight. Examples of outstanding service contributions could include service to the Society, scientific editorial service to Society publications, noteworthy contributions to the international outreach of the Society, educational service (e.g. writing an influential text book), institutional service (e.g. establishing or maintaining a world-class scientific research centre) and promotional services to scientific glaciology (e.g. through communications media). Recent recipients are T.H. Jacka (2010), W.S.B. (Stan) Paterson (2012), J.W. Glen (2013) and A. Weidick (2013)

The Seligman Crystal is *awarded to one who has made an outstanding scientific contribution to glaciology so that the subject is now enriched.* Recent recipients are L.G. Thompson (2007), P.A. Mayewski (2009), A. Iken (2011), D.E. Sugden (2012) and P. Duval (2013).

The list of recipients of these awards shows that the bar is set high, and the Society may choose not to make any awards in any particular year if there are deemed to be no suitable candidates at that time.

The current Awards Committee wishes to maintain the tradition of making occasional awards of Honorary Membership, the Medal and the Crystal to candidates who have made an outstanding contribution to glaciology, in the broad terms described above. Nominations are solicited for outstanding individuals who are recognised by their broad peer group for their achievements. Nomination packages should include three elements: an ***abridged CV***, a ***nomination letter*** and ***three other letters of support***. The abridged CV should highlight the principal achievements of the nominee throughout their career. The nomination letter should outline the case for an award, including the contributions that the nominee has made with respect to the criteria above. The letters of support can be multisignatory if a large number of people wish to support the nomination. It seems sensible that younger scientists should be encouraged to write one of these letters, stating how the nominee has inspired and/or encouraged their career development.

Nominations should be sent to the Chair of the Awards Committee, presently Martyn Tranter, and copied to the Secretary General, and enquiries can be made to any of the Committee (see below). Each year, nominations can be made at any time, but ***must be received by 31 December at the latest***. They will usually be considered during the first months of the following year, and recommendations will then be made to the IGS Council, which has the ultimate authority to make awards.

Awards Committee

Awards Committee 2013/14

Chairman	Martyn Tranter	m.tranter@bristol.ac.uk	
Members	Kumiko Goto-Azuma	kumiko@pmg.nipr.ac.jp	
	Regine Hock	regine@gi.alaska.edu	
	T.H. Jacka	jglac@bigpond.com	
	Rob Massom	r.masssom@utas.edu.au	
	Martin Sharp	martin.sharp@ualberta.ca	
	D.R. MacAyeal	drm7@midway.uchicago.edu	(ex-officio: President)
	M.M. Magnússon	magnus@igsoc.org	(ex-officio: Secretary General)

News

Richardson Medal for Anker Weidick

The IGS has awarded the Society's Richardson Medal to Anker Weidick.

Anker Weidick's career spans six decades and counting. His publications list includes 127 articles spanning 54 years: 1958–2012. Of these, 95 are as lead author and 76 are as sole author. Today, Anker is 85 and has just published a 68-page copiously illustrated book.

Throughout this period, he has inspired, advised and collaborated extensively with a spectrum of glaciologists from across the generations. He is an observant, systematic and thorough scientist, with a thoughtful, modest and friendly nature and a quiet sense of humour. His contribution to the compilation of long-term mass balance, length and volume changes of glaciers surrounding the Greenland ice sheet, which includes both Holocene and recent ice-sheet-margin fluctuations, is seminal and has been widely acclaimed. He has been, and still is, the go-to person for all Greenland ice masses – 'he is a master of late Holocene glacial fluctuations in Greenland, where many scientists have and still seek him for inspiration, for explanations and for insight to the history of fluctuations of glaciers in Greenland'.

Anker still exudes a passion for Greenland glaciology and good practice in historic literature and cartographic research. Most of his publications contain issues that extend beyond solely Greenland glaciology. These includes Anker's long-term attention to the problem of defining individual drainage sectors within an ice sheet, the development of methods to separate local glaciers from ice sheets, the demonstration of variability in glacier response to climate change, and an emphasis on systematic glacier inventory work. These papers are still as topical now as when he first pioneered these ideas.

A pioneer, Anker Weidick was the first, and for a very long time the only, scientist working on the Greenland glacier inventory. It is only now, several decades later, that widespread Greenland glacier inventories are attempted, with the aid of abundant computing power. 'All modern glacier sensitivity studies from Greenland rely on the pioneering work done by Anker Weidick well before it became "modern".'

Anker's innovation comes not only from his early start and sustained dedication. 'Anker Weidick started very early to bring different disciplines together (geomorphology, archaeology, climatology) in order to make progress in glaciological research.

Anker thus created his own science as modern glaciology was still crystalizing.'

Yet another unifying theme of his work is thoroughness. '... still frequently consult Anker's review papers and monographs on Greenland glaciology and glacier fluctuations, as they are still the most thorough reviews available.'

We have learned from Anker fundamentals that change the way we think about ice–climate interaction. We have also learned from him that the Greenland ice sheet margin was located well back from its present day position during the Holocene Thermal Maximum. The implications establish and reinforce how sensitive ice is to climate. Anker was one of the first scientists to point out that neighbouring tidewater glaciers often behave very differently. Rather than despairing that glacier idiosyncrasy equates to unpredictability, the reader of Anker's latest work is offered an explanation that glacier advance amid a period of widespread retreat may have to do with sub-glacier topography funnelling accelerating ice forward.

Finally, Anker is known to continually promote the importance of research integrity in all of his collaborations. The combination of his research passion, integrity and attainment, and the inspiration that others find in his work and via his generous collaborations, make Anker Weidick a fitting recipient of the Richardson medal.

The Awards Committee of the International Glaciological Society

Obituary: William Stanley Bryce (Stan) Paterson, 1924–2013

Stan Paterson studied mathematics and physics at the University of Edinburgh where he graduated with an honours degree in 1949. His interest in glaciology was kindled in the early 1950s when he joined the survey team of the 1953/54 British North Greenland Expedition. This adventure introduced him to glaciology and saw him involved in measuring altitudes at 300 points on a 1200 km traverse across the Greenland ice sheet, achieving a remarkable closure error of only a few tens of centimetres. From 1955–56, he was employed as assistant surveyor of the South Georgia Survey, where Mount Paterson (54°39′32′ S, 36°7′37′ W, 2196 m a.s.l.) is named after him.

In 1957 Stan emigrated to Canada and several years later began doctoral studies in the Physics Department at the University of British Columbia. His thesis research was supervised by John A. 'Jack' Jacobs with help from James C. Savage and involved surface flow measurements, thermal drilling and borehole inclinometry on Athabasca Glacier in the Canadian Rockies. The aim of the research was to test Glen's flow law and Nye's generalization of it against field observations and, if necessary, to suggest modifications. John Nye served as external examiner of the thesis and Stan was awarded a PhD in 1962.

Shortly after receiving his doctorate, Stan joined the Polar Continental Shelf Project (PCSP) as its glaciologist and set out to do pioneering research in Canada's high Arctic. In the late 1950s this huge region was poorly mapped and scantily researched, shortcomings that might weaken Canada's sovereignty assertions. Thus the PCSP was formed in 1958 as a cross-departmental logistical and scientific organization that would do basic surveys and polar research. Ice coring was new at the time Stan started at PCSP and he realized that the history of climate in the Canadian Arctic was bound up in the tens of thousands of annual layers of snow and ice. He became the architect of Canada's original ice-coring program on Meighen Island and Devon Island and assembled a small but able staff that included Roy 'Fritz' Koerner and Bea Alt. With solid support from his group and PCSP he purchased a Cold Regions Research and Engineering Laboratory thermal drill, married it to a winch and control system and then flew the whole 1600 kg rig up to the Meighen Island ice cap in a Twin Otter. In 1965 the team retrieved what was one of the first surface-to-bedrock ice cores.

Stan and Fritz analysed the core for stable isotopes (paleo-temperature), micro-particles (wind speed), conductivity and ice fabric. They established that the ice cap was a nearly static neo-glacial feature that started around 4000 years ago and owed its survival to the thick fog that covers it during the polar summer. After Meighen, Stan and Fritz used an aviation SCR718 radar altimeter to map the ice thickness of four glaciers/ice caps in the high Arctic. This work was done in 1970 by pulling the antenna and electronics behind a snow machine for many hundreds of kilometres. The thicknesses together with the elevations provided invaluable baseline data that have allowed quantitative measures of ice loss in recent times.

Stan and Fritz went on to extract cores from Devon Ice Cap and showed that at its base the ice was older than 120 thousand years (early Eemian). Taken together, the three cores from Devon showed a full glacial cycle, with particularly good detail in the post-glacial (Holocene). Although they had cores, they lacked the facilities to analyse them so Stan forged close links with international colleagues in the growing field of ice core glaciology. Willi Dansgaard's group in Copenhagen did most of the stable isotope work and Hans Oeschger's group in Berne did the C14

dating. The then-young Canadian David Fisher was sent to Copenhagen to do his PhD with Willi Dansgaard and Sigfús Johnsen and to analyse the Devon ice cores, thus cementing a valuable connection. These collaborations have persisted for nearly five decades and much of what is known about the climate history of the Arctic stems from Stan's pioneering work. He and his wife Lyn spent many happy and useful months in Copenhagen as guests of the Danish group.

After Devon, Stan's group moved the whole field camp and drill by Twin Otter to Agassiz Ice Cap on Ellesmere Island and started a series of six surface-to-bed ice cores arrayed along a flow line that resulted in a much-cited suite of papers. It was there that Stan was the first to discover that Ice-Age ice was much weaker than Holocene ice and developed a method for measuring vertical strain rate down a bore hole. Using stable isotopes and melt features, the group discovered that the early Holocene was the warmest part of the post-glacial period. They also were the first to obtain a history of acid pollution from an ice core. The records of temperature from this work have been included in all the reconstructions of climate change and have played a key part in establishing its reality in the assessment reports of the Intergovernmental Panel on Climate Change.

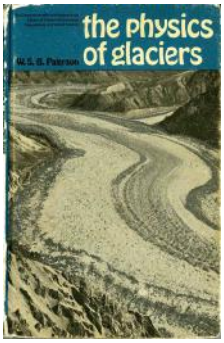
Stan applied his critical and rigorous method of analysis to a number of other key problems in glaciology. His estimate for the volume of the Laurentide Ice Sheet remains remarkably similar to the best estimates now available, 40 years later. Stan recognized that borehole deformation studies can reveal the properties of ice creep at low stresses, a problem that poses severe challenges to experimentalists in the laboratory. Using information from his field studies at Athabasca Glacier, Stan also discerned the energetics and water balance constraints that make temperate glaciers possible.

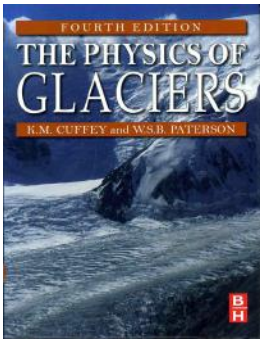
While fully engaged with high Arctic field work and data analysis Stan served as a key member of the National Research Council of Canada's Subcommittee on Glaciers and as IGS Correspondent on Canada's snow and ice research. Yet somehow he also found the time to complete his monumental text on *The Physics of Glaciers*. Stan's rare gifts of excellence in remote field science combined with solid physics and rigorous standards for data quality made it possible for him to write the most used and most influential textbook in glaciology. Now in its fourth edition, each new edition is profoundly different from the previous one yet the book has remained the standard text for most university courses and sits on the shelf of virtually everyone who has any interest in ice sheets and glaciers. The first edition appeared in 1969 and the

A young Stan working on Athabasca Glacier in the early 1960s.

fourth (co-authored with Kurt Cuffey) in 2010. As a measure of its influence, the third edition, published in 1994, has been cited in every *Journal of Glaciology* and *Annals of Glaciology* volume since that date and has been translated into several other languages, including Russian and Chinese. Stan was always economical with his words and those who co-authored papers with him found the experience transformative. Anyone interested in the art of scientific writing should read *The Physics of Glaciers* just to see how it is done. And everyone seeking an understanding of glaciers should discover for themselves such gems as 'Temperate glaciers are widespread in the literature. How widespread they are in reality is uncertain.'

Because of its clarity and economy Stan's book became the single glaciology text to be found on the bookshelves of climate scientists, earth system scientists and planetary scientists. It is no exaggeration to say that Stan has directly influenced the quality and trajectory of four decades of glaciological science of the Earth and solar system. At times non-terrestrial specialists





Stan's text book has been the most used and most influential in the field of glaciology from the first edition of 1989, and is now in its fourth.

Stan Paterson was presented with the Richardson Medal of the IGS in 2012.

misused the basic theory, and when Stan brought one such misuse to account, it revealed what could be gained by bringing together terrestrial glaciologists with those whose focus was the ice caps of Mars or the ice shelves of Europa. These fruitful collaborations started in the early 1990s and have resulted in five International Conferences on Mars Polar Science and Exploration. Terrestrial glaciology was represented on the successful Mars polar Phoenix mission that discovered ground ice near the Martian pole and several mission proposals have been made that would robotically produce ice cores from the Northern Ice Cap on Mars.

Following Stan's retirement from PCSP in 1980, he and Lyn moved to Quadra Island in British Columbia and Stan began work as a glaciological consultant. In that role he became a visiting scientist with the Geophysics Department at the University of Copenhagen and with the Australian Antarctic Division and presented a comprehensive lecture course at the Institute of Glaciology and Geocryology in Lanzhou, China.

Stan's contributions to glaciology in the field and in print have been outstanding and those he has influenced are numerous and productive. In 1994 he was awarded Honorary Membership in the International Glaciological Society and in 2012 the Richardson Medal for outstanding service contributions to the IGS and to glaciology through publication of *The Physics of Glaciers*. Stan regretted that he had no opportunity to supervise his own graduate students and viewed his book as his way of contributing to the education of glaciologists. In the final year of his life he endowed the 'Stan Paterson Scholarship in Canadian Glaciology' of the Canadian Geophysical Union which was awarded for the first time in May 2013.

Stan loved the west coast of Canada and its mountains, but his first love was always Scotland, where he returned yearly to hill walk, ski and visit old friends. With them he returned to Greenland, but he never made it back to South Georgia, although he kept in touch with all his old mates. The last two of his companions on that expedition died a few months ago so Stan's death seems to mark the end of some kind of happy age of scientific exploration.

Stan will be greatly missed by his friends and colleagues but his legacy will endure.

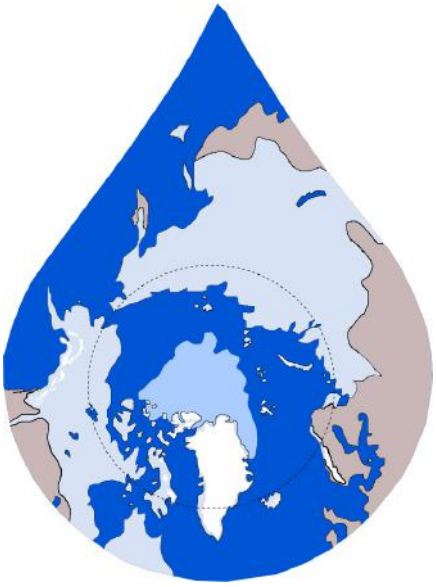
Friends and colleagues of Stan.

(For those interesting to read more about Stan and his life, his autobiography 'Ice Man: the Making of a Glaciologist' has just been published by the Papyngay Press, and is available as an e-book for Kindle and in PDF format: http://www.amazon.ca/Ice-Man-Stan-Paterson-ebook/dp/B00HDE2A4U)

INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on

The Changing Arctic Cryosphere



Edmonton, Alberta, Canada
18–22 August 2014

Co-sponsored by:
Earth and Atmospheric Sciences, University of Alberta

SECOND CIRCULAR
January 2014
http://www.igsoc.org/symposia/2014/alberta
http://www.eas.ualberta.ca/igs/

The International Glaciological Society will hold a Symposium on 'The Changing Arctic Cryosphere'. The symposium will take place in Edmonton, Alberta, Canada from 18–22 August 2014. Registration and the Icebreaker will take place on Sunday 17 August.

THEME

The Arctic is warming more rapidly than the Earth as a whole, and the warming is driving major changes in all elements of the Arctic cryosphere, from the Greenland Ice Sheet to glaciers and ice caps, the Arctic Ocean sea ice cover, terrestrial and sub-sea permafrost, and seasonal snow cover. Many of these changes are unprecedented in the period of scientific observations, and they produce strong feedback effects on the Arctic climate system through changes in surface albedo, emissions of greenhouse gases from thawing permafrost, and atmospheric and oceanic circulation. The changes observed are already having major impacts on the nature and extent of human activity in the Arctic, resource exploration and production activities, and Arctic marine and terrestrial ecosystems and biogeochemical processes.

Satellite and airborne remote sensing technologies and ground-based sensor webs play an important role in documenting rates and spatial patterns of these changes, and Arctic System models are under development to investigate the processes that are driving them, predict future changes and provide a basis for predicting their environmental, social and economic consequences. Major syntheses of scientific knowledge, such as the Snow, Water, Ice and Permafrost in the Arctic (SWIPA) report, have been commissioned to report on current understanding of these changes and their impacts, but they are already out of date.

By bringing together experts in all areas of cryospheric science with climate scientists, oceanographers, biologists and social scientists, the symposium seeks to update our knowledge and understanding of all elements of cryospheric change in the Arctic and their implications for Arctic peoples and ecosystems. It will also address the challenges of modelling and monitoring future changes and their likely consequences.

UNIVERSITY OF ALBERTA

eas Earth & Atmospheric Sciences

TOPICS

Participants are encouraged to present observational, theoretical and model-based studies of historical, ongoing and projected rates and patterns of cryospheric change in the Arctic, processes of cryospheric change, cryosphere–climate interactions, the impacts of cryospheric change on climate, oceanography, surface hydrology, biogeochemistry and ecosystems, and the consequences of cryospheric change on Arctic peoples and economic activity in the Arctic.

1. **Recent and projected changes in Arctic climate and oceanography**
2. **The Greenland Ice Sheet, Arctic ice caps and glaciers:** Rates and processes of change, future projections and potential impacts on sea level and the marine environment; (bio)albedo feedbacks on surface melt processes; the role of firn processes in modulating melt–runoff relationships; thermal evolution; changes in hydrology and their impact on ice dynamics; quantifying mass loss to the ocean; impacts of change on water resources
3. **Seasonal snow cover:** Role in the Arctic climate system; rates and processes of change, feedbacks on the climate system; impacts on ecosystems, biogeochemical processes and surface hydrology; projecting future changes; socio-economic consequences of snow-cover change
4. **Permafrost:** Rates, processes and patterns of change; impacts on landscape stability, hydrology, biogeochemical processes, vegetation, albedo and greenhouse gas fluxes; stability of sub-sea permafrost and methane hydrates; projections of future permafrost states; socio-economic consequences of permafrost change
5. **Lake and river ice:** The changing extent and phenology of lake and river ice; climatic, hydrological, ecological and socio-economic impacts of changes in freshwater ice; predictive modelling of changes in freshwater ice
6. **Arctic sea ice:** Changes in extent, thickness, snow cover and physical properties; feedbacks associated with changing sea ice cover; biological impacts of sea-ice change; socio-economic and socio-cultural impacts of sea-ice change.
7. **Cryo-ecosystems:** Effects of climate change on cryospherically hosted ecosystems and the role of these ecosystems in cryosphere–climate feedbacks.

REGISTRATION FEES

All fees are in CAD Dollars. An 'Early-bird' discount of $100 is available for registrations received before 16 May 2014

– Participant (IGS member):	$750
– Participant (not IGS member):	$880
– Student or retired (IGS member):	$425
– Student or retired (not IGS member):	$500
– Accompanying person (18 years or over):	$325
– Accompanying person (12–17 years):	$270
– 'Early-bird' discount (deducted from fee):	$100
– Late registration surcharge (after 28 July 2014):	$100

The fees include the Icebreaker, daily morning and afternoon tea and coffee, lunch (Mon–Fri), the symposium banquet and the mid-week excursion (including dinner).

Although we strongly prefer registration 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 is 16 May. After 16 May the registration fee will be as indicated in the table above. A late registration surcharge of $100 will be added after 28 July.**

When registering for the symposium you must first register your details (online) if you are not already on the IGS database. You may already be on our database if you have been an author in any of our publications or attended any of our events. If unsure, please email us before proceeding. This will avoid the creation of duplicate entries on our database.

ACCOMPANYING PERSONS

The registration fee for accompanying persons includes the icebreaker, symposium banquet and midweek excursion. It does not include tea/coffee, lunch **or attendance at symposium sessions**.

ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper at the workshop are required to **submit an abstract by 1 April 2014**. There will be oral as well as poster presentations. A USB memory stick containing the submitted abstracts will be provided to all participants at the symposium. The same information and other relevant information will also be made available online. 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. Participants and nonparticipants alike are encouraged to submit manuscripts for this volume. The deadline for receiving *Annals* manuscripts is **2 June 2014**.

VENUE

The Symposium will take place at the University of Alberta in Edmonton, a 4-hour drive from the Rocky Mountain National Parks of Banff, Jasper and Yoho. Sessions will be held in rooms 1-430 and 1-440 of the Faculty of Science's Centennial Centre for Interdisciplinary Science (CCIS). The first of its kind in Canada – and one of just a handful around the world – CCIS fosters an interdisciplinary approach to scientific discovery that facilitates a cross-fertilization of ideas and techniques. The nearest airport is Edmonton International.

LOCATION

Edmonton is the capital of the province of Alberta and home to more than one million people. Located on the North Saskatchewan River, Edmonton is the most northerly of Canada's large cities and is often called Canada's Gateway to the North. Edmonton has excellent road, rail and air transportation links. It has a wide range of cultural, sporting and tourist attractions, and is the host to 30 established festivals each year. The University of Alberta is situated alongside our city's beautiful river valley. Its main campus is just a few minutes' walk from Edmonton's popular Whyte Avenue, offering shopping, cafés and nightlife aplenty.

GETTING TO EDMONTON

In summer there are direct flights to Edmonton from London, Reykjavik, Denver, San Francisco, Los Angeles, Seattle, Minneapolis, Chicago, New York, Houston and all major Canadian cities (Vancouver, Toronto, Ottawa, Montreal). There are also flights to Calgary from other European destinations, including Frankfurt and Amsterdam. Calgary is a 45-minute flight from Edmonton. The University campus can be reached from the Edmonton International airport by taxi, shuttle or public transit (bus 747 to Century Park Light Rail Transit (LRT) Station and LRT from there to either Health Sciences –Jubilee or University stations.

ACCOMMODATION

Blocks of rooms have been reserved for symposium participants in the Lister Conference Center on the University of Alberta campus (100 single rooms with en suite), and in one hotel adjacent to campus (Campus Tower Suite Hotel; 50 doubles with kitchenettes) and the Coast Edmonton Plaza Hotel (a mix of different types of room).

Lister Center and Campus Tower are on the edge of campus, about 10 minutes' walk from the meeting venue, while the Coast Edmonton Plaza is located downtown, a short LRT ride from the University Campus. Accommodation can be booked via the contact details below. In all cases tell the hotel that you are attending the International Glaciological Society Symposium and you should be offered the discount conference rate.

Lister Center: Tel: +1 780 492 3000 or email groupbookings@ualberta.ca

Campus Tower Suite Hotel: Tel: + 1 866 332 3590 or book online
11145 87 Avenue NW, Edmonton

Coast Edmonton Plaza Hotel: Tel: 780 423 4811
10155 105 Street, Edmonton

EDMONTON INTERNATIONAL FRINGE THEATRE FESTIVAL will be taking place at the time of the Symposium in the Old Strathcona District, which is about a 25-minute walk from the meeting venues.

Edmonton International Fringe Theatre Festival (14–24 August 2014)
http://www.fringetheatre.ca/festival.php

ICEBREAKER/RECEPTION
The Icebreaker will be held on Sunday 17 August in the PCL Lounge on the ground floor of the Centennial Centre for Interdisciplinary Science, located at the north end of the main quad on the University of Alberta campus, starting at 5.00 pm. You will be able to pick up your registration package at the Icebreaker, and there will be opportunities to get oriented and meet your fellow delegates.

BANQUET: Wednesday 20 August
This will be held at the Faculty Club.

MID-WEEK EXCURSION: Thursday 21 August
Elk Island National Park (www.pc.gc.ca/pn-np/ab/elkisland/index.aspx) and the Ukrainian Cultural Heritage Village (www.history.alberta.ca/ukrainianvillage/) followed by a barbeque at the Elk Island Golf Course & Bison Bar Café.

POST-SYMPOSIUM EXCURSION
A 4-day tour to visit Alberta's less well known World Heritage Sites, including the Royal Tyrell Museum at Drumheller, famous for its dinosaur collections, spectacular Waterton Lakes National Park (with a boat trip to Glacier National Park, Montana), and the remarkable Head-Smashed-In Buffalo Jump.

Price per person NET CAD funds, based on 50 passengers:

Single	$765.00 + GST
Double	$570.00 + GST
Triple	$525.00 + GST

Sign-up deadline for the Post-Symposium Excursion is 15 June 2014

Drumheller: Royal Tyrell Museum of http://www.tyrellmuseum.com/
Palaeontology/Red Deer River Badlands: http://www.traveldrumheller.com/
Head-Smashed-In Buffalo Jump: http://history.alberta.ca/headsmashedin/
Waterton Lakes National Park:
http://www.pc.gc.ca/eng/pn-np/ab/waterton/index.aspx

SYMPOSIUM ORGANIZATION
Magnús Már Magnússon (International Glaciological Society)

SCIENTIFIC STEERING AND EDITORIAL COMMITTEE
Ross Brown (Chief Editor; Environment Canada), Anthony Arendt, Chris Burn, Claude Duguay; Richard Essery, Alex Gardner; Jon-Ove Hagen; Alex Jarosch, Hugues Lantuit; Kari Luojus, Walt Meier; Peter Nienow; Don Perovich; Carleen Tijm-Reijmer; Anette Rinke; Martin Sharp; Drew Slater; Julienne Stroeve

LOCAL ORGANIZING COMMITTEE
Martin Sharp (Chair); Brian Lanoil; Anita Dey Nuttall; Cindy Mason; Shyra Craig

FURTHER INFORMATION
Information will be updated on the local conference website, http://www.eas.ualberta.ca/igs/, as it becomes available

Please register online at www.igsoc.org/symposia/2014/alberta/registration
Registration will open shortly. In case of difficulty with the online registration, please contact the IGS office via igsoc.org.
Please note that **abstract submission is a separate system** (at http://www.igsoc.org/abstracts/) and requires different login details

IMPORTANT DATES

International Symposium on The Changing Arctic Cryosphere

Abstract submission deadline:	1 April 2014
Notification of acceptance:	15 April 2014
Deadline for 'Early-bird' discount:	16 May 2013
Deadline for full refund:	20 June 2014
Deadline for partial refund:	28 July 2014
Late registration surcharge applies after	28 July 2014
Registration and Icebreaker:	17 August 2014
Symposium begins:	18 August 2014

Annals of Glaciology volume 56, issue 71

Paper submission deadline:	2 June 2014
Final revised papers deadline:	30 September 2014

Glaciological diary

** IGS sponsored * IGS co-sponsored

2013

9–13 December 2013
AGU Fall Meeting
San Francisco, California, USA
Website: http://fallmeeting.agu.org/2013/

2014

9 January 2014
2014 Annual Danish Greenland Ice Sheet Seminar
Copenhagen, Denmark
Contact: Ruth Mottram [rum@dmi.dk]

3–5 February 2014
IASC Workshop on the Dynamics and Mass budget of Arctic Glaciers
Ottawa, Canada
Contact: Carleen Tihm-Reijmer [c.h.tijm-reijmer@uu.nl]
Website: http://www.iasc.info/nag/

11–13 February 2014
4th DUE Permafrost User Workshop
Frascati, Italy
Website: http://www.climate-cryosphere.org/meetings/due-permafrost-2014

18–20 February 2014
Workshop for preparing applications to EUROFLEETS2 Regional Calls
Tallinn, Estonia
Website: http://www.eurofleets.eu/np4/370.html

27–28 February 2014
18th Alpine Glaciology Meeting (AGM)
Innsbruck, Austria
Contact: Irmgard Juen [irmgard.juen@uibk.ac.at.]
Website: http://imgi.uibk.ac.at/iceclim/agm2014

9–14 March 2014
Intercomparison of Snow Grain Size Measurements Workshop
Davos, Switzerland
Contact: Martin Schneebeli [schneebeli@slf.ch]
Website:
http://%20http//www.wsl.ch/dienstleistungen/veranstaltungen/veranstaltungskalender/Snow_Grain/index_EN

10–14 March 2014
****International Symposium on Sea Ice**
Hobart, Australia
Contact: Secretary General, International Glaciological Society
Website:
http://www.igsoc.org/symposia/2014/hobart/

17–20 March 2014
13th International Conference on the Physics and Chemistry of Ice (PCI-2014)
Hanover, New Hampshire, USA
Website:
http://engineering.dartmouth.edu/pci-2014

2–3 April 2014
Workshop: Liquid Water in Snow – measurement techniques and modeling approaches
Davos, Switzerland
Contact Christoph Mitterer [mitterer@slf.ch]

7–11 April 2014
Workshop: Subglacial processes
Copenhagen, Denmark
Contact Alexandra Messerli [messerli@nbi.ku.dk] or Nanna B. Karlsson [nbkarlsson@nbi.dk]

8–12 April 2014
Association of American Geographers Annual Meeting
Tampa, Florida, USA
Cryosphere Sessions:
Advances in Cryosphere Research
High Latitude Environments in a Changing Climate
Ice and Snow
Contact Vena Chu [venachu@ucla.edu]

15–17 April 2014
10th Annual Polar Technology Conference
Bloomington, Indiana, USA
Website: http://polartechnologyconference.org/

27 April–2 May 2014
European Geosciences Union General Assembly
Vienna, Austria
Website:
http://meetings.copernicus.org/egu2014/

22–24 May 2014
Joint model-data workshop for the late Pleistocene evolution of the Greenland and Antarctic ice sheets
Grenoble, France
Website: http://www.physics.mun.ca/MOCA/IceSheetModelandData2014.html

26–28 May 2014
International Conference on Cold Climate Technology 2014
Narvik, Norway
Website: http://www.iccct2014.com/

26–30 May 2014
****International Symposium on Observations, Modelling and Prediction of the Cryospheric Contribution to Sea Level Change**
Chamonix, France
Website: http://www.igsoc.org/symposia/2014/chamonix/

2–4 June 2014
2014 Ice Sheet System Model (ISSM) Workshop
Bergen, Norway
If interested, e-mail the ISSM team at issm@jpl.nasa.gov

2–6 June 2014
XIX Geological Congress of Argentina
Cordoba, Argentina
Special Session on Cryosphere Science.
Conveners: Dario Trombotto[dtrombot@mendoza-conicet.gob.ar], Lucas Ruiz [lruiz@mendoza-conicet.gob.ar]
Second Circular:
http://www.congresogeologico.org.ar//assets/pdf/XIX_CGA_2da_Circular.pdf

3–5 June 2014
71st Eastern Snow Conference
Boone, North Carolina, USA
Website:http://www.easternsnow.org/annual_meeting.html

18–21 June 2014
EUCOP4: 4th European Conference on Permafrost
Évora, Portugal
Website: http://www.eucop4.org/

22–25 June 2014
28th International Forum for Research into Ice Shelf Processes (FRISP)
Schloss Wahn, Cologne, Germany
Contact Adrian Jenkins[ajen@bas.ac.uk]

4–5 August 2014
Intercomparison of Snow Grain Size Measurements Workshop (follow-up to March Workshop in Davos)
Reading, UK
Contact:
Martin Schneebeli [schneebeli@slf.ch]

6–8 August 2014
Workshop on Microstructure in Snow Microwave Radiative Transfer (MICROSNOW workshop)
Reading, UK
Contact:
Melody Sandells [m.j.sandells@reading.ac.uk]

6–16 August 2014
***Third International Summer School in Glaciology**
McCarthy, Alaska, USA
Website: http://glaciers.gi.alaska.edu/courses/summer-school/2014

11–15 August 2014
22nd IAHR International Symposium on Ice
Singapore
Website: http://www.iahr-ice2014.org/

16–21 August 2014
World Weather Open Science Conference Montréal, Canada
Cryosphere sessions:
Cryosphere and stable atmospheric boundary layers
Ocean and cryosphere observations and their assimilation
Website: http://wwosc2014.org/

16–31 August 2014
Advanced climate dynamics course: The Dynamics of the Greenland Ice Sheet
Arctic Station, Disko Island, West Greenland
Website: http://www.uib.no/en/rs/acdc/54141/acdc-2014

17–22 August 2014
International Workshop on Ice Caves (IWIC)
Idaho Falls, Idaho, USA
Website: http://www.iwic-vi.org/

18–22 August 2014
****International Symposium on the Changing Arctic Cryosphere**
Edmonton, Alberta, Canada
Contact: Secretary General, International Glaciological Society
Website:
http://www.igsoc.org/symposia/2014/alberta/

22 August–3 September 2014
XXXIII SCAR Biennial Meetings and Open Science Conference
Auckland, New Zealand
Contact: Katrina Hall [gateway-antarctica@canterbury.ac.nz]
Website: http://www.scar2014.com/

9–20 September 2014
Karthaus course: Ice sheets and glaciers in the climate system
Karthaus, Italy
Contact: J. Oerlemans[J.Oerlemans@uu.nl]
Website: http://www.projects.science.uu.nl/iceclimate/karthaus/

2015

March 2015
****International Symposium on Himalayan glaciology**
Kathmandu, Nepal
Contact: Secretary General, International Glaciological Society

June 2015
****International Symposium on the Hydrology of Glaciers and Ice Sheets**
Iceland
Contact: Secretary General, International Glaciological Society

17–22 August 2015
****International Symposium on Contemporary Ice-Sheet Dynamics: ocean interaction, meltwater and non-linear effects**
Cambridge, UK
Contact: Secretary General, International Glaciological Society

2016

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

August/September 2016
****International Symposium on Polar Sea Ice, Polar Climate and Polar Change**
Boulder, Colorado, USA
Contact: Secretary General, International Glaciological Society

New members

Mr Takahiro Abe
Department of Natural History Sciences,
Hokkaido University
8-304, Graduate School of Science, N10W8,
Kita-ku, Sapporo, Hokkaido 060-0810, Japan
Tel +81 11-706-3527
abetaka@frontier.hokudai.ac.jp

Miss Josefin Ahlkrona
Övre Slottsgatan 15A, SE-75312 Uppsala, Sweden
josefin.ahlkrona@it.uu.se

Ms Lauren Andrews
Institute for Geophysics, Univ. of Texas at Austin
J.J. Pickle Research Campus, 10100 Burnet Road,
ROC 196, Austin, TX 78758-4445, USA
landrews@ig.utexas.edu

Frau Stefanie Arndt
Sea Ice Physics, Alfred-Wegener-Institut Helmholtz-
Zentrum für Polar- und Meeresforschung
Bussestraße 24, D-27570 Bremerhaven, Germany
stefanie.arndt@awi.de

Mr Steven Baker
Department of Space & Climate Physics, MSSL,
University College London
Mullard Space Science Laboratory, Holmbury
House, Holmbury St Mary, Dorking, Surrey
RH5 6NT, UK
Tel +44 (0)1483 204100
sgb@mssl.ucl.ac.uk

Dr Luke Bennetts
Maths Sci, University of Adelaide
Ingkarni Wardli Building, North Terrace Campus,
Adelaide, South Australia 5005, Australia
luke.bennetts@adelaide.edu.au

Ms Cecilia Bitz
University of Washington
Atmospheric Science 351640,
Seattle, WA 98195-1640, USA
bitz@uw.edu

Mr Denis Blumstein
CNES/LEGOS
14 avenue E., Belin, F-31400 Toulouse, France
Tel +33 05-61-33-30-44
denis.blumstein@legos.obs-mip.fr

Ms Anne-Julie Cavagna
AMGC, Free University Brussels
Pleinlaan 2, B-1050 Brussels, Belgium
acavagna@vub.ac.be

Ms Ilaria Clemenzi
ETH Zurich
IfU, Stefano-Franscini -Platz 3, HIF CO 46.7,
CH-8093 Zurich, Switzerland
clemenzi@ifu.baug.ethz.ch

Dr Jihong Cole-Dai
Department of Chemistry and Biochemistry,
South Dakota State University
Box 2202, Brookings, SD 57007, USA
Tel +1-605-6884744
jihong.cole-dai@sdstate.edu

Ms Sue Cook
Arctic Geology, UNIS
86/1 Spring Gardens, Edinburgh EH8 8HX, UK
Susan.Jennifer.Cook@unis.no

Dr Michael Dallaston
Mathematical Institute, University of Oxford
Andrew Wiles building, Radcliffe Observatory
Quarter, Oxford OX2 6GG, UK
dallaston@maths.ox.ac.uk

Mr Jack Davie
32 Burstead Drive, Billericay Essex CM11 2QP,
UK
Tel +44 (0)7887 890108
jack.davie@sky.com

Ms Clara Deal
University of Alaska Fairbanks
930 Koyukuk Avenue, Fairbanks, AK 99775, USA
deal@iarc.uaf.edu

Dr Basile de Fleurian
University of California Irvine
3200 Croul Hall, Irvine, CA 92697, USA
basile.defleurian@uci.edu

Professor Anne de Vernal
GEOTOP, UQAM
CP 8888, Montréal, Quebec H3C 3P8, Canada
Tel +1 514-987-3000 ext. 8599
devernal.anne@uqam.ca

Mr Bert Driessen
2XL Consultancy
512 Back Line, Goulds, Newfoundland A1S 1E3,
Canada
bertdriessen@yahoo.com

Ms Francesca Falcini
Environment Agency, 8 City Walk, Leeds
LS11 9AT, UK
Tel +44 (0)113 819 6206
f.a.falcini@gmail.com

Dr Lionel Favier
Laboratoire de Glaciologie, ULB CP 160/0
3 50 Avenue F.D. Roosevelt, B-1050 Brussels, Belgium
lionel.favier@ulb.ac.be

Mr Feng Tiantian
Tongji University
Room 307, Cehui Building, 1239 Siping Road, Shanghai 200092, P.R.China
fengtiantian@tongji.edu.cn

Mr Noel Fitzpatrick
Department of Earth Ocean and Atmospheric Sciences, University of British Columbia
416-6230 Thunderbird Blvd, Vancouver, BC V6T 1Z4, Canada
n.p.fitzpatrick@gmail.com

Dr Agneta Fransson
Sea Ice & Cryosphere, Norwegian Polar Institute
Fram Centre, NO-9296 Tromsø, Norway
Tel +47 77750539
agneta.fransson@npolar.no

Dr Guisella Gacitúa
Glaciology and Climate Change, Centro de Estudios Cientificos
Av. Prat 514, Valdivia 5110466, Chile
Tel +56 632234535
ggacitua@cecs.cl

Dr Fabien Gillet-Chaulet
LGGE - Laboratoire de Glaciologie et Géophysique de l'Environment
Université Joseph Fourier, Domaine Universitaire, 54 rue Molière, B.P.96,
F-38402 Saint-Martin-d'Hères Cedex, France
gillet-chaulet@lgge.obs.ujf-grenoble.fr

Miss Gaelle F. Gilson
Geography, University of Lethbridge
Alberta Water & Environmental Science Building (WESB), 4401 University Drive, Lethbridge, Alberta T1K 3M4, Canada
gaelle.gilson@uleth.ca

Mr Philipp J. Griewank
Max Planck Institute for Meteorology
Bundesstrasse 53, D-20146 Hamburg, Germany
Tel +49 4041173150
philipp.griewank@mpimet.mpg.de

Mr Joel Harrington
Geology and Geophysics, University of Wyoming
416 E Hancock St Apt D, Laramie, WY 82072, USA
Tel +1 360 689 4481
jharrin9@uwyo.edu

Dr Malte Heinemann
University of Hawaii
1680 East West Road, Honolulu, HI 96822, USA
malteh@hawaii.edu

Ms Kay Helfricht
Centre for Climate Change Adaptation, alpS-GmbH
Grabenweg 68, A-6020 Innsbruck, Austria
Tel +43 6502016396
helfricht@alps-gmbh.com

Mr Paul Hezel
TECLIM, Université catholique de Louvain
Pl Louis Pasteur, 3, L4.03.08,
B-1348 Louvain-la-Neuve, Belgium
Tel +32 488078386
paul.hezel@uclouvain.be

Professor Claude Hillaire-Marcel
GEOTOP, UQAM
CP 8888, Montréal, Quebec H3C 3P8, Canada
Tel +1 514 987 4080
chm@uqam.ca

Dr Peter J. Hudleston
Earth Sciences, University of Minnesota
310 Pillsbury Dr. SE, Minneapolis, MN 55455, USA
Tel +1 612 625 0046
hudle001@umn.edu

Ms Ruhi Humphries
University of Wollongong
School of Chemistry, Northfields Ave,
Wollongong, New South Wales 2500, Australia
rsh615@uowmail.edu.au

Ms Polona Itkin
Department of Climate Sciences/Sea ice physics, AWI Helmholz-Zentrum für Polar- und Meeresforschung, Bussestraße 24,
D-27570 Bremerhaven, Germany
Tel +49 47148311703
Polona.Itkin@awi.de

Dr Guillaume Jouvet
Institut für Mathematik, Freie Universität Berlin
Office 120, Arnimallee 6, D-14195 Berlin, Germany
Tel +49 30 838 75348
guillaume.jouvet@fu-berlin.de

Dr Richard Katz
Department of Earth Sciences, University of Oxford
South Parks Road, Oxford OX1 3AN, UK
richard.katz@earth.ox.ac.uk

Ms Laura Kehrl
Department of Earth and Space Sciences, University of Washington
Johnson Hall Rm-070, Box 351310, 4000 15th Avenue NE, Seattle, WA 98195-1310, USA
Tel +1 206-849-1226
kehrl@uw.edu

Dr Kristian K. Kjeldsen
Natural History Museum of Denmark, University of Copenhagen
Oester Voldgade 5-7, DK-1350 Copenhagen K, Denmark
Tel +45 26794810
kkjeldsen@snm.ku.dk

Ms Miriam S.E. Kneidl
UTAS
2/16 Chessington Court, Sandy Bay, Tasmania 7005, Australia
Tel +61 (0)408704223
polaris1905@gmail.com

Mr Conrad Koziol
Scott Polar Research Institute
University of Cambridge, Lensfield Road, Cambridge CB2 1ER, UK
cpk26@cam.ac.uk

Frau Lisbeth Langhammer
Geosciences, University of Oslo
Rolf E. Stenersens allé 10, H 0102, NO-0858 Oslo, Norway
lisbeth.langhammer@gmx.de

Dr Delphine Lannuzel
ACE CRC/IMAS, University of Tasmania
28 Morrison St, Hobart, Tasmania 7000, Australia
delphine.lannuzel@utas.edu.au

Mr Pierre Lardeux
Department of Geography & Earth Sciences, Aberystwyth University
H6, Llandinam Building, Penglais Campus, Aberystwyth SY23 3DB, UK
pfl4@aber.ac.uk

Mr Benoit Lecavalier
Physics and Physical Oceanography, Memorial University of Newfoundland
8a Weymouth Street, St. John's, Newfoundland, A1B 2B6, Canada
Tel 1-709-351-6222
b.lecavalier@mun.ca

Dr Victoria Lee
School of Geographical Sciences, University of Bristol
University Road, Bristol BS8 1SS, UK
v.lee@bristol.ac.uk

Mr Gunter Leguy
LANL/NMT
941 Calle Mejia apt 1310, Santa Fe, NM 87501, USA
Tel +1 5754181021
gunter@nmt.edu

Mr Stefan R.M. Ligtenberg
Institute for Marine and Atmospheric Research, Utrecht University
PO Box 80.0005, NL-3508 TA Utrecht, Netherlands
s.r.m.ligtenberg@uu.nl

Mr David Lilien
Earth and Space Sciences, University of Washington
1900 NE 68th Street, Seattle, WA 98115, USA
dlilien90@gmail.com

Dr Marianne S Madsen
Danish Meteorological Institut
Lyngbyvej 100, DK-2100 Copenhagen, Denmark
msm@dmi.dk

Mr Andrew Malone
Department of Geophysical Sciences, University of Chicago
5734 South Ellis Ave, Chicago, IL 60637, USA
Tel +1 703-966-9237
amalone@uchicago.edu

Dr Rakia Meister
Geodynamics, Danish Technical University, National Space Institute
Elektrovej 327, Room 017, DK-2800 Kongens Lyngby, Denmark
rame@space.dtu.dk

Mr Richard Moir
Department of Geography and Earth Sciences, Aberystwyth University
10 Powell Street, Aberystwyth, SY23 1QQ, UK
rim10@aber.ac.uk

Dr Jérémie Mouginot
Dept. of Earth System Science, University of California, Irvine
Croul Hall, Irvine, CA 92617, USA
jmougino@uci.edu

Ms Samiah Moustafa
Geography, Rutgers University
54 Joyce Kilmer Ave, Piscataway, NJ 08854, USA
samiah.moustafa@rutgers.edu

Mr Leo Nathan
Geography and Earth Sciences, Aberystwyth University
4 Llainwen Uchaf, Llanberis, Caernarfon LL55 4LL, UK
Tel +44 (0)7976907122
leo.nathan.mail@gmail.com

Miss Isabel Nias
School of Geographical Sciences, University of Bristol
University Road, Bristol BS8 1SS, UK
Tel +44 (0)7870923594
isabel.nias@bristol.ac.uk

Dr Kerim Nisancioglu
Department of Earth Sciences, University of Bergen
Allegaten 70, NO-5007 Bergen, Norway
Tel +47 55589866
kerim@uib.no

Dr Jaime Otero
Departmento de Matematica Aplicada, Universidad Politecnica de Madrid
E.T.S.I. de Telecomunicacion, desp. A315,
Av. Compluteuse, 30, Ciudad Universitaria,
ES-28040 Madrid, Spain
jaime.otero@upm.es

Mr Mark L. Pittar
IMAS, UTAS
Private Bag 129, Hobart, Tasmania 7001, Australia
Tel +61 414170887
mark.pittard@utas.edu.au

Ms Kristin Poinar
Earth and Space Sciences, University of Washington
1013 NE 40th St (PSC), Box 355640,
Seattle, WA 98105, USA
kpoinar@u.washington.edu

Mr Jonathan Ryan
Centre of Glaciology, Aberystwyth University
Llandinam Bulding, Penglais Campus,
Aberystwyth SY23 3DB, UK
Tel +44 (0)7807808731
jor44@aber.ac.uk

Mr Marco Scaioni
College of Surveying & Geo-Informatics, Tongji University
1239 Siping Road, Tumu Building, Room 708,
Shanghai 200092, P.R.China
Tel +86 15618082902
marco @tongji.edu.cn

Dr Marius R. Schaefer
Universidad Austral de Chile
4to piso Edificio Emilio Pugin, Campus Isla Teja,
Valdivia 5110259, Chile
Tel +56 32221534
mschaefer@uach.cl

Mr Thomas Shaw
Engineering and Environment, Northumbria University
39 Moncrieff Drive, Burton upon Trent
DE13 0RJ, UK
Tel +44(0)7791394786
tefshaw1@gmail.com

Ms Véronique Schoemann
Laboratoire de Glaciologie, CP 160/03,
Université Libre de Bruxelles
Avenue F.D. Roosevelt, 50,
B-1050 Bruxelles, Belgium
Tel +32 (0)2 650 22 19
vschoem@ulb.ac.be

Ms Roberta Sciascia
EAPS, Massuchusetts Institute of Technology
77 Massachusetts Avenue, 54-1410,
Cambridge, MA 02138, USA
sciascia@mit.edu

Dr Kristen St John
Geology and Environmental Science, James Madison University
MSC 6903, Memorial Hall 7300A,
Harrisonburg, VA 22807, USA
Tel +1 540-568-6675
stjohnke@jmu.edu

Dr Gunnar Spreen
Oceans and Sea Ice, Norwegian Polar Institute
Fram Centre, NO-9296 Tromsø, Norway
Tel +47 777 50 506
gunnar.spreen@npolar.no

Ms Anne Stefaniak
62 Dane Road, Birchington, Kent CT7 9QT, UK
Tel +44 (0)7905012513
anne.stefaniak@gmail.com

Mr Ian Stevens
Aberystwyth University
10 Powell Street, Aberystwyth SY23 1QQ, UK
its@aber.ac.uk

Mrs Mekdes A. Tessema
University of British Colombia
8493 Hudson Street, Vancouver V6P 4M3, Canada
mtessema@eos.ubc.ca

Dr Tian Yixiang
Tongji University
Tumu Building B707, 1239 Siping Road,
Shanghai 200092, P.R.China
tianyixiang@tongji.edu.cn

Dr Tong Xiaohua
College of Surveying and Geo-Informatics, Tongji University
1239 Siping Road, Shanghai 200092, P.R.China
xhtong@tongji.edu.cn

Ms Ilona Välisuo
Meteorological Research, Finnish Meteorological Institute
PL 503, FI-00101 Helsinki, Finland
Tel +358 504091719
ilona.valisuo@fmi.fi

Mrs Dorothée Vallot
Earth Science, Uppsala University
Västmannagatan 20, SE-113 60 Stockholm, Sweden
dorothee.vallot@geo.uu.se

Mr Brice van Liefferinge
Glaciology, Université Libre de Bruxelles
CP160/03 Av. F. Roosevelt 50, B-1050 Brussels, Belgium
Tel +32 26502227
bvlieffe@ulb.ac.be

Mr Alexander P.U. Walmsley
Geoscience, University of Oslo
Keysers Gate 7A, NO-0165 Oslo, Norway
Tel +47 93877398
apuw2@live.com

Dr Feiyue Wang
Center for Earth Observation Science, University of Manitoba
588 Wallace Building, Winnipeg, Manitoba R3T 2N2, Canada
Tel +1 (204) 474-6250
wangf@ms.umanitoba.ca

Mr Matthew Whipple
Earth Sciences, University of Bristol
9 Westfield Park, Bristol BS6 6LT, UK
Tel +44(0)7907869412
matt.whipple@bristol.ac.uk

Mr Andrew G. Williamson
Scott Polar Research Institute, University of Cambridge
Lensfield Road, Cambridge CB2 1ER, UK
agw41@cam.ac.uk

Dr Jan Wuite
ENVEO IT GmbH
Technikerstraße 21a, A-6020 Innsbruck, Austria
Tel +43 5125074830
jan.wuite@enveo.at

Hongjie Xie
Geological Sciences, University of Texas at San Antonio
One UTSA Circle, San Antonio, TX 78249, USA
Tel +1 210 458 5445
hongjie.xie@utsa.edu

Mr Ye Wenkai
Tongji University
Siping Road 1239, Shanghai 200092, P.R.China
Tel +86 15216718527
yewenkai1990@gmail.com

Ms Jenna Zechmann
Geology and Geophysics, University of Alaska Fairbanks
940 76th Ave. NE, Olympia, WA 98506, USA
Tel +1 360 790 5724
jmzechmann@gmail.com

Dr Florian Ziemen
Geophysical Institute
University of Alaska, 903 Koyukuk Drive, Fairbanks, AK 99775, USA
Tel +1 9074747759
florian.ziemen@posteo.de

Dr Lucas Zoet
Iowa State University
253 Science 1, Ames, IA 50011, USA
luke.zoet@gmail.com