

Ice

News Bulletin of the International Glaciological Society

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1st, 2nd and 3rd issues 2020

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Cover picture: The year has been dominated by virtual meetings. Photo by Doug MacAyeal.

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

From the Editor

Dear IGS member

Today it is almost exactly one year since I walked out of our office, which is based at the British Antarctic Survey on Madingley Road, Cambridge, having spent the whole day working. The building was almost empty. I have not been back to the office since, apart from a couple of short trips, after getting official permission, to go and pick up some things I needed. I am sure many of you can say the same thing.

It has been an extraordinary year. I have tried to maintain a routine and be at my desk by 07:30 with a cup of tea, having a lunch break and top up of tea. As a matter of fact, I was drinking too much tea, so I bought a smaller tea pot.

At first, we were optimistic. We had scheduled a symposium in Durham towards the end of July; surely this would be all over by then. How wrong we were! In the end, all our symposia and meetings had to be postponed. Some even twice! And things do not look promising for this year at least. We are hoping we will be able to hold the IGS British Branch meeting, in person, at the beginning of September. We'll see!

In 2022 we have a full program of symposia and meetings. Hopefully we will be able to go ahead with those, although the covid-19 situation is rather bleak at present.

Right now the most important thing for the IGS is to be able to hold an 'in-person' Council meeting, followed by an 'in-person' Annual General Meeting (AGM). This is so we can approve the amended IGS constitution. The amended constitution specifically includes the necessary clauses that will allow us to hold 'virtual' Council meetings and AGMs. The UK Charity Commission does not permit 'virtual' meetings for registered charities, such as the IGS, unless they are explicitly allowed in the constitution. But for this to take effect we must approve the amended constitution in 'face to face' meetings. We are hoping we will be able to do so at the British Branch meeting in September. Failing that, there is the Nordic Branch meeting in Norway in October and failing that, hopefully there will be the possibility to hold it during the AGU Fall Meeting. But again, we'll see.

One fantastic thing has come out of the pandemic and that is the weekly IGS Global Seminar, which you no doubt will have heard of. Tavi Murray, the 'prime mover' of this endeavour, has written a report on the webinar which is published in this covid issue of *ICE*.

Speaking of the 'covid issue' we decided to publish a triple issue of *ICE* this time, mainly because of the lack of material. Normally we include reports from our symposia and meetings in *ICE*, which fill up a good many pages, but this year there were none.

Sadly, a big part of this triple issue consists of obituaries of well known and much loved IGS members, but we do also try and bring you news of various things that have happened during this past year. I do hope you will find it an interesting read.

We did hold virtual branch meetings, both the British and the Nordic one. But there is only so much one can say about sitting in front of a computer and listening to talks, albeit some very interesting talks. Normally, IGS events are full of social interactions, which are very difficult to transfer onto a two-dimensional laptop screen. Both of our virtual branch meetings were very successful but it was very noticeable that during the 'final farewells' people were saying 'let us hope that we will be able to meet in person next year'.

Some regular *ICE* features have disappeared this year, mostly because it is possible to access the material more easily on the web. These features include the listing of accepted papers for our

journals and regional country reports. Instead, we will have ‘stories of interest’ submitted by our correspondents. The first of these ‘stories’ comes from our correspondent in Iceland and is about the Icelandic Glaciological Society, which had its 70th anniversary in 2020. We also have a report from our Argentinian correspondent, Lucas Ruiz, who has contributed ‘News from the Southern Andes’. We also have a very interesting and appropriate piece by Paola Araya, an early career glaciologist from Chile writing about ‘The role of women in glaciology in the Andes’.

Another thing that is missing from this covid issue is the ‘Glaciological diary’. This is due to the fact that things happening are almost entirely virtual and we have traditionally not included such events, which were often not communicated to us by the organizers. We may have to rethink that policy. Hopefully the ‘Diary’ will return in the next issue.

We trust you will find this long awaited issue of *ICE* an interesting one and also an inspiration for you to put ‘pen to paper’ and write a piece for *ICE*. We very much look forward to reading it.

Magnús Már Magnússon
Secretary General



2021 Awards by the International Glaciological Society

The International Glaciological Society is currently seeking nominations for its three Honorary Awards:

- The *Seligman Crystal* (awarded to a single person or a collaborative group/team that has made exceptional scientific contributions to glaciology, defined as any snow and/or ice studies.)
- The *Richardson Medal* (awarded to a single person or a collaborative group/team that has provided outstanding service to the International Glaciological Society and/or to the field of glaciology), and
- *Honorary Membership* (recognizes individuals who have made outstanding contributions to the field of glaciology at a national or regional level.).

Details of these awards, their eligibility and the requirements of the nomination packages are available at <https://www.igsoc.org/awards/>. Members of the Awards Committee are listed at <https://www.igsoc.org/committees/awards/>.

Please note that the award system was revamped in 2018 and some awards have changed in scope and content. It is the intention of IGS to give these awards on roughly an annual basis.

Nominations can be made at any time, but the close off date for the 2021 awards is **Friday 11 June 2021**. (Nominations received after that date will be considered for 2022). Nomination packages should be sent by email, marked confidential, to the Chair of the Awards Committee (ian.allison@utas.edu.au) and copied to the Secretary General (magnus@igsoc.org).

All nominations will be acknowledged, and the result of any successful 2021 awards will be announced in late July/early August.

We look forward to receiving nominations of your peers from the community.



New Zealand Branch Meeting 2020

3–5 February 2020

On 3–5 February 2020 the New Zealand Snow and Ice Research Group (SIRG) (the New Zealand branch of the IGS) held its annual meeting. Meetings are usually held in unique locations around New Zealand, with this year's meeting taking place on Mātū Somes Island, located in the Wellington Harbour, only a ~30 minute ferry ride from the city centre. Each year the responsibility for hosting the annual workshop is rotated between Otago University, Victoria University of Wellington and Canterbury University. This year the task fell to Victoria University of Wellington.

We had about 30 participants present their research. New Zealand-based research included mapping snow cover using drones (with application to areas in New Zealand and Colorado), measuring snow accumulation in the Southern Alps, investigating the drivers of iceberg calving at Haupapa/Tasman Glacier (New Zealand's largest glacier), studies that involved direct measurements from Rolleston and Fox/Te Moeka o Tūawe Glaciers, and using cosmogenic dating to understand past glacier history.

Two Victoria University of Wellington environmental scientists, who recently received funding to study dust on glaciers in the Southern Alps, gave a talk to get feedback from the snow and ice community. This was especially timely, as

the fires in Australia from October 2019 through January 2020 have deposited huge amounts of dust on the New Zealand glaciers, a fact that has been covered by news and media outlets around the world. Images of the dust on the ice can be seen here: <https://earthobservatory.nasa.gov/images/146100/traces-of-australia-on-new-zealand-glaciers>. We're looking forward to seeing the work that's done with this funding!

Research outside of New Zealand usually focuses on Antarctica. We had talks focusing on new methods to measure sea-ice thickness more accurately, modelling sea ice, and sea-ice movement. We heard about research on Antarctic Ice Sheet processes, from large scale ice-shelf fracturing and subglacial drainage, to smaller scale deformation and ice mechanics.

Almost half the participants were students (undergraduate, masters and doctoral candidates), who all gave really high-quality talks! Our student talk prize winners included Florence Isaacs (Victoria University of Wellington), who presented links between sea ice and East Antarctica and El Niño, and Maren Richter (University of Otago), who presented a new method to more accurately measure sea-ice thickness. Thanks to the New Zealand Alpine Club (who donated a year's membership), Bivouac Outdoor (who donated



The 2020 workshop participants waiting for the ferry to return home.



Enjoying beers, kombucha, and BBQ for dinner.

a \$100 voucher) and Icebreaker (who donated heaps of merchandise) for our student prizes.

The newly-established IGS Early-career Glaciology Group (EGG) held a mixer on the first night of the meeting. This gave students new to

SIRG meetings an opportunity to meet everyone. We also asked for suggestions for future EGG events, and what students would like from the group, the aim of which is to provide more support and community for young glaciologists. Thanks to the local brewery Garage Project, and Good Buzz Kombucha, for donating drinks for this mixer.

When we weren't busy with the meeting, chatting about research, and BBQing, participants enjoyed exploring Matiu Somes Island. The island is free of any pests (defined in New Zealand as mammals), making it a great spot to see and hear native wildlife. Native birds, including the pīwakawaka/fantail, kākārīki (parakeets), and the kororā/little blue penguin were all spotted. Night time explorers spotted nocturnal tuatara, a medium sized reptile and the last survivor of an order of reptiles that thrived 200 million years ago.

Thanks to our sponsors NIWA, Antarctica New Zealand, and the Antarctic Science Platform for their support, including keeping the meeting registration free for students.

Lauren Vargo and Heather Purdie

Northwest Glaciologists' Meeting 2020

14–16 October 2020

On 14–16 October 2020, the University of Montana hosted the 48th annual Northwest Glaciologists Meeting (NWG), which recently also became an IGS branch meeting. NWG2020 was also the first year that the meeting was held virtually. There were 123 registrants, and the meeting featured 27 talks and five posters. As is traditional at NWG, contributions by early-career researchers were prioritized, with that demographic responsible for 27 of the 32 presentations. In addition to the scientific program (and in lieu of the traditional keg party), NWG2020 also featured a trivia night, in which early-career participants were grouped with senior scientists to answer questions on a variety of topics, including glacier vocabulary (what do you call floating ice that is greater than a 'bergy bit' and smaller than an 'iceberg?'), glacier lore (the smell of frying fat can be so offensive that it triggers what glaciological phenomenon?), and the history of NWG (which three institutions were

represented at NWG1972?). While the reward for the winners of trivia night was ostensibly the voice of IGS regional representative Martin Truffer on their home answering machines, the real prize was the opportunity to pass along the oral history of Northwest Glaciologists, which despite being notoriously (and perhaps intentionally) unorganized has served as a fixture of the glaciological community in the Pacific Northwest for nearly 50 years.

Doug Brinkerhoff

British Branch Meeting 2020

7–9 October 2020

The IGS British Branch (BB) meeting was successfully held over 7–9 Oct 2020 via video-conference, becoming the first BB meeting to be held entirely online! Undeterred by the restrictions imposed by the covid-19 pandemic, the organizing committee worked to retrain the friendly and comfortable atmosphere of the BB meeting into the virtual environment. The Zoom rooms and hallways were navigated by 80 attendees at a time, with 211 individuals registering for the meeting in total. Awareness of

the presented work, shared through 25 talks and 13 posters, was amplified more widely through dedicated tweets (#IGSB2020).

The John Glen prizes for best oral and poster presentations were respectively awarded to Katarzyna Warburton and Joshua R. Leigh. Poster presenters described their work to small groups in thematic break-out rooms, which provided ample opportunity for group discussion.

Further discussion and networking opportunities were delivered in the form of a 'speed-dating'



A small selection of the speakers during the meeting.

A variety of presentations from the BB meeting (part 1).



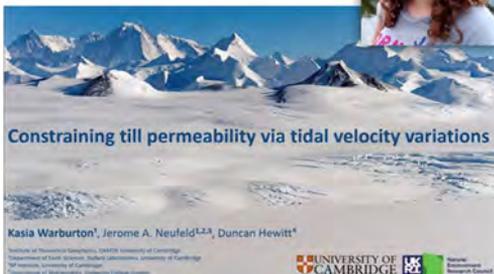
The organizing committee for IGS BB 2020 (Anna Crawford, Helen Ockenden, Rob Bingham, Rebecca McCerery, Magnús Már Magnússon, Rebecca Schlegel).



A variety of presentations from the BB meeting (part 2).

John Glen prize for
best oral presentation

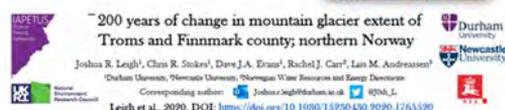
Katarzyna Warburton



Ed King (now retired, but used to work for the British Antarctic Survey in Cambridge) talking about his early days in the field.

John Glen prize for
best poster presentation

Joshua R. Leigh



The John Glen prize for best oral presentation went to Katarzyna Warburton from the University of Cambridge, and for best poster presentation to Joshua R. Leigh from Durham University.

event, which was so popular that an additional speed-date during the meeting needed to be scheduled! This format was subsequently used for early-career researcher networking at the Nordic Branch meeting a few weeks later.

The early career student (ECS) community had a strong presence at the BB meeting, with eight talks and five presentations by students and multiple ECSs co-facilitating sessions.

A guest presentation by an esteemed senior scientist, Ed King, was a great highlight of the meeting. Ed spoke about four significant changes to polar research (the impact of the Falklands War; the advent of GPS; the building of the Rothera runway; and the evolution of field-to-home communication). Ed's talk gave the audience a feeling for what Antarctica was like during his first field-work seasons and how communication abilities have evolved over the decades.

Thanks go out to Ed, the speakers and presenters, the organizing committee, and all of the participants for making this virtual British Branch meeting so effective and enjoyable.

Rebecca Schlegel
Anna Crawford

❄️ Nordic Branch Meeting 2020

11–13 November 2020

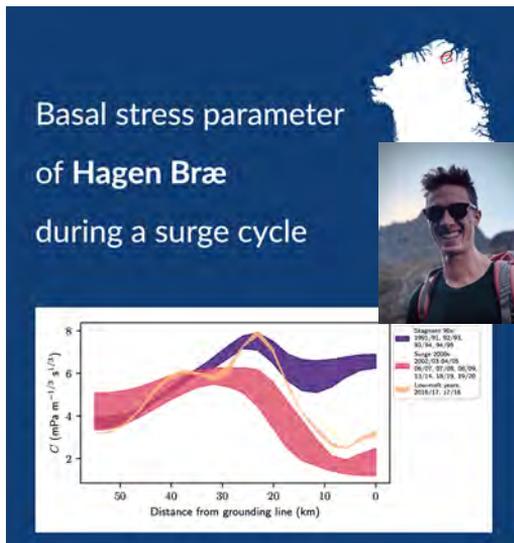
Normally, I would be recounting the good times we had exchanging ideas and insights during the IGS Nordic Branch Meeting. Normally, I would share nice photographs of fellow scientists showing their latest results or having a good time on a field excursion after the workshop. Normally, I would emphasize the importance of glaciologists meeting each other across nationalities and generations.

But nothing in 2020 was normal. Instead, the 28th Annual Meeting of the international Glaciological Society Nordic Branch was hosted, as were most events in 2020, online. A local organizing committee in Copenhagen, Denmark, with members from the Geological Survey of Denmark and Greenland, the

University of Copenhagen, the Technical University of Denmark, and the Danish Meteorological institute made this happen on 11–13 November 2020. Normally, the IGS Nordic Branch meeting is an opportunity for scientists from Nordic countries and beyond to get together and present and discuss their latest research in an informal setting and, while the circumstances were challenging, the aim was to provide as similar an experience to the regular meetings as possible.

Technically, this was achieved by having the face-to-face activities on the Zoom platform and background information on the online platform Padlet. Padlet was used for broadcasting the programme, posters, personal profiles and similar.

In an attempt to obtain the feeling of a regular IGSNB meeting, we started each day by randomly assigning participants to virtual Meet & Greet breakout rooms in small groups. The idea was to simulate the way we would run into each other when grabbing a cup of coffee or tea before starting the programme of the day. The oral presentations were shown to all, but for



Øyvind A. Winton



Andreas Alexander



Organizing committee, from left to right: Nanna B. Karlsson, Louise S. Sørensen, Christine S. Hvidberg, Ruth H. Mottram, Andreas P. Ahlstrøm, Magnus M. Magnusson.

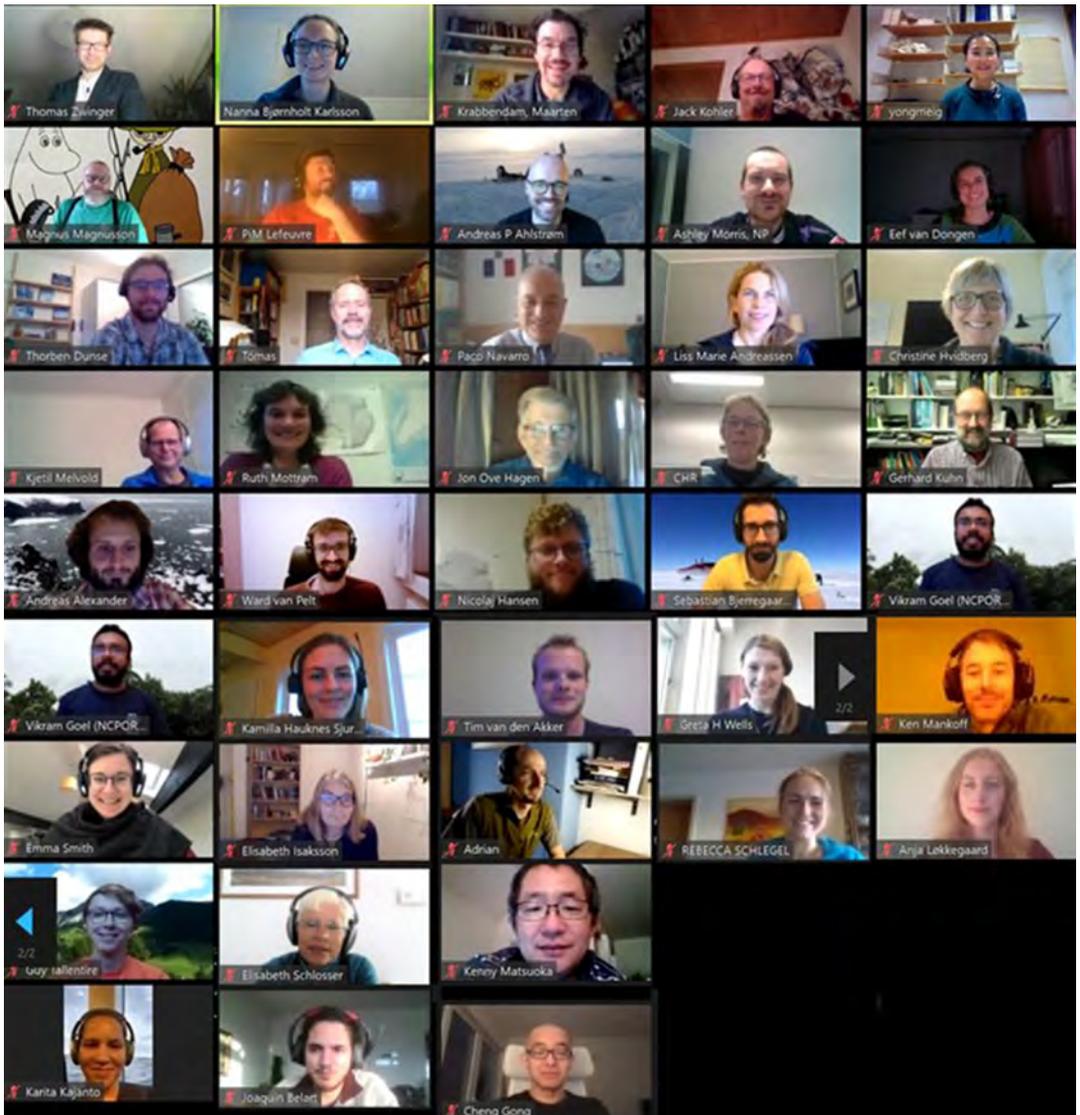
the poster presentations we again created virtual breakout rooms with only a few posters being presented in each, roughly simulating the way we would experience posters walking around in a regular IGSNB poster session.

The IGS Early-career Glaciologist Group (EGG) arranged two great sessions during the meeting, reported elsewhere in this issue of *ICE*, to provide a networking opportunity and a career panel discussion, respectively.

With a turnout of 141 participants including a large number of students and early-career scientists, the event was a resounding success

and the prestigious Ymir awards for best student oral presentation and best student poster were won by two impressive student presentations from Andreas Alexander from Oslo University and Øyvind Winton from DTU/GEUS, respectively, incidentally both dealing with the increasingly hot topic of conditions at the base of glaciers.

Andreas P. Ahstrøm



Screen shot during the IGSNB meeting.



A short history of

Zeitschrift für Gletscherkunde, 1906–2014

Over more than 100 years, 76 volumes of *Zeitschrift für Gletscherkunde* have appeared in two phases with slightly different names.

1. As *Zeitschrift für Gletscherkunde*, für *Eiszeitforschung und Geschichte des Klimas*, *Annales de Glaciologie*, *Annals of Glaciology*, *Annali di Glaciologia* (ZGK) it was founded in 1906

by Eduard Brückner in Vienna under the patronage of the International Glacier Commission, and was published by Verlag von Gebrüder Bornträger in Berlin.

Up to Vol. X, S. Finsterwalder (Munich), F.A. Morel (Morges), J. Geikie (Edinburgh), W. Kilian (Grenoble), Olinto Marinelli (Firenze), Fridtjof Nansen (Kristiania), A. Penk (Berlin), F. Porro (La Plata), Charles Rabot (Paris), H.F. Reid (Baltimore), F. Wahnschaffe (Berlin) and A. Woeikof (St. Petersburg) were mentioned as what we would call today the editorial advisory board. Starting with volume XI (1918–20), the cooperation of 'numerous scientists inland and abroad' was acknowledged.

From 1927 on, up to the last issue of volume XXIX in 1942, Raimund von Klebelsberg, in Innsbruck edited ZGK, in cooperation with Sebastian Finsterwalder in Munich and Heinrich von Ficker in Vienna.

2. When peaceful conditions for science and commerce were re-established after World War II, Raimund von Klebelsberg revived the *Zeitschrift für Gletscherkunde und Glazialgeologie* (ZGG), published by Universitätsverlag Wagner in Innsbruck with ISSN 0044-2836 from Band I, Heft 1, (August 1949)



1906



1942



1949

INHALT VON BAND 47/48 (2013/14)

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ZEITSCHRIFT FÜR GLETSCHERKUNDE UND GLAZIALGEOLOGIE Bd. 47/48, 2013/14

ZGG

BAND 47/48
(2013/14)

Zeitschrift für Gletscherkunde und Glazialgeologie

Herausgegeben von MICHAEL KUHN



Universitätsverlag Wagner

to Band 47/48, 2013/14, published in 2015. The new ZGG 'shall continue the old tradition in new form, putting more emphasis than hitherto on the present and past glaciers' (Klebelsberg, 1949).

Compared to the numerous present publications on glaciology and cryospheric sciences, the *Journal of Glaciology* and ZGG were nearly alone at that time. In a review of ZGG in the *Journal of Glaciology* vol. 1 (1947–51), p. 397, Gerald Seligman noted, 'It has been suggested that this journal (i.e. ZGG) would be a competitor of the *Journal of Glaciology* and as such would be unwelcome to us. We do not agree. The field is so large and the interest in glaciology is growing so fast that there is plenty of room for more than one journal, as Professor von Klebelsberg himself has written to the reviewer'. This has been substantiated many times since.

I started my editorial career in 1970 assisting Herfried Hoinkes in the preparation of ZGG Vol. VI. In the course of the years Raimund von Klebelsberg as editor was followed by Hans Kinzl, Herfried Hoinkes, Gernot Patzelt and myself. We were supported by Universitätsverlag Wagner in Innsbruck with Günter Grasl and Mercedes Blaas,

and by the Institute of Meteorology and Geophysics (now the Institute of Atmospheric and Cryospheric Sciences) of the University of Innsbruck with Elisabeth Steger and Angelika Neuner, and by an editorial board including Jon Ove Hagen (Oslo), Ole Humlum (Copenhagen), Peter Jansson (Stockholm), Georg Kaser (Innsbruck), Vladimir Kotlyakov (Moscow), Heinz Miller (Bremerhaven) and Koni Steffen (Zürich).

At this time, I want to express my appreciation to those who have contributed to ZGG and ZGG as authors, reviewers, editors, publishers and readers. All together, they have promoted cryospheric sciences for more than a century: the first volume of ZGG was published before men set foot on the ice of the South Pole, and the last volume of ZGG appeared at a time when glaciologists studied the ice of the planets and their moons. Indeed, an exciting century for science and society.

Michael Kuhn
Institute of Atmospheric and Cryospheric
Sciences, University of Innsbruck



From our correspondents

Hrafnhildur Hannesdóttir, Iceland

The Iceland Glaciological Society

The establishment of the Society The Iceland Glaciological Society (IGS) was established by people interested in glacier research and travel, with experience in wilderness excursions. One of the founders was the meteorologist Jón Eypórsson, a pioneer in modern glaciological research in Iceland, who also was the first chairman of the society. Among the people involved in the establishment of the society were Einar B. Pálsson (engineer) and Steinþór Sigurðsson (chemist, geologist, physicist), who founded the Icelandic ski association, and they promoted the collaboration

between scientists and enthusiastic skiers. The IGS is still built on the volunteering effort of different groups of the society, and it has been very successful in promoting glaciological research. A total of 42 persons showed up at the inaugural meeting in 1950; in a few years the members numbered around 250 and now there are more than 500. The members of the society have a diverse background, including engineers, health-care workers, lawyers, scientists, craftsman,



Visiting Öraefajökull during a spring expedition some time during the time period 1953–57, using a Bombardier owned by Guðmundur Jónasson. Hvannadalshnúkur, the highest peak of Iceland, in the background. Photo: Árni Kjartansson.



Two Weasels and a Bombardier coming down from Grímsfjall (in the background) during a spring expedition some time during the time period 1953–57. The box on the sled is the expedition kitchen. Photo: Árni Kjartansson.



Camping east of lake Grímsvötn during a spring expedition during 1953–57. Photo: Árni Kjartansson.



Participants in one of the first spring expeditions in the early 1950s. Photo: Árni Kjartansson.



Spring trip of the Society, arriving at the terminus of Tungnaárjökull 15 June 1958. Photo: Valur Jóhannesson.



Volunteers carrying out terminus measurements on Sólheimajökull outlet glacier in 1973. Photo: Valur Jóhannesson.

students, technicians, artists, anthropologists, rescue team members, etc. The objective of the IGS is to encourage glacier research and travel, publish the journal *Jökull*, hold lectures about glaciers and maintain the terminus measurements. The research committee of the Society is a venue where scientists from institutions, universities and other stakeholders meet. At this forum ideas for research are discussed and upcoming research projects are prioritized and formulated.

Research and travel One of the objectives of the IGS is to enable glaciological research and support the transport of people and equipment on Icelandic glaciers. To reinforce these efforts, various vehicles have been owned and operated by the IGS. These include all-terrain track vehicles and modified super jeeps and snowmobiles in recent years. Individuals as well as institutes have also supported the efforts of the IGS by lending various vehicles for travelling on glaciers, among them the University of Iceland, the Icelandic

Met Office (IMO), the road authorities (IRCA) and the national power company (Landsvirkjun). The rescue teams have also collaborated with the society and their Snowcats have played an important role in many expeditions. The IGS has built seven mountain huts on or near Vatnajökull and one on Langjökull to support travellers and scientists. The first two huts were built by members of the IGS in the summer of 1951 on Breiðamerkursandur and in Esjufjöll. A few years later the first hut on Grímsfjall in the center of Vatnajökull was built and another one at Jökulheimar near the terminus of southwestern Vatnajökull. They support one of the main travel routes to the glacier via Tungnaárjökull outlet glacier. In the 1970s small huts were built in Kverkfjöll and Goðahnjúkar in eastern Vatnajökull. Since the early 1980s, electricity has been produced from geothermal heat on Grímsfjall. For many years the seismometer at Grímsfjall was powered in this way. Since 2002, a generator has also been located at Grímsfjall to meet the demands for various monitoring instruments and radio communication equipment.



Members of the Society participating in the ice core drilling at Bárðarbunga in 1972, Grímsfjall in the background. The yellow Bombardier is brand new; it was later painted red. Photo: Valur Jóhannesson.



Radio echo sounding measurements on lake Grímsvötn 1978. Photo: Marteinn Sverrisson.



Radio echo sounding team on Grímsfjall 1979. Glaciologist Helgi Björnsson far right. The first society hut on Grímsfjall (1957) is illustrated; now there are three huts. Photo: Marteinn Sverrison.



Camp on Grímsfjall 1979. Photo: Marteinn Sverrison.

Terminus variation measurements Jón Eypórsson pioneered in 1930 a programme to monitor the annual variations of glacier termini in Iceland with the participation of locals all around the country. These observations have been continued by volunteers of the society since its foundation. Each fall the distance to the glacier margin is measured from a benchmark typically marked with a cairn or iron post. During the first decades, the observers made use of measuring tape or a rope of known length, but some paced the distance between the benchmark and the glacier margin. More recently, GPS- instruments are typically used to mark the location of the glacier snout. The measurements describe the oscillations of glaciers and thereby, indirectly, variations in the climate. The measurements are reported through a website and in the journal *Jökull*, and they are also submitted to an international database. The measurements are one of the most important activities of the IGS and the best documentation of glacier variations in Iceland over almost a century.

The journal *Jökull* is published by the Glaciological and Geological Societies of Iceland. The journal is primarily intended to be an international forum for geoscience research in Iceland. *Jökull* also publishes research notes and reports from glacier expeditions, book reviews and the annual reports of the societies. The first volumes contain mainly articles on glaciological research, expeditions and travel diaries by the society leaders, Jón Eypórsson, Sigurður Þórarinnsson and Sigurjón Rist, as well as other researchers doing work on Vatnajökull. Scientific articles are published in English with abstract and figure texts in Icelandic, and societal reports in Icelandic with English clarifications. Summaries of annual reports by the volunteers measuring the termini fluctuations have been published since the first volume. The number of research articles on volcanology and geoscience



Another view of the original Grímsfjall hut. Photo: Marteinn Sverrison.

has increased considerably since *Jökull* (ISSN 0449-0576) was indexed and abstracted by Clarivate Analytics in the Science Citation Index Expanded (SCIE). The journal can be viewed and downloaded from jokulljournal.is and timarit.is.

Spring expeditions The first annual spring expedition of the society to Vatnajökull took place in 1953. The expeditions take place in early



One of the snow mobiles used during an expedition on Vatnajökull in 1980. Photo: Hannes H. Haraldsson.



Taking a break from the mass balance measurements in lake Grímsvötn in 1984. Photo: Hannes H. Haraldsson.



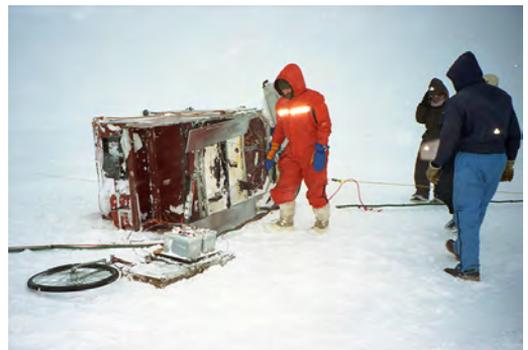
Swimming in lake Galtarlón in Kverkfjöll during the spring expedition in 1984. Photo: Hannes H. Haraldsson.

summer and are usually 1–2 weeks long. The trips provided a platform for research at a time when research institutions in Iceland were weak or non-existent. The work carried out forms the basis for our current knowledge of Vatnajökull, the land underneath the ice cap and its many volcanoes. Over the 67 years since the first expedition, a few hundred people have taken part in one or more trips. Some members have been regular participants in the spring expeditions for many years, while others join once or twice. The trips are a collaborative effort of lay volunteers and scientists, often with 20–30 participants. The huts at the mountain Grímsfjall are the main base during the expeditions. The houses are warm, dry and geothermally heated. There is also warm water for showers and a sauna that plays an important role after long working days on the glacier. Many people have caught the ‘glacier bug’ during these trips, a term used to describe the attachment to and the desire to visit again this white world of ice and snow.

During the expeditions various scientific work has been carried out, including mass balance surveys, installation of weather stations, radio-echo soundings to map the bedrock topography, snow depth measurements, drilling into subglacial lakes at Grímsvötn and Skaftá cauldrons, ice core drilling, analysis of micro-organisms in geothermal lakes, GPS measurements of crustal deformation and ice flow, exploration of geothermal areas, installation and maintenance of seismic stations, analysing gas emissions from active volcanoes, mapping of moraines, studies of volcanic vents in Gjálp, Grímsvötn and beneath Dyngjufjökull, mapping the distribution of tephra layers in the ice, seismic, gravimetric and magnetic campaigns to study internal structure of volcanoes beneath the ice, repeat photography to assess glacier changes, and dust deposition on glaciers. Apart from mass balance measurements on Vatnajökull, the IGS has carried out mass balance measurements on Mýrdalsjökull since 2001, which is a volunteering



On Tungnaárjökull snout at the start of the spring expedition in early June 1990, changing from tyres to skis on the National Power company hut for use in glacier expeditions. Photo: Finnur Pálsson.



The last use of the hut on skis containing the Radio Echo Sounding receiver, in a third attempt to RES survey the area where 4 years later the Gjálp eruption took place. Photo: Finnur Pálsson.



Coffee break after finishing measurement of winter snow in Grímsvötn in 1992. Photo: Finnur Pálsson.



Crossing river Tungnaá to get to the terminus of Tungnaárjökull during the spring expedition in 1992. Photo: Hannes H. Haraldsson.



First attempt to survey location and elevation of a mass balance survey site with kinematic GPS, with ~10 cm accuracy in 1992. Helgi Björnsson (left), Magnús Tumi Guðmundsson holding antenna; both long term presidents of the society. Páll Einarsson, seismologist, taking a photograph of the setup of his GPS instrument. Photo: Finnur Pálsson.



Digging out the instrument mast in Grímsvötn in June 1999 (~8 m). The instruments measured the water level of the lake and relayed data to Reykjavík. The instruments broke down during the Grímsvötn eruption in December 1998. The ~1 m thick tephra layer was tough as concrete. Photo: Finnur Pálsson.



Drilling a 15 m hole with a steam drill to install a wire to measure summer ablation on the snout of Skeiðarárjökull in 1997. Photo: Finnur Pálsson.



Hot water drill used to drill through the ~300 m thick floating ice shelf of Grímsvötn lake to sample the lake water in June 1998. Happy drillers toasting after hitting through. Photo: Finnur Pálsson.



Exploring the site of the 1998 eruption at lake Grímsvötn in 2000. Photo: Magnús Tumi Guðmundsson.

effort of members of the Society, with support from the University of Iceland, the Icelandic Meteorological Office and Landsvirkjun, providing vehicles and coring equipment.

International co-operation The seismic measurements undertaken by the French-Icelandic expeditions in 1951 and 1955 were probably the first joint research project after the establishment of the Society, although Jón Eyþórsson and Sigurður Þórarinnsson had both already had fruitful collaboration with Swedish glaciologists and meteorologists during the mass-balance campaigns on Hoffellsjökull in the 1930s. Several international research projects have benefited from the huts of the Society, not least the first hut on Breiðamerkursandur, where, for example, British groups have stayed during field work for many years. Seismologists from the University of Cambridge have participated in joint projects, establishing seismometers on Vatnajökull. A drilling project to sample the eastern and western Skaftá subglacial lakes was led by a joint effort of Icelandic and US scientists a few years back.



The PistenBully snow groomer has prepared the ground for tephra sampling in lake Grímsvötn, spring expedition 2008. Photo: Brynjar Gunnarsson.



Some of the founding members of the Society in front of the huts on Grímsfjall during the spring expedition in 2007. Photo: Józef Hólmjárn.



Logging the tephra “hills” in lake Grímsvötn during the spring expedition in 2007. Photo: Józef Hólmjárn.



Organizing mass balance stakes on Grímsfjall and the numerous oil barrels in 2008. Photo: Einar Ragnar Sigurðsson.



On the way from the sauna to the hut, spring expedition 2008. Photo: Brynjar Gunnarsson.



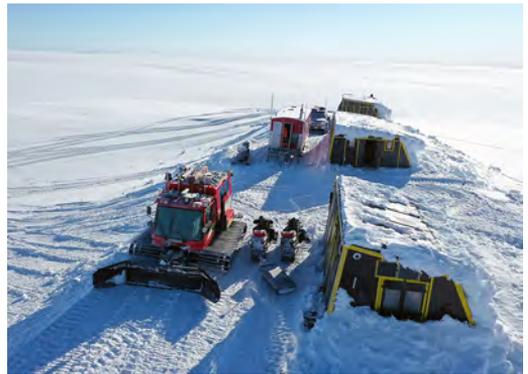
Lots of digging as usual, the PistenBully stuck on Tungnaárökull in 2010, in exceptionally wet conditions. Photo: Brynjar Gunnarsson.



At Grímsfjall in the centre of Vatnajökull in September 2014; the bright lights from the magma plume of the Holuhraun eruption in the background. Photo: Snævarr Guðmundsson.



Due to difficult conditions at the terminus of Tungnaárjökull in spring 2019, the expedition had to access Vatnajökull from Skálafellsjökull outlet glacier on the southeast side. Photo: Golli.



The three huts on Grímsfjall in 2019, the PistenBully of the Reykjavík Rescue team, and the mobile 'suite' belonging to the National Power Company that is used during the mass balance surveys. Photo: Andri Gunnarsson.

An exhibition on the history of the IGS will be opened in the Icelandic museum of natural history in Perlan Reykjavík in November 2020. Some of the material will also be available on the website of the Society, www.jorfi.is.



Breakfast at Grímsfjall, June 2019. Photo: Golli.



The small 12-person society hut in Esjufjöll nunataks, Öräfajökull in the background. March 2020. Photo: Andri Gunnarsson.

Lucas Ruiz, Argentina

Glaciology of the Southern Andes on YouTube I am pleased to announce the release of the promotional video for the postgraduate course 'Glaciology of the Southern Andes', made by CONICET Documental.

Hosted by the Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA-CONICET) in Mendoza Argentina, and with the support of the International Glaciological Society, this postgraduate course provides an introduction to glaciology with a focus on the Southern Andes.

Reports from the course in previous years are available in ICE 171 and 178, so I will not describe it here. As a second disclaimer, I must mention that the video is in Spanish. But even if you do not speak the language of Isabel Allende or Jorge Luis Borges, I guarantee that you will not be disappointed by the amazing Andean landscapes depicted in the video, which is available on YouTube at <https://youtu.be/iFtQztFYrWU>.

Besides showing the beauty of the Andean glacial and periglacial landscapes of Argentina, the video emphasizes the students' experiences during the 2018 course. Listening to these inspiring students who care deeply about glaciers and the mountain environment is a reward for all the hard work that IANIGLA's researchers and professionals

put into creating this course. But in some way, also, it reminded me how all this started back in 2014. At that time, I was a post-doc with still-fresh memories of the second staging of the Summer School of Glaciology of the University of Fairbanks, organized by Regine Hock. Regine and the other lecturers on the course communicated glacier physics with passion in a friendly and unstructured environment, in a manner that changed my way of thinking about postgraduate courses forever. That was the only formal glaciological course I attended throughout my PhD. I do not say this with sadness. Indeed, I was lucky. Most PhD students from South America do not have the resources to attend courses abroad.

Thus, with Pierre Pitte, Lidia Ferri, Laura Zalazar, Mariano Masiokas, Mariano Castro and Maximiliano Viale, I decided to bring glaciology to the students but focused on the Southern Andes. Now, 6 years later, and after putting on the course three times (unfortunately, due to covid-19, we had to postpone the one planned for 2020 to 2021), we are happy that *Glaciología con gusto a mate*, as we like to call it, is recognized as a benchmark for the new generation of South American glaciologists.

We don't know if the 2021 course will be virtual or in person, but it will be fun for sure.



Participants and instructors in the Glaciology of the Southern Andes course analysing the geomorphology of rock glaciers during the field trip to the Central Andes of Mendoza, Argentina.



A faint snow cover over the Stepanek rock glacier in the Central Andes of Mendoza, Argentina.

Paola Araya, Geophysics Department, University of Chile

Between Women and Glaciers: a historical perspective on the representation of women in glaciology and its current challenges ('Entre Mujeres y Glaciares' in Spanish)

Webinar, 15 October 2020, Santiago, Chile

In October, as a part of a series of webinars hosted by the Universidad Alberto Hurtado (UAH) entitled 'Diálogos en Línea – Encuentros Virtuales', I had the opportunity to give the above talk about the history of women in Glaciology and the current challenges that gender discrimination pose to the international glaciological community and also here in South America.

The talk was structured in three parts: first, I presented a general introduction of some of the historical reasons why women have been underrepresented in STEM (Science, Technology, Engineering and Mathematics) fields, and in particular in the cryospheric sciences, based on contributions from the works of Hulbe et al. (2010)¹, Koenig et al. (2016)² and Case et al. (2019)³. I emphasized the need to pay more attention to things other than metrics derived from tracking published literature, which is indeed important academically speaking but is still an incomplete reflection of gender diversity in the cryospheric sciences (Carey et al. 2016⁴).

Second, I went through some of the main concepts regarding women leaving academia because of the leaky pipeline phenomenon (see

below). Here, I pointed out the need to openly discuss finding other ways of effectively assessing diversity and inclusion in our local glaciological communities and raising awareness of sexual harassment and assault, which might be present in our field, supported by the relevant literature (Blickenstaff, 2006⁵, Clancy et al. 2014⁶; Bell & Koenig, 2017⁷; Wadman, 2017⁸, Nash et al. 2019⁹).

At the end of my talk, I had the chance to talk briefly about things that a woman may hesitate to discuss openly when she is conducting research in the field, such as personal hygiene, toileting, menstruation, menopause, clothing or gear appropriate to your own physical needs, etc. Many female students are exposed to fieldwork for the first time during their undergraduate years without any instruction in or knowledge of these important things. On top of that, some women have opted for self-defence training or have looked for other ways of preventing and managing sexual harassment and assault in the field, as if it were their responsibility to defend themselves from unwelcome attention. This part of the talk was mostly based on the IARPC Diversity & Inclusion Webinar that Jennifer Mercer (NSF) and Zoe Courville (USACE) gave earlier this year.

Finally, the talk ended by reflecting on some of our current challenges and engaging to work together towards ensuring a diverse field of glaciology now and in the future.



The 'leaking away' of women over time and the injustices, both obvious and also 'below the surface', that women face in STEM.

mujeres y glaciares

ENTRE MUJERES Y GLACIARES: UNA PERSPECTIVA GLOBAL



Paola Araya

Discusiones en torno a la diversidad de género en las ciencias de la criósfera

PAOLA ARAYA, M.Sc.(C) Meteorología y Climatología, DGE UChile



I want to thank Dr José Araos, a glacial geomorphologist and professor at the UAH, who invited me to share research and thoughts collected from the available literature on gender and glaciology with mostly undergraduate and graduate students from Earth and Social Sciences. I am also grateful to the Physical Geography and Anthropocene Studies group at the Department of Geography at the UAH for allowing me to use their platforms to visualize and promote discussion on gender discrimination topics in science. I also want to thank Lucas Ruiz at IANIGLA-CONICET for helping me spread the word and his contagious enthusiasm in promoting the discussion of these topics with the glaciological community in South America.

Link to the webinar (public access): <https://www.youtube.com/watch?v=We1MbplEi2U&t=2s>

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Early-career Glaciologists Group

Report on 2020 from the voice of EGG

At the start of 2020, the newly formed IGS Early-career Glaciologists Group (EGG) was mainly focused on planning events at the IGS symposia and IGS branch meetings for early-career (EC) glaciologists. Our aims quickly changed, but the pandemic has encouraged us to be creative in supporting and bringing together our community.

Multiple branch meetings in 2020 included IGS EGG events. The New Zealand branch meeting in February of 2020 included an in-person mixer (see p.5 for more details). EGG events were organized for the online British Branch and Nordic Branch meetings. The British Branch meeting had a networking event on the first afternoon, with about 80 people from all career stages attending. The event was so well attended and everyone was so keen that a second event was organized! The Nordic Branch meeting had a networking event, but this time only EC researchers. About 30 people attended that event, which was really good as well. The Nordic Branch meeting also included a career panel – five panelists from both academia and government organizations introduced themselves and EC researchers then had the chance to ask questions. They gave great tips on mental health, how to handle stress, etc. The Northwest Glaciology Branch meeting also had an online networking event organized by the EGG for researchers at all levels.

In addition to online meetings, the EGG tried to bring the EC glaciology community together while we've been in various forms of lockdown.

Working with the IGS Global Seminar Series, we've had three seminars given by EC researchers. Each seminar has included shorter, 15-minute talks by three different researchers. It's been a wonderful way to be part of the seminar series, without the daunting task of speaking for a full hour on your own (speaking from experience!). We have at least four more of these early-career talks planned in 2021, hearing from more EC researchers from about the world.

Back in April, after *Journal of Glaciology* editors were having trouble finding reviewers, the EGG organized a Cryosphere EC Researcher Database: <https://forms.gle/Xiwq3rWgryZ6XFnC6>. The goals were 1) to help editors find reviewers more easily and 2) to boost visibility of EC researchers who were keen to review papers but might not yet be well known. We now have 220 researchers signed up, more than 80% of whom identify as early-career.

The EGG put together a blog where EC researchers could write about and post pictures of field work. This let us both reminisce on times spent in the field and reflect on the comparisons between field work and lockdown, which can often be quite isolating also. Our first blog post made especially great comparisons: <https://igsegg.org/2020/04/15/natural-social-distancing.html>.

We're looking forward to 2021, and to continuing to help support and bring together early-career glaciologists!

Lauren Vargo



One break-out room during the networking event at the British Branch meeting.



2021 A NEW International Glaciological Society Award

The International Glaciological Society is pleased to announce that it has recently established an Honorary Award, commencing in 2021, exclusively for Early Career Scientists.

This new IGS Early Career Scientist Award will be given in recognition of significant scientific and/or community contributions to glaciology by an Early Career Scientist.

Nominations for the award will be called for every second year (in those years when nominations are not called by IGS for the Graham Cogley Award). The Award prize will include an engraved medallion, a certificate and a cash prize (500 GBP in 2021). Details of the prize, and guidelines for nomination, are available at <https://www.igsoc.org/awards/>.

The close off date for the 2021 award is **Friday 11 June 2021** (Nominations received after that date will be considered for 2023). All nominations will be acknowledged, and the result of any successful 2021 awards will be announced in late July/early August. Although the ECS nominations will be considered on the same timetable as the other recently announced IGS Awards for 2021 (the Seligman Crystal; the Richardson Medal; and Honorary Membership), this is a distinctly new award.

Nomination packages should be sent by email, marked 'Confidential', to the Chair of the Awards Committee (ian.allison@utas.edu.au) and copied to the Secretary General (magnus@igsoc.org).

We are excited by this new award, and very much look forward to nominations of worthy Early Career Glaciologists from your community.



Pictures from the Nordic Branch EC Career panel event.

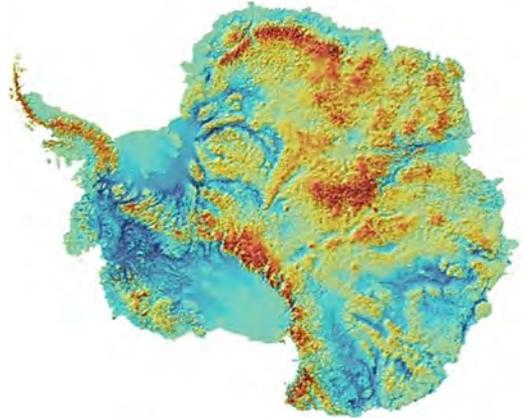
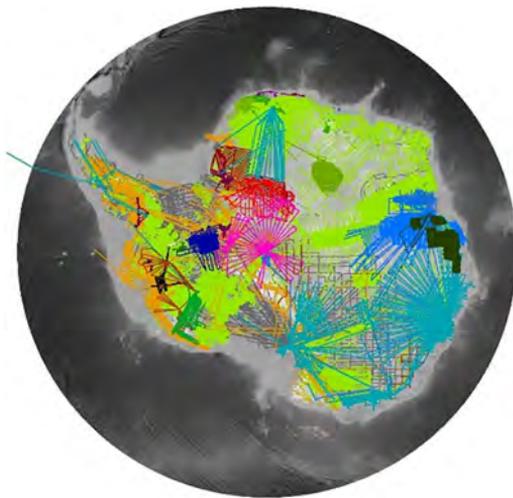
Update on the Bedmap3 project

Bedmap3 is a collaborative community project, aiming to produce a new map and datasets of Antarctic ice thickness and bed topography for the international glaciology and geophysical community. Additionally, Bedmap3 will act as a repository and portal for standardized radio-echo sounding (RES) data.

The project has been driven through a number of Town Hall meetings over the last few years in Kuala Lumpur, Davos, Incheon and Stanford, and has now been formally approved as an Action Group by the SCAR Executive Committee (ExCom) for three years (<https://www.scar.org/scar-news/bedmap-news/bedmap-ag/>).

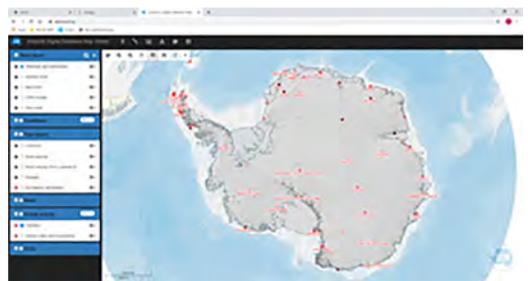
Over the next few months we plan to produce a number of products, starting with grids of ice thickness and bed topography similar to those of Bedmap2, but incorporating new data and with extra resolution and information. Other products, such as data on bed roughness and new sub-shelf gravity inversions, will also be incorporated into the project.

At the time of writing, we have completed the initial data acquisition and data formatting and all known RES data have been collated. We have incorporated data from numerous international sources and have received permission to make all of these data openly available to the community. The figure below gives an indication of the new coverage.



As you can see, we now have substantial improvement in data coverage over Bedmap2, filling several of the previous data gaps.

Our next step will be to grid the data, using the same intricate and carefully considered method developed for Bedmap2. For Bedmap3 we will also develop grids at a number of scales and a seamless variable-resolution grid dependent upon data density, as well as grids that show bed roughness.



We will serve the grids and underlying ungridded RES data via a web-map using an architecture similar to that used for the SCAR Antarctic Digital Database, with browser and download facilities similar to that existing product.

Our plan is to publish the new grids, a data paper and the web-browser simultaneously, hopefully in the spring of 2021 (a challenging, but achievable deadline!).

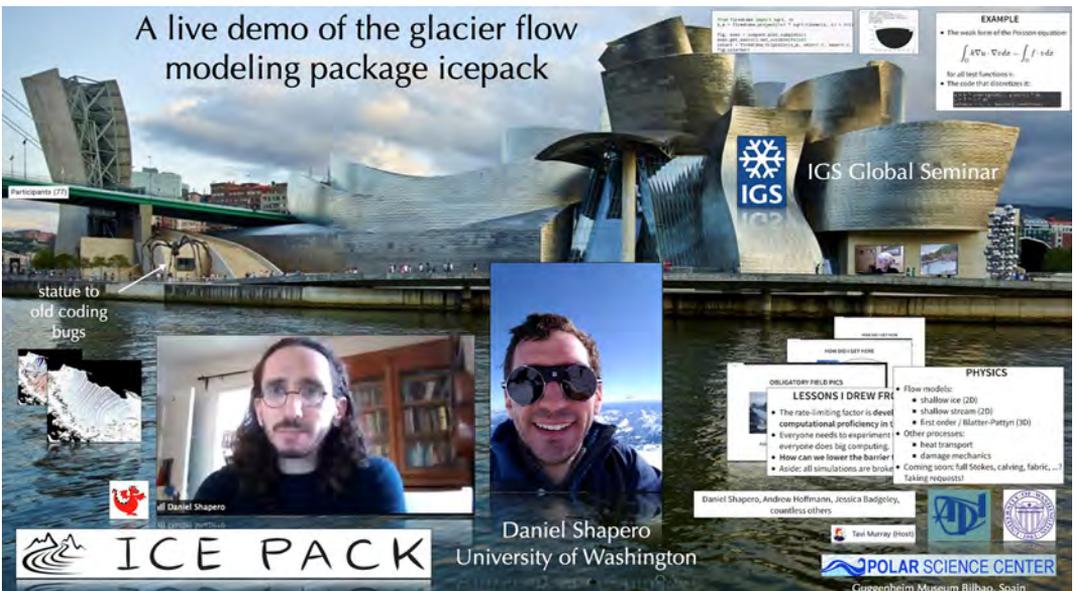
The Bedmap3 Core group

Correspondence to Dr Peter Fretwell, [ptf@bas](mailto:ptf@bas.ac.uk)



commitment, energy and creativity they have put into the presentations. There has been a mix of longer and shorter talks, with lively discussion arising. Early-career scientists have been strongly involved and the shorter talks have included the two Graham Cogley Award winners. Live audiences on both Zoom and Facebook ask questions. And it's been really lovely to see and hear colleagues from around the world on the calls. The talks have been far more adventurous than a typical seminar and have included created

art, data played on a piano and a guitar ballad, as well as lots of current science. Various presenters have also included personal stories of their research careers, as well as lessons learned and tips to foster diversity and inclusiveness. There has been a real sense of community building, with PhD students and other early-career scientists acting as chairs and discussion leads as well as giving talks. So I think all our speakers, chairs and co-organizers deserve a huge vote of thanks! The seminars have also had a really diverse audience



ICE SHEET MASS BALANCE, SEA LEVEL AND EQUITY, DIVERSITY AND INCLUSION IN SCIENCE

PROF. ISABELLA VELICOGNA
U. CAL. IRVINE & NASA/JPL

THE WEIGHT OF THE WORLD'S ICE IS ON HER SHOULDERS

Ice Sheets, Sea Level, and Diversity, Equity and Inclusion in Science
Creating a Diverse and Inclusive Environment

- Diversity is not a magic pill for Excellence
- Diversity by itself is not enough to warrant excellence, we also need Inclusion
- How to do that? We need a positive climate, make people feel welcome and appreciated, make them feel that they belong, provide a support system.
- Key it is to listen to people, observe others, become aware; Cultural Change
- How do we make this Cultural Change? How do we make people buy in?
- It is both a bottom up and top down approach!

Ice Sheets, Sea Level, and Diversity, Equity and Inclusion in Science
Weighting the ice sheets from space

UCI Department of Earth System Science

NASA JPL Propulsion Laboratory Caltech Institute of Technology

IGS

Participants

base: all continents have been represented (including Antarctica!), as well many career stages (from teachers and undergraduate students through university, government and industry scientists to retired scientists).

Q: You've mentioned the diversity of the audience, what about the speakers? The series started with Helen Fricker's Nye lecture and has maintained a balance of women and men throughout the series. Was that deliberate?

That has definitely been deliberate, along with the inclusion of frequent Early-career Scientist slots. Diversity is one of the things both Helen Fricker (the inaugural seminar speaker) and I are passionate about, and is a core value of the IGS we really value. Early on in the series the Black Lives Matter movement really took off in the USA, and that presented us with an additional drive to try include as diverse a range of presenters as possible. Diversity in a field of science such as glaciology requires us to think about race, gender,

Exploring controls on glacier dynamics: What remotely-sensed iceberg calving, submarine melting, and frontal ablation datasets tell us about ocean forcing

IGS Global Seminar Prof. Ellyn Enderlin, Boise State University

Background: My path to glaciology

- Question can be a scientist?
- My background
- Career decisions that led me to glaciology
- Career path to get college admission
- Career path to get college admission
- Career path to get college admission

Early-Career Advice

Disclaimer: Advice based on my personal experiences & will not apply to everyone!

1. Follow your interests, work will be more enjoyable!
2. Find good mentors, people like you, people different from you, people who are just there to support you & challenge for you
3. Don't let failure, bad experiences, etc. stop you from... make sure you have a good relationship

Background: My path to glaciology

Background: Modern Glacier Change

Background: Glacier Change

Climate Change

Boise State University

IGS

Participants



career stage, geography, discipline, research methodology and so much more. We have tried hard, but if you can help us improve this aspect more, then please get in contact!

Q: You mentioned that your view of the aims of the series have changed... what do you think the seminar series is now achieving?

Well I've become increasingly aware that as scientists and researchers our carbon footprints

are large and that we need to look for ways to decrease them. I feel that the model of creating collaboration through attending large conferences relatively frequently cannot be maintained, and we need to look for ways to build new collaborations in a more *sustainable* way. The online European Astronomical Society meeting, normally held in Lyon, was held online this year with a 3000 times smaller carbon footprint¹. That's the sort of reduction in carbon emission the seminar series can help us achieve!



IGS Global Seminar
Prof. Eric Rignot

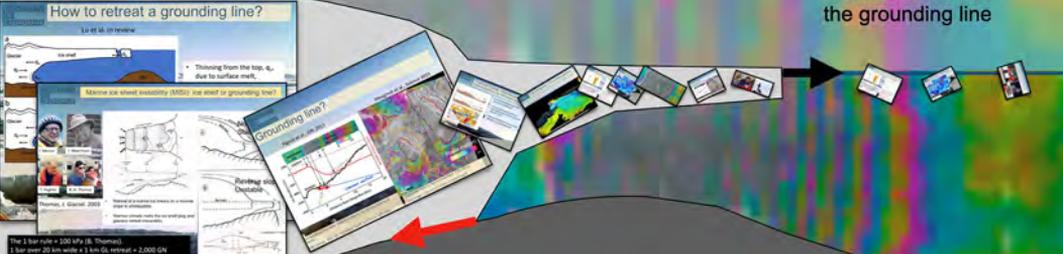




"It's all in the fringes, man!"



Prof. Tavi Murray maybe
rocked too hard at
the grounding line



How to retreat a grounding line?

Grounding line?

Keep on 'rocking at the grounding line'

What's more, the cost of attending typical conferences prevents many students and those living in less developed countries or in geographically remote locations from benefiting, and the time taken and other issues also prevent carers, parents and those with disabilities from attending. PhD and MSc students typically don't get to present or attend international conferences until late in their career. The list of disadvantages for the pre-covid conference model is really long in terms of *inclusion*.

So I hope the seminar series, which is more distributed in time and low-cost to attend, has a lot to offer in terms of improving access to our science. I'm really excited that the seminar series can help us become more *sustainable* and more *inclusive* in the way that we communicate with colleagues and do science!

Q: So all of *sustainability, community and inclusion* are now what the series is aiming for? Do you think the series should continue?



IGS Global Seminar
Participants (24)

Dr. Kevin Hand
NASA/JPL

I submitted a Comment to Nature Geoscience

MATTERS ARISING

Pleistocene formation is unlikely on Europa

Prof. Steve Warren
University of Washington, Seattle

Snow spikes in the dry Andes; maybe not on Europa

Kubrick, 2001: A Space Odyssey

IGS Global Seminar

Featuring:

→ 3 early career scientists ←



Ben Davison
University of St. Andrews

Melissa Diaz
Woods Hole Oceanographic Inst.



Rebecca Schlegel
Swansea University



Yes, that's right... and yes I really do think that we can make a difference by doing so. I hope the IGS will continue to support the series and the benefits it can have. See you at the next talk!

Tavi Murray

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Fiamma Straneo, Scripps, UCSD, USA

7 Oct 2020

IGS Global Seminar Series

"Ahoj Captain is that a glacier up ahead? Lessons learned from working at Greenland's marine margins"

Many lessons learned have been of a technical nature, but many have to do with how to do science with people

Lesson #2 – Science progresses faster in a community culture of inclusivity and collaboration (in contrast to a culture of competition and individual achievement)

Observed fjord scale circulation is due to subglacial discharge

Slater *et al.* 2018

Lesson #1 – Science is NOT done by superstars but by teams

Challenge: How do we foster this?

After all of this, can we balance mass at the glacier front?

NO – residual calving would be two orders of magnitude greater than melting which is at odds with the lack of the ice in the fjord – something is off

Wagner *et al.* 2019; Jackson *et al.* 2020; Sutherland *et al.* 2019

Lesson #1 – Science is done by diverse teams

Ice Sheet Modeling Intercomparison Project for CMIP6 | ISMIP

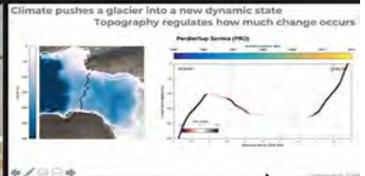
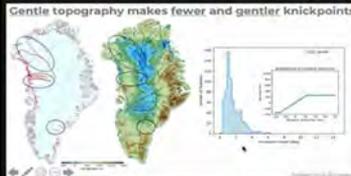
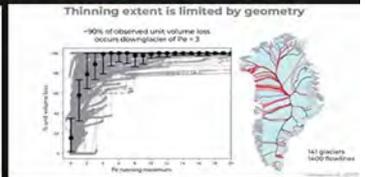
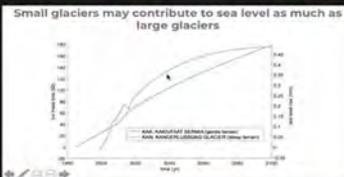
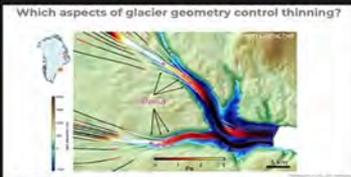
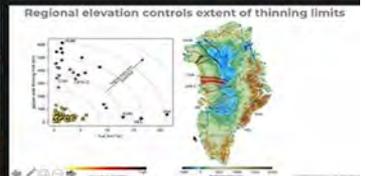
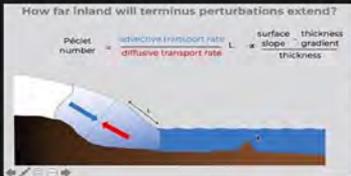
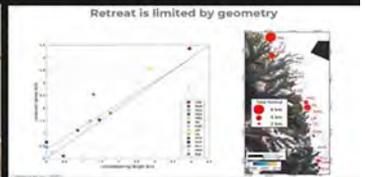
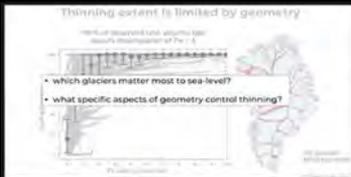
Nowicki *et al.* 2020

"Provide process-based projections of the sea level contributions from the Greenland and Antarctic ice sheets that are linked to the CMIP6 projects"

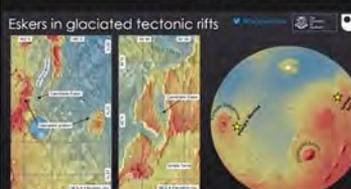
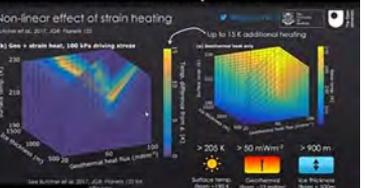
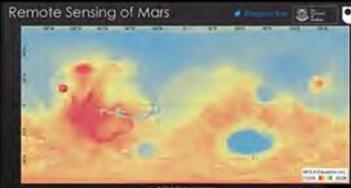
Ice Sheet Modeling Intercomparison Project for CMIP6 | ISMIP

Shepherd *et al.* 2020

"Topographic modulation of ice-ocean interaction"



"Recent glaciation on Mars: stubbornly cold-based or reluctantly wet-based?"



Eskers on Mars are much wider than eskers on Earth

National correspondents of the IGS

This piece is based on a letter that the IGS President, Francisco (Paco) Navarro, wrote to old and new IGS correspondents.

As soon as Paco took office in 2017 one of his main goals was to redefine the duties and responsibilities of IGS correspondents to make them more proactive in promoting the IGS rather than simply compiling a 'list of research activities' within their respective countries every few years. As most such information was freely available on the internet it was felt those reports were no longer needed within the scope of *ICE*.

The main purpose of the 'rebranding' of the IGS correspondents is to make them the point of contact for the IGS in their respective countries or regions. The most important duty of such correspondents will be to encourage and keep track of membership of the IGS, promoting both continued memberships and new memberships. For this, a close contact with colleagues and students is most important, and this can be more easily achieved when smaller communities are involved (in this case, the national/regional ones rather than global ones). We feel that personal contact is the best way to promote membership, and correspondents should strongly encourage their fellow IGS members to also contribute to this promotion of the IGS. Our Membership & Accounts Manager, Louise Buckingham, can support and help you in clarifying any aspect related to membership.

Membership fees and page charges for publishing in IGS journals are our two main sources of income. It is a fact that membership has strongly declined since the IGS journals became open access, so membership is no longer needed to access them. Moreover, recent events out of our control (e.g. Brexit and its associated depreciation of the GB pound) have involved a noticeable decrease in the monetary value of our reserves. Hence the importance of putting some effort into maintaining a healthy level of membership and promoting publication in IGS journals. A wider membership also reinforces our feeling as a community, helping to promote the study of snow and ice, which is our most important goal as a learned society.

Accordingly, another important task for the national correspondents will be to promote the publication of papers in the *Journal of Glaciology* and the *Annals of Glaciology*, as well as attendance at IGS symposia. Regarding IGS symposia, the national correspondents should

also play an important role in promoting their realization in their respective countries, as they know better than most the community and its main fields of interest and expertise.

The correspondents need to be active and convincing in making clear to their colleagues and students that membership (as well as attending IGS symposia and publishing in the IGS journals) is crucial to the continuation of independent thematic symposia and high-impact journals. Another very important fact is that the IGS contributes to the funding of various summer schools. The latter is to be strongly emphasized and correspondents will stress that support of the IGS will mean the continuation and hopefully increased support of such endeavours, which benefit students and early-career glaciologists especially, both graduate and post-graduate.

Correspondents will work closely with and promote the IGS Early-career Glaciologists' Group, famously abbreviated as EGG. The EGG has been very active and is an excellent group where early-career scientists can interact with their peers. It has also been instrumental in promoting and proactively supporting and helping run all IGS events.

During this redefining of the IGS correspondents many of the 'old guard', some of whom have been on duty for decades, have used this opportunity to step aside and make room for new colleagues to pick up the torch. Equally many have decided to 'stay on', possibly inspired by new possibilities.

We would like to thank those correspondents who have retired for their important contributions over the years. At the same time, we would like to welcome our new correspondents and express our dedication and enthusiasm to work with all correspondents in the future.

To finish off, we would like to say that any suggestions on how to effectively achieve our goals are of course welcome, as are any types of suggestion on new and innovative ways that the correspondents, or for that matter any officer and member of the IGS, can further improve the workings of our Society.

Overleaf you will find a listing of all the IGS correspondents. Details on how to get in touch with them are on the IGS website.

Francisco (Paco) Navarro, IGS President
Magnús Már Magnússon, IGS Secretary General

ARGENTINA
Lucas Ruiz

AUSTRALIA
Petra Heil

AUSTRIA
Elisabeth Schlosser

BELGIUM
Philippe Huybrechts

Brazil
Jefferson C Simões

CANADA
Wesley van Wychen

CHILE
Andrés Rivera

CHINA
Yao Tandong
and
Jing Gao

DENMARK
Andreas Peter Ahlstrøm

FINLAND
Thomas Zwinger

FRANCE
Étienne Berthier

GERMANY
Daniela Jansen

ICELAND
Hrafnhildur Hannesdóttir

ITALY
Guglielmina Diolaiuti

JAPAN
Shin Sugiyama

NETHERLANDS
Carleen Tijn-Reijmer

NEW ZEALAND
Heather Purdie

NORWAY
Geir Moholdt

POLAND
Grzegorz Rachlewicz

RUSSIA
Ivan Lavrentiev
and
Sergey Sokratov

SPAIN
Francisco J. Navarro

SWEDEN
Ward van Pelt

SWITZERLAND
Frank Paul

UNITED KINGDOM
Bryn P. Hubbard

USA (Alaska)
Martin Truffer

USA (Eastern)
Kristin Schild

USA (Western)
TJ Fudge



We love to see what our beanies get up to once they've flown the nest. Here are two being sported by Seth Campbell and Kristin Schild. We have lots left in Cambridge. Perfect for these chilly days and nights. Just drop Louise Buckingham an email at louise@igsoc.org.



Obituary: Konrad Steffen, 1952–2020

On Saturday 8 August this year, a long-standing member of the IGS left us abruptly. Professor Konrad Steffen died in an accident during his annual field work on the Greenland ice sheet. Koni, as he was always called by his friends and students, was an active cryospheric scientist, and Director General of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), one of the major institutions affiliated with the Swiss Federal Institute of Technology (ETH). Simultaneously, he was professor at the Institute for Atmospheric and Climate Science of ETH. He also held a professorship in Architecture, Civil and Environmental Engineering at the École polytechnique fédérale de Lausanne, beside his responsibility as scientific director of the Swiss Polar Institute. Professor Steffen's life was truly international, living and working both in Switzerland and in the United States. His international commitments extended to many other countries, such as Denmark, Canada, Japan, China and Australia.

Koni was born on 2 January 1952 in Zurich to a Swiss father and a Swedish/Swiss mother. By the time he entered ETH in 1972, he was proficient in three languages besides his native German: English, French and Swedish. Five years later, he completed the Diplom nat. wiss. (equivalent to an MSc in North America) under the supervision of Professor Fritz Müller, with a thesis on snow-cover characteristics on the tundra of Axel Heiberg Island, Canadian Arctic. Completing his 5 years' study at ETH required unusual effort. As his artist father was not positively inclined towards his son's university education, Koni financed his studies by working as a part-time employee of Swissair. This sideline turned out not to be entirely negative for him. Although he was part-time, his employment in Swissair gave him two free tickets a year, with which he could fly to any destination in the world. Using this opportunity, he exercised his photographic enthusiasm by travelling free to regions of difficult access, such as Siberia and Afghanistan.

Upon completion of his MSc, Koni joined the fledgling North Water Project, Phase II, in 1978. During the 1970s, polynya was only vaguely envisaged as the ice-free area surrounded by sea ice in the polar regions, as it is still portrayed in most glossaries. Koni went one step further



to see what the polynya was really made of. Combining this aim with his personal interest in remote sensing, he proposed overwintering to investigate the surface conditions of the North Water from a low-flying (150 m) aircraft. The operation was based on Resolute in order to carry out biweekly flights during the winters of 1979/80 and 1980/81, measuring the surface temperature and albedo, accompanied by high-resolution photography of the surface of the polynya. The results of the two-winter investigation brought many new findings to the scientific community. The most important finding was that most of the polynya surface was not ice-free, but covered with new ice at various stages. Second, but not less important, was the discovery of 'hot spots': truly ice-free circular water surfaces, several hundred metres in diameter, scattered within the new ice field, especially in the eastern half of the North Water. The temperature of the hot spots was clearly above freezing point and in places reached +2°C. This fact indicated that the large polynya, like the North Water, was not caused by local winds sweeping the sea ice through the polynya, but by upwelling warm water from the deeper ocean layers in Baffin Bay. The precise mechanism of heat transport from the ocean interior to the surface still remains unclarified, as this investigation demands an

oceanographic project in the polynya in winter, which unfortunately has not yet been carried out. A magnificent by-product of the low-altitude flights over the North Water, however, was the publication of a photographic album of sea ice at various stages, which even today stands as the best collection available of sea ice photographs.

After the completion of his doctoral study in 1984, Koni married an intelligent and kind girl, Regula Werner. On the scientific side, he wished to pursue his studies further in the direction of remote sensing. At this stage, I encouraged him to experience remote sensing research in the USA. In Europe, it was difficult for him to make an advance in remote sensing, as the ESA was still at the fledging stage. The best remote sensing works were carried out in the USA. Koni spent the following 2 years on a NASA postdoctoral fellowship at the Cooperative Institute for Research on Environmental Sciences (CIRES) of the University of Colorado, Boulder. Besides his remote sensing studies, he amassed valuable international experience as a young scientist. Upon returning to ETH in 1988, he was appointed to a senior assistant's post and continued with his work on North Water. During this time Koni and Regula became parents. He also added new experience in remote sensing and meteorology of the Alps. In 1990 he participated in the ETH expedition to West Greenland, which was aimed at clarifying the processes that lead to the formation of the equilibrium line on the ice sheet, based on the ETH Camp.

Koni's association with Boulder continued after his return to his native Switzerland. He was appointed to the position of tenure-track associate professor in climatology at the University of Colorado in fall 1990, being promoted 3 years later to full professor. Both in Switzerland and the USA, he always offered students and scientists of both sides of the Atlantic an open home, and many enjoyed his and Regula's hospitality. After the move to Boulder, Koni took charge of the ETH Camp, which continues to the present time. A major step during this period was setting up an extensive network of automatic meteorological stations, beginning in 1995. The network quickly developed, covering most of Greenland within 5 years. Koni's appointment to the directorship of CIRES in 2005 was a turning point in his career. His main everyday job was to secure the research funds to keep CIRES going. Nevertheless, his time at CIRES was a happy one. During this period, he managed to expand the network of the automatic meteorological stations on Greenland to 18. It

must have been a relief to dash to Greenland in the midst of a busy schedule, no matter how short the field trip would have been. Work there during this time condensed into one of the earliest presentations of the rising warm climatic zones on the Greenland ice sheet, based not only on remote sensing but on in-situ observations on the ice sheet.

In 2012 Koni took up a position as Director General of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL). The WSL is one of the most inhomogeneous research institutions I have encountered in my life. It is a hard nut, I said to Koni before he decided to take up the appointment, but I did not stop him. If anybody could lead the WSL, Koni's ability and mental preparedness were close to making him the best qualified. As is the case in many Swiss research organizations, the director is seconded by a highly qualified, able administrator. This condition gave Koni more time to continue his polar and cryospheric research. Besides, one's native country is the dearest. So, Koni had a happy 8 years, before his life ended on the Greenland ice sheet, to which he dedicated most of his scientific life. He was one of the first scientists to warn society of rapidly warming conditions in Greenland and left an unparalleled observation network and, above all, a group of young scientists from his institution who will no doubt carry on his legacy. His and Regula's children, Anico and Simon, are both grown up and independent personalities. Late in life, Koni married again, to Bianca Perren, a palaeoclimatologist working at the British Antarctic Survey. All these developments serve to comfort us a little for his unexpected departure from us.

Atsumu Ohmura



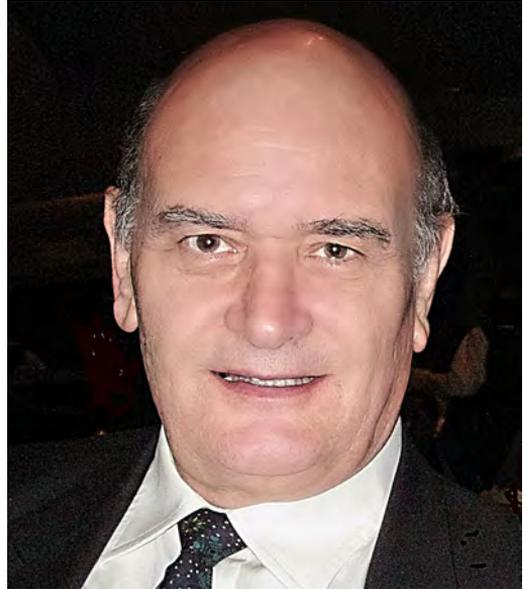


Obituary: C. Simon L. Ommanney 1942–2020

Simon Ommanney, who from 1993 to 2003 served as Secretary General of the IGS, died in Foxboro, Ontario, Canada, on 18 September 2020.

Charles Simon Lacon Ommanney was born in 1942 in Farnham, Surrey, England, where the Ommanney name has long associations with the Royal Navy and polar exploration. He immigrated to Canada in 1964, to enrol in the third year of the BA program in Geography at McGill University in Montreal. While an undergraduate, he encountered the magnetic Fritz Müller and joined Müller's Arctic Research Expedition on Axel Heiberg Island. In 1965, upon completion of his undergraduate studies, Simon began an MSc study under Müller in Interdisciplinary Glaciology, which was jointly organized by Physics, Meteorology and Geography. During his 4 years with Müller, he rose from assistant to Field Leader of the Axel Heiberg research expedition.

At that time, the International Coordinating Council of the International Hydrological Decade (IHD) probed Fritz Müller's interest in leading the World Glacier Inventory (WGI) program. Fritz was reluctant to take up the offer, considering inventory work to lack scientific challenge. Realizing that Fritz might turn down the IHD council offer, Simon set out to persuade him to accept. His argument was remarkable. The scientific content of the inventory would depend on how the inventory was designed. The world lacked basic information on glaciers, such as their surface area, ice volume, geographical distribution and the presence of glacier-dammed lakes. A world inventory would therefore supply basic information on the global hydrological cycle, a major goal of the IHD. Such an inventory should be repeated every 50 years to monitor the change of glaciers on the global scale. Fritz remained unenthusiastic about devoting his time to such 'donkey work', as he described it, but Simon promised that it would not cost Fritz any additional time because he would do most of the work himself. In this way, he managed to pull Fritz into the WGI, establish the Temporary Technical Secretariat for WGI, and launch an initial inventory of glaciers on Axel Heiberg Island that served as a pilot project for the WGI. He devoted an entire year to creating the inventory of the glaciers on McGill Ice Cap and Steacie Ice Cap and establishing how a global



scale inventory might be conducted. The Steacie Ice Cap inventory became his MSc thesis.

Upon completing an MSc in Geography, Simon joined the Canadian civil service, and from 1967 to 1993 worked as a glaciologist, starting in Ottawa as Section Head of the Glaciology Subdivision in Energy, Mines and Resources and ending in Saskatoon as Head of the Climate and Hydrology Project at the National Hydrological Research Institute (NHRI). Simon developed an early appetite for data management and put this to great scientific advantage. He became the principal advocate for the Canadian Glacier Inventory and, with meager resources, turned the Canadian effort into a shining achievement. As an associated project, Ommanney developed ICEREF, the bibliography of Canadian glaciers. Simon not only catalogued his materials he devoured them, making him a living archive for Canada's glaciological community and uniquely qualified to write the first and only comprehensive history of glacier investigations in Canada.

Viewed in retrospect, Simon's years in government service coincided with a long decline in support for the kind of research that drew him to glaciology. In 1993 he stunned his Canadian

colleagues by accepting the position of Secretary General of the International Glaciological Society and, with his adventurous and supportive wife Margaret, moved from Saskatoon to Balsham, near Cambridge. When Simon left NHRI, it came as no surprise that glacier inventory activities ceased, seeming to confirm that without Simon's leadership things would have gone differently. In Cambridge, the scheduled retirement of the founding Secretary General had raised anxiety about the search for her successor during a pivotal time for the Society. Among those close to IGS one could almost hear a sigh of relief – the Society would be in safe hands. Canada's loss was a big gain for the IGS.

As a graduate student in 1964, Simon had joined the IGS and subsequently served as its Canadian Correspondent (1975–80 and 1991–93), editor of *ICE* (1980–86), member of IGS Council (1991–93) and much else.

The crown jewel of Simon's long and productive career in glaciology will be regarded by many as his decade of service to the IGS as only its second Secretary-General. It was a service to the Society that knew no bounds. Faced with a challenging financial sheet driven by a combination of stagnant membership numbers, long publishing lead times and declining library subscriptions to the *Journal*, Simon led restorative efforts on all fronts. Employing his characteristically calm demeanour, Simon worked extensively with the Society's senior officers (President, Vice-Presidents, Chief Editor, Council and the long-serving Treasurer, John Heap) and its various committees, as well as enlisting the support of additional Society members, to address these myriad challenges. The publication process was streamlined, and the backlog of papers all but eliminated. More papers were published, a large portion of them being financially supported by author-provided page charges, while retaining the Society's high-quality standard. The number of symposia was doubled to two per year; no small feat given the extensive workload each

symposium imposed on the office staff. By persuasive articulation of membership benefits, Simon grew the Society's membership by 25%. In essence, he can be credited with a wholesale modernization of the Society operations, including introducing e-mail, payment by credit cards and computerizing office operations in Cambridge. Accomplishing such an extraordinary and wide sweeping transformation in such a short period of time would not have been possible without Simon's legendary discipline of long work hours both at home and in the office. This was possible, in no small measure, because of the support of his devoted wife Margaret. Always seen alongside Simon at Society meetings and adding her own personal charm to the collegial atmosphere of IGS symposia, she kept their home in Balsham a comfortable and relaxing place to deepen the personal relationships that grow with membership in our Society.

In 2003, after 10 years as Secretary General, Simon and Margaret returned to Canada to join their children and their expanding families. They settled in Toronto for the first five years, moved to Nova Scotia for a decade, then to Foxboro near Toronto in 2019. No one expected Simon to retire and that did not happen. Back in Canada he served as Secretary of the Canadian Committee on Antarctic Research for the Canadian Polar Commission. In the course of his long career in glaciology Simon received numerous awards and honours, among them, the Richardson Medal of the IGS (2003), the Queen Elizabeth II Diamond Jubilee Medal (2012) for service to Canada, Fellowship in the American Association for the Advancement of Science and in the Royal Canadian Geographical Society. He will be remembered for his unflagging energy, tactful leadership, organizational skill and generosity of spirit.

Garry Clarke, Bob Bindshadler, Bjørn Wold and Atsumu Ohmura

Former Presidents of the IGS



Obituary: Wendell V. Tangborn 1927–2020

Wendell Verner Tangborn died of congestive heart failure on 3 October 2020. He was 93. He passed away peacefully at Mirabella Retirement Community, in Seattle, Washington, USA, where he lived with his wife Andrea Lewis.

Born in Sioux City, Iowa, USA, Wendell grew up with four brothers and one sister on a farm near Bemidji, Minnesota. After serving in the US Army, he graduated from the University of Minnesota with a BS degree in geological engineering and became a glaciologist with the US Geological Survey (USGS, 1960–79), where he played an important role in the development of modern glaciology. Subsequently, in 1983, he formed his own company, Hymet Inc., for the purpose of predicting stream runoff using weather-station data from catchment areas and modeling methods without physically going into the field to measure snow depth. His discharge simulations of the Columbia River, the fourth largest river by volume in North America, carried out individually using only his personal computer, compared favorably with those of the National Weather Service Advanced Hydrologic Prediction Service.

Later, Wendell realized he could convert his river discharge model to a glacier mass balance model, calling it the precipitation-temperature-area-altitude (PTAA) mass balance model. It uses only meteorological data from low-altitude and relatively distant weather stations to define the regional climate, plus glacier topographic data obtained from maps, and does not require field measurements.

Wendell once said it was one of the luckiest days of his life when Dr Mark F. Meier offered him a position at the USGS Glaciology Project Office, then located in Tacoma, Washington. Mark needed a hydrologist to help fulfill the mission of the new research office, which included understanding the effect of glaciers on water runoff. Wendell was working as a hydrologist with the USGS at the time, gauging streams in Minnesota. The position Mark was offering also required someone who could, in addition to the rigors of glacier work, endure the strenuous brush-crashing needed to get to and from South Cascade Glacier for mass balance measurements (travel by aircraft support came later). A 9-mile trail was later constructed single-handedly by Austin Post, who had worked on trail crews in the region prior to his hire by Mark Meier. Wendell, with his expertise, long legs and strength, was a natural.



In 1960, Wendell relocated to the mountainous west, never having walked on, and probably never having seen, a glacier. The new study site, South Cascade Glacier, is northeast of Seattle in the North Cascade Mountains of Washington. It is called South Cascade because it is the headwaters of the South Fork of the Cascade River. Wendell helped implement a mass balance program there that has since become the longest continuous mass balance data-set in the Western Hemisphere. Early during that effort, he and Mark published a seminal paper in the *Journal of Glaciology* (Meier & Tangborn, 1965) linking mass balance with glacier dynamics, as well as establishing the geophysical basis of mass balance measurements. The paper is unusual in its clarity of text and figures and should be included in every graduate class in glaciology. Partly because of this work, in 1967 Wendell was part of a Norwegian exchange program during which he spent 6 months working with Dr Gunnar Østrem and his group comparing mass balance and stream-gauging methods. This experience profoundly affected Wendell's professional life. He and Gunnar became life-long friends (which frequently involved sampling ice cream).

Like many in the field sciences, Wendell had his share of mishaps and successes, near misses and achievements. He liked to tell amusing stories about his experiences, such as carrying Mark Meier on his back across a glacial stream to short-cut the distance back to the hut, or how, on his way out of

the hut, he could easily reach the supply of candy bars on the upper shelf while Mark, in frustration, had to get a chair. After those early years the Tacoma research office grew to include such notables as Bill Campbell, Bob Krimmel, Steven Hodge, Austin Post and Al Rasmussen.

Wendell also co-authored, among many other papers, a seminal paper that examined the hydrological budget of South Cascade Glacier (Tangborn et al., 1975). By measuring precipitation and snowmelt in the basin, the mass balance of the glacier, and the glacial runoff, he showed that the glacier stored significant volumes of water not only for weeks but perhaps for months. This was one of the few papers to quantify the hydrologic balance of a temperate glacier. Ahead of its time, it preceded by years our general understanding of increased winter and spring water storage within temperate glaciers. The intent of the paper, however, was to compare three different and commonly used methods of estimating glacier mass balance (the glaciological, hydrological and geodetic methods). As a result of the water storage processes discovered by Wendell, this paper helped discourage use of the hydrological method.

Wendell became interested in modeling snowmelt as part of estimating glacier mass balances, and soon realized the practical importance of his work for predicting runoff from snow-covered basins, which are major water sources in the western USA and Canada. In 1979, he left the USGS to pursue his modeling interests, then formed his own company, Hymet, Inc. His clients included BC Hydro in Canada, Puget Sound Energy near Seattle, and the Salt River Project near Phoenix, Arizona.

Wendell also maintained his interest in glaciers, however. He had a talent for asking interesting

(and solvable) questions about mass balance and hydrology. His precipitation–temperature–area–altitude (PTAA) model is based on the physically reasonable assumption that a glacier’s mass balance variables are correlated. Thus, although the number of coefficients to be solved for is significantly larger than the number of constraining equations, their values can be estimated by starting with an initial set of guesses then maximizing the correlation among them. This Wendell accomplished by using a simplex optimization technique (from Press et al., 1986). He then applied his PTAA model to a number of glaciers in the the western USA, the European Alps and the Nepal Himalaya, and showed that it yielded good results relative to time series (the longer the better) of field-measured mass balances. On the well measured South Cascade Glacier, he found that ‘the agreement between annual balances for individual years was fair. For long-term volume changes measured by the geodetic method, agreement was excellent.’ (Tangborn, 1999)

Throughout his life, Wendell remained close to his Minnesota roots. He wrote several detailed memoirs about his early years there, and loved *Prairie Home Companion* (1974–2016), a nationally famous radio show set in a fictional small town in Minnesota. He claimed to know real-life versions of all the characters portrayed. Gentle and self-effacing, he continually advocated for policies to ameliorate the adverse human drivers of climate warming. He was particularly proud of his published children’s book on glaciers. His contributions to glaciology, his gentle soul and his warm smile will long be remembered.

Wendell V. Tangborn was preceded in death by his eldest son John and is survived by his wife, Andrea Lewis, his sons Andrew and Eric, and his daughter Inger. He leaves behind two adopted families from Nepal with whom he had close relationships: the Birbal Rana family and the Moti Thapa family, both of Vashon Island, Washington, USA, where Wendell and Andrea lived for many years.



Wendell walking on the valley wall above South Cascade Glacier

Andrew Fountain, Andrea Lewis and Craig S. Lingle

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Obituary: William D. Harrison, 1936–2020

After a long illness, William (Will) Douglas Harrison passed away on 30 October 2020 in Fairbanks, Alaska, USA, where he had spent the last 48 years of his life.

Will was born in Saint John, New Brunswick, Canada, in 1936; the year of Black Rapids Glacier's last surge, which he loved to refer to as his 'Star of Bethlehem'. He initially chose a path that had little to do with glaciology and earned a BSc from Mount Allison University in Sackville, N.B., in 1958, and a BSc (Special) in Physics from the University of London, UK, in 1960. In 1966 he received his PhD in Nuclear Physics, working in the famous Kellogg Radiation Laboratory at Caltech in Pasadena, California, USA. This field of work did not exert a long hold on him, however: after a year as a research associate at the University of Minnesota, he returned to Caltech as a Postdoctoral Fellow in Geology. Maybe his decision to switch fields was helped by joining an expedition to the summit of Mt Logan in 1967. As part of a series of climbs organized to celebrate the Centennial of the Dominion of Canada, the team (under the leadership of the extraordinary climber Vin Hoeman) completed a first ascent of the Hub-Sew ridge and traversed the 5959 m high mountain, Canada's tallest and perhaps the most massive mountain in the world. Will wrote a description for the *American Alpine Journal* (1968) in his typical witty style and dry humor.

Realizing that the study of glaciers could actually be a full time job, he became a Postdoctoral Fellow at Caltech in Geology and never looked back to nuclear physics. He applied his machine-shop skills to build borehole cameras and started working with Barclay Kamb at Blue Glacier in the Olympic Mountains of Washington, USA, where he used the cameras to study the movement of ice over its base. On a fateful Friday in 1968 Will flipped a coin, Anne Katherine Sloss accepted his proposal and they got married the following Monday, a day before Will left for Athabasca Glacier. In 1970 they moved to Seattle, Washington, where he joined his life-long friend and collaborator Charlie Raymond at the University of Washington to continue their studies of Blue Glacier and Athabasca Glacier.

In the middle of a cold 1972 winter, Will and his wife Anne drove to Fairbanks, Alaska, where Will joined the University of Alaska and the



Geophysical Institute as a faculty member in the Physics Department. The cold and dark winter did not deter them and they made Fairbanks and Alaska their home, where they raised their two sons. They did eventually upgrade from a dry cabin to their home at Rosie Creek, which Anne purchased while Will was in the field. The house became a welcoming place for many visitors over the years, who remember it as a warm and homey residence.

Will participated in a research project that was under way on the McCall Glacier in the Brooks Range, but he soon became fascinated with glacier surges. Together with Charlie Raymond he started looking for a suitable target glacier that could be monitored in a comprehensive fashion and where one could reasonably expect a surge to occur within the time frame of a decade or so. Thus the Variegated Glacier project was born, which, to this day, stands as the foundational work on surging. Many budding and already established glaciologists joined Will and Charlie over the many years of this project, including Barclay Kamb, their former mentor at Caltech. Will's frugality in the field and ability to make do with minimal resources, perhaps a product of his Canadian maritime roots, became the stuff of legend. Will used to explain to his graduate students how to hang tea bags up in the tent, so they could dry out and be reused.



Will in 1981.

His interest in surging glaciers also extended to those in the Alaska Range, with investigations of the surge of the West Fork Glacier. He developed and made extensive use of time-lapse cameras, which were triggered by the alarm signal from a digital watch and could be serviced with nothing but a Swiss Army knife. Among all those glaciers, Black Rapids Glacier held a special place in Will's heart. From his borehole camera work he was already suspicious of the view of glaciers flowing over clean bedrock, and he decided that Black Rapids Glacier was the place to investigate this closer. He used boreholes to access the glacier bed and sample and instrument a thick layer of underlying till.

In the 1980s, Alaska became interested in big hydroelectric projects, such as building a dam on the glacier-fed Susitna River. Will had to remind the engineers that glaciers were part of the hydrological basin and that they fundamentally affect the hydrology, particularly the many surge-type glaciers of the area. He and Carl Benson convened an international workshop with many participants from countries with experience in hydroelectricity from glacier-fed river basins. Engineers and planners from the USA with no such experience formed the target audience.

During these years, a younger Keith Echelmeyer joined Carl Benson and Will, and UAF became a powerhouse of glaciology. Will and Keith were a very successful team that accomplished some of the foundational work on the fast flow of Jakobshavn Isbræ (where they also collaborated with Almut Iken of ETH Zurich) and the role of margins in controlling the flow of the Siple Coast ice streams, in particular Ice Stream B (now Whillans Ice Stream). Will's work was recognized by the naming of the Harrison Ice Ridge. But he probably took more pride in the naming of the

Will's Ear survey monument on Black Rapids Glacier, which commemorate his pouring cement into his ear through a small hole in a bag he carried up the mountain to establish the monument.

In the early 1990s Keith and Will's team developed a lightweight laser profiler that led to the first comprehensive mass loss measurements of Alaskan glaciers. In a landmark paper by graduate student Anthony Arendt, they clearly demonstrated that Alaska and neighboring Canada were major contributors to global sea-level rise.

Will's interests were far-ranging and included work on subsea permafrost off Alaska's north coast. This was a somewhat obscure topic at the time, but was well suited to his interests in drilling and precise temperature measurements. The topic is currently seeing a revival with interest in offshore oil drilling in the Arctic.

In 1998 Will retired and became Professor Emeritus. He greatly reduced field work but remained active in research. He became increasingly interested in what he called macroscopic glacier theory and in how to properly interpret glacier mass balance and relate it to climate change. This resulted in the concept of a 'reference surface balance', which was the first clear description of which part of glacier change is due to warming climate versus adjusting geometry. In 2000, the American Geophysical Union recognized his work by awarding him the title of Fellow of the AGU.

From 1998 to 2004, together with Matthew Sturm, Will was Chief Editor of the *Journal of Glaciology*. He had always believed in rigorous and clear writing and his graduate students and co-authors had to suffer many drafts before something was cleared for publication. But he was equally hard on himself: Once, after a journal



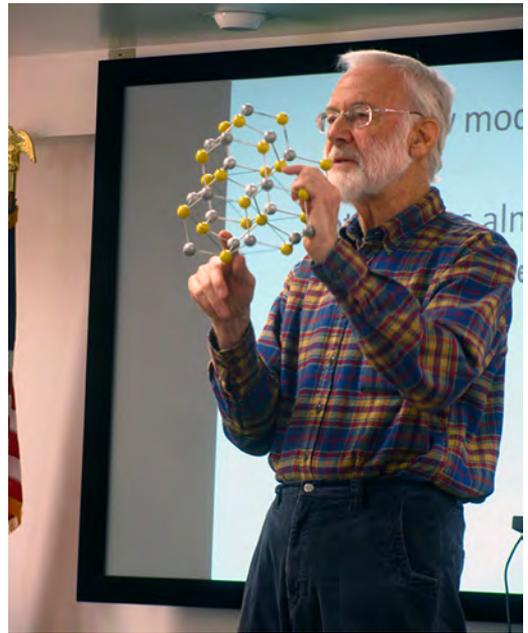
Will Harrison in Antarctica.

had already accepted his article, he rewrote it in its entirety, because he believed the reviewers hadn't been sufficiently careful!

Will was a very hard worker, both in the field and in the office. But he was also an immensely generous person. His wife Anne and he invited visitors and 'lost souls' into their home at Rosie Creek, where they fed many hungry graduate students and where there seemed to be endless entertainment from a variety of pets. He loved talking about history, in particular naval and sailing history. Growing up he had spent a lot of time with his brothers, Evans and Richard, on the waters of the Bay of Fundy. His native land kept a lifelong hold on him. He retained his Canadian citizenship and he and Anne visited their cottage on the Saint John River almost every summer.

Will relished the forest in his neighborhood and the mighty Tanana River, a great place for walks and snow machine rides in the winter. Many in the Geophysical Institute will miss the annual spring ritual of the appearance of a 'lady's slipper' orchid on their desks that he had collected in his neighborhood. We miss him very much.

Martin Truffer and Carl Benson



Will teaching.



Seligman Crystal for Andrew C. Fowler

Andrew has made substantial theoretical advances to understanding a diverse set of processes governing the behaviour of glaciers and ice sheets. He has made significant contributions to the understanding of glacier sliding, subglacial hydrology, subglacial bedform evolution, glacier surging, ice sheet modelling, ice-stream dynamics, frost heave and periglacial processes leading to pattern formation, cryospheric waves, ice-age climate cycles, Dansgaard–Oeschger events, and subglacial outburst floods. In 1978 he produced the first formal derivation of what is known as shallow ice models for glacier flow.

His theories are mathematically rigorous, but also have physical sense and inform real system observations. His advances arise from clear thinking, often outside the box, and while many are still ahead of their time, they support continuing progress and have a long-lasting impact on glaciological understanding and direction. He has a strong record both of mentoring graduate students, many of whom are themselves today's glaciological leaders, and also of broadly and generously sharing his ideas and knowledge.

In view of each of these bases, but above all his groundbreaking and inspirational science, the Council of the International Glaciological Society has decided to award the Seligman Crystal to Andrew Fowler.

**On behalf of the Awards Committee of the
International Glaciological Society
Ian Allison, Chair**





Seligman Crystal for Catherine Ritz

Catherine Ritz has made outstanding contributions to ice sheet and paleoclimate research and particularly to ice-sheet modelling. She pioneered the development of three dimensional thermo-mechanically coupled ice-sheet models for studying large-scale evolution of ice sheets and ice-core dating. She also made significant advances in the analysis of ice-sheet temperature profiles. Together, these have enabled better understanding of how ice sheets behave during glacial–interglacial cycles, the future behaviour of ice sheets in a warming world, and estimates of their future contribution to sea-level rise.

She has also investigated Heinrich events, Snowball Earth, ice fabrics, the effects of thermal diffusion on firn densification, and much more. Her contributions have a long-lasting impact on the development of ice-sheet modelling and the interpretation of ice-core records. She introduced ensemble modelling and Bayesian calibration into model intercomparison; she led integration of borehole temperature analysis, ice-sheet mechanical modelling and ice-core geochemistry to improve the dating and interpretation of ice-core records; and she continues to impact future directions in glaciological research through her leadership in several international bodies.

In view of each of these bases, but above all her groundbreaking and inspirational science, the Council of the International Glaciological Society has decided to award the Seligman Crystal to Catherine Ritz.

**On behalf of the Awards Committee of the
International Glaciological Society
Ian Allison, Chair**





Richardson Medal for Christina Hulbe and Eric Wolff



Christina and Eric led the decision process that completely changed the Society's publishing operations from in-house publication of the *Journal of Glaciology* and *Annals of Glaciology* to universal open access publishing by Cambridge University Press. The decision involved long and arduous argument, between 2011 and 2016, led by the dedicated commitment of the nominees. They recognized the risk of such a transformation, but argued that the risk was justified not only by the basic core value of the IGS to disseminate scientific knowledge as widely as possible, but also by the fact that the IGS was unlikely to survive if it did not respond to competitive pressure in a changing publication environment.

The decision to make the change to Gold Open Access was forward-looking. The transition was made while maintaining the Society's strictest,

independent control over editing, scientific content and core values and has had a major benefit for both the glaciological community and the IGS.

It is in recognition of their substantial contribution to the move of the IGS journals towards Gold Open Access that the Council of the International Glaciological Society has decided to award the Richardson Medal to Christina Hulbe and Eric Wolff .

**On behalf of the Awards Committee of the International Glaciological Society
Ian Allison, Chair**



Honorary Membership for Michael Kuhn

Michael Kuhn has contributed more than 40 years of outstanding service as Chief Editor of *Zeitschrift für Gletscherkunde und Glazialgeologie*, the longest running glaciological journal. He has had more than 50 years involvement in glaciological and meteorological research in the Alps, the Arctic and Antarctic, with contributions to the study of radiative transfer and energy balance at a snow surface; glacier response to climate change; ice dynamics; glacier hydrology; seasonal snow cover and permafrost; katabatic wind and föhn processes.

He has made major contributions to research coordination and administration at the international and national level in organizations such as the International Association of Meteorology and Atmospheric Sciences; the International Commission on Snow and Ice; the Austrian Meteorological Society; and the Bavarian Academy of Sciences. Michael initiated surveys and inventories of glacier outlines, DEMs, and ice thickness for glaciers in Austria, leading to creation of the second Austrian Glacier Inventory and led mass balance programs at Hintereisferner and Kesselwandferner, resulting in two of the longest time series.

He is acknowledged as an outstanding teacher and excellent mentor in glaciology at the Institute for Meteorology and Geophysics at the University of Innsbruck.

In view of each of these bases, the Council of the International Glaciological Society has decided to award the IGS Honourary Membership to Michael Kuhn.

**On behalf of the Awards Committee of the
International Glaciological Society
Ian Allison, Chair**





CRYOSPHERE 2022

International Symposium on Ice, Snow and Water in a Warming World

Harpa Conference Centre
Reykjavík, Iceland
21–26 August 2022



Postponed until 2022

Organizers: Icelandic Meteorological Office, World Meteorological Organization, International Association of Cryospheric Sciences, International Association of Hydrological Sciences, International Glaciological Society

Co-sponsors: University of Iceland, UNESCO Intergovernmental Hydrological Programme, Danish Meteorological Institute, WSL-Institute for Snow and Avalanche Research, Melnikov Permafrost Institute, University of Wisconsin, University of Alaska Fairbanks, Stefansson Arctic Institute, University of Ottawa, UNESCO-IOC, Alfred Wegener Institute, Technical University of Vienna, European Centre for Medium-Range Weather Forecasts, International Arctic Science Committee, Arctic Monitoring and Assessment Programme, Scientific Committee for Antarctic Research (SCAR), National Snow and Ice Data Center, St Petersburg State University, University of Oslo, Third Pole Environment Programme, University of Saskatchewan, National Oceanographic and Atmospheric Administration, Agrocampus OUEST

SECOND CIRCULAR (REVISED)
March 2021
<https://www.cryosphere2022.is>



The Icelandic Meteorological Office, the WMO Global Cryosphere Watch (GCW) and the International Glaciological Society (IGS) will, in cooperation with several international scientific organizations and research institutes, host a symposium on the Earth's Cryosphere in Reykjavík, Iceland, 22–26 August, 2022. Presentations will start on 21 August. Registration will begin on 10 January 2022.

THEME

As a result of global atmospheric and ocean warming, **all components of Earth's cryosphere** are now changing at a dramatic pace. More than a quarter of the planet's land surface receives snow precipitation each year and declining snow cover in many parts of the world is causing concern over the future of snowmelt as a water resource. Mass loss continues from **glaciers and ice-fields** in all mountainous regions of the world and from **Arctic and sub-Arctic ice caps**. The two large **ice sheets in Greenland and Antarctica** are major contributors to rising sea-level and may have begun to show signs of irreversible mass loss. The areal extent and thickness of **Arctic sea ice** continues to decline and the resulting albedo changes may be affecting winter weather patterns in North America and Eurasia. Increasing attention is being given to hazards due to thinning of **lake and river ice cover** and **permafrost** degradation, including slope failure.

This symposium will bring together scientists and policy makers for a discussion on the latest results from studies of the entire cryosphere, which plays an important role in the hydrological cycle and the Earth System and is one of the most useful indicators of climate change. The symposium will allow ample time for panel discussions on scientific results, new technologies, research gaps and future perspectives in the light of the Paris Agreement that calls for limiting global warming to 1.5–2°C.

KEYNOTE SPEAKERS

Dorthe Dahl-Jensen (University of Copenhagen and University of Manitoba), **Valerie Masson-Delmotte** (Laboratoire des sciences du climat et de l'Environnement), **Eric Rignot** (University of California Irvine), **Jason Box** (GEUS, Copenhagen), **Olga Makarieva** (St Petersburg State University and Melnikov Permafrost Institute), **Mark Serreze** (National Snow and Ice Data Center, Boulder), **Mandira Singh Shrestha** (ICIMOD, Nepal), **Julia Boike** (Alfred Wegener Institute, Germany), **Michael Zemp** (World Glacier Monitoring Service), **Regine Hock** (University of Alaska), **Robert DeConto** (University of Massachusetts), **Astrid Ogilvie** (Stefansson Arctic Institute), **Bernd Etzelmüller** (University of Oslo) and **Peter Bijl** (University of Utrecht)

TOPICS

We seek presentations and papers on timely topics related to all components of the cryosphere and its changes due to global warming. Sessions will cover the following topics:

1. **Earth's snow cover:** Snow science, recent snow cover changes in mountain and polar regions; satellite monitoring of snow cover; GPR measurements of snow thickness; importance of snow cover for tourism; avalanche hazard mitigation
2. **The cryosphere and hydrology:** Importance of snow and ice melt as a water resource for mountain region populations and for hydropower utilization; runoff changes due to atmospheric warming; monitoring of changes in lake and river ice
3. **Permafrost:** Nature and distribution; ongoing changes; impacts on the hydrological cycle; monitoring challenges; increased risks of landslides due to permafrost thawing; adaption implications for populations
4. **Ocean–cryosphere interactions:** Transfer of water between the oceans and snow and ice masses on land; changes in ocean heat content; effects of declining Arctic sea-ice cover on the climate system; effects of oceanic warming on tidewater glaciers; potential changes in deepwater formation in the North Atlantic ocean; tipping points in the ocean–cryosphere system
5. **Glaciers and ice caps:** Historical changes in glacier area and mass balance all over the world; mass-balance measurements and modelling; glacier dynamics and evolution; melt processes and glaciohydrology; glacier outburst floods (jökulhlaups); glaciers in high-mountain areas and impacts of their melting on populations; future perspectives on glacially fed rivers as water resources
6. **The Greenland Ice Sheet:** Age and history; deep ice-core records; internal structure; recent changes; likely response to near-future warming; varying contribution of Greenland mass loss to sea level in different parts of the world's oceans; research on surface melt lakes and runoff; ice velocity studies



7. **The Antarctic Ice Sheet:** History; internal structure; key data from ice cores on past atmospheric composition; vulnerability of the West Antarctic Ice Sheet to rising sea level; research on subglacial water systems; Antarctica in the climate system
8. **Sea ice:** Nature and distribution; changes in area, thickness and volume; past variations; likely changes during the 21st century; importance of sea ice in the Earth's climate system; ongoing developments in the Arctic (e.g. shipping, settlements, research coverage)
9. **Climate variations, climate- and Earth-system modelling:** Representation of the cryosphere in climate models and Earth systems models; modelling of cryospheric variations and resulting hydrological changes on all time scales from ice ages through Holocene climate variations to centennial, decadal and annual variations; importance of the cryosphere as a trigger of rapid climate change
10. **Research gaps, monitoring programmes, new technologies:** Emerging methods and technologies in surface-based, airborne and spaceborne studies of snow, glaciers and ice sheets, lake and river ice conditions and permafrost, with special emphasis on the development of derived products for cryospheric and polar scientific research and applications
11. **Opportunities, adaptation and mitigation:** Importance of evaluating and estimating current and future cryospheric variations for the design and operation of societal infrastructure, such as coastal and hydrological infrastructure and hydropower systems
12. **Humans and the cryosphere: navigating complex change in the Anthropocene.** Adaptation of human beings to cryospheric environments through time, challenges to indigenous communities presented by increasingly rapid environmental and social change





ABSTRACT SUBMISSION AND PAPER PUBLICATION

Participants who wish to present a paper (oral or poster) at the Symposium will be required to submit an abstract. The International Glaciological Society will publish a thematic issue of the *Annals of Glaciology* on topics consistent with the Symposium themes. Participants are encouraged to submit manuscripts for this *Annals* volume, see https://www.igsoc.org/annals/a85_call_4_papers.pdf. The abstract should not contain any figures nor references and should not be longer than 2500 characters. Abstracts should be submitted through the conference website (<https://www.cryosphere2022.is/abstract-submission>).

Deadline for submitting abstracts: Summer 2022.

REGISTRATION

To register, visit <https://www.cryosphere2022.is> where you will be directed to the registration pages. Registration fees will be listed on the websites in January 2022. Early registration will be possible until 1 June 2022.

ACCOMPANYING PERSONS

The accompanying person's registration fee includes the Icebreaker and the Symposium Banquet. **It does not include attendance at the presentation sessions.**

VISA REQUIREMENTS

Please check whether you will require a visa to visit Iceland. If you need an invitation letter, please contact Iceland Travel Conferences at: conferences@icelandtravel.is. The sooner you do this the more likely it is that your visa will be processed in time.

TRAVEL GRANTS FOR EARLY CAREER SCIENTISTS

Travel grants will be made available for a limited number of young scientists. Detailed information will be posted on the conference website in February 2022.





UiO : University of Oslo



PROGRAM

The program will consist of plenary and topical sessions. On Day 1, world-leading researchers will present overviews of past, present and projected future changes in all components of the cryosphere, including glaciers and ice sheets, snow cover, sea ice, lake and river ice and permafrost. Sessions on Days 2–5 will cover the topics outlined above. We anticipate a total of 70 oral presentations. Panel discussions will be held on each day of the conference. Poster presentations are welcome and posters can be up all week. Additional activities will include an opening Icebreaker reception on Sunday 21 August, a Banquet dinner and optional 1- and 3-day post-conference field excursions.

VENUE AND AUDIENCE

The symposium will be held in the Harpa Conference Centre, in downtown Reykjavík, the capital of Iceland. Invited lectures will be delivered in plenary sessions. Parallel sessions will be held on specialized session topics, if a high number of abstracts is received on particular topics. We seek participation from the scientific community and from various sectors of society affected by snow and ice, either through utilization, hazard prevention or in other ways. See information on Harpa at: <https://harpa.is>

ACCOMMODATION

The conference organizers have made block bookings at hotels and guesthouses in Reykjavík. From 1 February 2022, rooms can be reserved through the registration page on the conference website. Participants can also book accommodation on their own.

PUBLIC EVENTS

Public lectures and exhibitions will be held on the symposium topics, as part of activities commemorating the 100th anniversary of the Icelandic Meteorological Office in 2020 (celebrations delayed due to COVID-19). On Sunday 21 August 2022 a public presentation will be given by writer and photographer **James Balog**, author of the award-winning documentary *Chasing Ice*.



ICEBREAKER

The Icebreaker will be held on Sunday 21 August at 18:00. Details will be announced later on the conference website and through the conference mailing list.

BANQUET

The Banquet will be held on Wednesday evening, 24 August. Information will be given on the conference website and through the conference mailing list.

FIELD TRIPS

Two post-conference field trips will be arranged, starting on Saturday 27 August:

1. A one-day trip to Langjökull, the second largest ice cap in Iceland, situated within Iceland's western volcanic zone. Participants will have the opportunity to visit a 400 m long tunnel dug into the ice cap. A lecture on glacier changes in Iceland will form part of the program.
2. A three-day tour through the glaciated and volcanic regions of South Iceland. Sights will include the glacier-capped volcano Eyjafjallajökull; the Mýrdalsjökull ice cap and floodplains inundated during eruptions in the subglacial volcano Katla; the 1783 lava flow from the devastating Skaftáreldar (Laki) eruption; Skeiðarárjökull and other outlets from the Vatnajökull ice cap; Skaftafell; Örfajökull volcano and the steadily enlarging glacier lagoon in front of Breiðamerkurjökull.

Detailed information on the field trips will be given on the conference website.

EDITORIAL COMMITTEE

Chief editor: Regine Hock (University of Alaska, Fairbanks; President, IACS)

Co-editors: Christophe Cudennec (IAHS, Agrocampus OUEST, Rennes), Jeff Key (NOAA, UW-Madison), Tómas Jóhannesson (Icelandic Meteorological Office), Douglas MacAyeal (University of Chicago).





St Petersburg
University



SCIENCE ORGANIZING COMMITTEE

Árni Snorrason (IMO, GCW, Chair), Barry Goodison (GCW, WMO), Charles Fierz (SLF, IACS), Guðfinna Aðalgeirsdóttir (Univ. of Iceland), Magnús Már Magnússon (Secretary General, IGS), Pavel Kabat (Chief Scientist, WMO), Olga Makarieva (Melnikov Inst. & SPSU), Mark Serreze (NSIDC), Ruth Mottram (Danish Met. Inst.), Anil Mishra (UNESCO-IHP), Christian Haas (AWI), Yao Tandong (TPE), Halldór Björnsson (IMO), John Pomeroy (Global Water Futures), Níels Einarsson (Stefansson Arctic Institute), Laura de Santis (SCAR), Patricia de Rosnay (ECMWF), Larry Hinzman (President, IASC; UAF), Bernd Etzelmüller (Univ. of Oslo), Luke Copland (Univ. of Ottawa), Rodica Nitu (GCW, WMO), Günter Blöschl (President, IAHS), Salvatore Arico (UNESCO-IOC), Peter Pulsifer (NSIDC), Thorsteinn Thorsteinsson (IMO).

LOCAL ORGANIZING COMMITTEE

Haukur Hauksson, Erla B. Ágústsdóttir, Hrafnildur Hannesdóttir, Jórunn Harðardóttir, Sigurlaug Gunnlaugsdóttir, Tama Jóhannesson, Thorsteinn Thorsteinsson.

IMPORTANT DATES

Cryosphere 2022

Opening of online abstract submission:	10 January 2022
Opening of online registration:	10 January 2022
Abstract submission deadline:	15 March 2022
Notification of abstract acceptance:	1 May 2022
Early registration deadline:	1 June 2022
Registration deadline:	1 August 2022
Deadline for field trip registration:	1 August 2022
Symposium starts:	21 August 2022

Annals of Glaciology volume 62, issue 85

Paper submission opens:	Autumn 2021
Paper submission deadline:	Summer 2022
Final revised papers deadline:	December 2022

Accepted papers will be published as soon as authors have returned their proofs and all corrections have been made. Hard copy publication is scheduled for the first half of 2023.

For further information please e-mail cryosphere2022@vedur.is.



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