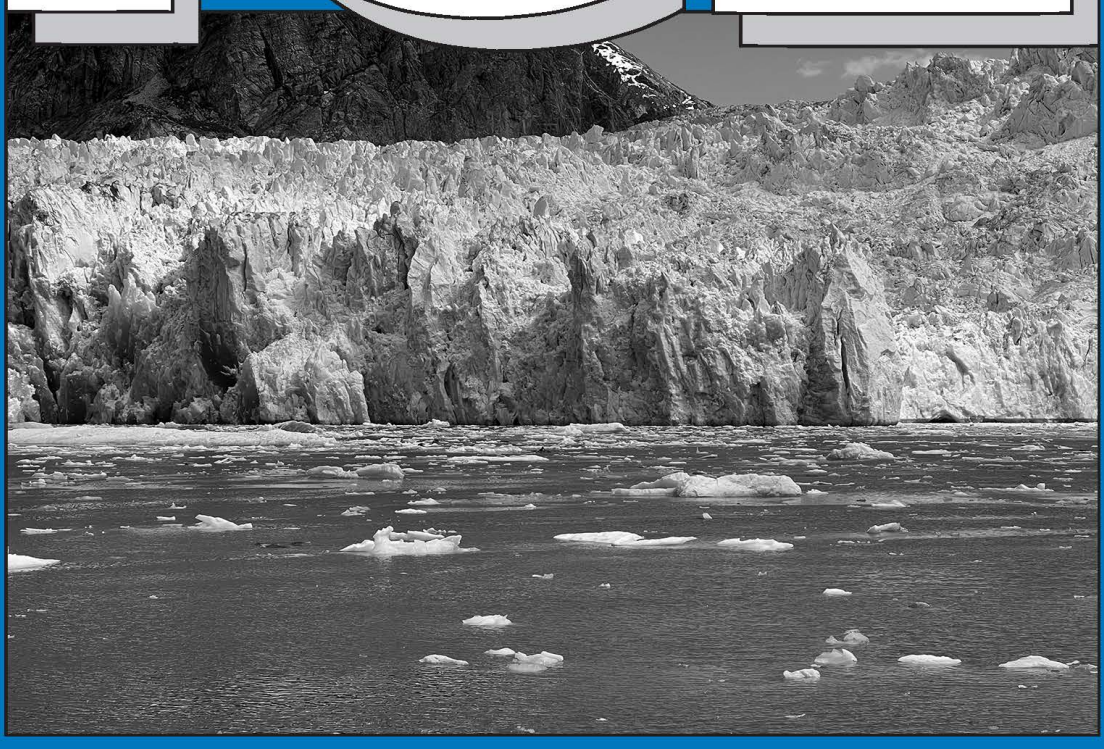
Numbers 189 and 190 *2nd and 3rd Issues 2022*

ICE



NEWS BULLETIN OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

ISSN 0019–1043

Ice

News Bulletin of the International Glaciological Society

Numbers 189 and 190 2nd and 3rd issues 2022

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Cover picture: The calving front of South Sawyer Glacier. Photo by Magnús Már Magnússon.

From the Editor

Dear IGS member

It is time for the next *ICE*. It is a double issue, numbered 189–190 set to close the issues for 2022.

In the old days, the *ICE* issues were typically 15–25 pages. Nowadays each issue is commonly 60+ pages. One reason for the increased size is that we are waiting for material from various sources, e.g. reports from symposia. Quite often they are written by several people, some of whom submit their contribution very promptly but, sadly, others take for ever to send us the account they promised. So we keep waiting for the material in the hope of keeping all of it to a reasonably accurate timeline. Hence the issues grow in size and when they finally appear online and in print it has been much too long since the previous issue appeared.

I would like to implore people who agree to contribute to do so promptly. Typically, we get asked 'when do you need it by?'. My typical response is 'in a few weeks'. A few weeks pass … and promises are eventually forgotten.

We are now thinking of changing our policy and simply publishing *ICE* with the material we have at hand and not worrying about the timeline.

We have a major change coming up on the 1 January.

When we originally signed the contract with Cambridge University Press (CUP) back in 2015, we had a clause that stated we would continue to publish hard copies of both the *Journal* and the *Annals* as long as it was financially viable. Sadly, this is no longer the case: only a handful of members are interested in purchasing hard copies, so we have had to stop printing our journals and hence they will only be available online as of 1 January 2024. Starting in 2024, we will transition to Online Only and Continuous Publication of both *Journal of Glaciology* (JoG) and the *Annals of Glaciology* (AoG).

This means no more printed copies, no separate issues, and only one Volume per year for each journal, which is filled online as we go. Papers will be assigned a paper number rather than page ranges. *Annals of Glaciology* will also have one Volume per year, but the current thematic Issues will become online thematic Collections. It will be relatively easy to combine articles into collections.

In addition, the current typeset First View papers will be replaced with non-typeset Accepted Manuscripts, which will be online with their final DOI just days after authors receive their acceptance decision. This will shorten

the time to online publication of accepted papers by about a month. Once the final typeset proofs of the paper are corrected/accepted by all parties, the paper will be incorporated into the respective online JoG/AoG volume and this final version will then replace the Accepted Manuscript.

Note that we always encourage our authors to submit the preprint of their submitted manuscript to an earth sciences preprint server (e.g. EarthArXiv) at the time of first submission. Please use the PDF of your JoG/AoG manuscript created in our system, as its cover page contains necessary information for the preprint server.

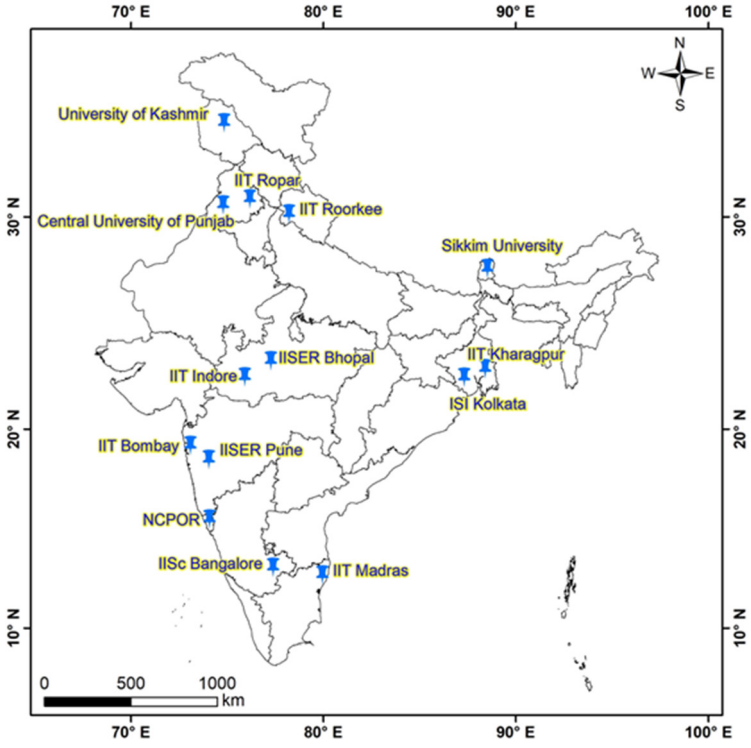
The decision to go the route of Online Only Continuous Publication is driven by the IGS Core Values to minimize negative impacts on the environment; and to excel and innovate service to our authors and readers by reducing time to first publication and inclusion into a journal volume. I know this is seen as a sad development by many and some have voiced their concern about the posterity of our journals. We will of course do our best to ensure that our journals will be available to everyone for generations to come.

Magnús Már Magnússon
Secretary General

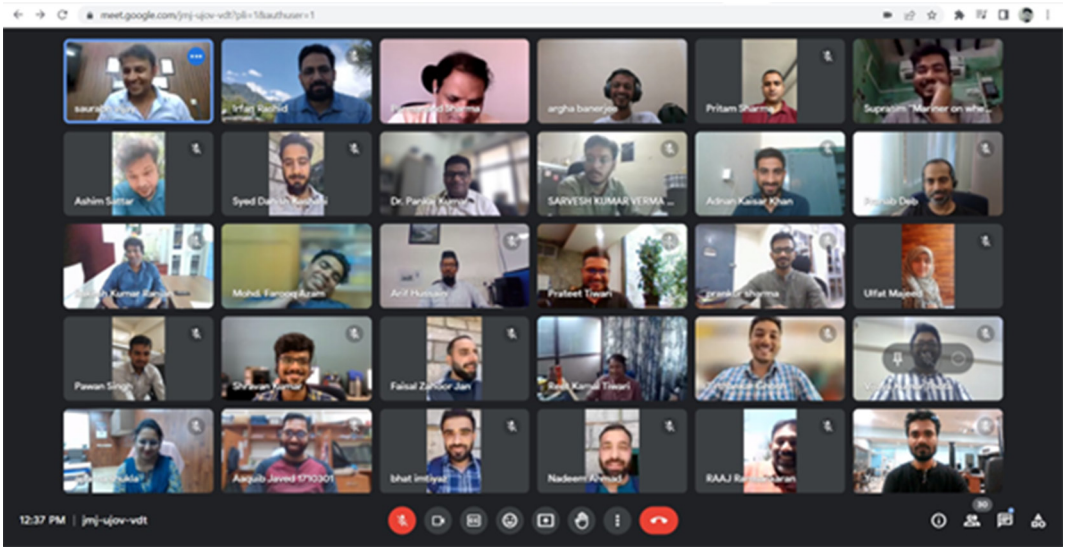
The Indian Glaciological Research Network:
an inclusive initiative by early-career Indian glaciologists

The scientific community to study the cryosphere (glaciers, ice sheets, snow, etc.) and climate change is growing globally, and India is no exception. The Indian cryospheric community is old and probably goes back to the colonial era, as a few measurements, such as the retreat of Gangotri Glacier, the largest glacier in the Indian Himalayas, date back to the 19th century. After India's independence in 1947, a few institutes emerged as centres to study the Himalayan cryosphere, including glaciers, snow and glacial lakes. The Geological Survey of India, Wadia Institute of Himalayan Geology (Dehradun), National Center of Polar and Ocean Research, Snow and Avalanche Study Establishment and Space Application Centre, ISRO are a few classic examples of India's cryospheric research in independent India.

In the last two decades, India's cryosphere and climate research has expanded to other Indian academic institutes such as the Indian Institute of Technology (IIT), the Indian Institute of Science Education and Research (IISER) and central and state-funded universities. This expansion opened many opportunities for a larger academic community to get involved in glacier research, significantly increased global connections and created a pool of many young Indian glaciologists. This young force (the Indian Glaciological Research Network, IGRN), consisting of early- and mid-career faculty and scientists from various academic and research institutes in India took a new initiative to better connect within the



Current IGRN partnering institutes, a growing community (Courtesy: Irfan Rashid).



A glimpse of the monthly Indian glaciology meetups (Courtesy: Ravindra Kumar).

community. The IGRN started monthly online meetings in January 2021 and has been conducting such online meetings since then.

This initiative is called MIGM – monthly Indian glaciology meetups – and was inspired by a few similar initiatives begun globally (e.g. the IGS Seminar Series, Alpine Glaciology Meetings in Europe, Mid-West Glaciology Meetings in the USA). The MIGMs have been a platform to present research work, create a database of planned fieldwork, discuss scientific and other issues, and plan future research, collaborations and capacity building. Apart from monthly meetings, the IGRN members connect with great enthusiasm when meeting in person. So far, more than 15 research groups and 50+ members are associated with the IGRN and the numbers are growing. This young community is well travelled and highly ambitious. They understand the importance of scientific collaboration, networking and partnership, data and resource sharing and equal opportunities. The IGRN strives to be a space where anyone, from faculty and experienced researchers to young Masters and PhD students, has an equal opportunity to discuss issues freely. The issues need not be restricted to glacier research, but could be anything that makes the wider Indian cryosphere community more open, accessible, supportive and inclusive.

In the last two and a half years, IGRN members have:

1. Conducted a 1-day online workshop on cryosphere and research-related themes at which more than 40+ researchers were present and 20+ speakers gave talks in different formats.

2. Enhanced faculty/student exchanges and interdisciplinary discussions, for example atmosphere–cryosphere–hydroclimate interactions.

3. Enhanced resource and data sharing by joint field works. The community creates a document before the field season for cognisance of the field campaigns of various groups and the feasibility of collaboration.

4. Submitted joint research proposals and are carrying out joint research and field work.

5. 20+ IGRN members met at the National Conference of Polar Sciences, Goa, India, in May 2023 and propagated this idea to the wider community.

IGRM members met an Emperor penguin at the National Conference of Polar Sciences, Goa (India) in May 2023.

The IGRN continues to grow and plans to conduct annual physical meetings of researchers apart from monthly online meetings. The IGRN is committed to create a pool of next-generation researchers to address larger scientific problems and train a globally aware workforce by organizng summer schools, training workshops and more collaborative supervision of Masters and PhD students. The IGRN is open to stronger international collaborations to enhance the cryosphere and climate research of the world. The future looks promising.

Saurabh Vijay and Argha Banerjee with input from many IGRN members

International Symposium on Maritime Glaciers

19–24 June 2022, Juneau, Alaska, USA

The IGS International Symposium on Maritime Glaciers was held 19–24 June 2022 in Juneau, Alaska, USA. For many, this was the first in-person conference since the start of the COVID pandemic. It was great to see old friends, make new friends, and be able to talk face-to-face. Delegates converged on the University of Alaska Southeast from the USA, Canada, Japan, Iceland, the United Kingdom, Norway, Germany and Australia.

The conference started off with an immersive Tlingit language lesson, a bit of history, and local geography from local professor X̲'unei Lance Twitchell. Sít' is the Tlingit word for glacier. Many of the indigenous place names in Southeast Alaska are descriptions of the landforms. For example, Sít' Tlein translates as Big Glacier (applies to both Malaspina and Hubbard); Sít' Kusá translates to Narrow Glacier (briefly known as Turner Glacier). The name for Glacier Bay, Sít' Eeti Geiyí, conveys not only the present-day geography (bay) but also the history of the place - the full translation is Bay in Place of the Glacier, representing the retreat of ice from the Little Ice Age to today. A session on Tuesday covered the archaeology of Tlingit sites in Yakutat Bay and Disenchantment Bay. The focus on using Indigenous names for glaciers continued throughout the week.

A special session honored Roman Motyka and his excellent work on tidewater glaciers in southeast Alaska. Our understanding of the unique interplay between ice, water, ocean heat and sediment at tidewater glacier margins continues to build upon the work of people such as Roman. Talks throughout the week focused on the interface between ice and ocean in a variety of ways – simply identifying the location of the margin over time, parameterizing frontal ablation in models, considering the role of subglacial

After verifying COVID-negative status, we enjoyed a social hour at Forbidden Peak Brewery.

The University of Alaska Southeast library provided the backdrop for the presentations. While no glaciers were visible out the window, there was a nice temperate rainforest.

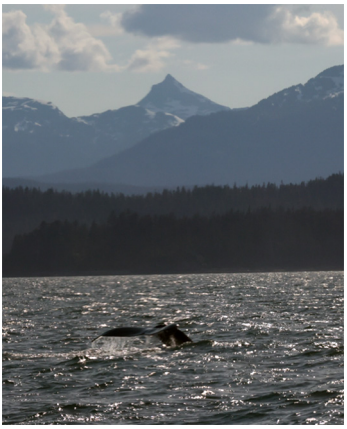
discharge in ice front evolution, and continuing down the fjord to consider implications for the sound environment, distribution of icebergs and iceberg meltwater in the fjord, nutrient fluxes such as iron, as well as implications for biology such as plankton, salmon and seals. A few talks explored the implications of glacier change for people too – both direct effects such as glacial outburst floods and indirect effects such as global-scale ice melt leading to global sea level rise.

An innovative outreach session gave participants a chance to share materials, activities and ideas. These included science communication best practices, open code repositories, games, 3-D models, artful sound installations and more!

Quite a few talks and posters focused on Sít' Tlein (Malaspina Glacier). Recent work has led to much better understanding of the bed topography, velocity variations, and conditions along the forested margin of the glacier, and Bayesian inference can be used to bring all these data together. Sít' Tlien may transition into a tidewater glacier in the future as Sitkagi Lagoon expands, so the focus on understanding the glacier's current behavior will hopefully lead to interesting projections of its future.

The poster session started with 3-minute introductions by each poster presenter followed by the traditional mingling, lively discussion, some excellent figures and, of course, more coffee. The spatial reach of presentations included not just Alaska, but Greenland, Svalbard, Patagonia and Antarctica.

There was plenty to see on the excursion.



The mid-week excursion was a boat tour south from Juneau to Tracy Arm where we saw the South Sawyer Glacier (pictured) and the Sawyer Glacier. Along the way we saw humpback whales, orcas, harbor seals resting on icebergs, sea gulls, giant cruise ships, countless waterfalls, a grizzly bear eating mussels on a rocky shoreline, and more.

Group photo at Orca Point.

After returning most of the way to Juneau, we stopped at Orca Point Lodge to feast on salmon. The best student poster award was awarded to Yoram Terleth, with runners-up Coline Bouchayer and Michael Shahin. The best student talks were given by Nicole Abib and Kamilla Hauknes Sjursen, with runner-up Jacob Fowler. Then we enjoyed a leisurely Alaskan sunset on the boat ride back to town.

After more talks on Friday morning, many participants joined a short excursion to Juneau's backyard glacier Áak'w T'áak Sít' (Mendenhall Glacier). Hopefully others felt it too, but the conference energized me to keep studying these spectacular landscapes at the interface between ice and ocean.

Andy Bliss; photos by Andy Bliss and Magnús Magnússon.

Whales, bears and glaciers: presymposium excursion to Glacier Bay National Park

In conjunction with the Symposium, we organized a 3-day, 2-night pre-symposium excursion (Friday 17 June to Sunday 19 June to world-famous Glacier Bay National Park (GBNP), a World Heritage site (https://www.nps.gov/glba/index.htm). Guides on the excursion included Andy Bliss (National Parks Service (NPS) glaciologist), Jamie Womble (NPS marine biologist), Greg Strevelar (NPS naturalist, ret), Tanya Lewis (NPS biologist), Cathy Connor (UAS, ret), and Roman Motyka (GI-UAF, ret).

With the Coast Range Mountains of southeast Alaska as a backdrop, over 40 participants and guides departed from Juneau on a sea journey to GBNP on Friday morning, 17 June. Clear skies afforded spectacular views of Mendenhall, Herbert and Eagle glaciers descending from the Juneau Icefield. Field guides discussed past glaciations that affected the region, including post-LGM glacial rebound, and the current status of the Juneau Icefield. The route took us through Icy Straits, where we spotted numerous humpback whales and sea otters. Approaching the entrance to GBNP, we passed over the shallow submarine moraine that marks the farthest extent of the Little Ice Age (LIA) advance (circa 1750 AD) of

Participants making their way to the Xunaa Shuká Hít to meet representatives of the local indigenous community

glaciers flowing from Glacier Bay. Andy Bliss discussed the timelines of the rapid post-LIA tidewater glacier calving retreat in GBNP, while Roman Motyka talked about the post-LA glacial rebound of nearly 6 m over the last 250 years that this region has experienced and the GPS measurements of the current ongoing uplift rate of ~ 3 cm per year.

Following our arrival at Bartlett Cove and the NPS headquarters, participants checked into the historic Glacier Bay Lodge. We later convened at the nearby Xunaa Shuká Hít – The Huna Tribal House – to meet with representatives of the Tlingit indigenous community. Xúnaa Shuká Hít, roughly translated as 'Huna Ancestors' House', is the first permanent clan house in Glacier Bay since Tlingit villages were destroyed by the advancing glaciers over 250 years ago. Dedicated on 25 August 25 2016, the house serves as a gathering place where tribal members reconnect with their homeland through ceremonies, workshops, camps, tribal meetings and other events. It also serves as a source of healing between the Huna Tlingit and the park service. Traditionally, four Huna Tlingit clans occupied territories in and around Glacier Bay for millennia. When Glacier Bay became a National Monument in 1925, its borders encompassed much of the traditional Huna Tlingit homeland and federal laws severely curtailed Native activities within the monument boundaries. The Huna Tribal House in Bartlett Cove has helped start the much-needed healing process.

The next day's adventure was a scenic a boat trip up the West Arm of Glacier Bay

The house was beautifully decorated inside and out.

Our guide, a representative of the Tlingit indigenous community enlightened us on Tlingit history. She had made her incredibly beautiful hat herself.

The Healing Pole, Xunaa Shuká Hít, sea lions on South Marble Island, mountain goats resting on a glacially carved groove on Gloomy Knob, and Margerie Glacier. Photos by Andy Bliss.

into Tarr Inlet, then onward to the tidewater faces of the Margerie and Grand Pacific Glaciers. The 8-hour trip featured narrations by a National Park Service Ranger, as well as by the excursion guides and other scientists who helped answer participants' questions regarding glacial isostatic adjustment, LIA advance and retreat, the tidewater glacier cycle, geology and regional tectonics, recent glacial histories, landslides, the park's wildlife, and the region's post-LIA plant succession.

The route took us past Marble Island where we observed hundreds of Stellar sea lions, as well as puffins, murres and seagulls. Continuing along the east shoreline of the West Arm, we were excited to spot several brown bears grazing in intertidal zones. As we passed Tidal Inlet, Roman Motyka pointed out a potential landslide mass on the north flank of the inlet that, if released, would be quite destructive to the environs of Tidal Inlet. Tanya Lewis discussed the effects that deglaciation has had on the bay's flora and fauna. As we passed Johns Hopkins Inlet, Jamie Womble discussed her research regarding relationships between icebergs and harbor seal populations in Glacier Bay. Approaching the head of the fjord, glaciologists Andy Bliss and Roman Motyka discussed the tidewater glacial cycle and the pioneering work of Austin Post. While our tour vessel idled near the 60 m high calving termini of Margerie and Grand Pacific glaciers, Michele Koppes (UBC) described the how submarine morainal banks evolve and their stabilizing influence on tidewater glaciers.

During our return along the west shore, we spotted a 'glacier' bear grazing on the west shoreline. The rarely seen glacier bear (sometimes referred to as the 'blue bear') is a subspecies of the black bear with silver-blue or gray hair and is endemic to Southeast Alaska. Following the tour and after returning to Bartlett Cove, participants enjoyed a relaxing dinner, conversations and libations, all with the 4000+ m Fairweather Range as a backdrop.

The next morning a number of participants followed Cathy Connor to explore an intertidal stump forest marking a late-stage LIA advance that forced THE indigenous Tlingit to abandon their villages in Bartlett Cove. A noon departure from Glacier Bay returned us to Juneau in time for the symposium icebreaker and registration at the Forbidden Peak Brew pub.

Roman Motyka

Part of the group went for a walk to see interstadial stumps near Bartlett Cove. Photo by Andy Bliss.

Cryosphere 2022 – International Symposium on Ice, Snow and Water in a Warming World

21–26 August 2022, Reykjavík, Iceland

Introduction

The symposium *Cryosphere 2022* was held in Reykjavík, Iceland, on 22–26 August 2022. Originally planned for 2020 to commemorate the 100th anniversary of the Icelandic Meteorological Office (IMO), the event had to be postponed twice due to the covid pandemic. Another purpose of the event was to signal the formal start of operations of the WMO Global Cryosphere Watch, a monitoring and research programme encompassing all components of Earth's cryosphere. The symposium was organized by the IMO in collaboration with the International Glaciological Society (IGS), with sponsorship from the World Meteorological Organization (WMO), the International Association of Cryospheric Sciences (IACS), the International Association of Hydrological Sciences (IAHS), Global Cryosphere Watch, the International Arctic Science Committee (IASC) and Unesco.

Organization and participation

The international Scientific Organizing Committee included 23 scientists from 16 countries, representing all components of the cryosphere and major bodies coordinating research and monitoring of snow, ice and hydrology worldwide. These included WMO, IGS, IASC, IACS, IAHS, SCAR, TPE and Unesco (IHP and IOC). National glaciological and hydrometeorological programmes and institutes were also represented in the committee, which was headed by Árni Snorrason, director general of the IMO. The Local Organizing Committee (LOC) comprised six representatives from the IMO, Thorsteinn Thorsteinsson (chairman), Haukur Hauksson, Hrafnhildur Hannesdóttir, Jórunn Harðardóttir, Sigurlaug Gunnlaugsdóttir and Tómas Jóhannesson, and staff from the conference organizer Iceland Travel.

The spectacular Harpa Conference Centre, Reykjavík, venue for the symposium.

In total, 430 abstracts were received prior to the 15 April deadline. The number of accepted abstracts and participants was somewhat lower, mainly because of covid-related restrictions. About 30 abstracts were submitted by scientists working in China but only five of them could participate due to travel restrictions imposed by the Chinese government. Nevertheless, the number of participants exceeded the initial expectations of the LOC.

A total of 306 people from 33 countries on six continents registered for participation in the conference: 191 from Europe, 80 from North America, 19 from Asia, 11 from South America, four from Australasia and one from Africa. The largest national delegations were from the United States (52), United Kingdom (33), Norway (28) and Iceland (26). With 156 female and 150 male participants registered, gender balance was very close to 50/50. In total, 348 presentations were given at the symposium, 174 oral and 174 posters, of which 106 were presentations by students.

Sponsorship and support

The main sources of income of the Symposium were registration fees paid by attendees, financial support from government ministries in Iceland and a grant from the National Power Company of Iceland (Landsvirkjun), as well as direct financial support from the IMO.

Indirect sponsorship in the form of advice provided by SOC members, review of submitted abstracts, membership in the editorial committee and other support was provided by 36 institutions and organizations in 14 countries. See full listing of sponsors and supporting bodies on the homepage: https://www.cryosphere2022.is/organizers-and-sponsors

Travel grants

A €5000 grant from the IASC was used, together with €2000 support from the Nehru Iceland–India fund, as well as other symposium funds, to offer travel grants to students and early-career researchers attending the conference. Of the 22 grantees, 10 travelled from India, seven from Europe, three from North America, one from South America and one from Australia.

The Symposium

Cryosphere 2022 was held in the Harpa conference centre by the Reykjavík harbour. Plenary and main sessions were held throughout the week in Harpa and special sessions were run in parallel in the nearby building Safnahús, only a 5-minute walk from Harpa. The full symposium program is available at: https://www.cryosphere2022.is/symposium-program

The conference week kicked off with a public presentation on Sunday afternoon, 21 August, given by James Balog, founder and director of the Earth Vision Institute and Extreme Ice Survey. Balog described monitoring of rapid glacier retreat in several parts of the world using time-lapse cameras. The presentation was followed by a lively discussion. The icebreaker followed and was held in Björtuloft on the top floor of Harpa, where brief addresses were given by IMO, WMO and IGS representatives.

Icebreaker in Björtuloft, Harpa Conference Centre. Photo: Haukur Hauksson.

MONDAY started with opening addresses given by: the IMO director Árni Snorrason; the President of Iceland Guðni Th. Jóhannesson; the minister of the Environment, Energy and Climate Guðlaugur Þór Þórðarson; the WMO Secretary General Petteri Taalas; the CEO of Landsvirkjun Hörður Arnarson; and the IGS Secretary General Magnús Már Magnússon. In the first plenary session, invited presentations were given by Áslaug Geirsdóttir (Climate history of Iceland), Robert DeConto (Antarctic ice sheet instabilities), Jason Box (Accelerations in the climate system) and Eric Rignot (Future projections of ice sheet melt). The first afternoon session focused on changes occurring in the cryosphere around the world, with talks by Valerie Masson-Delmotte (on IPCC AR6), Olga Makarieva (Arctic hydrology), Julia Boike (Arctic permafrost) and Mark Serreze (Arctic sea ice). The final Monday session dealt with

Opening address given by the President of Iceland, Dr Guðni Th. Jóhannesson. Photo: Haukur Hauksson

Astrid Ogilvie giving her presentation in the Plenary session in the Silfurberg auditorium in Harpa. Photo: Hrafnhildur Hannesdóttir.

Eric Rignot giving his presentation in the Plenary session in the Silfurberg auditorium in Harpa. Photo: Haukur Hauksson.

Michael Zemp explaining a question in his off-venue glaciological pub-quiz at Bryggjan Brugghús. Photo: Hrafnhildur Hannesdóttir.

research history and the effects of cryospheric change on human activities and settlements. Presentations were given by Astrid Ogilvie (Polar exploration and research), Mandira Singh Shrestha (Glacial lake outburst floods in the Himalayas) and Helgi Björnsson (The Icelandic experience of living with glaciers for more than 1000 years).

An off-venue event was held in the Bryggjan Brugghús brewery on Monday evening, in cooperation with the Iceland Glaciological Society. Eric Rignot, Guðfinna 'Tollý' Aðalgeirsdóttir and Jason Box gave presentations about exciting and sometimes harrowing fieldwork experiences and Michael Zemp gave an overview of the activities of the World Glacier Monitoring Service, which included an informative pub quiz.

TUESDAY was dedicated to topical sessions in Harpa. In the session on snow monitoring, Kari Luojos described new estimates of Northern Hemisphere seasonal snow mass and trends since 1980. Yao Tandong gave a recorded keynote presentation in a session on glacial outburst flood hazards, which included an overview of ongoing glacier melting in the Asian Water Tower. Bergur Einarsson described hydrological modelling of jökulhlaups originating within (or close to) the ice-filled Katla caldera in south Iceland. The session on permafrost included presentations on developments in Svalbard, mainland Norway, the Swiss Alps, Siberia and High Mountain Asia. Keith Morrison described attempts to detect permafrost subsidence in northern Alaska from InSAR satellite imagery. In the sea-ice session, Marcel Nicolaus gave an overview of results from the MOSAiC project in the Arctic Ocean and discussed how the new observations in the Central Arctic are helping to improve the representation of the Arctic climate system in climate models. Studies of Antarctic sea ice were also covered in this session.

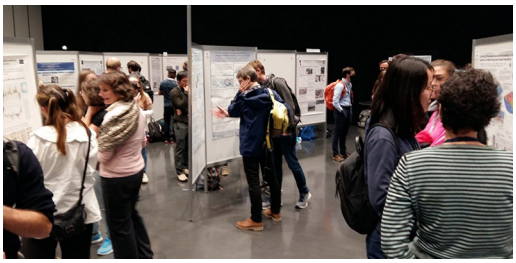
The ISMASS consortium held a full-day session on Tuesday in the Safnahús building entitled: 'Ice Sheets: Weather versus Climate'. In 14 oral presentations, the focus was on

From the ISMASS session in the Safnahús building. Photo: Thorsteinn Thorsteinsson

atmosphere–ice-sheet interactions, ice-sheet modelling and potential instabilities of the West and East Antarctic Ice Sheets. In the same vein, Hilmar Guðmundsson gave a public presentation in Perlan on Tuesday evening in collaboration with the Iceland Glaciological Society and the Natural History Museum, focusing on Antarctic studies. His talk was given in Icelandic and was well received, especially among young people in the audience, who appreciated the cool graphics and videos of ocean currents and ice shelves.

WEDNESDAY morning sessions focused on glacier mass-balance studies and projections of glacier changes around the world until 2100 or later. Michael Zemp gave a historical overview of glacier monitoring worldwide, using examples from the WGMS database and from IPCC Assessments. Ines Dussaillant described recent and ongoing efforts to determine geodetic mass balance of all the world´s glaciers using data from the RGI and WGMS FoG databases. Eyjólfur Magnússon presented a revised time series of bias-corrected annual mass balance for catchments of the Vatnajökull ice cap in Iceland. Regine Hock presented GlacierMIP simulations indicating that – assuming 1.5°C warming relative to preindustrial – half of all 200.000 glaciers in the world will disappear by 2100, most of them small ones (<1 km^2). Fabien Maussion used OGGM results to show how glacier mass loss and associated sea-level rise until 2300 will depend on the timing of peak emissions of greenhouse gas emissions and reduction rates after the peak is reached.

THURSDAY sessions in Harpa focused mainly on the two large ice sheets. In the Greenland session, Dorthe Dahl-Jensen gave an overview of the palaeoclimatic information extracted from deep ice cores over the past half century, with focus on inferred climate and ice-sheet volume during the Eemian interglacial. Edward Hanna presented results on Greenland Ice Sheet surface mass balance 1806–2021 and Riley Culberg described englacial storage of refrozen meltwater in the porous firn layer in a northwest region of the ice sheet. In the Antarctica session, focus was on the Thwaites glacier project, WAIS instability and uncertainties in Antarctic ice projections. Gavin Piccione presented new results from U–Th dating of opal and calcite precipitates from the Ross Embayment, where geochemical transitions correlate with millennial climate cycles and record acceleration and thinning episodes associated with Southern Ocean upwelling. In a session on Ocean–Cryosphere Interactions, Peter Bijl outlined the evolution of oceanographic conditions in the Southern Ocean since the formation of the Antarctic Ice Sheet and discussed implications for modelling past ice-sheet conditions. Other presentations focused on ice-shelf breakup events, melting at the base of ice shelves, calving mechanisms and the effects of variable ocean heat transport on glaciers in the North Atlantic region. In the session on Climate variations and Earth System Modelling, Michiel van den Broeke presented results indicating the timing of peak refreezing of meltwater in Greenland firn under different climate warming scenarios. Should this peak be reached, the storage capacity of the firn layer will be reduced and the runoff and thus the sea-level rise contribution will become enhanced. Ketil Isaksen gave an overview of record-high surface air temperature increase



Poster session in Harpa. Photo: Thorsteinn Thorsteinsson

in the northern Barents Sea over the past decades and discussed the connection with the reductions in sea ice cover in the region.

Special sessions were held in Safnahús on Thursday, on sea-ice studies, glacier changes and inventories, and glacier dynamics. Hrafnhildur Hannesdóttir presented a national glacier inventory for Iceland and outlined glacier changes since the end of the Little Ice Age. Remya Namboodri gave a talk on glacier recession in the Alaknanda Basin, Central Himalayas.

The Symposium Banquet was held in the Perlan exhibition centre, on top of the Öskjuhlíð hill in Reykjavík. Participants were treated to standing buffets and drinks at various levels in the building, which is made up of tanks originally built as hot water containers. These containers now house natural history exhibitions and a planetarium. Participants could explore the museum while enjoying the food, including the ice cave, the glacier exhibit, and a special section on water in Icelandic nature. The observation deck on top of the building offers splendid views of the surroundings of the capital, including a direct line of sight to the famous glacier-capped volcano Snæfellsjökull. Short speeches were given and a philharmonic choir conducted by Magnús Ragnarsson performed Icelandic folksongs.

FRIDAY morning main sessions dealt with Monitoring Systems, Research Gaps and New Technologies. Dustin Schroeder described recent advances in platforms and instrumentation for satellite, drone and sensor-network-based ice-penetrating radar systems and Iris Hansche outlined efforts to coordinate the collection, treatment and publication of cryospheric data from Austria (glaciers, snow cover, permafrost, lake ice). Charles Fierz described technical solutions for delivering raw data from stations operated by WMO´s Global Cryosphere Watch (GCW), and for processing and making the data available in standardized form through the GCW Data Portal.

Special Friday sessions in Safnahús dealt with cryosphere and hydrology in Arctic and high mountain areas and specialized studies of the large ice sheets and their interactions with the atmosphere–ocean system.

On Friday afternoon key listeners Karen Alley, Anna Hulda Ólafsdóttir and Halldór Þorgeirsson summarized some of the main advances presented at the symposium. Journalist and talk-show host Kristján Kristjánsson then led a panel discussion that also included

Árni Snorrason delivers a speech during the banquet in Perlan. Photo: Haukur Hauksson.

Panel discussion, Friday afternoon. Photo: Haukur Hauksson.

Participants in the hike through Steinsholt on the northern slopes of Eyjafjallajökull. Photo: Francisco Cereceda

Árni Snorrason (IMO director), Anthony Rea (Director of Infrastructure Department, WMO), Gunnar Jakobsson (Deputy Governor, Central Bank of Iceland) and Brynja Dögg Ingólfsdóttir (Hornafjörður Municipality, southeast Iceland). Discussions focused on the challenges facing societies worldwide due to changes in the cryosphere, and the impacts of those changes on policy making and financial stability. The need to build bridges between the scientific community and society was discussed, with emphasis on the important role that WMO should play in that process.

IGS representatives Regine Hock and Magnús Már Magnússon addressed participants during closing and presented awards for best student presentations at this symposium and a previous one to Gavin Piccione and Lizz Ultee.

Excursions

Four excursions were offered during Wednesday afternoon and into the evening (dinner included). All excursions were led by glaciologists and/or geoscientists.

1. **Þingvellir, Geysir and Gullfoss.** The classic tour to the Viking age parliament site Þingvellir and from there on to the Geysir geothermal fields and Gullfoss waterfall. Dinner in Efstidalur. Leader: Oddur Sigurðsson.
2. **Sólheimajökull glacier** and surroundings. Glacier walk on the most accessible valley glacier in Iceland, led by Bergur Einarsson and Matthew Roberts. Dinner in Hótel Anna, Moldnúpur.
3. **Steinsholt valley.** A glacier carved valley on the north side of Mt Eyjafjallajökull, where a large rockfall on to a glacier and into a proglacial lake caused a major flash flood in 1967. Barbecue in Þórsmörk. Leader: Tómas Jóhannesson.
4. **Fagradalsfjall volcano.** Hike to the site of recent volcanic activity on the Reykjanes peninsula, only 30 km from Reykjavík. The August 2022 eruption had stopped only few days before the start of the symposium. Dinner at the Blue Lagoon. Leaders: Einar Bessi Gestsson and Sigríður Kristjánsdóttir.

Fagradalsfjall excursion participants view the new lava erupted during the August eruption on the Reykjanes peninsula. Photo: Sigríður Kristjánsdóttir

An excursion to the ancient parliament and gathering place of Iceland (Þingvellir, Gullfoss and Geysir)

Some of the other mid-symposium excursions may have covered greater distances and required higher levels of physical fitness, but the excursion to the ancient site of parliament (since 930 AD) guided by Oddur Sigurðsson, renowned geologist and teller of fine tales, as well as several other fine local guides, visited the cultural heart of Iceland. Departing by comfortable coach with boxed rations in hand, a group of about 45 delegates were enthralled by Oddur's exposition on the geomorphology and plant species seen on the road leading out of Reykjavík.

The first stop was Þingvellir, located at the head of a great lake (Þingvallavatn) which filled the graben between the ever-separating North American and Eurasian plates. The significance of Þingvellir, Oddur explained, was more than just tectonic. At the site at the confluence of the river and lake, the original settlers of Iceland established a meeting ground to hold discussions and parliamentary decisions in 930 AD. We were in awe of the unique scenery, featuring a wall-like fissure that gently descended from the rift shoulder, which we walked while examining the diverse and colorful ground cover and casting long looks across the valley, wondering where the 2.5 m of extra Earth was located that had emerged since the days of the first parliament. After ascending the wall again to see the remarkable waterfall, we boarded the coach for the next stop: Gullfoss.

Having learned that Gullfoss means 'golden falls' in Icelandic, we disembarked from the coach to take the short hike to a viewpoint where a most powerful and complexly cascading waterfall was in view. In the distance, we could catch glimpses of Langjokull, the ice cap located closest to Reykjavík. After spending a relaxing period of time admiring the powerful display of Iceland's natural beauty, and taking copious photographs to brag about in the future, we boarded the coach for Geysir.

Geysir, the un-tapped geothermal field located on the European side of Thingvellir, was an impressive geyser which did not fail to meet its appointed schedule of anointing the sky with an impressive steam bath. At this stop, many of the delegates decided to visit the nearby shop to gather various woolen goods to bring home as souvenirs.

The relaxing travel, accompanied by interesting discussions and expositions by the Oddur and the other guides, came to its final and most delightful stop at a restaurant at Efstidalur run by a local farm near Gullfoss and Geysir. The menu featured various tasty meats and vegetable dishes that were locally produced. The relaxed conversation was a perfect way for the delegates to wrap up a wonderful afternoon of sightseeing as well as to gather energy for the remainder of the Symposium to begin the next morning.

Doug MacAyeal

Two post-conference excursions were offered:

5. Langjökull ice cap. A full-day trip through the historical region of Borgarfjörður to Langjökull, the second largest ice cap in Iceland. Visit into a 400 m long tunnel dug into the ice cap, above the equilibrium line. Leaders: Matthew Roberts and Sif Pétursdóttir.

6. South Iceland: Glaciers and volcanoes. A 3-day trip through the glaciated and volcanic regions of Southern Iceland, passing by or near Hekla, Eyjafjallajökull, Skógafoss, Katla, Eldhraun (the 1783 Laki lava), Skeiðarársandur, Öræfajökull, Breiðamerkurjökull and Jökulsárlón (Glacier Lagoon), Hoffellsjökull and the town of Höfn. Leader: Þorsteinn Þorsteinsson.

Publication, editorial board

The IGSociety will publish a thematic issue of the A*nnals of Glaciology* on topics consistent with the themes of Cryosphere 2022. Participants were encouraged to submit manuscripts for this *Annals* volume. Hard-copy publication is scheduled for late 2023.

The issue will be part of *Annals* Volume 64. The Chief Editor for this issue is Regine Hock (U Oslo and U Alaska,Fairbanks). Scientific editors are Christophe Cudennec (IAHS), Jeff Key (NOAA, UW-Madison), Douglas MacAyeal, (U Chicago), Tómas Jóhannesson (I MO), Mats Granskog (Norwegian Polar Institute), Isabelle Gärtner-Roer (U Zurich), Lauren Vargo (Victoria U Wellington), Karen Alley (U Manitoba), David Rounce (Carnegie Mellon U) and Luke Copland (U Ottawa).

Þorsteinn Þorsteinsson
Tómas Jóhannesson

Participants on the daytrip to the Langjökull ice cap. Photo: Matthew J. Roberts.

Postsymposium excursion to Langjökull

My first trip to the land of fire and ice surprised me in many ways. Not the least surprise was the weather. I packed warm clothes and rain gear, but none of this was finally required during this week's symposium. Saturday was no different: it was under a radiant morning sun that 30-odd of us waited to board the bus for a one-day excursion to Langjökull, the second largest ice cap in Iceland after Vatnajökull.

The first leg of the bus trip took us north from Reykjavík along the Icelandic west coast through a volcanic landscape shaped by successive glaciations and interspersed by huge landslides. The landscape bears witness to the previous existence of glaciation by large glaciers that also cut out deep fjords, such as the Hvalfjörður fjord between Saurbær and Akranes, just north of Reykjavík. Here we took a road tunnel underneath the fjord, a journey of almost 6 km long reaching a depth of 165 m below sea level! As a reference, the Eurostar tunnel linking France to the UK is only 75 m below sea level at its deepest point. It was a bit of a scary thought to find oneself under an overburden pressure of 1.7 MPa, but this wasn't going to be our sole tunnel experience of the day.

Landslides near Mosfellsbær in a glacially-eroded volcanic landscape.

Into Langjökull.

Not yet a marriage in the glacier chapel, but close!

From here, we drove inland to Húsafell, an old farm estate (and the most inland farm estate in the west of Iceland) that now serves as a hub for various types of tourist activity in the area. In the local hotel auditorium, we were entertained by a presentation from our excellent field guides, Matthew Roberts and Sif Pétursdóttir, on the geology and glacial history of Iceland and the impacts of the changing climate on the glacierized areas. The fate of Icelandic glaciers is in line what is expected all around the world, and t is expected that the Langjökull ice cap will lose somewhere between 58% and 86% of its 2020 volume by the end of the century under a RCP2.6 and RCP8.5 scenario, respectively (Compagno et al., 2021, *Journal of Glaciology*; https://doi.org/10.1017/jog.2021.24). Langjökull (Icelandic for 'long glacier') is the second largest ice cap in Iceland (953 km^2), has an estimated volume of 195 km^3 and is up to 580 m thick. It culminates at about 1450 m above sea level.

A gravel road through a stunning valley brought us after an early lunch in Húsafell closer to Langjökull, with the Langjökull Klaki Basecamp as our destination (https://intotheglacier.is/). Here we boarded out-of-scale trucks that brought us up the glacier towards the accumulation area, or at least what once has been above the equilibrium line. A rocky and slippery road through snow slush, alongside a few crevasses. We observed a couple of moulins where the abundant surface meltwater made its way into the glacier. Not only surface meltwater enters the glacier, but we were also supposed to make our way through a man-made tunnel

Entrance tunnel into Langjökull.

View towards Eiríksjökull from Langjökull

Langjökull outlet glacier

One of the many normal faults in the rift system of Þingvallavatn, looking toward the North American plate.

in the ice. For several years now, this tunnel has been dug under several tens of meters of ice. Given the volcanic activity in Iceland, it is neat to be able to detect clearly visible ash layers from the Eyjafjallajökull eruption back in 2010, which caused enormous disruption to air travel across northern and western Europe for a week. Sif Pétursdóttir, one of our two field-trip guides, measured ice displacement within the tunnel as part of her bachelor thesis and had a lot of useful information for us, but the over-enthusiastic Klaki guide had unfortunately a keener interest in marrying couples in the so-called ice chapel. For those who are interested in a couple of spectacular views of Langjökull and its tunnel, the latest publicity for the iPhone 13 was filmed last year at this location. A crew of more than 100 people stayed there for over a month to make this happen.

The return from Langjökull brought us along Ok, the volcano where Okjökull used to be, as the glacier was declared deceased in 2014. Ok is one of the first glaciers to have lost its status as a glacier, which was commemorated by a plaque. Since then, such commemoration services have been held at several places around the world where glaciers have lost their glacier status. From the same gravel road, we had a very nice view of the different outlet glaciers of Langjökull, descending along the flanks of the volcano, almost touching the main valley.

The final stretch brought us into the spectacular Þingvallavatn rift valley that separates the Eurasian tectonic plate from the North American plate. A large lake spreads out between a series of parallel normal faults and seeded with a few small volcanoes. After the last pit stop with some drinks and ice cream (it was warm weather!), we returned to Reykjavík. Although we spent quite some time in the bus, it was a very rich experience that showed us quite a stretch of the western part of Iceland and enabled us to familiarize ourselves with the diversity of its landscapes. Many thanks to Matt and Sif.

Frank Pattyn

Cryosphere 2022: Three Day Excursion to the South of Iceland

On Saturday 27 August 2022, 21 Cryosphere 2022 attendees and guests boarded a bus for a 3-day excursion to the south of Iceland. Skillfully led by Þorsteinn Þorsteinsson of the Icelandic Met Office, the participants had a whirlwind tour of volcanoes, glaciers and waterfalls.

Our journey of approximately 450 km started with a drive across the southern lowlands and a stop at the Lava Centre. Three volcanos, Eyjafjallajökull, Katla and Hekla are near the Lava Centre, which had some. excellent displays and interactive exhibits. Real-time earthquake activity at various sites around Iceland near volcanoes and glacial lakes was available. The Centre's video of the Eyjafjallajökull eruption in 2010 vividly demonstrated Icelandic volcanic activity.

Katla is a subglacial volcano beneath the Mýrdalsjökull ice cap and eruptions have produced large jökulhlaups (glacier outburst floods). Hekla is Iceland's largest volcano and the most active. It last erupted in 2000 and is overdue for another eruption. Iceland has many waterfalls and the first one we stopped at was Skógafoss, which falls about 60 km from a pass between two glaciers.

Our trip took us eastward through the lava that flowed during the Laki eruption in 1783. This eruption resulted in cooling of the Northern Hemisphere for a number of years.

Jökulsárlón

Skogafoss.

At the southernmost point in Iceland, Dyrhólaey, we viewed some interesting rock formations. At Dverghamrar, otherwise called Dwarf Rocks, we saw classic hexagonal columnar basalts.

Three proglacial lakes were visited on this trip, Fjallsárlón, Jökulsárlón and Höffellsjokull. Our visit to Jökulsárlón, the glacial lake from the Breiðamerkurjökull glacier was awesome. We had a boat ride around the lake and could see the icebergs up close. This was followed by viewing the icebergs floating down the lake outlet to the sea and small icebergs stranded on the black sand beach. This was our only poor weather of the excursion and it was cold and raining.

We hiked to the waterfall Svartifoss, which was backed by columnar jointing. Later that day we also visited Seljalandsfoss waterfall, part of the Seljalandsá river, which has its origins underneath the glacier Eyjafjallajökull. Seljalandsfoss has a path behind the waterfall that is easily reached.

We visited the retreating glacier Kvíárjökull, which is bounded by moraines to the east and west. At the Fjaorargljufur gorge, which is about 100m deep in places, people (none from our group) were going beyond the safety fence to get photos of themselves in front of the gorge.

The Icelandic vegetation was mostly short and mounded and the number of species were limited. Woolly fringe-moss (*Racomitrium lanuginosum*) covers large areas of lava. Interestingly, dandelion is a wildflower, not a noxious weed, and seeds are sold in tourist shops.

Seljalandsfoss.

On a personal note, this was the best trip I have ever been on. Thank you, Þorsteinn. I learned so much and saw so many interesting things. Coming up a hill and seeing a glacial lake for the first time was breathtaking. Never had I seen anything like this. I also enjoyed the immense black sand beaches, the columnar jointing, and the vegetation.#

Susan Serreze

News

Seligman Crystal for Dorthe Dahl-Jensen

Dr Dorthe Dahl-Jensen (Niels Bohr Institute and University of Manitoba) has played a foundational role both in deciphering the history of Northern Hemisphere climate recorded in Greenland ice cores and in elucidating the history of the Greenland Ice Sheet. Dr Dahl-Jensen is perhaps best known for her role as a leader in ice-core research, playing key roles mobilizing the international ice-core community to collaborate and drill deep ice cores in Greenland. The insight from the ice cores has led to transformations in our knowledge of the Greenland ice sheet and climate change, including early studies that demonstrated that boreholes could be used to calibrate ice-core isotopic data. Dr Dahl-Jensen has also been involved in developing new methods and analysis techniques that span ice physics, ice dynamics and geophysics. One example is Dr Dahl-Jensen's innovative use of borehole strain rates to constrain the rheology of ice, a topic and approach that remains highly relevant today. Beyond her work as a leading glaciologist and climate scientist, Dr Dahl-Jensen has elevated many scientists, frequently highlighting the work of others in scientific presentations and as seen in her numerous co-authored papers.

To quote from one of the nomination letters: 'Dr Dahl-Jensen has … been the most important force behind the study of the Greenland ice sheet for more than three decades.' We recognize Dr Dahl-Jensen for both her scientific accomplishments and the leadership and mentoring she has provided to the glaciological community over the past 30 years.

On behalf of the Awards Committee of the International Glaciological Society
Jeremy Bassis, Chair

Richardson Medal for the ISMIP6 team

We recognize the entire ISMIP6 team for its academic and leadership activities in the design and production of future sea-level projections. The ISMIP6 team, consisting of over 80 members, has provided outstanding service to the field of glaciology by planning and coordinating projections of ice-sheet change. The ISMIP6 team has been instrumental in providing a community-led response to two WCRP Grand Challenges: 'Melting Ice and Global Consequences' and 'Regional Sea Level Change and Coastal Impacts'. Although ice-sheet model comparisons have a long history in the field of glaciology, dating back to the EISMINT experiments in the 1990s, the atmospheric, oceanic and other climate communities have made significant advances through the suite of CMIP simulations that form the basis of sections of the IPCC report. The ISMIP6 team was responsible for collaborative design and interpretation of the ensemble of model runs used for projections of future ice-sheet change and bringing the ice-sheet community under the auspices of the international CMIP community. As part of this, the ISMIP6 team has been instrumental in building international collaborations that span career stages and nations. Their projections have had a wide impact on the global community, serving as the basis for policy and adaptation discussions. We recognize the impact and leadership provided by the entire ISMIP6 team and its service to the glaciological and wider communities.

On behalf of the Awards Committee of the International Glaciological Society
Jeremy Bassis, Chair

Early Career Scientist award for Fanny Brun

Dr Fanny Brun (Institut des Géosciences de l'Environnement and Université Grenoble Alpes) is a talented scientist who has already made outstanding contributions to our understanding of the evolution of Earth's glaciers.

Dr Brun's PhD thesis focused on the influence of debris on the mass balance of High Mountain Asia glaciers using a multi-scale approach. Dr Brun studied the relationship between glacier mass change and lake changes over the Tibetan Plateau as a postdoctoral researcher at the University of Utrecht, and has continued her research activities in High Mountain Asia since being hired by the Research Institute for Development in Grenoble. In a short time, Dr Brun has become one of the pioneers in research on debris-covered glaciers in Asia and has demonstrated impressive abilities in remote sensing.

Dr Brun's work includes studies that span a spectrum of scales, ranging from the local scale (using terrestrial photography and drones) to regional scales (using a variety of satellite images). This scope has led to significant advances in our understanding of glaciers in remote environments. For example, Dr Brun was able to create high-resolution mass balances for thousands of individual glaciers using a vast amount of digital elevation model data, providing detailed insights into the spatial heterogeneity of glacier response to climate in High Mountain Asia. Dr Brun has also been involved in the collection of field observations and glacier mass and energy balance modeling and has been instrumental in developing new state-of-the-art methods to process satellite imagery.

Dr Brun has also demonstrated a strong commitment to service within the glaciological community, serving as co-chair

of the Regional Assessment of Glacier Mass Change working group of the International Association of Cryospheric Sciences and serving on the scientific advisory board of the Glacier Mass Balance Intercomparison Experiment. Dr Brun served as Scientific Editor for *Frontiers in Earth Sciences* and *Journal of Glaciology* and has recently been chosen to be a lead author for the Hindu Kush Himalaya second assessment report about mountains and population coordinated by ICIMOD (Nepal).

Dr Brun's contributions to our understanding of glaciers and service to the community have been significant, and model an outstanding commitment to both research and service within the glaciological community worthy of recognition.

On behalf of the Awards Committee of the International Glaciological Society
Jeremy Bassis, Chair

Early Career Scientist award for Samantha (Sammie) Buzzard

Dr Sammie Buzzard (Cardiff University) has made significant contributions to the field of supraglacial hydrology and outstanding contributions to outreach and efforts to improve the diversity of polar science.

Dr Buzzard defended her dissertation at the University of Reading in 2017, where she was selected among a crowded field to deliver the prestigious Fairchild lecture on her PhD research to the general public.

Dr Buzzard's research programme seeks to develop a community model that represents the supraglacial transport of meltwater over ice shelves. In this endeavour, Dr Buzzard has worked collaboratively to build a supraglacial hydrology model that is useful, usable and accessible to the wider glaciological community. In this work Dr Buzzard has solicited feedback from the broader community to add features of interest.

Dr Buzzard's commitment to outreach and diversity has been stellar and has led to tangible improvements to diversity, equity and inclusion across the polar sciences. For example, Dr Buzzard was on the steering committee for the Diversity in Polar Sciences Initiative. Through this initiative Dr Buzzard led efforts to enhance Antarctic science opportunities for under-represented groups, including women, people from racial and ethnic minorities in the UK, members of the LGBTQ+ community and people with a disability. Dr Buzzard also spearheaded efforts to promote maths and climate science communication, presenting at the Maths Educators International conference.

Dr Buzzard has received NERC funding for a project to improve access to nature and environmental awareness in a diverse but historically deprived community in Cardiff.

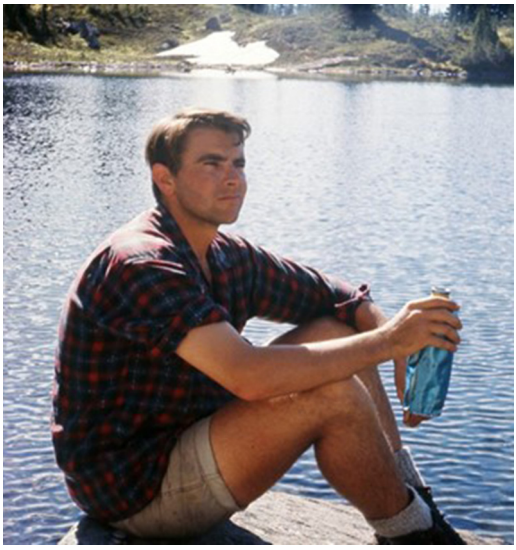
Dr Buzzard co-chairs the UK's Diversity in Polar Sciences Initiative steering committee and was the lead organizer of the Arctic Sciences Summit Week 2023 workshop on Race and Systemic Bias. Dr Buzzard's commitment to diversity, community, communication and mentoring provides clear examples of the core values of IGS in action that are worthy of recognition.

On behalf of the Awards Committee of the International Glaciological Society
Jeremy Bassis, Chair

Obituary: Gary A. Maykut 1939–2023

Gary Allen Maykut died peacefully at his home on 10 March 2023. He held the position of Research Professor in the Department of Atmospheric Sciences at the University of Washington from the early 1970s until his retirement in 2004. Gary pioneered the numerical simulation of the Arctic surface energy budget, specifically quantifying the 1-D accounting of heat by the ice cover.

Gary's graduate work (1971) produced the highly-cited paper 'Some results from a time-dependent thermodynamic model of sea ice'. This work laid the foundation for how modern global (and regional) climate models do the 'accounting' of heat by the Arctic sea ice cover. Many of the results from that work continue to bear out in current observations. In fact, on 15 March 2023 a paper was published in *Nature* citing this work – underscoring its ongoing relevance.



Photographs courtesy of Wolfe Maykut

During much of his career, Gary spent a significant portion of his time thinking about the thickness of sea ice: how it is changing and how it is represented in numerical models. He co-authored the fundamental paper 'The thickness distribution of sea ice' (1975) on which all sea-ice modeling is based. Additionally, he co-authored the 1999 paper 'Thinning of the Arctic sea-ice cover', which broke ground as an early confirmation of predicted sea ice volume loss.

Gary's many other contributions include studies of the thermodynamics of young ice, the optical properties of sea ice, and the solar heating of the ice and upper ocean beneath the ice cover. In the 1970s, Gary, working with Norbert Untersteiner and Alan Thorndike, was instrumental in developing the Arctic Ice Dynamics Joint Experiment. This ultimately led to the formation of the Polar Science Center at the University of Washington.

Chapter 5 of *The Geophysics of Sea Ice* ('The surface heat and mass balance') was penned by Gary, and remains a foundational reference. In one of his last lectures (given at the annual AGU meeting in San Francisco), Gary predicted the mode of Arctic sea ice loss we are seeing today, wherein ice is melting from 'within' via melt ponds and similar structures. Gary had a deep understanding of sea ice microphysics and thermodynamics that gave him insight into such processes.

Gary was generous with his ideas and always ready to chat about potential research projects or really anything about sea ice, earth science and even beyond. He held strong opinions, carried a big backpack, and always enjoyed a vigorous discussion.

Bonnie Light, Don Perovich, Harry Stern and Mike Steele

See also the obitiuaries that appeared in the *Seattle Times* (https://obituaries.seattletimes.com/obituary/gary-maykut-1087283593) and on the University of Washington Atmospheric Sciences website (https://atmos.uw.edu/about/history/in-memoriam/gary-a-maykut/).

Obituary: David G. Vaughan 1962–2023

Professor David Glyn Vaughan, who has died aged 60 from stomach cancer, was a world-leading expert on how polar ice sheets are responding to climate change. Former Director of Science at the British Antarctic Survey (BAS), David was the UK lead for the International Thwaites Glacier Programme and served as co-ordinating lead author in two rounds of the Intergovernmental Panel on Climate Change (IPCC) assessment reports.

During his 36 years at BAS, David's science and leadership advanced our knowledge of the impact of climate change on polar ice sheets, his 15 years of service to the IPCC helped ensure that science was available to policy makers worldwide, and his enthusiasm for science communication enabled wider publics to understand why the polar regions are crucial for planet Earth.

Early in his career at BAS, an interest and talent in drawing maps made David his group's expert in analysing satellite imagery. This ensured the group was able to identify profound changes in the ice on the Antarctic Peninsula. In 1989, using a series of Landsat images, they showed that the Wordie Ice Shelf had halved in area in little over a decade.

The Wordie's retreat was, their paper in *Nature* concluded, a rapid and dramatic response to recent climate warming recorded along the Antarctic Peninsula. It was the first major climate impact reported in continental Antarctica and one of the first examples of a large-scale physical system impacted by contemporary climate change.

In 1995, far more dramatic changes took place on the Antarctic Peninsula. David was in Cambridge when two ice shelves on the Peninsula's northern tip collapsed in a matter of weeks. He asked a planned flight from Rothera to the Argentine station Marambio to take aerial photographs of the Larsen Ice Shelf, images that showed behaviour never previously recorded. A 1600 km^2 section of the 200m-thick Larsen A had shattered like a car windscreen, its remains – an armada of icebergs as big as football pitches – drifting out to sea.

For the group, the changes provided certainty that these ice-shelf changes were due to regional climate change. The pattern of retreating ice shelves fitted their theory that there was a 'climatic limit-of-viability' for ice shelves which had been driven south as climate warmed on the Antarctic Peninsula. Once again, the findings were reported in *Nature* and provided a graphic illustration of climate change in action.

Despite the dramatic changes on the Antarctic Peninsula, they were limited in importance – a symptom of climate change, rather than something that would have wide impact. By the end of the 1990s, David saw an opportunity to refresh glacier dynamics research at BAS by looking over the ridge

towards the Amundsen Sea and the West Antarctic Ice Sheet (WAIS).

Setting his sights on Pine Island Glacier (PIG) – remote from Rothera Research Station, heavily crevassed and beset by notoriously poor weather – his first foray to PIG came in 2004 with US colleagues. In following seasons several small parties led by BAS glaciologist Andy Smith undertook radar and seismic surveys there but struggled with challenging conditions.

Convinced that delivering data depended on scaling up operations, David and Andy lobbied to bring in tractor trains – a first for BAS – and a team of nine scientists joined the iSTAR traverse in late 2013. A second successful traverse followed in 2015/16, laying the foundations for the International Thwaites Glacier Collaboration – one of the the largest field programmes ever undertaken in Antarctica – which will help glaciologists understand and predict the future of this epic glacier to global sea-level rise.

Born in Akrotiri, while his father was working for the Met Office in Tobruk, Libya, David grew up in Yately, Hampshire and Noss Mayo, Devon. At the local comprehensive schools he attended, he was good at maths, science and exams – something he approached as sport – and applied to read Natural Sciences at Churchill College, Cambridge.

Arriving by train for his interview, he recalled being awed by Cambridge and very nervous. Asked by Dr Brian Westwood to describe the mathematical proof that the square root of two is an irrational number he floundered, but when Westwood changed tack to quiz him about sailing, David excelled. He was given a conditional offer of four As and went up to Cambridge in October 1981.

His love of sailing came from his father, who taught him rigorously on land before taking to the water. As an 8-year-old, he sailed with his father from Lymington across the Solent to Yarmouth on the Isle of Wight in their 10-foot Mirror dinghy. Sliding into a solitude, he recalled being thrilled by the realization that they had disappeared from the world's gaze. It was sailing with his father that David credited as giving him access to the University of Cambridge, as well as his enchantment with isolation.

Determined to study Physics and Theoretical Physics in his final year, he struggled with lectures and course work but did well in the lab. When his lower second class degree seemed to close off a research career, he got a summer job with Dr Chris Doake in the geophysics department at BAS. A grant enabled him to do an MSc at Durham after which he joined BAS as a glacier geophysicist in 1985.

His first trip South – by air to Montevideo and then on the BAS ship RRS *John Biscoe* – was not plain sailing. Even before making camp on the Rutford Ice Stream, the object of his data gathering, David dislocated his shoulder, was forced to abandon the *Biscoe* in thick sea ice and spent 3 weeks digging out 600 drums of aviation fuel buried under 400 tonnes of snow on Spaatz Island.

In almost four decades at BAS, David spent the equivalent of 2 years under canvas in the Antarctic: with clothing hanging to dry in the apex of a pyramid tent, the primus stove roaring for tea, he thought there was no better place. That first season, however, remained the most significant watershed in his life: in the Antarctic, he felt he'd grown up and found his place in the world.

In 1985, while David was on the Rutford Ice Stream, a conference in Villach, Austria framed the science that would guide his career. The conference brought together for the first time experts in all areas of what was then termed 'the Greenhouse Effect'. The advisory group established following the conference went on to become the IPCC, which to this day provides scientific advice to the Framework Convention on Climate Change, and which David served for 15 years from 1999 to 2014.

When in 2003 David moved to rural Northamptonshire with his wife Jacqui, it was green and pleasant countryside. He became fascinated, however, with the county's preeminence in tanning leather and making fine leather goods. In 2010, he stumbled on

a shop selling leather craft supplies. Aided by a dinner fork and a sharpened nail, he made a case for his iPad, progressing to handbags, boxes and a leather bottle modelled on one brought up from the mud of the English Channel with the *Mary Rose*. Despite being a lifetime away from the skill of his adopted county's cobblers, he felt the quiet days spent in his shed with needles, knives and the smell of beeswax were rarely wasted.

David loved animals, especially dogs and horses; he learnt to ride when he met Jacqui and became an accomplished rider, exploring many parts of the world on horseback (Africa, Chile, New Zealand, USA and Wales). He very much enjoyed a gallop on Holkham Beach in Norfolk.

David excelled at endurance sports, enjoying triathlons, fell running and long-distance open water swimming. He completed an Iron Man and the last major event he took part in was a swim of 5.25 miles on Lake Coniston in 2019 where he came 3rd out of 47 in his age group.

David enjoyed cooking and was an inventive chef, never following a recipe. His paella was famous amongst his many friends in Northamptonshire, always cooked outside watching the sunset over the Tove Valley.

In the summer of 2022 David organized a festival party at his house for 150 people to celebrate his and Jacqui's 60th birthdays. Over 60 people camped out overnight in campervans and under canvas and everything was organized perfectly: the event even had perfect weather.

As his final project, David made an urn – a bright green leather cylinder stitched in yellow thread and marked with his initials. As this obituary is based on the draft of a book David was working on – *Essays on Antarctica and Climate Change with Diversions of a More Personal Nature* – it seems right the end of the story should be his words.

'When the time comes, Jacqui will carry it across the fields with friends and as many dogs and horses as can be mustered, to scatter the contents beneath my favourite tree. An English oak, which in winter provides dozens of sheep with shelter from the rain, and in summer gives them protection from the sun. After that, I suggest Jacqui uses the urn to hide a bottle of the best booze.'

He is survived by his wife Jacqui.

David Glyn Vaughan, glaciologist, born 23 October 1962; died 9 February 2023.

Becky Allen, writer and friend

INTERNATIONAL GLACIOLOGICAL SOCIETY

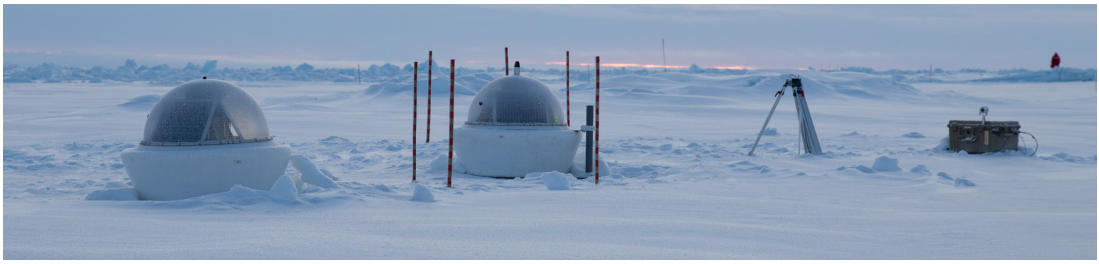
International Symposium on

Sea Ice across Temporal and Spatial Scales

Bremerhaven, Germany
4–9 June 2023

Co-sponsored by:
Alfred Wegener Institute,
Helmholtz Institute for Polar and Marine Research (AWI)
University of Bremen

SECOND CIRCULAR
January 2023
https://www.igsoc.org/event/bremerhaven_2021
https://igs2023.awi.de



The International Glaciological Society, the Alfred Wegener Institute, Helmholtz Institute for Polar and Marine Research (AWI) and the University of Bremen will hold the next **International Symposium on Sea Ice** in Bremerhaven, Germany, on 4–9 June 2023.

THEME

Sea Ice across Temporal and Spatial Scales. Sea ice is an important component of the Earth's climate system and strongly affects marine ecosystems and human activities in both hemispheres. Sea ice is changing rapidly on various temporal and spatial scales, and systematic observations and modeling across these scales is required to better understand underlying processes and interactions, and to predict the ice's future fate. This symposium will invite contributions by the international sea ice research community to exchange recent findings and advances in observations, process understanding, and modeling of sea ice worldwide. While the focus of the symposium will be on the physical ocean–ice–atmosphere system, cross-cutting interdisciplinary contributions are invited from fields such as sea ice ecology and biogeochemistry, ice engineering, human use of the sea ice environment, and others.

SESSIONS AND TOPICS

We seek papers and presentations on any timely topic related to sea ice across temporal and spatial scales, ranging from case studies to year-round investigations as during MOSAiC. All contributions may include and/or combine observational, numerical, theoretical, laboratory or conceptual approaches. Proposed session topics are:

- Sea ice in the regional and global climate
- Antarctic sea ice – present and future
- Sea ice processes and ocean–ice–atmosphere interaction

- Snow on sea ice
- Sea ice thickness
- New technologies and methodological advances for sea ice observations
- Physical properties of sea ice
- Sea ice biogeochemistry and ice-associated ecosystems
- Sea ice remote sensing
- Climate data records of sea ice: what's next?
- Multidisciplinary Arctic system studies – Tribute to David Barber
- Human use and sea ice services
- Arctic and Antarctic land-fast ice
- Sea ice deformation, leads, and ridges on temporal and spatial scales

Detailed session descriptions may be found on the local website, https://igs2023.awi.de/

PROGRAM AND REMOTE PARTICIPATION

The symposium will include oral and poster sessions and will be a friendly and intellectually stimulating environment to facilitate face-to-face interactions and networking. On some days there will be invited keynote sessions or panel discussions in the morning. Additional activities will include an opening reception, a banquet dinner, and a mid-symposium afternoon excursion. A public talk (in German) is included in the symposium program to reach out to people interested in sea ice topics in Bremerhaven and around.

Remote participation will be possible, with some limitations. All oral sessions will be provided as video streams to registered participants, including a chat function for questions to the speakers. Remote oral presentations can be

realized for selected cases if none of the co-authors is available on site. Poster presentations will only be available on site. The design and timing of all sessions and events during the symposium is illustrated in a diagram at https://igs2023.awi.de/programme/week-at-a-glance/.

SIDE MEETINGS

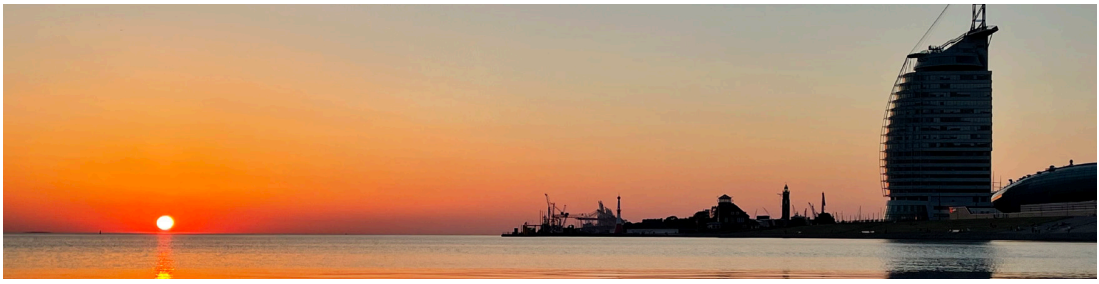
The organizing committee welcomes requests from groups and organizations for meeting spaces to host side meetings. Side meetings can take place in seminar rooms at the Alfred Wegener Institute in Bremerhaven on the weekends before (3 and 4 June) and the weekend after (10 and 11 June) the symposium. Please send your requests to igs2023@awi.de. Please include information on the main contact, expected number of participants, timing, and a short (few sentences) description of the topic/content. Scheduled side meetings will be listed on the conference web site once available.

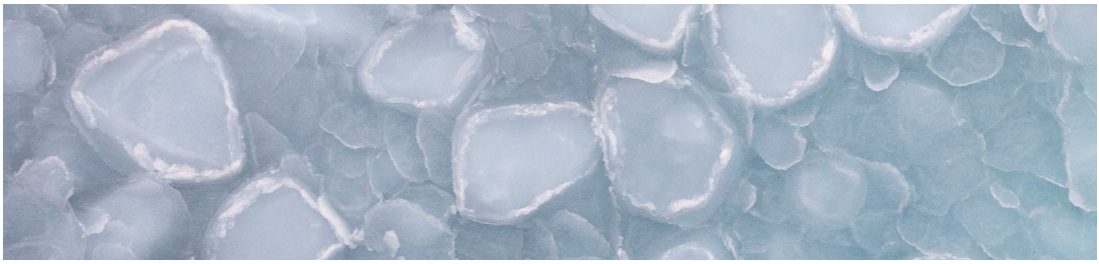
VENUE

The symposium will take place in the waterfront hotel Atlantic Hotel Sail City in Bremerhaven, Germany. The hotel is centrally located at the Weser River waterfront and near the city center, and next to many of Bremerhaven's renown tourist attractions like the Climate House, the 'Deutsches Auswandererhaus' (Museum of Emigration), the German Maritime Museum, the U-Boot Museum, Bremerhaven Zoo by the Sea, and the New Harbor Havenwelten. There are numerous eating venues, markets, and shops nearby. The Hanseatic City of Bremen with its medieval city center is less than an hour away.

For all questions about the venue and travel to Bremerhaven, please contact igs2023@awi.de.

A map with all sites of the IGS2023 symposium on sea ice is available at https://bit.ly/402KOoX.





REGISTRATION FEES

All fees are in Euros, €
Early registration until 28 March 2023

– Participant on site (IGS member):	€690
– Participant on site (not IGS member):	€775
– Remote participant (IGS member):	€500
– Remote participant (not IGS member):	€585
– Student or retired (IGS member):	€415
– Student or retired (not IGS member):	€500
– Accompanying person (≥12):	€175
– Accompanying person (<12):	€100
– Accompanying person (≤6):	Free

Surcharges

– Registration after 28 March 2023:	add €40
– Registration after 7 May 2023:	add further €100

All prices will be charged in UK£ equivalent at the exchange rate valid near the date of transaction.

The fees include:

– **Participants:** the Icebreaker, the midweek excursion, the Banquet, light refreshments during all breaks at the venue and all lunches.
– **Accompanying persons:** The accompanying person's registration fee includes the Icebreaker, the midweek excursion and the banquet. **It does not include attendance at the presentation sessions nor the refreshments and lunches during the week.**

Non-member registration includes a year's membership of the IGS.

Please register for the symposium at https://www.igsoc.org/event/bremerhaven_2021. If you need assistance, please contact the IGS via igsoc@igsoc.org. If payment by credit card is not possible, contact igsoc@igsoc.org to arrange bank transfer.

The maximum number of on-site attendees is capped at 300 to ensure a more intimate and interactive symposium. Please check whether you will require a visa or letters of invitation. In both cases, please contact the IGS office at igsoc@igsoc.org. Proof of registration is required for an invitation letter. The sooner you do this, the more likely it is that your visa will be processed in time.

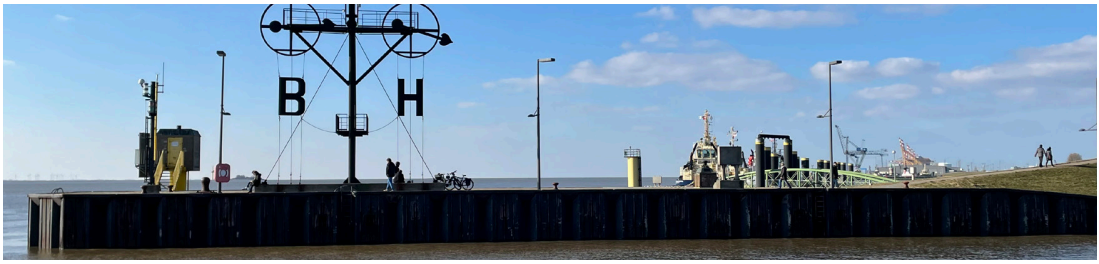
To request a refund, send an e-mail to igsoc@igsoc.org.

EARLY CAREER SUPPORT

We are currently raising funds to support early career scientist travels. The call and further details will be published on the local web site, https://igs2023.awi.de/ and will be distributed through the conference's mailing list. Notifications of funding will be sent to all applicants prior to the deadline for early registration (see below).

ABSTRACT AND PAPER PUBLICATION

Participants who wish to present a paper (oral or poster) at the Symposium will be required to submit an abstract through the IGS website by 17 February 2023. Accepted abstracts will be posted on the Symposium's website. The Council of the IGS will publish a thematic issue of the *Annals of Glaciology* on topics consistent with the Symposium themes. Participants and nonparticipants alike are encouraged to submit manuscripts for this *Annals* volume.



ACCOMMODATION

Bremerhaven is a tourist destination and hotels are usually fairly full, especially during June. Please make sure to book your accommodation early. Several hotels are providing group rates for the IGS symposium between 4 and 10 June 2023. All hotels listed are located within walking distance of the conference venue. When making your reservation use the promo code: IGS2023. Detail on prices and conditions are summarized on the IGS web site.

- Atlantic Hotel Sail City: https://www.atlantic-hotels.de/hotel-sail-city-bremerhaven/
- Hotel Amaris https://www.hotel-amaris.de/
- Hotel Adena https://www.hotel-adena.de/
- Nordseehotel Bremerhaven https://www.nordseehotels.com/city/de/willkommen
- The Liberty Hotel https://www.liberty-bremerhaven.com/
- Hotel Haverkamp https://hotel-haverkamp.de/
- Schulschiff Deutschland https://schulschiff-deutschland.de/

An interactive map with all hotels that have a contingent for participants is available at https://bit.ly/3YbguXN.

SOCIAL PROGRAM

The scientific symposium will incorporate a social program to increase interaction and networking of participants as well as to allow them to become more familiar with Bremerhaven, Bremen and its surroundings on the German North Sea coast.

ICEBREAKER

The symposium will start with an icebreaker reception on the sailing ship *Segelschulschiff Deutschland* in Bremerhaven harbor next to the main venue ('Neuer Hafen') on Sunday 4 June from 18:00 to 21:00. Please note that the reception will take place on the deck of the vessel (in the open air) and dress according to the weather conditions.

BANQUET

The symposium banquet will be held as a barbeque at the beach of the River Weser (restaurant 'Sandbank') on Thursday 8 June starting at 19:00. The banquet will include the awards ceremony.

MID-WEEK EXCURSIONS

On Wednesday 7 June, the scientific program will be paused at lunchtime. The afternoon will be used for guided trips in and around the cities of Bremerhaven and Bremen. You will be able to select your three top choices during the general registration process. All excursions will commence at around 13:00 from the Sail City Hotel in Bremerhaven by bus or on foot. All excursions will have food options for dinner, but these are not included in the conference fee and must be paid individually in the restaurant. We will update the excursion descriptions on the IGS symposium web site over time. Here are your options:

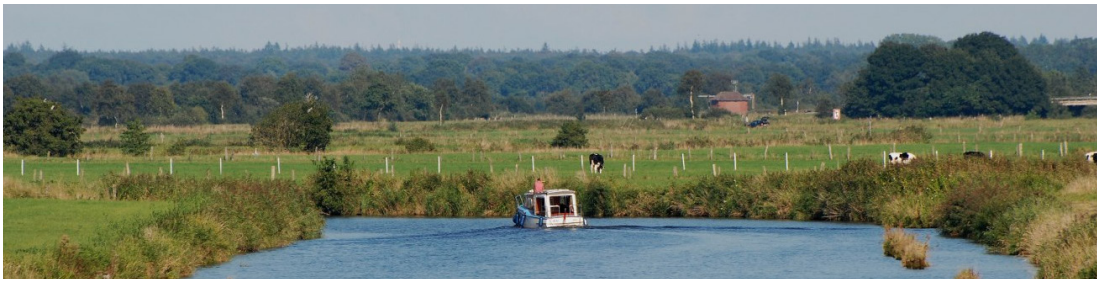
BHV01 – Fishing harbour 'Fischereihafen': The first Bremerhaven excursion starts with a short bus-trip to the famous fishing-harbour area of the city. The 100-year-old area around the so-called 'Show Window Fishery Harbour' is unique in northern Germany and hosts a wide range of gastronomy, accommodation and small local shops. As part of the excursion, you will board a small tour-boat ('Barkasse') that will get you in the right mood for fish, drinks and more in the evening hours, before heading back to the city centre.

BHV02 – 'Klimahaus' museum & tour-boat: The second Bremerhaven excursion is in direct proximity to the conference hotel – a visit to the Klimahaus ('Climate house') museum that will take you around the different climatic zones of the earth within just a few hours. You will even have the possibility of a short visit to our German overwintering base in Antarctica, Neumayer Station III – so cool, literally. Afterwards, you will board a small tour-boat in the new harbour area to explore this newer part of the city with a whiff of sea-air in your nose.

BHV03 – 'Auswandererhaus' Museum& tour-boat: The third Bremerhaven is also in direct proximity to the conference hotel – a visit to the distinguished German Emigration Centre ('Deutsches Auswandererhaus'), recognizing Bremerhaven's important role as a main European emigration hub to the New World. Follow in their renewed and extended exhibition of unknown life stories from Europe and the world. You can even trace and explore the emigrant routes of your own family! Discover the everyday life of emigrants: in the country of arrival and the history of the Federal Republic through the eyes of immigrants. Afterwards, you will board a small tour-boat in the new harbor area to explore this newer part of the city with a whiff of sea-air in your nose.

BHV04 – Canoe on the Geeste: This excursion is for the sporty among you. Pack your dry clothes and get into the canoe! The entrance is a short bus ride away – at the Schiffdorf lock. From there you can explore the reeds, small channels and green fields of the area on a 2–3-hour tour. Pure nature!

BRE01 – Bremen hangar of Polar 5 and 6 research aircrafts and city of Bremen tour: We will visit the hangar at the Bremen airport where the AWI Basler BT-67 Polar 5 & 6 aircrafts are parked and maintained when not on a flight campaign. The tour will guide you through the hangar and aircraft



and give details about their main research missions. The visit to the hangar is followed by a guided tour through the old downtown of Bremen. You will see the famous town musicians as well as the impressive town hall, parts of the UNESCO world heritage site. The tour also takes you along the Weser River and into the oldest quarter of Bremen, called Schnoor.

BRE02 – Bremen Drop Tower and city of Bremen tour: The Drop Tower is probably the most prominent building on the University of Bremen campus. Here microgravity experiments are conducted in the fields of astrophysics, biology, chemistry and more by dropping a capsule from 120 m height and thereby creating 4.74 seconds of zero gravity (or more precisely microgravity). The visit to the Drop Toweris followed by a guided tour through the old downtown of Bremen. You will see the famous town musicians as well as the impressive town hall, parts of the UNESCO world heritage site. The tour also takes you along the Weser River and into the oldest quarter of Bremen, called Schnoor.

CUX01 – Climbing Forest Cuxhaven: This is high! An approximately 45-minute bus ride takes us to the North Sea coast. And once again, this excursion will be unique and sporty at the same time: The high ropes course in Cuxhaven is the only one in the world directly on the Wadden Sea World Heritage Site. Fasten your climbing harness - and off you go on one of the seven courses through the treetops. Not for those who are afraid of heights! Afterwards we come back down to earth – and follow the mud worms in the surrounding mudflats of the Wadden Sea when the tide is low in the evening hours. A very special experience – for which a towel is a necessity!

CUX02 – Coastal pasture Cuxhaven: However, the North Sea coast can also be a little quieter, as we will learn on our second tour in the region. A guided tour through the coastal pasture including exciting stories about the

breath-taking nature will quickly immerse us deeply here. Afterwards we will join the previous group and follow the mudworms in the surrounding mudflats of the Wadden Sea, when the tide is low in the evening hours. A very special experience – for which a towel is a necessity!

WORPS01 – Torfkutter: A bus-ride of approximately 1 hour will take you to the beautiful small town of Worpswede – a place of art, culture and traditional crafts situated in the Teufelsmoor, northeast of Bremen. Over 130 artists and craftsmen call or called this place their home. In Worpswede, you will enjoy a guided tour through the surrounding nature on one of the traditional peat boats. Afterwards, you will have plenty of time to explore the town with its famous art exhibitions, ateliers, cafés and restaurants.

SYMPOSIUM ORGANIZATION
Magnús Már Magnússon (International Glaciological Society

SCIENCE STEERING COMMITTEE
Christian Haas (Chair), Marcel Nicolaus, Gunnar Spreen, Feiyue Wang (past Co-chair), David Babb, Sinead Farrell, Alexander Fraser, Mats Granskog, Jari Haapala, Polona Itkin, Alexandra Jahn, Thomas Lavergne, Ruibo Lei, Klaus Meiners, Wolfgang Rack, Randy Scharien, Axel J. Schweiger, Julienne Stroeve, Letizia Tedesco, Takenobu Toyota, Melinda Webster

LOCAL ORGANIZING COMMITTEE
Marcel Nicolaus (Chair), Gunnar Spreen, Christian Haas, Lilian Schubert, Stephanie Carstensen, Marietta Weigelt plus numerous representatives of AWI's senior and junior, interdisciplinary sea ice research community.

FURTHER INFORMATION
If you wish to attend the symposium, please register online at https://www.igsoc.org/event/bremerhaven_2021/

Information will also be updated on the local website: https://igs2023.awi.de

IMPORTANT DATES

Sea Ice across Temporal and Spatial Scales

Opening of online abstract submission:	25 January 2023
Abstracts due:	17 February 2023
Notification of abstract acceptance:	3 March 2023
Opening of online registration:	19 February 2023
Early registration deadline:	28 March 2023
Deadline for full refund:	21 April 2023
Deadline for refund on a sliding scale:	7 May 2023
Late registration surcharge starts:	7 May 2023
Symposium starts:	4 June 2023

Annals of Glaciology volume 65

Papers due:	31 October 2023
Final revised papers:	31 March 2024

The Call for Papers for the *Annals of Glaciology* is posted on https://www.igsoc.org/annals/call_4_papers/. Accepted papers will be published as soon as authors have returned their proofs and all corrections have been made.

Publication of this *Annals* issue is scheduled for 2024.

INTERNATIONAL GLACIOLOGICAL SOCIETY

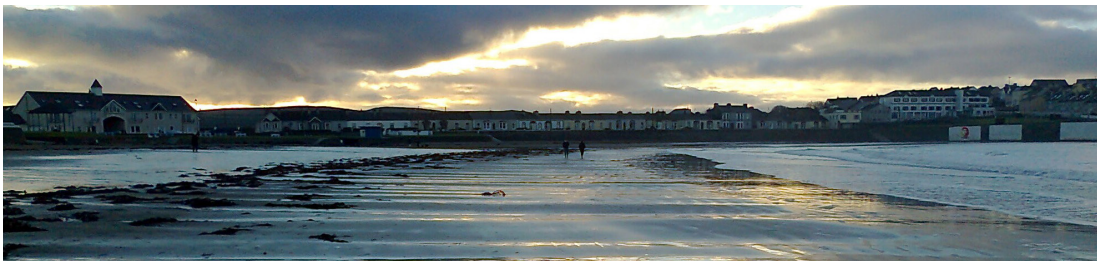
International Symposium on

The Edges of Glaciology

Limerick, Ireland
2–7 July 2023

Co-sponsored by:
MACSI (Mathematics Applications Consortium for Science and Industry), University of Limerick

SECOND CIRCULAR
February 2023
https://www.igsoc.org/event/limerick_2023



The International Glaciological Society will hold an **International Symposium on The Edges of Glaciology** in 2023. The symposium will be held in Limerick, Ireland, from 2–7 July. This will be an in-person conference.

THEME

The edges of glaciology are most obviously those parts of the study of ice and ice masses which involve boundaries: grain boundaries, ice cores, the glacier bed, the glacier surface, shear margins, crevasses, calving. But these and other subjects also sometimes involve philosophical edges, where different presumptions and practices can lead to controversy: for example, theories of drumlin formation or till deformation. And, yet again, there are territorial edges, where glaciology lies at the interface with other disciplines, as for example in ice-shelf–ocean interactions, rheology of granular materials, firn sintering and compaction. The aim of the symposium is to explore and encourage discussion of all such edges. In keeping with this aim, we hope to include some open problem-solving sessions, and will also recover the long-lost final open discussion.

SESSIONS AND TOPICS

Oral and poster presentations will be held on three and a half days. There will be ample opportunity for poster displays. There will be at least one 'open problem' session and a final open discussion. The suggested topics include, but are not limited to:

1. Subglacial processes
2. Supraglacial processes
3. Snow, firn and ice at the grain scale
4. Calving and crevassing

5. Glacial geomorphology

6. Ice shelves and oceans

7. Till rheology

PROGRAMME

The symposium will include oral and poster sessions interlaced with ample free time to facilitate the interactions of the participants. Additional activities include a pre-symposium excursion, an opening Icebreaker, a mid-week excursion to the Loop Head peninsula, a Banquet and a post-symposium excursion to Clare and Connemara.

ABSTRACT AND PAPER PUBLICATION

Participants wishing to present a paper (oral or poster) at the Symposium will be required to submit an abstract by 1 March 2023. Abstracts need to be submitted via the IGS website. Accepted abstracts will be posted on the Symposium website. **Abstracts are also sought for (i) open problems and (ii) topics on the edge. The intention is that open problems will provide for a short presentation of a problem whose explanation is unknown, and topics on the edge will provide for a short presentation of a subject whose current status is contentious. Both types of presentation will be followed by an open discussion. Any number of open/edge abstracts can be submitted.**

The Council of the IGS will publish a thematic issue of the *Annals of Glaciology* on topics consistent with the Symposium themes. All papers (including those based on posters) will be refereed and edited according to the Society's regular standards before being accepted for publication. Paper submission will open 15 May and the deadline for submitting papers is 31 October 2023. The call for papers is posted on https://www.igsoc.org/annals/.

REGISTRATION FEES

All fees are in Euros, €
Early registration until 1 May 2023

– Participant (IGS member):	€650
– Participant (not IGS member):	€750
– Student or retired (IGS member):	€450
– Student or retired (not IGS member):	€525
– Accompanying person (18+):	€350
– Accompanying person (12–17):	€250
– Accompanying person (<12):	€100

Surcharges

– Registration after 1 May 2023:	add €100
– Registration after 1 June 2023:	add further €100

All prices will be charged in UK£ equivalent at the exchange rate valid near the date of transaction.

The fees include the Icebreaker, the mid-symposium excursion, the Symposium Banquet, dinner on Monday and Tuesday, lunches and morning and afternoon refreshments from Monday to Friday.

Accompanying persons
The accompanying person's registration fee includes the Icebreaker, the midweek excursion, dinner on Monday and Tuesday, and the Symposium Banquet. **It does not include attendance at the presentation sessions.**

Non-member registration includes a year's membership of the IGS.

Please register for the symposium through the IGS website. If you cannot do this, contact the IGS office directly at igsoc@igsoc.org. If payment by credit card is not possible, contact the IGS office to arrange for a bank transfer.

Please check whether you will require a visa to enter Ireland. If you need an invitation letter, please contact the IGS office at igsoc@igsoc.org. The sooner you do this the more likely it is that your visa will be processed in time.

LOCATION

Limerick is a city of some 100 000 people, whose origins lie in the mists of time. It is situated at the mouth of the River Shannon, where it opens into the Shannon estuary. While much of its former architectural splendour has gone, notable remnants include the mediaeval King John's Castle, and St Mary's Cathedral. The University of Limerick was established in 1972 as the National Institute for Higher Education, becoming a university in 1989. It is situated in the grounds of a former manor house dating from the 18th century, which now serves as an administrative hub. The River Shannon runs through the campus, which is several kilometres from the city centre.

TRAVEL

Limerick is easily accessed from Shannon airport, from which a taxi takes 40 minutes and costs around €50; a cheaper alternative is the express 51 bus (direction Cork), which takes you to the Limerick bus and train station in the centre of the city, from where a taxi will cost around €10. For those travelling to Dublin airport, there are two buses that take you to Limerick; one is Dublincoach.ie, which requires you to change at the Red Cow Luas station, but will let you off at the university; the other is Eireagle.com, which is direct (get off at the Hurler's and then walk to the University (or Kilmurry Lodge, if you're staying there)). Trains (Irishrail.ie) connect to Limerick (note: Limerick Colbert station) after a change at Limerick Junction (which is still 40 km away) from Dublin Heuston.

VENUE

The meeting will be held in the Kemmy Business School at the University of Limerick in the west of Ireland. The surroundings offer plenty of scope for glaciological, geological and geographical excursions (drumlins, limestone pavement, caves, hill forts, alpine flora).

ACCOMMODATION

The university campus, set in 300 hectares of beautiful riverside parkland, provides a convenient, scenic and self-contained environment for delegates. Accommodation (1.5 km from the venue) is available at €65.00 per person per night B&B. This consists of shared apartments of four or six bedrooms (each with its own private toilet and shower) and a shared living room with cable television and a fully fitted kitchen. High-speed WiFi is provided free of charge. Bed linen and towels are supplied and continental breakfast at a nearby restaurant is included. There is free adjacent parking. Double rooms are available, booked as two singles at a reduced rate. Please email your dates of stay to conference@ul.ie to book a double room.

Alternatively, participants may choose to stay off-campus. The Kilmurry Lodge Hotel is located in Castletroy, approximately 2.5 km from the venue. The Local Organizing Committee has reserved a very limited number of rooms in this hotel (€132.00 per person per night B&B or €149.00 per room for double occupancy B&B).

Book any of the above accommodation at https://ulevents.eventsair.com/international-glaciological-society-conference-2023/igsoc23accom

All accommodation will be available at the above pricing until 31 April 2023. After that the rooms will be released and will only be available directly from the accommodation provider at a higher rate. **Only very limited local accommodation is available at this time, so early booking is strongly advised.**

ICEBREAKER

The icebreaker will be held on Sunday 2 July in the Kemmy Business School foyer from 7.30–9.30 pm, with refreshments and a light buffet. In addition there are two bars (Scholars' and Stables) located centrally on campus, which should be open throughout the week.

BANQUET

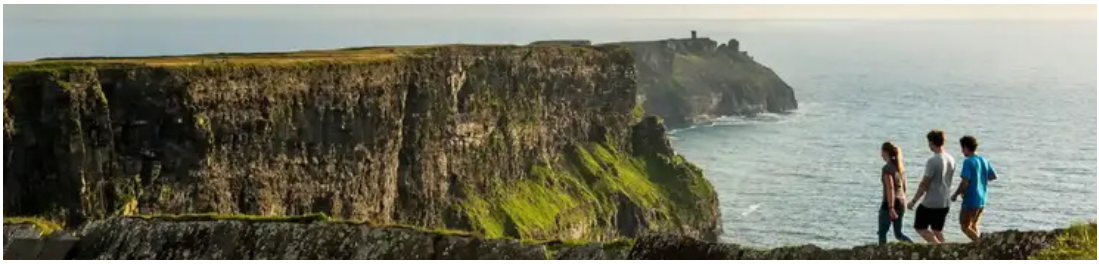
The symposium banquet will be held on Thursday evening, 6 July, at a venue yet to be ascertained. Further details will be provided as they become available.

PRE-SYMPOSIUM EXCURSION

There will be a pre-symposium excursion on Sunday 2 July to Skellig Michael. The cost for this will be €165, inclusive of travel to Portmagee and a packed lunch. We have pre-booked five boats and thus 60 places. Those wishing to book a place or places should **book online at https://ulevents.eventsair.com/international-glaciological-society-conference-2023/igsocsmt as soon as possible to secure a place.** There are two booking options: one with payment, which guarantees a seat on a boat, and one without payment, which places you on a waiting list with no guarantee of a seat. Payment for the boat trip is non-refundable except in exceptional circumstances. We aim is to have these bookings settled by the end of February if possible. The reason is that, if not all places are taken up, then we can get a full refund with sufficient notice. **No children under the age of 10 can make the trip**.

Skellig Michael is the larger of a pair of islands in the North Atlantic some 8 miles off the coast of County Kerry, and was the site of a monastic settlement from about the 5th century to the 12th. Access is by small boats that sail from Portmagee, the trip taking an hour. The landing at the pier is in choppy water; there is then a path part way round the island, and then an ascent of about 150 m on about 600 steps cut into the stone. It is steep and exposed, and there are no hand rails. No rubbish can be left on the island. Those wishing to attend should be aware that the sea voyage is likely to be choppy (the boats will not go in bad weather, and a full refund for the boat cost (€125) is then made, and an alternative excursion will take place), and that the ascent and descent is slightly arduous. Further information can be found at www.skelligcoastadventures.ie .

The bus or buses will leave the University of Limerick at 7 am, to arrive at Portmagee at 10 am. They will leave Portmagee to return at around 4 pm, in time for the symposium icebreaker.



OTHER EXCURSIONS

As well as the pre-symposium excursion to the early Christian settlement on Skellig Michael, there will be a mid-week excursion through the drumlin landscape of south County Clare to the Loop Head peninsula.

We also intend to host a post-symposium tour, leaving Limerick on the morning of 8 July and returning to Limerick via Shannon airport on the afternoon of 10 July. This tour will proceed providing sufficient numbers (12) sign up, and also providing accommodation can be secured; the current Ukrainian refugee crisis is having a severe impact on hotel accommodation. The itinerary is not yet established, but it is likely to comprise a day in Clare, exploring the Burren, including visits to neolithic sites such as hill forts and portal dolmens, karst cave systems, meanderkarren in limestone pavement, subglacial meltwater channels, and a chance to walk on the fabled limestone pavement of the Burren. A second day will take us north through Connemara towards Westport and the famous drumlins of Clew Bay, past a landscape carved by ice, including former cirques, drumlins, eskers and other glacial relict formations. As well as the geographical features, we will aim to include visits to other landmarks of note.

SYMPOSIUM ORGANIZATION

Magnús Már Magnússon (International Glaciological Society)


SCIENCE STEERING COMMITTEE
Andrew Fowler, Chris Clark, Felix Ng, Christian Schoof, Ian Hewitt, Jenny Suckale, Sophie Nowicki, Paul Dunlop.

LOCAL ORGANIZING COMMITTEE
Andrew Fowler, Peg Hanrahan, Ena Brophy, Megan Tuite, Deb Tudge, Mark McGuinness (photography), Iain Moyles (catering), Guy Kember (music), Sarah Mitchell (travel advisor).

FURTHER INFORMATION
If you wish to attend the symposium, please register your interest online at http://www.igsoc.org/symposia/2023/limerick. Please suggest (i) 'edges' you would like to see as topics for a discussion session and (ii) particular open problems you would like to be addressed in an open forum.

IMPORTANT DATES

The Edges of Glaciology

Opening of online abstract submission:	16 January 2023
Abstract submission deadline:	1 March 2023
Notification of abstract acceptance:	1 April 2023
Opening of online registration:	16 January 2023
Early registration deadline:	1 May 2023
Deadline for full refund:	1 June 2023
Late registration surcharge starts:	1 June 2023
Symposium starts:	2 July 2023

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Paper submission deadline:	31 October 2023
Final revised papers:	30 April 2024

The Call for Papers for the *Annals of Glaciology* is posted on https://www.igsoc.org/annals/call_4_papers/. Accepted papers will be published as soon as authors have returned their proofs and all corrections have been made.

Publication of this *Annals* issue is scheduled for 2024.

Glaciological diary

** IGS sponsored * IGS co-sponsored

2023

26–28 January 2023
IASC Workshop on the Dynamics and Mass Budget of Arctic Glaciers
Obergurgl, Austria
Website: https://nag.iasc.info/workshop

29 January–4 February 2023
EGU Snow Science Winter School 2023
SFL, Davos, Switzerland
Website: https://www.slf.ch/more/snowschool

6–8 February 2023
10th Workshop on Remote Sensing of Land Ice and Snow
Bern, Switzerland
Website: https://www.earsel.org/SIG/Snow-Ice/workshop/call.php

6–10 February 2023
International Advanced Training Course on Snow and Avalanches 'Practice meets science'
SFL, Davos, Switzerland
Website: www.slf.ch/more/training

9–10 February 2023
26th Alpine Glaciology Meeting
Birmensdorf, Switzerland
Website: https://www.wsl.ch/en/about-wsl/events/details/alpine-glaciology-meeting.html

13–17 February 2023
2nd MOSAiC Science Conference
Boulder, Colorado, USA
Website: https://mosaic.colorado.edu/second-science-conference

17–24 February 2023
Arctic Science Summit Week (ASSW) 2023
Vienna, Austria
Website: https://assw.info/

10–16 March 2023
Glacier modelling: Practical applications with the Open Global Glacier Model
Lahore, Pakistan
Website: https://huc-hkh.org/events/training-on-glacier-modelling-practical-applications-with-the-open-global-glacier-model

21–23 March 2023
Sea Ice Data Assimilation Workshop
Oslo, Norway
Website: https://iicwg-da-11.met.no

28–29 March 2023
Workshop: Ice-sheet modelling initialization
Utrecht, Netherlands
Website: https://www.igsoc.org/event/two-day-workshop-on-ice-sheet-model-initialisation

1–8 April 2023
Field school: Physics of Arctic Snowpacks and Climate
Ikaluktutiak Nunavut, Canada
Website: https://sentinellenord.ulaval.ca/en/arcticsnow2023

24–27 April 2023
AITC 2023: Mapping the Arctic
Nuuk, Greenland
Website: https://dtu.events/aitc2023/conference-description.html

15–19 May 2023
Polar Postdoc Leadership Workshop
Nederland, Colorado, USA
Website: https://psecco.org/outreach/conferencesworkshops/polar-postdoc-leadership-workshop

24 May–2 June 2023
23rd Karthaus Summer School: Ice sheets and glaciers in the climate system
Karthaus, Italy
Website: http://www.projects.science.uu.nl/iceclimate/karthaus/

4–9 June 2023
****International Symposium on Sea Ice across Spatial and Temporal Scales**
Bremerhaven, Germany
Website: https://www.igsoc.org/event/bremerhaven_2021

6–8 June 2023
79th Annual Eastern Snow Conference
Easton, Pennsylvania, USA
Website: https://www.easternsnow.org/

18–22 June 2023
6th European Conference on Permafrost
Puigcerdà, Spain
Website: http://eucop2023.com/

19–22 June 2023
36th Forum for Research into Ice Shelf Processes (FRISP 2023)
Stalheim, Norway
Website: https://www.tipaccs.eu/frisp2023/

2–7 July 2023
****International Symposium on the Edges of Glaciology**
Limerick, Ireland
Website: https://www.igsoc.org/event/limerick_2023

3–7 July 2023
Polenet Training school: Glacial Isostatic Adjustment Modelling
Gävle, Sweden
Website: ttps://polenet.org/2023-gia-training-school/

3–7 July 2023
Ross Sea Conference
Naples, Italy
Website: http:www.rossseaconference.org

11–20 July 2023
IUGG General Assembly
Berlin, Germany
Website: https://www.iugg2023berlin.org/

14–20 July 2023
Quaternary Mediterranean Glaciers
Rome, Italy
Website: https://inquaroma2023.org/

23–27 July 2023
17th US National Congress on Computational Mechanics
Albuquerque, New Mexico, USA
Minisymposium on Geomechanics of the Cryosphere
Website: https://17.usnccm.org/705

31 July–11 August 2023
Glaciology of the Southern Andes
Mendoza, Argentina
Flyer: https://www.igsoc.org/wp-content/uploads/2023/07/Flyer_glaciologia_andes_del_sur_2023_red2.jpg

14–18 August 2023
SOOS Symposium: Southern Ocean in a Changing World
Hobart, Tasmania, Australia
Website: https://soos.aq/soos-symposium-2023

20 August–2 September 2023
ACDC-GRISO summer school 2023: Past and future changes in Greenland climate
Qeqertarsuaq, Greenland
Website: https://www.uib.no/en/rs/acdc/160261/acdcgriso-2023

28 August–1 September 2023
7th annual OGGM workshop)
Edinburgh, UK
Website: https://oggm.org/2023/02/20/7th-workshop-announcement/

29 August–1 September 2023
International Úa user meeting 2023
Newcastle, UK
Website: https://www.igsoc.org/event/international-ua-user-meeting-2023/

30 August–4 September 2023
The Interdisciplinary Polar Studies 2023 (IPS-2023) Modular Meeting
On board r/v *Horyzont II*, Longyearbyen and Hornsund/Isfjorden, Svalbard
Website: https://www.polarknow.us.edu.pl/ips-2022/

4–5 September 2023
IGS British Branch Meeting 2023
Cardiff, UK
Website: https://www.igsoc.org/event/igs-british-branch-cardiff-2023

4–8 September 2023
15th International Conference on Physics and Chemistry of Ice (PCI-2022)
Sapporo, Japan and Online
Website: http://www.lowtem.hokudai.ac.jp/ptdice/PCI-2022/index.html

11–14 September 2023
SCAR INSTANT Conference 2023 – Instabilities and Thresholds in Antarctica
Trieste, Italy
Website: http://www.instant2023.org/

13 September 2023
ISMASS workshop on ice sheet modelling across timescales
Trieste, Italy
Contact: Catherine Ritz<catherine.ritz@univ-grenoble-alpes.fr>

18–19 September 2023
UK Sea Ice Group Meeting
London, UK
Contacts: Michel Tsamados<m.tsamados@ucl.ac.uk> and Rosie Willatt

25–28 September 2023
2023 WAIS Workshop
Cloquet, Minnesota, USA
Website: https://www.waisworkshop.org/

4–6 October 2023
Polar CORDEX 2023
Utrecht, Netherlands
Website: https://climate-cryosphere.org/2023-polar-cordex-annual-meeting/

10–12 October 2023
Workshop on subglacial and englacial hydrology and geology
Tarraleah, Tasmania Australia
Website: https://antarctic.org.au/

20–21 October 2023
NorthWest Glaciologists Meeting
Seattle, Washington, USA
Contact: Michelle Koutnik

31 October–1 November 2023
Svalbard Science Conference 2023
Oslo, Norway
Website: https://forskningsradet.pameldingssystem.no/svalbard-science-conference-3

6–7 November 2023
Elmer/Ice Beginner Course
Espoo, Finland
Website: https://ssl.eventilla.com/elmericebeginner

8–10 November 2023
IGS Nordic Branch meeting, 2023
Ottaniemi, Finland
Contact: Thomas Zwinger

9–10 November 2023
International Conference on Mountain Hydrology and Cryosphere
Kathmandu and Dhulikhel Nepal
Website: https://antarctic.org.au/

14–17 November 2023
14th Symposium on Polar Science
Tokyo, Japan
Website: https://www.nipr.ac.jp/symposium2023

14–17 November 2023
International Symposium on Third Pole Environment
Chongqing, China
Website: http://www.tpe.ac.cn/

2024

30 January–2 February 2024
4th International Conference on Snow Hydrology
Grenoble, France
Website: https://snowhydro2024.sciencesconf.org

14–15 March 2024
27th Alpine Glaciology Meeting
Grenoble, France
Website: https://agm2024.sciencesconf.org/

22–31 May 2024
24th Karthaus Summer School: Ice sheets and glaciers in the climate system
Karthaus, Italy
Website: https://www.projects.science.uu.nl/iceclimate/karthaus/

16–20 June 2024
2024 International Conference on Permafrost (ICOP2024)
Whitehorse, Yukon Territory, Canada
Website: https://event.fourwaves.com/999e4551-2c44-4e79-8ee8-98270952a41f/pages

4–9 August 2024
****International symposium on Verification and Validation of Cryospheric models**
Northumbria University, Newcastle, UK
Contacts: Secretary General, International Glaciological Society (IGS); Jan De Rydt <jan.rydt@northumbria.ac.uk>

20–22 September 2024
****International symposium on Ice Drilling Technology**
Bremen, Germany
Contact: Secretary General, International Glaciological Society (IGS)

2025

20–25 July 2025
****International symposium on Ice Streams and Outlet Glaciers**
Durham, UK
Contact: Secretary General, International Glaciological Society (IGS)

20–25 July 2025
IAMAS-IACS-IAPSO BACO-25 Joint Assembly
Busan, South Korea

17–22 August 2025
****International symposium on Artificial Intelligence in Glaciology**
Hanover, New Hampshire or Baltimore Maryland, USA,
Contact: Secretary General, International Glaciological Society (IGS)

2026

5–10 July 2026
****International symposium on Interactions of Ice Sheets and Glaciers with the Ocean**
La Jolla, California, USA
Contact: Secretary General, International Glaciological Society (IGS)

6–11 September 2026
****International symposium on Radioglaciology**
Tübingen, Germany
Contact: Secretary General, International Glaciological Society (IGS)

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