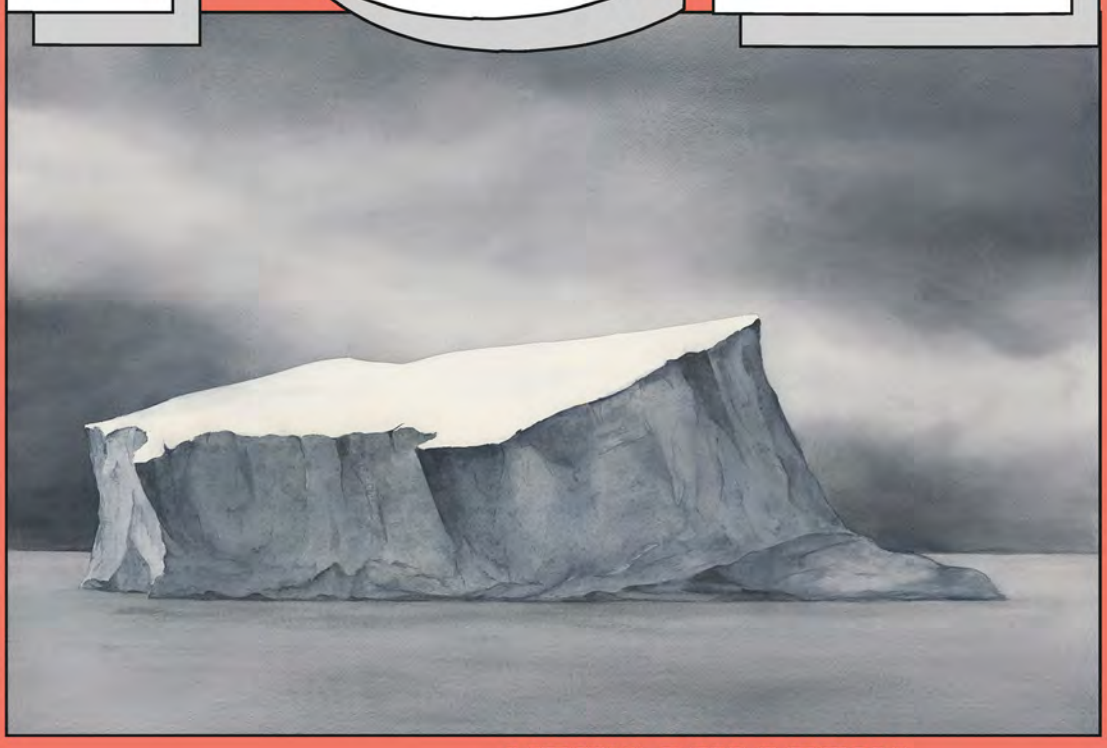
Number 185 *1st Issue 2021*

ICE



NEWS BULLETIN OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

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Ice

News Bulletin of the International Glaciological Society

Number 185 1st issue 2021

Contents

Cover picture: All through covid 19 the IGS International Seminar Series has kept us entertained and informed. This is a painting by Maria Coryell-Martin that serves as an introduction to her talk, 'Expeditionary art: drawing inspiration from the past to communicate climate science', given at the Seminar on 27 October 2021. Her inspirational talk is an indication of the spread of topics covered by the IGS Seminar Series.

From the Editor

Dear IGS member

A few months down the line and no end in sight. I doubt very much that we will be back in the IGS office until the new year. Some people in the UK are talking as if everything is over. I'm sorry, I do not agree. But enough of my whining.

This is quite a momentous issue of *ICE*. It brings to you the results of a 3-year project, the modernization of the IGS constitution. The constitution was first approved at a Special General Meeting held in Cambridge, England on 6 January 1962 and amended on 22 February 1968, 1 January 1972, 6 April 1977, 31 July 1985, 5 July 1989 and lastly on 14 October 1992, shortly after the birth of the internet. The IT technology we now take for granted was nowhere in sight and the rules and regulations within the Society reflected that.

As you may know, the IGS is a registered charity and thus falls under the auspices of the UK Charity Commission and related laws. Why are we bothering with being a 'registered UK charity?', some of you may ask. The fact is that being a charity comes with several benefits, mostly financial. As an example, we can claim back Value Added Tax (VAT), essentially a sales tax. So, if we buy a computer for £500 then we can claim back £83.33. And so on.

What has this to do with our constitution? you may ask. The answer is that our operation is governed by the rules and regulations of the Charity Commission.

When I became Secretary General in April 2003 one of the first things the President at the time, Liz Morris, and I embarked upon was how to better involve the Council in the operation of the Society, something that the then Treasurer, John Heap, had already started investigating. The IGS has a large governing body. We have eighteen members of what we call the Council. The Charity Commission refers to it as the 'Board of Trustees'. The size of the Council and the fact that our symposia have become more and more 'specialized' has resulted in a smaller and smaller percentage of Council members attending the symposia where we traditionally hold Council meetings, and indeed our Annual General Meeting. In the past our symposia were much more general and thus the attendance was much broader. Although our constitution stipulates that '*This Council shall have power to co-opt not more than three extra members. Six members of the Council shall form a quorum*', very rarely do we have more than three or four Council members at one of our symposia, which means we have usually had to co-opt additional members for the Council meeting. Sometimes we have been able to co-opt former Council members familiar with the workings of the Council but more often than not we have had to co-opt members who have had no previous dealings with Council. This is far from ideal, for obvious reasons. So, what could be done? We were often asked why we didn't hold Council meetings in Cambridge and invite Council members to attend. This may sound ideal but the financial implications are quite substantial. Quite often we only have one or two Council members in the UK and only a handful from around Europe. So, we would have had to fly in and accommodate up to 18 people for such a meeting. That would have been a substantial financial burden on the Society, considering that we traditionally hold two Council meetings a year.

The next option was to explore an emerging technology: teleconferencing. We contacted the Charity Commission to investigate if that would constitute a legal meeting of the board of trustees. The reply was yes, as long as everyone could see the faces of all other attending trustees at all times, even if they were not speaking. In other words, we had to produce an exact replica of Council members sitting around a table. This was quite a challenge. These setups were very expensive so only a few were in place around the world, usually in major centres. There was one

such system in Cambridge. Others were in California and New York, one in Beijing, etc. Plus, they were very expensive to rent and they were not mobile. We did go back to the Charity Commission claiming that this was not a suitable option for a small international charity, but in vain.

So back to the drawing board. The next possibility explored was to form an 'executive committee' consisting of the President, Vice Presidents, Treasurer, immediate past President and Secretary General. This idea had some support among members but not enough to be implemented.

So, fast-forward a few years and it had now come to pass that the Charity Commission had decided to join the 21st century and allow electronic means of communication. But only if the constitution of the relevant charity specifically made provisions for doing so. So, we had to change our constitution. Not quite so easy as it sounds! There are certain sections of the constitution where we could not change even a comma unless we subjected ourselves to a very thorough scrutiny at the hands of Charity Commission, as my predecessor Simon Ommanney and the then Treasurer John Heap found out. This could take years and they discovered that they could believe they were close to resolving the issue only for the person they had been dealing with to be replaced and they had to start afresh. This happened at least twice. I'm not even sure if things were ever resolved.

The process that has now come to fruition started with a members survey followed by the formation of an ad-hoc committee to review the governance of the IGS under the able guidance of Regine Hock as Chair. It has been a long and arduous journey and just as we were getting close to the finish the dreaded covid-19 hit.

As mentioned earlier, it was unrealistic to attempt to completely renew the constitution, so the path of amending it was chosen.

You will be able to read all about the process in articles in this issue of ICE but I would just like to emphasize four things I see as pivotal.

1. Council meetings and Annual General Meetings (AGMs) do no longer require an in-person meeting but can be held via tele- or videoconferencing or a combination of in-person meeting and videoconference.
2. The total number of Council trustees is reduced from 18 to 14
3. The IGS Chief Editor and the Chairs of the standing committees are to be be ex-officio members of the Council, albeit without voting powers.
4. What has previously been referred to as 'Council members' has been changed to 'Council trustees' in line with the convention of the Charity Commission. This is done in order to distinguish between those members who are eligible to vote on matters before Council – 'trustees' – and those that are members of the Council due to their position within the Society, but are not eligible to vote.

But there was a Catch 22 here. To implement the amended constitution, we had to have a face-to-face Annual General Meeting! And this proved to be quite tricky. We were optimistic at first. Maybe we could hold an AGM at Durham or Reykjavík in 2020. Alas, no. We then set our hopes on the La Jolla symposium this past summer or the re-scheduled Iceland conference. Again, we were disappointed. We then set our sights on the British Branch in early September – to no avail.

Finally, it looks as if we will be able hold an 'in person' AGM during the Nordic Branch meeting in Oslo at the beginning of November, more precisely 5 November 2021 at 1600.

We will all be tremendously relieved.

Apologies for rambling on a bit, but I thought the IGS membership would benefit from knowing something about the history of this monumental step we are about to undertake.

Magnús Már Magnússon
Secretary General

New Zealand Branch (SIRG) Workshop

9–13 February 2021, Christchurch, New Zealand

In early February the New Zealand (NZ) snow and ice community (SIRG) held their annual workshop in Christchurch at the University of Canterbury's Student Association building Haere-Roa. Hosting of the annual workshop is rotated between three NZ universities; this year the meeting was organized by the University of Canterbury (UC). Given the challenges of running large public events with changing covid levels it was decided to combine this year's SIRG workshop with the New Zealand Antarctic Science Conference, and the NIWA 'Understanding Mountain Climates II' workshop. The aim was for all three organizations to work together to provide a week-long celebration of snow and ice research. This collaboration not only delivered a great week of science but also reduced participants' travel and therefore our collective carbon-footprint. Many SIRG participants took the opportunity to attend the conference for the whole week. It was amazing to have 150+ researchers attending this combined event in our covid world.

The conference kicked-off on 9 February with workshops on Antarctic science and policy, media and communication, integration of Mātauranga Māori into western science, and the Icebreaker. Antarctic-related SIRG presentations for both land and sea ice were included in the Antarctic program during days 2 and 3. Highlights from a SIRG perspective were sessions on ice–ocean interaction, sea-ice processes, and ice and earth system dynamics with superb keynote talks from Pat Langhorne, Christina Hulbe and James Renwick. Presentations also covered contributions from the Arctic Mosaic expedition. Day 3 saw presentations of Antarctic perspectives of human connections and impacts, marine life in the Ross Sea and beyond and ecosystems in a changing environment. An evening function was held for student and early-career researchers to meet and intermingle with key researchers in the Antarctic science community. The Antarctic Conference dinner was held in the beautiful Transitional Cathedral in Christchurch city centre.

Later in the week the alpine research was presented. As diverse as the snowpack, we saw a great range of presentations including alpine hazards (Simon Cox – GNS Science), alpine ecology as an indicator of climate change (Warren Chinn – Department of Conservation) and marginal snow packs in the Australian Alps (Simon Morris, from Australia via Zoom). There was also important discussion about monitoring techniques and the challenges of obtaining good data in years when glacier mass balance is very negative. A plenary celebrating George Denton's contribution to snow and ice research was given by Aaron Putnam (University of Maine, also via Zoom), with an in-house introduction by Davis Barrell. The full program of the whole conference can be downloaded at https://www.antarcticanz.govt.nz/nzasc21/antarctic-science-conference.

SIRG/Mountain Climate II workshop participants.

SIRG field trip near Arthurs's Pass with paleo-glacier guide Jamie Shulmeister.

On Friday evening, in true 'SIRG' style, we cooked our own BBQ dinner on the UCSA Haere-Roa lawn. It was perceived as a great variation on the conference dinner earlier the week.

For those still keen at the end of the week, staff from the UC School of Earth and Environment ran a field excursion, showcasing the fantastic resource UC has with the Cass field centre, a research centre situated in the Canterbury foothills (near Arthurs Pass), which is surrounded by world-class glacial geomorphology.

A huge thanks goes to all the members of our collaborative organizing team from Antarctica New Zealand, NIWA and the University of Canterbury.

Heather Purdie (NZ National Correspondent)

Constitution changes

Report from the ad-hoc committee on governance changes

Background

The organizational structure of the IGS, including its main governance bodies and processes of decision making, is defined by its constitution. The first constitution was approved in 1962; it has since been amended six times, most recently in 1992. In light of the many technological advances during the last 30 years such as teleconferencing as well as other societal changes, an ad-hoc committee was initiated by Council at its meeting in Davos, Switzerland, on 20 June 2018 to review the current constitution and propose changes. The committee was also tasked to develop a membership survey with emphasis on governance to guide the committee´s recommendations.

The committee´s members included Regine Hock (chair), Doug Brinkerhoff (resigned in 10/2019), Hilmar Gudmundsson (resigned in December 2018), Christina Hulbe, Doug MacAyeal, Magnús Magnússon, Francisco Navarro, Rebecca Schlegel (since October 2019) and Lauren Vargo (since October 2019). The committee conducted its work via email and held several teleconferences.

Membership survey

A survey with 34 questions was prepared and launched on 17 December 2018 and remained open until 20 February 2019. The survey was fully or partially completed by 337 respondents, 65% of whom were IGS members. The detailed results from the membership survey are summarized in a report available at https://www.igsoc.org/about/constitution/2021constitution/ and reproduced on p. 10. Significant results relevant to IGS governance included:

1. A majority support for allowing electronic voting instead of requiring physical presence at Annual General Meeting;
2. Strong support for making committee chairs and chief Editor ex-officio members of the Council;
3. Almost ¾ of the respondents were in favour of some kind of change on how council members are selected, although there was little support for an open call (instead of the current nomination slate);
4. 39% favoured the current size of the Council but advocated to establish a smaller Executive Committee; 36% wanted to leave it as it is; a minority advocated to reduce the size
5. High interest to serve on IGS governance bodies (80% of respondents).

Proposed changes to the constitution

The committee´s recommendation for a revised constitution is given below on pp 7–9, while the current constitution can be found at https://www.igsoc.org/about/constitution/. The most important recommendations include:

1. Council meetings and Annual General Meetings (AGMs) do no longer require an in-person meeting but can be held via tele or videoconferencing or a combination of in-person meeting and videoconference. The motivation is to make it easier for Council Members to participate and thus reduce the need for co-options to achieve a quorum, and to facilitate all IGS members being able to join an AGM. (Article 8)
2. What has previously been referred to as 'Council members' has been changed to 'Council trustees'. This is done in order to distinguish between those that are eligible to vote on matters before Council – 'trustees' – and those that are 'ex-officio members' of the Council due to their position within the Society, but not eligible to vote.

The total number of Council trustees is reduced from 18 to 14, more specifically the number of maximum 3 Vice Presidents is reduced to 1, and the number of Elective trustees is reduced from 12 to 10. This recommendation aims at increasing the Council's efficiency and engagement. In addition, the option of teleconferencing is expected to lead to more active Council meeting participation so that a quorum can be reached even with a smaller Council. (Article 8)

3. The chief editor and the chairs of the standing committees shall be ex-officio members of the Council albeit without voting power. The motivation is to give the editor and committee chairs a permanent voice in the Council given their important role in running business within the IGS; however, the committee felt they

should not have automatic voting rights since they are not elected by the Society's Members but appointed by Council. (Article 8)

4. Electronic voting is possible for Council elections and matters at the Annual General Meeting as well as for adopting changes to the constitution. (Articles 9, 15, 16)
5. It was added that the President shall have the decisive vote in case there is a tie in the Council. (Article 8)
6. It was added that the Council may establish Terms of Reference (ToR) (which can be modified any time by Council) to define in more detail additional modes of operation of the IGS. Topics may include, for example, rotation and election of standing committee chairs and members, and editors; voting rules of all standing committees; modes of operation of ad-hoc committees; actions in case the president is incapacitated; strengthening the role of Early-Career Scientists and the recently formed standing committee EGG in governance; guidelines for diversity/inclusion; modalities on TOR changes. (Article 19)
7. A statement on diversity and inclusion was added. (Article 4)

The committee discussed possible changes to Article 2 (Objects of the Society) to facilitate future changes to the Annals of Glaciology or ICE, such as a name change, however, this was discarded because any changes to Article 2 require a different, more elaborate authorization process including the Charity Commission. The committee sought to implement such changes instead under other suitable Articles where possible.

We welcome any comments on the recommended changes to the Constitution. It is planned to adopt the amended version of the current constitution at the IGS Nordic Branch annual meeting in Oslo, Norway on Friday 5 November 2021.

Regine Hock, August 2021
On behalf of the ad-hoc governance committee

THE INTERNATIONAL GLACIOLOGICAL SOCIETY

CONSTITUTION

Name

1. The name of the Society shall be 'The International Glaciological Society'.

Object

2. The objects of the Society shall be:
   to stimulate interest in and encourage research into the scientific and technical problems of snow and ice in all countries;
   to facilitate and increase the flow of glaciological ideas and information;
   to publish the *Journal of Glaciology*, *Annals of Glaciology*, *ICE* and such other publications as the Council from time to time determine;
   to sponsor lectures, field meetings and symposia.

Branches

3. The Society shall encourage the establishment of branches in any country or region to foster the objects of the Society.

Membership and Payments

4. The Society shall consist of Ordinary Members, Junior Members, Corporate Members and such other categories as the Council shall from time to time determine,

   Ordinary Members shall be individuals of any country who are qualified in the scientific or technical aspects of snow and ice, who shall be admitted on payment of an annual payment to be determined by the Council.

   Junior Members shall be individuals under thirty years of age, who shall be admitted on payment of a reduced annual payment to be determined by the Council. Junior Members shall not be required to become Ordinary Members until the first day of January following their thirtieth birthday. Full-time students over the age of thirty shall be eligible for Junior Membership if their student status is fully validated.

   Corporate Members shall be organizations which desire to support the objects of the Society by payment of an annual payment to be determined by the Council.

The Society shall promote and support diversity and inclusion within its Membership and its governing bodies. Members of the Society are expected to abide by the 'Core Values' and

'Scientific Code of Conduct' of the Society. The Society's officers and committees shall take these values into account when considering the Society's matters such as nominations to Council, appointment of editors and committee members, and eligibility for awards.

5. Payments shall be payable in advance and shall be due on the first day in January each year.

Management

6. The affairs of the Society shall be managed by a Council and a Secretary General appointed by the Council. The office of the Secretary General shall be in the United Kingdom.

Officers

7. The Officers of the Society shall consist of a President, a Vice-President, and a Treasurer.

Composition of the Council

8. The Council is the main governing body of the Society and shall consist of the following trustees:
   The Officers
   The Immediate Past President
   Ten Elective Members

   This Council shall have power to co-opt not more than three extra trustees. Six elected or co-opted trustees of the Council participating in a council meeting shall form a quorum.

   The Society's Chief Editor and the chairs of standing committees appointed under Article 10 shall be ex-officio members of the Council. They shall not act as trustees of the Society nor have the power to vote.

   The Council may invite whomever Council deems relevant to the matters at hand, to attend meetings of the Council.

—In this document the expression 'meeting' includes, except where inconsistent with any legal obligation:

- a physical meeting
- a video conference, an internet video facility or similar electronic method allowing simultaneous visual and audio participation, and
- telephone conferencing
- or any combination thereof.

Decisions on any Council voting matters shall be determined by a simple majority of the votes cast. In case of a tie the President has the casting vote.

Elections of the Council

9. The Officers and Elective trustees of the Council shall be Members of the Society and shall be elected at the Annual General Meeting in accordance with Article 15. Officers and Elective trustees shall hold office for a term not exceeding three years without further election. At least one-third of the Elective trustees shall retire each year and shall not be eligible for immediate re-election. If necessary, the order of retirement of trustees elected on the same date shall be decided by ballot or electronic voting in Council. The names of Members nominated by the Council for such election shall be sent to all Members of the Society at least ten weeks before the Annual General Meeting. Any Member may propose other candidates for election, but such nominations, supported by at least ten Members of the Society, must reach the Secretary General five clear weeks before the Annual General Meeting. No person, with the exception of the Treasurer, shall serve on the Council for more than nine consecutive years without a break of one year. The progress of a President to the position of Immediate Past President shall not be interrupted.

10. The Council shall have the power to appoint one or more Members of the Society to Posts other than those referred to in Article 7. The Council may appoint Committees for which any Members of the Society shall be eligible

11. The Council shall have the power to fill, until the next Annual General Meeting, any vacancy occurring among the Officers or the rest of the Council. For the purpose of Article 9 such service shall not be counted.

12. The Council shall appoint an IGS Chief Editor who shall be responsible for the scientific journals published by the Society. The IGS Chief Editor shall hold office for three years and be eligible for reappointment. The IGS Chief Editor shall make recommendations to Council for Associate Chief Editors and Scientific Editors, as appropriate. Any other publications such as books and monographs shall be dealt with by the appropriate committee of the Society.

Annual General Meetings

13. An Annual General Meeting shall be held at a date to be determined by the Council to receive the Statement of Accounts for the preceding calendar year, to elect Officers and other Elective trustees of the Council for

the ensuing year, to appoint Auditors for the current year, and to transact any other business as determined by Council. Any Member may propose other matters, supported by at least ten Members of the Society, but such matters must reach the Secretary General five clear weeks before the Annual General Meeting. Twelve Members of the Society shall form a quorum. At least four weeks' notice shall be given of the Annual General Meeting and at least two weeks before this Meeting the Secretary General shall send a copy of the Agenda to each Member of the Society. A Statement of Accounts shall be available in the Secretary General's office for inspection by any Member during the two weeks preceding the Annual General Meeting, and a copy shall be sent to any Member on request.

Special General Meetings

14. Ten or more Members of the Society may at any time call a Special General Meeting by giving notice in writing to the Secretary General stating the motion or motions to be brought forward. A Special General Meeting shall be held at a time to be determined by the Council and shall take place within twelve weeks of receipt of such notice by the Secretary General. Not less than eight weeks' notice shall be given of a Special General Meeting. The notice of the Meeting shall state the business to be transacted and no business other than that specified in the notice shall be transacted at such a Meeting, at which twenty-one Members shall form a quorum.

Voting

15. Election of auditors and approval of officers' reports shall be adopted if approved by a majority of those Members present and voting at a General Meeting.
    Any decision, inclusive of any amendments, at a General Meeting, other than the election of auditors and the approval of officers' reports or a change in the Constitution, shall be adopted if approved by a simple majority of those Members voting either in person or by correspondence vote at a General Meeting.
    A correspondence vote includes post, fax, or electronic mail to the Secretary General, or a vote cast through any suitable electronic voting system and must be received at least one week prior to the meeting unless voting occurs through an electronic voting system that allows casting a vote during a General Meeting.
    For these purposes, each Corporate Member represented shall be entitled to one vote.
    Ballots for the election of the Council shall be circulated to all Members three clear weeks before the Annual General Meeting.

Changes in the Constitution

16. Any alteration in the Constitution proposed by the Council or favoured by a majority at a General Meeting shall be submitted to all Members and shall be adopted if approved by a two-thirds majority of those properly casting their correspondence vote as defined in Article 15 by a specified date which shall be not less than eight weeks after the issue of ballot papers.

Resignation

17. A Member may at any time resign from the Society by notifying the Secretary General in writing, but resigning Members shall be liable for any payment due.

Expulsion

18. If, in the opinion of the Council, any Member shall have acted in a manner prejudicial to the interests or good name of the Society, the Secretary General shall be instructed to write to that Member stating the nature of the offence, together with the name of informant, or source of information, and asking for an explanation. After allowing a reasonable time for a reply, the Council, providing not less than six are agreed, shall have the power to expel that Member from the Society. The Council shall also have power to remove from the Membership List the name of any Member whose payment is in arrears.

Contingent Authority of the Council

19. The Council shall have full power to deal with any matter affecting the Society's interest that is not provided for in this Constitution. The Council may establish Terms of Reference to define additional procedures of operation.

International Glaciological Society
High Cross
Madingley Road
Cambridge CB3 0ET
United Kingdom November 2021

* As approved at a Special General Meeting held in Cambridge, England on 6 January 1962 and amended on 22 February 1968, 1 January 1972, 6 April 1977, 31 July 1985, 5 July 1989, 14 October 1992, and 5 November 2021

IGS Member Survey

November 2019

1 Background

The IGS Council initiated an ad-hoc committee on IGS governance at its meeting in Davos, Switzerland, on 20 June 2018. The committee was tasked to review the current constitution) and propose changes. The committee´s members included Regine Hock (chair), Doug Brinkerhoff (resigned in 10/2019), Hilmar Gudmundson (resigned in December 2018), Christina Hulbe, Doug MacAyeal, Magnus Magnusson, Francisco Navarro, Rebecca Schlegel (since October 2019) and Lauren Vargo (since October 2019). To guide the committee´s recommendations the committee developed a membership survey (Appendix B) with emphasis on governance. The survey with 34 questions was launched on 17 December 2018 and open until 20 February 2019. The main findings are summarized in this report.

2 Respondents

The survey was completed or partially completed by 337 respondents (of 402 unique initialisations of the survey). Of these, 65% were current IGS members and 85% were in Europe or North America (Figure 2).
Throughout this report, "of respondents" means of the individuals responding to the particular question under consideration. Response options that were too long to include in tables are recorded in the last section of this report. The "demographic groups" considered include membership status and career stage (Figure 1).
Figures and tables summarizing the survey results are given in Appendix A.

3 Membership in the IGS

3.1 Representation

Two thirds of the respondents identify as male (Figure 4) and this goes up to 69% of the respondents who were IGS members. More than half of members who answered the years-of-membership question correctly (308 total) have been an IGS member for ten or fewer years (Table 1, Figure 5). All of the specialisations

named in the survey are represented in the respondents. Glaciers and ice sheets are the most common areas of specialisation (Figure 3).

3.2 Motivation for membership

Survey respondents were asked to rank a list of possible motivations for initiating or renewing their membership. The responses are tabulated and a weighted sum (a Borda count) is used to rank the options by popularity (Table 2).

- Belonging to a community of scientists with common interests is the top-ranked reason for membership in the IGS (67% of 1 and 2 ranks for all responses and 70% of 1 and 2 responses for members). This result holds across all demographic groups.
- Supporting the professional organization most closely aligned with my research and professional interests is also highly ranked by current members (not statistically different from "community" in most cases).
- Belonging to a community is differentiated from other responses more strongly for students (and non-members) than for other groups.
- Students and non-members rank reduced APCs more highly than do other demographic groups.

3.3 Membership fees

A majority of respondents, 54%, think that current membership fees are adequate and an additional 22% express no opinion (Table 3).

- This response is least strong for early career respondents, although a majority responded Adequate or No opinion.
- This response is strongest for current members, 78% of whom indicate Adequate or No opinion.
- This response holds for more than half of respondents for whom fees have been a factor in deciding to renew (Table 5).
- This response is equally strong for respondents living in Europe and North America (the largest region cohorts) although more North Americans respond that fees could be higher (11% vs 4%).

Nevertheless, membership fees have been a factor in the decision to renew for about half of respondents (Table 4). This is a stronger factor for early career and students than for mid-to-late career respondents.
Lack of funding and forgetting to renew are the most common reasons for not renewing membership (Table 6). Cost and Funding together are 41% of the non-renewal response. 46% of the repondents who indicated that at some time they "chose not to renew" are currently not members (they are 84 of the 88 survey respondents who are not currently members of the IGS).

4 Governance

4.1 Participation

In total, 21% of survey respondents have served on Council or an IGS committee and most of these are current members. Only 1 of the 71 early career respondents who answered this question has served on Council or an IGS committee. Encouragingly, 80% of respondents are interested in serving on Council or a committee now or in the future (Table 7). This positive response is strong for both early and mid-to-late career respondents (Table 8).
While a minority of respondents read AGM papers regularly, about half of respondents would like to know more about what Council is doing (Table 9).

- Of those who do read the AGM papers, 62% would like to know more about what Council is doing.
- Of those who do not read, 44% would like more information about Council.

Eighty-three percent of respondents are members of another professional society.

- The rate is similarly high for respondents who felt that IGS fees are too high or who reported that fees are a factor in their decision to renew their IGS membership.
- Of the respondents who reported on participation in another scientific society, most vote only occasionally (Table 10; 296 answered the first question but only 228 went on to respond about voting).
- IGS members dominate the frequent-voter cohort.

4.2 Procedures

Respondents do not think the Council selection procedure is adequate as it is currently managed (Tables 11 and 12).

- 74% are in favour of change of some kind.
- Electronic voting is the most preferred option in the list provided in the survey. This preference is strongest among mid-to-late career respondents and members, 53% and 50% of responses in those groups.
- Very few respondents think Council should be nominated purely at large.
- There is some interest in a larger representative Council with a smaller Executive Committee (39% of respondents; 43% of member-respondents), however, this response is not significantly different than the no-change response (36% of respondents to the question).
- A majority of respondents think chairs of standing committees should be members of Council and the response is even larger among members (64%).
- While there is no strong opinion about the number of vice presidents (44% yes, 45% no, 11% other) the idea of vice presidents with specific roles was described several times in the free text.

5 Symposia and other activities

Respondents were asked to choose all that applied from a list of statements regarding IGS Symposia. About half of respondents like IGS sympoisa as they are, although there is considerable interest in an infrequent, larger and more inclusive symposium (Table 15). 38% of respondents who indicated that they like symposia as they are also expressed interest in an infrequent, more inclusive IGS symposium.
About half of all survey respondents expressed an interest in one of the suggested "Other activities" the IGS might take up (Table 16).

- There is no strong preference for one activity over another, though more engagement with the media is the least popular response.
- Members are more positive about additional activities than are survey respondents at large.

6 Journal and Annals

Respondents were asked about the factors that influence the choice about where to submit a manuscript for review (Table 17). Open access is top ranked for all respondents but this rank is not significantly different than the rank for

other options provided in the survey. Impact factor, peer esteem and review standards are also highly ranked. Open access is relatively more important for European respondents than for North American respondents (23% of the Borda count compared to 15%) and for respondents who have been reviewers.

7 Appendix A: Figures and Tables

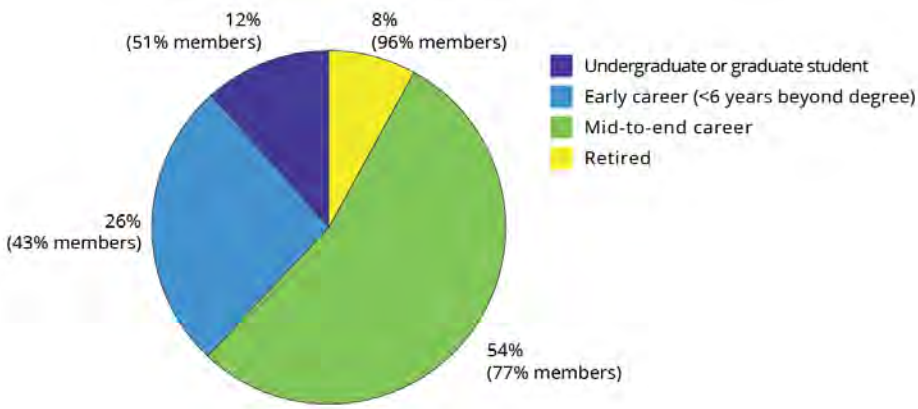


Figure 1: Career stage of respondents and proportion of each group who are IGS members.

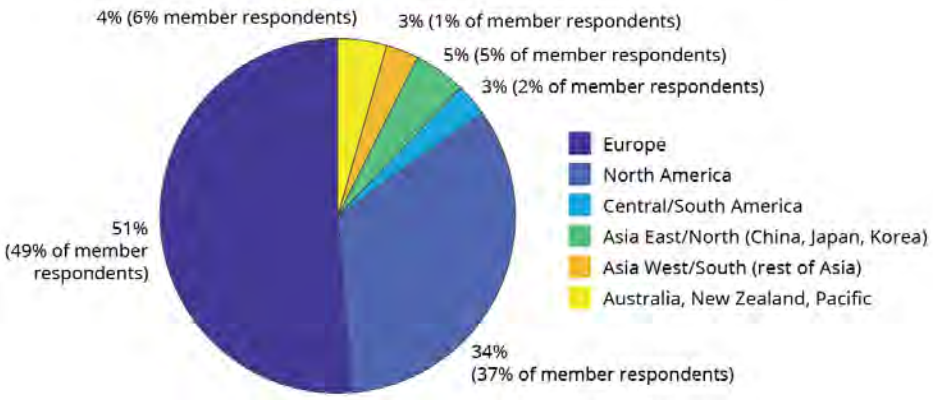


Figure 2: Regional representation among respondents. Proportion of IGS members who responded in brackets.

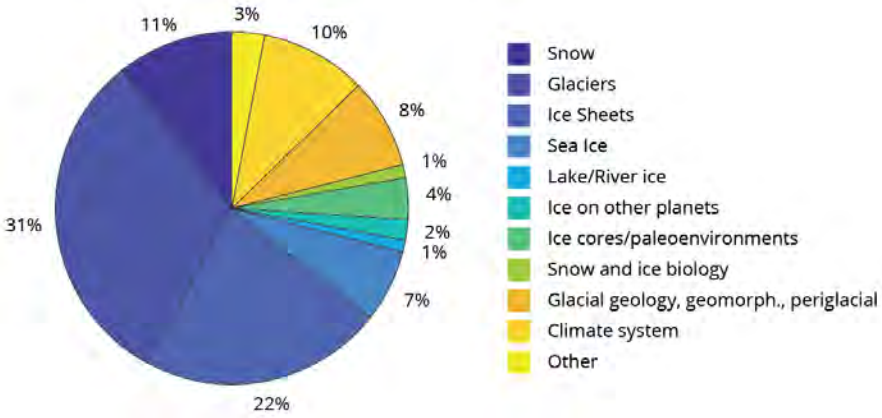


Figure 3: Areas of specialisation among respondents. It was possible to choose more than one area of spcialisation and there were 737 total selections. Proportions for members who responded to the survey are nearly identical.

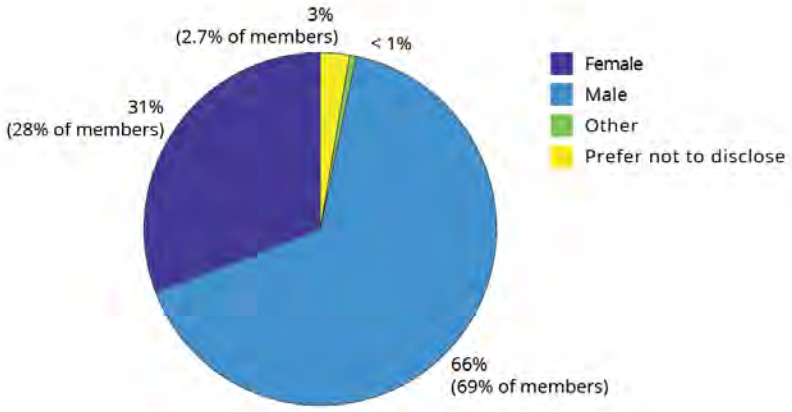


Figure 4: Gender identity of survey respondents. Proportion of IGS members in brackets.

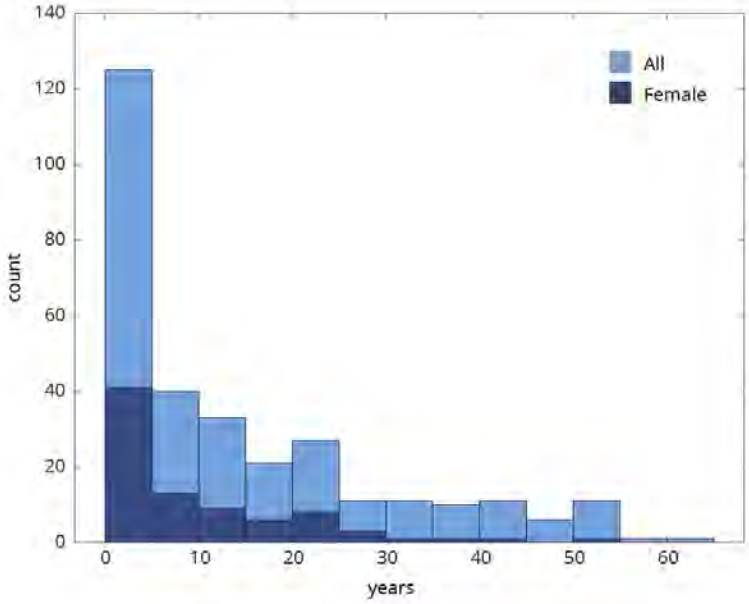


Figure 5: Years of membership among survey respondents.

Table 1: How many years have you been a member of IGS?. Some respondents are not current members. Not all respondents answered this question correctly and incorrect responses were removed.

	all		Female	
0 to 10	182	59%	68	72%
11 to 20	50	16%	16	17%
21 to 30	34	11%	8	8%
31 to 40	19	6%	2	2%
> 40	23	7%	1	1%

Table 2: When you consider renewing or initiating your IGS membership, what are your motivations? All respondents. The top 3 responses are not significantly different at 95%.

	Rank 1	2	3	4	5	count	% count
Belonging	152	49	55	18	15	1172	28
Professional	82	96	52	29	20	1028	25
Symposia	30	90	96	32	22	884	21
Symposium fees	25	28	29	96	71	587	14
Reduced APCs	13	27	40	64	103	524	12

Table 3: Do you think membership fees are

	all	student	early	mid-to-late	member
Could be higher	22	2	5	11	19
Adequate	170	20	33	105	133
Neutral/No opinion	68	6	26	27	43
Too high	37	4	12	20	18
Other	16	3	3	9	12

Table 4: Have membership fees been a factor when determining whether you plan to renew your IGS membership?

	all	student	early	mid-to-late
Yes	152	21	46	84
No	160	14	32	88

Table 5: If fees have been a factor, do you think membership fees are

	all	% of yes responses
Adequate	84	55
Neutral/No opinion	21	14
Too high	34	22

Table 6: If you have been a member and chose not to renew, what was your motivation?

	all	student	early	mid-to-late
Fees too high	28	5	7	16
No funding	39	4	19	16
Changed discipline	4	0	1	3
Not a good fit	4	0	1	2
No benefit (OA now)	19	4	5	10
I forgot	37	3	15	19
Meetings only	32	3	15	14
Other	18			

Table 7: Have you ever served on the IGS Council or any of its committees (Publications, Awards, Nominations)?

	all	student	early	mid-to-late	retired	member
Yes	61	1	1	43	16	57
No	236	30	71	125	10	159

Table 8: Would you be interested in serving on the IGS Council or any of its committees (Publications, Awards, Nominations)?

	all	student	early	mid-to-late	retired	member
Yes	98	3	29	62	4	75
Not now, but ...	140	26	38	74	2	94
No	38	0	1	19	18	34
Don't know	20	3	4	12	2	12

Table 9: Would you like to know more?

	Do you read AGM papers?	More information about Council?
Yes	105	141
No	180	144

Table 10: Are you a member of another scientific society?

	all	student	early	mid-to-late	ret.	member	fees too high	fees a factor
No	51	6	12	25	8	30	2	28
Yes	245	25	60	142	18	185	29	115
always vote	17	1	2	14		14		
most often	69	2	13	46		59		
occasionally	96	5	18	66		71		
never voted	46	12	20	13		31		

Table 11: Council selection procedure

	no change	open call	electronic vote	no opinion
Yes	76	33	171	65
No	221	264	126	232

Table 12: Council selection procedure: who said Yes to what

	student	early-career	mid-to-late	retired	member
no change	5	17	45	9	59
open call	6	6	23	4	29
electronic vote	14	38	105	14	130
no opinion	14	22	25	4	40

Table 13: Council size

	all	members
Current size, smaller Exec.	114	92
Current size and functioning	108	70
Reduce the size	37	25
Other	37	29

Table 14: Do you think that standing committee chairs, and the Chief Editor, should be ex-officio members of the IGS Council?

	all	members
Yes	196	145
No	99	69
N/A	42	11

Table 15: Regarding IGS symposia

	all (of 337)	members (of 225)
As they are	164	127
Often too narrow	42	25
Often too broad	13	11
Infrequent inclusive	149	106

Table 16: Other activities

	all (of 337)	members (of 225)
Media engagement	124	89
Public education	159	120
Policy-oriented statements	134	98
Mentoring	152	108

Table 17: Please rank the importance of these factors in your choices about where to submit a paper for review. The responses are not significantly different (for any reasonable level of significance).

	Rank 1	2	3	4	5	6	count	% count
Open access	81	46	38	29	19	22	969	20
Impact factor	50	57	39	37	29	18	871	18
Peer esteem	72	37	31	33	21	29	874	18
Visibility	28	29	42	36	41	34	676	14
Review standards	37	68	45	45	39	15	902	18
Review speed	4	23	55	48	48	43	619	13

8 Appendix B: Survey questions

1. At what stage are you in your career?
2. How would you best describe your professional position (for retirees, before retiring)?
3. Where do you live?
4. If you wish, identify your gender
5. What is your main research area? [tick all that apply]
6. Are you a current member of the IGS?
7. How many years have you been a member of the IGS? (Give number of years since first membership and subtract any years when you didn't renew. Give your best guess.)
8. When you consider renewing or initiating your IGS membership, what are your motivations? Please rank the following:

    - Belonging to a community of scientists with common interests
    - Supporting the professional organization most closely aligned with my research and professional interests
    - Supporting the organization that runs symposia relevant to my research and professional interests
    - Reduced fees for symposia
    - Reduced article processing charges for publication in Journal and Annals
    - [If there is another important factor in your decision, please explain here and say where you would rank it.]

    If you have been a member and chose not to renew, what was your motivation?

    - Fees are too high
    - No funding available any more
    - I changed discipline
    - No longer a good fit with my professional interest
    - I don't see much benefit any more since the Journal/Annals of Glaciology are available via open access
    - I simply forgot or did not get round to renewing it
    - I only become a member in the years when I attend an IGS meeting
    - [Other]

9. Have membership fees been a factor when determining whether you plan to renew your IGS membership?

10. Membership rates have been reduced in 2018 (standard membership 52 GBP and junior membership 26 GBP), and 2- and 3-year memberships (2 or 3 times the annual rate) and life-time membership have become available. Do you think current membership rates are:

    - Could be higher
    - Adequate
    - Neutral/no opinion
    - Too high
    - [Other]

11. What could IGS do to be more attractive to you and to attract new members – in particular, early-career members? [Free text]

12. Would you be interested in participating in an IGS early-career mentoring program?

13. Have you ever served on the IGS Council or any of its committees (Publications, Awards, Nominations)?

14. Would you be interested in serving on the IGS Council or any of its committees (Publications, Awards, Nominations)?

15. .

16. Determining IGS Council members: Currently IGS council consists of 12 members plus the President and three Vice-presidents, Treasurer and immediate past President, elected for a 3-year term. A slate of candidates is prepared by a standing nomination committee after considering suggestions from members in response to an open call for nominations (e.g. Cryolist). The nomination committee strives for a diverse slate which then is sent to members and further nominations invited. If more nominations occur these would be included on the ballot that is then voted on as a whole (or individually in case of multiple nominations) by any members present at an Annual General Meeting (AGM), typically held at an IGS symposium.

    - No changes. The procedure is adequate
    - Rather than the nomination committee preparing a slate that is voted on, nominations should be solicited from the membership at large and all nominations are then voted on individually by the members (although this may result in a less diverse slate)
    - The voting should occur electronically allowing all members to participate rather than taking place at an AGM, which requires physical presence

- No opinion
- Other

17. Size of IGS Council: The Council is currently formed of 18 members, including the President, three Vice-presidents, a Treasurer, the immediate past President and 12 elective members. The large size helps the IGS to maintain diversity (geographic, disciplinary, gender, career-stage). It is necessary to gather a quorum of Council members in order to hold a Council meeting and to make decisions. What of the options below seems best to you?

    - The Council should be kept at its current size, but a smaller Executive Committee should be formed from it and allowed to take some executive decisions by Council delegation (including budgetary issues up to a certain amount)
    - The size of the Council should be reduced with the intention that it should be more operative and executive, without creating an additional Executive Committee
    - The size of the Council should be reduced with the intention that it should be more operative and executive, without creating an additional Executive Committee
    - Other

18. The IGS has currently four standing Committees (Publications, Awards, Nominations, Early-career scientists) and an Editorial Board led by a Chief Editor. Do you think that the chairs of standing committees, and the Chief Editor, should be ex-officio members of the IGS Council?

19. Do you think that the current number of Vice-presidents (up to three) should be reduced to a single one? [Other]

20. Are you a member of another scientific or professional society? (AGU, EGU, ...)

21. If so, regarding elections of governance,

    - I always vote
    - I vote most often
    - I vote occasionally
    - I have never voted

22. Do you regularly read the AGM Minutes or the President's/Treasurer's report published in ICE and online?

23. Would you like to see more detail about what the Council is doing/deliberating on?

24. Regarding IGS symposia, click any that apply

    - I like the symposia as they are
    - Symposia topics are often too narrow. I prefer more broader meetings to allow for broader participation
    - Symposia topics are often too broad. I prefer more focused meetings
    - One 'big', very broad meeting including a large range of topics every few years

25. Should the IGS engage in other activities beyond its focus on organizing symposia and publishing?

    - Engage more with the media
    - Engage more in public education regarding ice and snow
    - Release policy-oriented scientific statements (e.g. climate change)
    - Provide an early-career mentoring program

26. Have you ever served as an editor of an IGS journal (Journal of Glaciology or Annals of Glaciology)?

27. Have you ever served as a reviewer for an IGS journal (Journal of Glaciology or Annals of Glaciology)?

28. Please rank the importance of these factors in your choices about where to submit a paper for review

    - Open access
    - Impact factor
    - Most colleagues with the same or similar expertise publish there
    - Visibility of the article once published (journal indexing, social media tools etc.)
    - Review standards (I have confidence in the review process)
    - Speed of the review process

Graham Cogley Award

This award was established in memory of Professor Graham Cogley, who made substantial and enduring contributions to glaciology, in particular to the understanding and quantification of glacier mass change. Graham is also recognized for his sustained and outstanding service to the wider glaciological community, including as IGS Chief Editor between 2016 and 2018. The Graham Cogley Award recognizes excellence in glaciological research by student scientists. The award was initiated and is generously sponsored by the Cogley family and is shared between the International Glaciological Society (IGS) and the International Association of Cryospheric Sciences (IACS), with the IGS and the IACS giving out the award in alternate years.

The IGS will give out two 'Graham Cogley Awards' to students who have published papers of exceptional quality in the *Journal of Glaciology* or the *Annals of Glaciology* within the last two years.

Each award will include a cash prize of CAN$ 500 and a certificate. The awardees and their papers will be promoted online, including in the 'Awards' section of the IGS web site.

The following have been awarded the Graham Cogley Award so far:

2020 **Carlo Licciulli**, University of Heidelberg, Germany
'Full Stokes ice-flow modeling of the high-Alpine glacier saddle Colle Gnifetti, Swiss/Italian Alps' – *Journal of Glaciology* (2020)

2020 **Paul Weber,** University of Portsmouth, UK
'Producing an ~1899 glacier inventory for Nordland, northern Norway, from historical maps' – *Journal of Glaciology* (2020)

News

Seligman Crystal for Adrian Jenkins

Adrian Jenkins (Northumbria University, Newcastle-upon-Tyne, UK; formerly, British Antarctic Survey, Cambridge, UK) has been at the forefront of research into ice-ocean interaction for over 35 years and has contributed outstanding interdisciplinary work at the boundary of glaciology and oceanography.

His formulation and application of a 1-D plume model (later extended to 2-D) has been fundamental to quantifying melting and freezing patterns under ice-shelves, and in analysing marine ice deposition.

His related parameterisations and studies on subglacial outflow have also been key to the study of ice-ocean interactions; as have his formulation of how ocean temperature, salinity, and turbulent mixing combine to control the rate of ice melting in the ocean. He has identified climatic processes that control the variable rate of upwelling of Circumpolar Deep Water onto the Antarctic continental shelf, and hence influence ice shelf melt. Adrian has been a pioneer in autonomous underwater vehicle development and the deployment of phase-sensitive radio echo-sounding for ice shelf observations.

He has influenced the research direction and interdisciplinarity of ocean- ice interaction studies not only from his publications, but also through his many international collaborations, his mentoring of ECS, his leadership of the Forum for Research into Ice Shelf Processes (FRISP) for 19 years, as a convenor of many EGU

sessions, and through his many contributions to the Karthaus/EISMINT summer schools. He has been on IGS council and served as an IGS editor.

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

Richardson Medal for Regine Hock

Regine Hock (Department of Geosciences, University of Oslo, Norway and Geophysical Institute, University of Alaska, USA) has given long-standing and ongoing service in support of glaciology within the IGS and much more broadly. Within IGS she has served on Council, as Vice-President, on the Awards and Nominations committees, as Chair of the Ad-hoc committee on IGS governance change, and as a champion for strengthening the IGS stance on inclusion and diversity. She has been an Associate Scientific Editor of both the *Journal of Glaciology* and *Annals of Glaciology* and was Chair of the Local Organizing Committee of the 2012 IGS Symposium in Fairbanks. Within IUGG Regine has been Secretary General of the Snow and Ice Hydrology Commission of IAHS (ICSIH), and served on the Bureau and as President of IACS.

Regine was instrumental in establishing the Cogley Prize for early career scientists, awarded alternately by IGS and IACS. She established the gold open-access on-line journal *Frontiers in Earth Sciences – Cryospheric Sciences* and was its Chief Editor from 2015 to early 2021. Regine played a lead role in establishing and updating the Randolph Glacier Inventory and has contributed as team member/leader to Global Land Ice Measurements from Space (GLIMS); CliC; AGU; Snow, Water, Ice and Permafrost in the Arctic (SWIPA); and the Glacier Model Intercomparison Project activities. She has contributed to the IPCC AR4 and AR5 Reports as Contributing author and expert reviewer and to the IPCC *Special Report on the Ocean and Cryosphere in a Changing Climate* as the Coordinating Lead Author.

Regine is an outstandingly productive scientist; a prolific supervisor and mentor of postgraduate students; and is active in outreach to school students. She Initiated, organizes and teaches at the International Summer School in Glaciology held in McCarthy, Alaska every second year since 2010.

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

Early Career Scientist Award for Elizabeth (Lizz) Ultee

In 2021, the Council of the Society decided establish an award to acknowledge outstanding contribution of Early Career Scientists, ECSs, through the creation of an award to recognise their scientific contributions to glaciology, and/or contributions to the glaciological community.

The IGS ECS Award is given to an early career scientist who has made significant scientific contributions to glaciology, defined as any snow and/or ice study, and/or contributions to the glaciological community.

Scientific contributions will be assessed on the basis of the depth, breadth and impact of the research contribution from a body of scientific output. Community contributions will be assessed on the basis of the nominee's service to glaciology and the International Glaciological Society, including outreach activities and promotion of IGS core values.

The nominee may be part of a collaborative group or team, but must be a major contributor to the work of the group and must be the lead author or organizer of at least one of the assessed outputs. All IGS award nominees are expected to exhibit high moral and ethical standards within the glaciological and wider communities.

Nominations for the IGS ECS Award will be called for every second year (in those years when nominations are not called by IGS for the Graham Cogley Award). One, or in exceptional cases not more than two, awards may be given following each call for nominations.

Lizz Ultee (Middlebury College, Vermont, USA) was awarded her PhD in 2018. She combines theoretically rigorous mathematical glaciology with geophysical observations to contribute across a range of glaciological topics.

These include a mathematical model of calving using an extended plastic approach, developing novel stochastic methods to model the variability of surface mass balance over Greenland, statistical examination of meltwater runoff and its societal impacts in Peru, and the use of remote sensing to bound the tensile strength of glacial ice.

As well as her substantial scientific contributions to glaciology, Lizz demonstrates an extremely strong commitment to a variety of community services including outreach and public engagement, service to the IGS, and a record of actively promoting diversity and equity, especially to increase the number of women in STEM (Science, technology, engineering and mathematics).

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

Obituary: Roger LeBaron Hooke, 1939–2021

Roger LeBaron Hooke died on 10 March 2021, a few days after sustaining severe head injuries in an ice-skating fall. He was 82 years old. As his widow put it to me, the ice finally got him.

Roger's scientific contributions covered a wide range of topics, but those who took his courses recognized that his main motivation was to get at physical processes that make the landscape. Teaching geomorphology using the Socratic method, which could be terrifying to new graduate students, a favorite question was 'where's the physics?' Very few things generate a force to move sediment and water and ice and soil, and how do you make the connection from these few things to what you see in the landscape?

Roger grew up in Montclair, New Jersey, USA, as the son of an electrical engineer. However, he had deep New England roots -- a descendent of Myles Standish from the Mayflower, with a family home in Castine, Maine, from the late 18th century. After graduating from Harvard College in 1961 with a degree in Engineering and Applied Physics, he entered the PhD program in Geology at CalTech, where he worked under the supervision of Robert P. Sharp. The shift towards geology was influenced by a geology major at Smith College, Ann Peck, with whom he would share a 60 year marriage.

Roger's scientific career is most simply described as broad, encompassing several areas of geomorphology, several areas of glaciology, and glacial geology. His techniques included field work, laboratory experiments, instrument design, and quantitative analysis that included mathematical theory, empirical studies and numerical modeling. His dissertation work was in desert geomorphology, on the growth and form of alluvial fans. He elucidated the processes that control the slope of alluvial fans in steady state. Two papers resulting from this dissertation have been collectively cited more than 400 times. His interest in desert geomorphology continued as one thread of his career for decades, with occasional field trips to the Mojave. A 1992 paper on desert varnish won the *Earth Surface Process & Landforms* award for best paper of the year in that journal.

After receiving his PhD in 1965, Roger took a professorship at the University of Minnesota, which he would hold for 35 years. Early on

at Minnesota, he began to work on fluvial geomorphology. While much of his scientific legacy is based on field projects, his dissertation also involved laboratory measurements of sediment flow on a small scale, and work with flumes and stream models became more important in his early academic career at Minnesota. A significant part of this work explored how sediment moves in response to shear stress fields in meander bends, with the primary result demonstrating that sediment mostly moves through the inside part of the bend, where velocity is relatively low but that the forces exerted are relatively high. This result surprised almost everyone in the field, and subsequently led to other important research by others on meandering rivers. Roger also published a short but highly influential paper justifying the use of small-scale laboratory models of geomorphic systems that continues to motivate experimentalists today. Roger provided important insights into the framing of watershed sediment budgets, parsing out supply contributions at the catchment scale relative to processes of sediment delivery with guidance on analytical expressions to estimate watershed sediment yield.

The glaciological component of his research began in the 1960s, no doubt inspired by his PhD advisor, Bob Sharp, who like Roger mixed glaciological and geomorphological interests.

Roger with a Swedish technician at the flume in Uppsala, Sweden, 1971.

Roger's first significant field work on a glacier was not his own research; rather he was a field assistant on the famous Clair Patterson expedition to Greenland in 1964, helping obtain ice samples to prove that atmospheric lead levels had risen dramatically after the introduction of tetraethyl lead in gasoline. It was extremely important to not have post-nasal drip on the samples, because humans at that time had far higher lead levels in their bodies than would be in the old ice.

In the late 1960s, Roger began working with a Canadian group on the South Dome of Barnes Ice Cap, Baffin Island, Canada, making mass balance measurements and taking ice samples for crystal fabric studies. In 1970, working with Gerry Holdsworth, he started a different field campaign there that would continue for 14 years. They established a strain net of 43 stakes along a 10 km flow line. Initial studies were of surface velocities, mass balance and crystal fabrics. Over the course of the project, boreholes were added to emplace square aluminum tubing for inclinometry and to assess the internal temperature field of the ice cap. An early assistant on Baffin was Bruce Koci, getting his introduction to ice drilling from Roger. Bruce would go on to become, as Richard Alley once said, 'one of the unsung heroes of ice-core science.' PhD student Robert Baker was brought in as field assistant and to work on the crystal fabric studies, and Minnesota colleague Peter Hudleston, a structural geologist, helped understand the flow. Making use of the wealth of intensive data for a small flowplane, Roger enlisted help from finite-element modelers such as Charlie Raymond and started a program of both velocity and temperature modeling for the flowplane.

The Baffin Island projects yielded results in several areas of glaciology. The long mass balance record, including not just net mass balances but elevation profiles of mass balance, led to the understanding that there were a complicated set of feedbacks with temperature in polar ice caps, such that an increasing climatic temperature would increase surface slope, leading to faster flow to the ablation area, but subsequently that flow would decrease surface slope. Roger also deduced that a complex stratigraphy near the margin of the Barnes Ice Cap flowplane resulted from the ice overriding its own frozen toe in an advancing phase. It was a cautionary tale about being simplistic about glacier flow. He and his colleagues determined that the bottom layer of Barnes Ice Cap was a remnant of the Laurentide Ice Sheet, and that it had significantly lower density and viscosity than the Holocene ice, primarily because of a higher air-bubble content, leading to the counterintuitive result that the ice cap might have slowed and thickened as the softer Pleistocene ice layer thinned. Based on both literature review and crystal-orientation studies, Roger significantly improved our understanding of the temperature-dependent coefficient in Glen's power law for flow – an important contribution to the modeling effort.

The Barnes Ice Cap field seasons were logistically difficult. While field studies had been carried out on Barnes for decades, there was no permanent infrastructure or nearby airstrip. There was a strip that a courageous bush pilot might land on about 20 km away, but the nearest maintained airstrip was at Clyde, 120 km and a two-day snowmobile ride away. Flights in and out were regularly delayed in the Arctic weather, and these all had to be arranged by Roger, not coordinated with a well-prepared NSF logistics program. Communication with the outside world was via shortwave radio, for which Roger did not have a highly reliable antenna, and all the food, fuel and new equipment for each season had to be thought through in advance and transported. Any problems during the season had to be fixed with what was available, so having one of the field assistants be a snowmobile mechanic was useful. Roger liked to tell the story of doing a makeshift repair using a nail heated by a camp stove as a soldering iron. Although the slopes of the ice on Barnes Ice Cap are not high compared to alpine glaciers, the surface could be dangerous to travel on. Roger had stories of long detours around surface meltwater streams and crawling on his belly across a snow bridge he didn't trust in order to spread out his weight.

Roger's colleagues on Baffin Island considered him to be a virtuoso of camp cooking. He specialized in breakfasts, alternating sourdough pancakes with various porridges. His field assistants guessed that the breakfast specialty was to make sure that none of the crew were sleeping in. While others typically prepared dinner so that

Roger could keep working, he weekly came up with a dessert treat that everyone looked forward to: shortcakes or coffee cakes using dehydrated berries or pineapple chunks.

Roger's second major glaciological campaign overlapped with the waning years of the Barnes Ice Cap project, but it was similarly long-lived and similarly started simple and grew to become comprehensive. Roger developed connections in Sweden during a sabbatical doing flume experiments in Uppsala in 1972. His second sabbatical was at the University of Stockholm in 1980, which led to a friendship with Valter Schytt, the founder of Tarfala Research Station and the initiator of the now 75 year Storglaciären mass balance record. For the next 15 years, most of Roger's fieldwork would be associated with Storglaciären (and Rabot Glacier on the other side of the mountain).

Valter Schytt had chosen Storglaciären as a place to establish a research and teaching facility for several reasons, one of which was that it was relatively safe to get around on. Most of the accumulation zone required roped-up parties of at least three to traverse (one particular crevasse had a name, 'the bus garage', and we avoided that area), but much of the ablation zone did not require ice-climbing or safety equipment to get around on, once a person was oriented to the crevasse zones and the area that was dotted with moulins. Tarfala was 25 km by trail from the end of the road, but helicopter support was close because Storglaciären flanks Kebnekaise -- a popular tourist destination as the highest point in Sweden. Also, Valter had established Tarfala Station just after the Second World War, and over time it had grown to include a lab and workshop for building and calibrating instruments, a mess hall and kitchen hut, a shower and sauna hut, and warm, dry sleeping huts, including electric power and a radio-telephone system to communicate with the outside world. It was basic, but to someone whose experience leading a glacier fieldwork campaign was on Baffin Island, it seemed luxurious.

Santa and three elves? Roger with three field assistants from University of Wisconsin – River Falls, Baffin Island, 1979. Photo by Bob Baker.

The studies carried out by Roger and his students at Tarfala started with glacier hydrology, including boreholes for salt-tracing and dye tracing experiments, hydrologic measurements in the outflow streams, sending a video camera down a borehole to analyze the intersection between conduits and the hole, and surface speed and strain-rate measurements, first as repeated theodolite surveys and later as short-time-resolution surface speed and strain rate with automated distance meters. A few borehole inclinometer measurements were also done. Finding that the internal conduit system tends to break down over winter and rebuild when there is a lot of meltwater and rainwater in summer was a significant element of the results, and also that there was no single relationship between internal water levels and glacier speed because it developed through the season.

In the late 1980s, the glaciology world became seriously interested in the effects of till layers at the bottom of glaciers, especially as they related to West Antarctic ice streams. The paradigm shift from Weertman's 'tombstone' model to a till layer required understanding till deformation. Roger, in close collaboration with PhD student and later post-doc Neal Iverson, and using some ideas from Garry Clarke's group at UBC, began designing experiments and instruments to work on till deformation on Storglaciären, where we already knew a till layer existed from previous drilling for the hydrology experiments. The last few years of the Sweden work were focused on till-deformation studies, and they led to several papers that are still regularly cited after 25 years. The final results of these experiments did not indicate that till behaved viscously or deformed consistently at depth. Rather, till behaved as a plastic material in which shear resistance increased with effective pressure, and slip occurred at the bed surface when effective pressure was sufficiently low.

Of Roger's 12 PhD graduates, nine worked with him at Tarfala and six received their PhD based primarily on work done there. The research group would gather for coffee in the library after dinner, go over the day's results, discuss preliminary graphs if we were getting data, and plan the next day. It was a dynamic project, where the success depended on a lot of people giving input into how our work would change the

With Brian Hanson overlooking Rabot Glacier, 1988.

next day, in part because most of the instruments were new designs and we were refining our understanding of how to install them and interpret the data. Nobody who was there would disagree that Roger was the leader, bringing the best out of all of us to generate some important results.

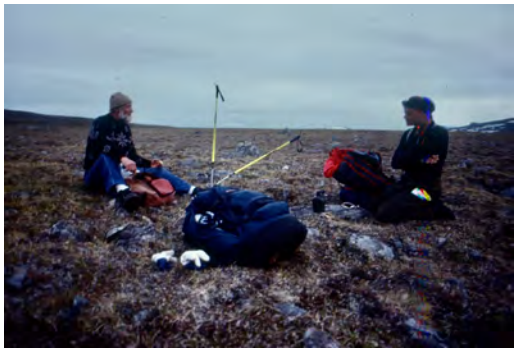
On Saturday night, the work at Tarfala would slow down. The cooks would break out some bottles from a well hidden stash of Chilean red wine, and Roger would take an evening off from working on the project and reminisce a little. The cooks at Tarfala had Sundays off and various volunteers filled in. Roger's Sunday morning tradition was to make sourdough pancakes for everyone. Tarfala station was acquiring real maple syrup for these breakfasts, and the pancakes were excellent. Some Swedes were a little bemused because pancakes are not usually a breakfast food in Sweden. The tradition of making sourdough pancakes on Sunday morning, using Roger's recipe, was carried on by Peter Jansson for many years after Roger's projects there were over.

Roger's last field season in Sweden was 1995 and, while papers about Storglaciären continued to come out for another few years, his research had moved in several other directions. He, along with his PhD graduate Paul Cutler, proposed a significant field and modeling campaign for a tidewater calving glacier in Alaska. The proposed field program was ambitious but had several technological long-shots. It was not funded and only a modeling portion of that project was completed. A close approximation of what he was proposing has been carried out in the last few years using drones, radio-controlled kayaks and digital time-lapse cameras. Everything that was proposed was a good idea, but technologically two decades too soon. Roger never led another major 'leave all summer and go to the Arctic' field campaign, but he continued to do field work for the rest of his life.

A lasting element of his post-Sweden work was the completion of *Principles of Glacier Mechanics*, with the first edition in 1998. Those of us who took the course on which it was based recognize that it reflected his interests, and that it was also bringing difficult concepts to a level of explanation that was needed by his graduate students. The third edition was published in early 2020 – a project he was keeping current into his 80s.

Roger's influence in geomorphology extended into natural resources and watershed management disciplines through his work to identify and quantify human activities as geomorphic agents in varied landscape settings and globally. His first published paper on this was in 1994, but already in the 1970s he was incorporating human-impact ideas into his geomorphology field trips, trying to get students to recognize that some of the landforms they were seeing were a result of human interference and not natural process. One of his hints was to refer to something as the 'Caterpillar Formation', by which he meant that we should think of earth-moving equipment, not larval butterflies. A 2012 review paper he co-authored in *GSA Today* has received more than 440 citations. It closes with a strong environmental plea for us all to damage the landscape less in the course of extracting the resources we need. A chapter Roger contributed to a book edited by José Francisco Martin Duque, one his co-authors of the 2012 paper, has yet to appear in print, so it is possible that Roger's final contribution to science will be on human impacts.

In the 1980s, Roger and Ann had acquired land on the shore of Deer Isle, Maine. He built a small house over a garage there while developing a plan for a permanent retirement house. The small house became his guest house when by 1992, the 'big house' was built. He spent nearly every August there after his field seasons were



Taking a break with field assistant Hjalmar Loudon in the middle of the night during the walk out of Tarfala, 1992.

Roger and Ann in their two-seat kayak, Deer Isle 1992.

over, but in 2000 he retired from the University of Minnesota and moved to Deer Isle permanently.

'Retirement' in this case just meant that he stopped taking a salary or a teaching obligation. Well before retirement, Roger developed an informal Adjunct Professor position at the University of Maine, and on retirement this turned into a Research Professor position. For the rest of his career he used the Maine byline. Roger was an ever-present member of the School of Earth and Climate Sciences at Maine. Even though he lived on Deer Isle, he spent several days a week during the academic year staying in Orono where he owned a townhouse and had an office in the School's building. He made a point of attending monthly faculty meetings and weekly research seminars in the School. Roger taught at least one graduate course each year in the School, without compensation, alternating Geomorphology and Glaciology. His courses were known in graduate-student lore to be the most challenging in the School. The graduate students had many colorful stories relating to the quantitative problem sets that he would assign. But Roger always received very positive student assessments of these courses, and the graduate students always spoke highly of him as a person and teacher -- he was generous with his time and supportive of both students and faculty who engaged with him on a variety of geomorphology and glaciology topics. Roger also sat on numerous Masters and Doctoral thesis committees over his years in SECS, and the School helped to support some of Roger's local research activities in return for his generous contributions to teaching and advising.

In Maine, Roger's research reflected his location and included the glacial geology of Maine and coastal geomorphology. Early in his time at Minnesota, he had established long-term research projects where he knew that publishable results might take more than a decade. In Minnesota these included meticulous measurements of soil creep that were maintained over several decades. In Maine, he started similar long-term measurement projects of estuary stream widening, beach cliff erosion and beach profile changes. At Minnesota and Maine, Roger used his teaching to keep these long-term measurements going. Everyone who took his geomorphology course at Minnesota helped with continuing the Rice Creek meander bend measurements and the soil creep measurements, and many of his Maine projects were executed through short courses with the Eagle Hill Research Institute. These long-term measurement series did not all lead to publications, but they were all based on serious scientific questions, and Roger used them as a combination of a teaching tool and a potential paper if the results proved significant.

In recent years, Roger focused attention on the development of landforms in the Penobscot River watershed and coastal areas of Maine, unraveling explanations for modern landscape conditions produced from deglaciation and related sediment transport dynamics. Related field trips he led were considered by the fortunate participants to be top-notch in terms of pedagogy, technical explanations for complicated earth surface processes, scientific curiosity, and long-lasting memories of a meaningful, thought-provoking day in the field.

Roger collaborated widely. The 120 publications on his CV show more than 100 unique co-authors In many cases, Roger sought these out from an awareness of his strengths and limitations. Similarly, with his PhD students, he was seldom seeking to clone himself, but was expanding the range of his work by finding students who could design and build laboratory and field equipment, establish microclimate networks, or do numerical modeling. He also improved the discipline through his two decades

Warming a foot on the water-heater component of the hot-water drill, Storglaciären 1995.

Explaining the Agassiz striations in Ellsworth, Maine, on a field trip after Midwest Glaciology Meeting, 2003. (These striations are the first evidence of glaciation that Louis Agassiz saw in North America, and this is nationally registered historic place.)

combined serving as an editorial board member or scientific editor of *Earth Surface Processes and Landforms* and the *Journal of Glaciology,* and as a regular reviewer of many manuscripts outside his role as an editor and as a reviewer of many grant proposals. This work included generous and meticulous efforts to improve the presentations of authors for whom English was a second language.

A variety of short memorials have been circulated on e-mail lists since we heard of Roger's passing. A tribute sent by several former students (who also helped with this obituary) to the Gilbert Society included 'Roger's approach to science was characterized by a remarkable passion for intellectual rigor and an unwavering pursuit of excellence. His grounding in the scientific principles essential for quantification of earth system processes was steadfast through his entire career of teaching and publications.' Richard Alley, who summarized Roger's glaciological contributions at a 'retirement' session at AGU two decades ago, gave this final tribute: 'Roger had an exceptional ability to find simple physical understanding in complex data. Working with outstanding students and collaborators, Roger blazed research paths in numerous important directions, including iceberg calving, glacier hydrology, basal lubrication and the flow law of ice. The breadth of Roger's contributions allowed him to bridge subdisciplines, helping to unify the field.'

Preparing to boil lobsters by the shore, Deer Isle 2013.

Roger and Ann led an active life of travel and adventure. In the last months before the world closed up for the pandemic, they visited New Zealand and California. Earlier Christmas letters told of visiting places ranging from the Himalayas to the Amazon to kayaking in the Arctic. They practiced their love of the outdoors at home as well, helping with trail maintenance, island cleanups and general preservation of Deer Isle and close-by islands, working with the Island Heritage Trust.

At Minnesota and Maine, Roger and Ann were generous hosts of scientific visitors and old friends. If a distant colleague or a scientific visitor came to the University of Minnesota, their house was likely to become the site of a soiree. The first Midwest Glaciology Meeting in 1992 landed there one evening. Field trips in Maine would sometimes end at Deer Isle for a dinner of Ann's lasagne or chilli. If you found your way to them at Deer Isle, the guest house above the garage became one of your favorite places, enhanced because there might be an evening of lobster boiled on a campfire near the shore. There would also be the oft-mentioned sourdough pancakes for breakfast, but now with fresh Maine blueberries.

The day I learned that Roger had died, I was working on answering a question he had sent me about calculating changes in ELA caused by small perturbations in climatic elements -- he never stopped working. Roger leaves behind a legacy that includes a wide-ranging set of published results that have improved fundamental understanding across several fields. He also leaves behind a host of collaborators, students and friends, who will cherish the memory of his impact on our lives and careers.

Brian Hanson, with contributions from former students Bob Baker, Jim Pizzuto, Neal Iverson and Peter Jansson; from his Minnesota collaborator Peter Hudleston; from his Maine colleagues Alice Kelley, Sean Smith and Scott Johnson; and most importantly from his widow Ann

Obituary: Lowell Alan (Al) Rasmussen 1937–2021

Following a fall and a short illness, Al died on 13 February 2021 aged 83, in Seattle, Washington, USA.

Al was born in 1937 in Enumclaw, in the foothills of the Washington Cascades near Seattle. He graduated from West Seattle High School, and in 1959 he graduated Bachelor of Science in Meteorology and Climatology from the University of Washington. At that time the university had an IBM-650, an early digital computer that required the user to punch in a FORTRAN program on a set of cards with holes (punch cards). The stack of program cards, together with cards containing the input data, and control cards, then had to pass muster with the FORTRAN compiler. The stacks of program cards for the complex programs that Al helped create were often a meter or more in length. The use of computers to help solve analytical problems appealed to Al, and after graduation he worked part-time as a research assistant at the university, developing numerical models to simulate the motion of Arctic sea ice, and as an instructor for evening classes in computer programming.

Between 1960 and 1968, Al worked for Boeing as a research engineer developing computer algorithms to create mathematical definition of the exterior surfaces of Boeing 727 airliners, and developing and updating computer standards as new computers came on-line.

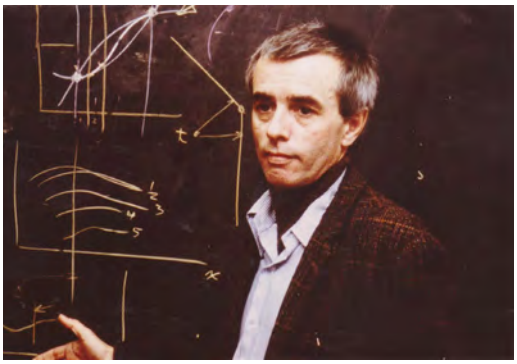
Fortunately for glaciology, Al was drawn to using numerical methods to solve geophysical problems. In 1968 he joined the US Geological Survey (USGS) Division at Tacoma, Washington. Al was the source of a lot of intellectual energy at the USGS office. Initially he worked with Bill Campbell and Chi-Hai Ling developing time-dependent numerical models of glacier flow, and a sea ice module for a global climate model.

During these early days, when computers required punch cards, Al worked nights at the University of Washington computer facility when there were fewer users and shorter wait times for reading the card decks. Because the process in rerunning card programs was tedious, Al became proficient in (and proud of) writing code that worked the first time. Even after virtual coding became the standard, he was never a fan of using a computer to check for coding errors. After the transition from cards to virtual computing, on-

line computer time was charged, and he was a bit annoyed that merely logging on and off cost $0.02, saying, 'But I didn't do anything!'

Later, Al was a part of the USGS Columbia Glacier team, led by Mark Meier. The research included a comprehensive assessment of active processes during the dramatic retreat and iceberg discharge from Columbia Glacier, Alaska during the early 1970s and through the 1980s. A fundamental goal of the project was to assess the iceberg hazard to large oil tankers transiting in and out of Port Valdez, the southern terminal of the Trans-Alaskan oil pipeline. Al, together with Bob Bindschadler, made a major contribution to this effort by creating a dynamic time-dependent flowband model to predict the retreat of Columbia Glacier and the resulting iceberg discharge. Other USGS colleagues included Suzanne Brown, Carolyn Driedger, David Frank, Andrew Fountain, Bob Krimmel, David Miller, Austin Post, Liz Senear, Bill Sikonia and Wendell Tangborn.

In addition to the Columbia Glacier research, Al published several seminal manuscripts about fundamental glaciological processes, including: (1) Inferring bed topography from sequential aerial photography; (2) Using sequential photography to estimate ice velocity; (3) Refraction correction for radio-echo sounding of ice overlain by firn; (4) Calculation of a velocity distribution from



Al explaining the mathematics of a physical process, Tacoma, December 1981

particle-trajectory endpoints; (5) Adjusting two-dimensional velocity data to obey continuity. He was also a silent co-author on Mark Meier's *Science* manuscript, 'Contribution of small glaciers to global sea level'.

It was a great benefit to us at the University of Washington when Al shifted his work place to the Seattle campus in 1987. He did not want a 'position' at the university, preferring to be a free spirit of science motivated only by the passion for doing it – an inspiration to us all. Al had a unique way of noticing and expressing where and when we should perhaps think a bit deeper.

Charlie Raymond and Al had first met in 1969, and they both enjoyed and benefited from ongoing fruitful discussions about ways to think about various problems. Others also benefited from Al's talents and expertise. For instance, he worked with Ed Waddington on a new method to infer surface velocities from repeat measurements of stakes or markers inserted on the moving surface of a glacier or ice sheet. This robust data reduction for survey data (called 'UVWXYZ') uses least squares based on singular value decomposition to simultaneously calculate velocities (UVW) and positions (XYZ) of moving markers in a geocentric coordinate system. The code has since been applied to surveys of the Greenland Ice Sheet summit, and of Taylor Dome, Roosevelt Island and WAIS Divide in Antarctica, and to frost-creep of a gelifluction slope in the Northwest Territories, Canada. He also worked with Bernard Hallet to solve the heat conduction equation for freezing–thawing ground.

Since the mid-1990s, much of Al's research combined his passion for meteorology and glacier mass balance. It started when Al teamed up with Howard Conway and mountain meteorologist Pam Hayes to evaluate the potential for using twice-daily measurements from a nearby radiosonde station to estimate spatial and temporal variations of atmospheric conditions at Blue Glacier in western Washington. Results showed that the free-air conditions (interpolated in altitude and time from the radiosonde data) provide a much better estimate of conditions on the glacier than measurements from low-altitude stations. Modeled and measured stake ablation measurements made over 30 years at two sites on the glacier agree within the error associated with stake measurements.

Encouraged by these results, in later work Al accessed the NCEP-NCAR reanalysis database, which starts in 1948 and consists of gridded radiosonde, satellite and surface observations that span the entire Earth. Using these data to construct models of glacier mass balance constrained by glacier measurements, he evaluated the sensitivity of numerous glaciers in North America, Patagonia, Iceland, Scandinavia and High Mountain Asia to variations in temperature and precipitation.

As might be expected, his mass-balance and glacier research fostered strong interest and connections with international collaborators, including Liss Andreassen, Andreas Bauder, Graham Cogley, Regine Hock, Francisco (Paco) Navarro, Lindsay Nicholson and many others. Al attended scientific conferences into his 70s and especially enjoyed the annual European Geosciences Union meeting in Vienna, Austria, where his passion for science and the international scientific community came together with the history and culture of Vienna. From 2008–11, Al was fully involved with an international working group that compiled a *Glossary of mass-balance and related terms*; the product's comprehensive high quality is in large part due to Al's clarity in thought and writing.

Al was a valued colleague and friend for staff, faculty and graduate students alike. Many were fortunate to share in discussions and office spaces with Al for nearly two decades at USGS, and for more than three decades at the University of Washington. Al shared not only insights about

Al with Liss Andreasson and Howard Conway on a field trip to Blake Island, Washington, June 2012.

glaciers and ice sheets but also his vast knowledge of baseball, politics, music, art and history. He followed his curiosity and modeled how much fun it is to learn and solve problems.

His ability to think deeply and to appreciate detail was manifest in his appreciation of a data sheet over a graph, correctly coding a computer program before running it, and enjoying a scoreless baseball game (a pitching game) over one with many hits and runs (a batters' game). He upheld principles of rigorous analyses and clear writing. In one memorable instance, after being asked to provide an informal review of a paper by a young colleague, his suggestions in red were more extensive than the original text in black.

The preface of his self-published book, *Analytic Geometry Solutions,* is a legacy of his rigor and his enjoyment of solving puzzles:

> the expectation is that this book will be used as a reference. Readers who enjoy simple mathematical puzzles as much as the author, however, may wish to treat the table of contents as a list of questions and work out their own answers to some of them. The author would appreciate learning of any solutions that can be expressed more precisely than those given here as well as corrections should that regrettable occasion arise.

Many of Al's accomplishments were through his contributions to others, and through sharing a unique type of unselfishness, expertise and frank advice. He was a source of hidden knowledge and understanding. Al was generous, kind and thoughtful, and shared his insights and humor with everyone.

We can't possibly do justice to Al's influences on the lives of so many graduate students and post-docs, but here are mail-in memories from just a few of them:

… discussions with him about politics, history, and Vienna stand out as much as those about glaciers (Michelle Koutnik)

… the literal and metaphoric feather in his cap. Trader Joe's quiche for lunch every day. His passion for politics and baseball (Kat Huybers)

… influenced my interest in software, and in matters of life (Bruce Weertman)

… lucky to have met Al, who is such a kind person (Felix Ng)

… a highlight of my time at UW. Really glad I got a chance to know him (Nick Holschuh)

… working with him on Blue Glacier. Being able to get geometric advice (TJ Fudge)

… his daily smile and attention to details (fridge-defrost day, plant-watering day, daylight-saving day, perihelion day). Passionate discussions about history, politics, Puget Sound geology/geography or the European chestnut tree and its beautiful oliage and fruits out the office window (Clément Miège)

… he really was the best. Such a good person (Erin Whorton)

… fun conversations with him in the lab (Seth Campbell)

… such a great force to have in our lives as we were traversing grad school (Bob Hawley)

… the best combination of prickly ('why can't I keep my Xterm?'), and thoughtful, insightful and kind (Tom Neumann)

… a real source of hidden knowledge and understanding; his ego factor was about as low as it gets. You don't find many people in the community like that these days (Steve Price)

… talking about the difficulty of deriving bed topography of glaciers using the continuity equation. Two days later he sent a paper he had written in the 1980s doing exactly that on Columbia Glacier, with a comment in red pen 'Not hard at all!' (Ben Smith)

… learned a whole lot from Al – some of it was on the importance of using spaces when formatting FORTRAN code! (Tony Gades)

… so many fond memories of sharing an office (Nadine Nereson)

… he had us focus on identifying the essence of what drove precipitation on the Blue Glacier and winnow those elements to identify what was essential. This was the same approach he took to writing. If a word was not essential, leave it out. (Pam Hayes)

Al is survived by sons Bill, John, Pete and Bob, and grandchildren Andrew, Erica, and Brock, as well as five siblings and many friends around the world.

We all miss him dearly, but we are eternally grateful for his inspiration.

Northwest Glaciologists, April 2021

INTERNATIONAL GLACIOLOGICAL SOCIETY
&
BASQUE CENTRE FOR CLIMATE CHANGE

BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

International Symposium on

Ice in a Sustainable Society

Conference Auditorium, Bizkaia Aretoa
Bilbao, Basque Country, Spain
5–10 June 2022

With the collaboration of:
- University of the Basque Country
- Unesco Etxea
- Salt Road (UK)

FIRST CIRCULAR
September 2021
https://iss.bc3research.org/
https://www.igsoc.org/symposia/2022/bilbao2022/

The International Glaciological Society (IGS) and the Basque Centre for Climate Change (BC3) are glad to announce the 'International Symposium on Ice in a Sustainable Society' (ISS), which will take place in the Basque Country in June 2022.

The ISS Symposium will be held at the Bizkaia Aretoa Convention Centre in Bilbao (Spain). This venue is located on one of the most emblematic sites of Bilbao, which opens out onto the estuary and the Guggenheim Museum. The Symposium will take place from Monday morning, 6 June, until the afternoon of Friday 10 June. On World Environment Day, Sunday 5 June, there will be several celebration activities and a pre-symposium icebreaker event at Bizkaia Aretoa. Different Social Events are scheduled throughout the Symposium.

During the ISS Symposium we will celebrate the 85th anniversary of IGS. The first official meeting of the 'Association for the Study of Snow and Ice' was held in April 1937. The Association would go through a few name changes through the years until it acquired its current name, 'The International Glaciological Society' in 1962. We will be celebrating the anniversary throughout the year, and of course during the ISS Symposium in Bilbao.

Come and attend* what will be a stimulating, innovative and productive symposium in a beautiful setting in the north coast of Spain!

THEME AND GOALS

The Symposium will focus on 'interdisciplinary relations' rather than isolated disciplines. Its main objective is to help the participants to look beyond their own specializations, identifying powerful interconnections and relationships that recognize no disciplinary borders, in order to highlight the extraordinary transdisciplinary potential of glaciology.

The goals of this symposium are:

- to assess the relevance of glaciology to a sustainable society, including the scientific, technological, social, economic and cultural dimensions.
- to serve as a transdisciplinary line of action and instrument to engage citizens, stakeholders and policymakers, promoting critical thinking about the climate crisis and providing them with the necessary tools to make better decisions, both personally and collectively.
- to encourage transdisciplinary ice research and activate participatory processes to solve complex problems.

We hope this symposium will attract experts in climate, engineering, environment, policy, economy, philosophy, arts and other specialities that will join forces to seek inter- and transdisciplinary solutions for sustainable development and climate change awareness.

*Required and recommended COVID-19 prevention measures will be followed during all ISS-related activities and remote participation options will also be offered. More details will appear soon on the local website and in the Second Circular.

COMMITMENT TO CULTURE AND SOCIETY

Within the framework of the Symposium, innovative actions and ways to connect the sciences of ice and sustainability to society will be proposed and implemented by the participants and the organizers, with the aim of contributing to more scientifically informed communities capable of actively participating in democratic processes, understanding that education and awareness raising are essential for actions to reduce human adverse effects on climate.

Besides the Symposium itself, various coordinated scientific communication, co-production and dissemination activities will be organized before and during the Symposium, including citizen participation, exhibitions, artistic performances, meetings and interactions with international experts from various areas of knowledge, from the natural sciences to the humanities. The transdisciplinary nexus of all these actions will be ice, considered in all its forms, from the cryosphere as the most sensitive component of the climate system and one of the dominant contributors to the recent rise in sea level, to glaciers as the water towers of the planet and snow as a source of tourist and economic attraction, as well as artistic and cultural inspiration.

All participants are welcome to organize or collaborate in those actions.

SUGGESTED TOPICS FOR CONTRIBUTIONS

The thematic focus of the Symposium is the recent interrelations of glaciology with the natural sciences, mathematics, applied and social sciences, and the humanities. All interpretations of this theme are welcome as submissions for presentation at the meeting. We organize the Symposium in five blocks of knowledge, whose structure follows the theme Glaciology meets X:

1. **Glaciology meets Physical Sciences:** encompasses the fundamental physics and chemistry of ice in all its forms, including snow and ice mechanics, microstructure and geochemistry; snow and firn metamorphism; thermal, optical and dielectric properties of ice; ice phases; solar system ices; and so on. It also hosts topics related to the physical foundations of low-temperature experimental techniques and technologies, such as cryo-geochemical analyses; neutrino detection; scanning electron microscopy (SEM); Raman spectroscopy; mass spectrometry (MS); atomic force microscopy (AFM); continuous flow analysis (CFA); neutron and X-ray crystallography (XRC), etc.

2. **Glaciology meets Formal Sciences and Engineering:** includes several themes related to mathematics, modelling and engineering. It encompasses all aspects of 'theoretical glaciology', from mathematical and numerical problems to glacier and ice-sheet modelling. Furthermore, it hosts glaciological applications in engineering and technology, including the use of ice as model material for condensed matter and materials science; issues in cold-regions engineering; architectural challenges on/in/with ice and permafrost; transportation on ice and permafrost; iceberg towing; borehole and ice-core drilling; refrigeration and cryogenic processes; food technology; technological aspects of ice-related sports; etc.

3. **Glaciology meets Life and Environmental Sciences:** covers several themes related to biology, ecology, medicine and the environment. In particular, it incorporates cryobiology and cryospheric ecology as a follow-up to the IGS Kyoto Symposium 2018. Furthermore, it deals with the role of the cryosphere in the climate system, including the cryospheric contribution to global and regional climate models (including CMIP6, CORDEX, etc.); ice-core paleoclimate records; glacier inventories and mass balance; sea-ice loss; permafrost degradation; (sub-/supra-/pro-) glacial lakes; etc. Finally, it provides a forum to discuss the recent conclusions from the Sixth Assessment Report of Working Group I of the IPCC (AR6 WGI).

4. **Glaciology meets Social Sciences:** covers the socio-economic importance and impacts of the cryosphere in a changing climate. It deals with topics related to climate-change adaptation, vulnerability, risk, resilience, mitigation, equity, litigation, governance and policy. It also addresses sustainability and the role played by the cryosphere for achieving the sustainable development goals (SDGs) following different scenarios and pathways. Finally, it offers a forum to discuss the conclusions coming up in early 2022 from the Sixth Assessment Reports of Working Groups II and III of the IPCC (AR6 WGII and AR6 WGIII).

5. **Glaciology meets the Humanities:** unravels the fascinating role played by ice and glaciology in the history, philosophy and culture of mankind. It includes the significance of ice and the cryosphere for the history and philosophy of science, for scientific communication and journalism, and for climate-change sensibilization and awareness. It addresses also timely themes relating ice to sports and tourism, local and indigenous knowledge, minorities rights, gender equality, etc.; as well as ice in the visual and conceptual arts, performing arts, music, literature, film, interactive media, applied arts and crafts, and so on.

PROGRAMME

Due to the multidisciplinary nature of this symposium, its structure will comprise a mix of plenary and poster sessions, panel discussions and additional forms of communication and expression through performances, exhibitions, workshops, etc. These activities* will be interlaced with free time to facilitate the interaction and exchange of scientific and transdisciplinary knowledge between participants in an informal and entertaining manner. Additional activities included for the attendees are the usual **pre-symposium icebreaker**, midweek **BioGeo field trip** to the flysch and cliffs of the Basque coast and the **Symposium's banquet at the Guggenheim Museum** on Thursday evening.

*Due to their nature, some of these activities will be face-to-face only, always following the required and recommended COVID-19 prevention measures.

SOCIAL EVENTS

Mid- & post-conference one-day tour: ***Bilbao + Gaztelugatxe***

A one-day optional guided tour of Bilbao + Gaztelugatxe will be offered on 06 June (Monday) for accompanying persons and on 11 June (Saturday) for attendees and their accompanying persons.

Mid-conference one-day tour: ***La Rioja***

An optional one-day tour to La Rioja will be offered on 07 June (Tuesday) for accompanying persons.

Post-conference one-day tour: ***San Sebastián***

We offer an optional post-conference excursion on 11 June (Saturday) for symposium attendees and their accompanying persons. It will be a one-day trip to San Sebastián (one of the three Basque capitals) that will include a visit to the Chillida Leku Museum.

VENUE

The symposium will be held at the Bizkaia Aretoa Convention Centre in Bilbao (Basque Country, Spain). The venue is located in one of the most emblematic sites of Bilbao, which opens out onto the estuary and the Guggenheim Museum, right in the centre of Avenida Abandoibarra, between two of Bilbao's iconic bridges: the Padre Arrupe Footbridge and the Puente de Deusto.

The venue is set up to follow all the required and recommended COVID-19 prevention measures for the event.

The neighbourhood of Bizkaia Aretoa is a tourist zone with numerous restaurants, cafés and bars. It is within walking distance of many of Bilbao's attractions and close to a shopping centre. It is also very well served by public transport. More information about how to get to the venue can be found on the local website: https://iss.bc3research.org/travel-and-accommodation/

LOCATION

Bilbao, with the Guggenheim Museum as its most iconic symbol, is the gateway to the Basque cultural universe. Since the 1990s it has been internationally recognized as a major example of urban transformation and revitalization, receiving numerous international prizes and serving as inspiration for many urban projects worldwide.

Bilbao is one of the three capitals of Euskadi, as the autonomous community of the Basque Country is known in Basque. With a history stretching back over 5000 years, Euskadi has a distinctive culture and a language that is unique in the world. Euskadi has managed to adapt to the times and is among the forefront regions of Europe in terms of quality of life and sustainable human development. It also maintains a strong link with the natural environment, with the sea and the mountains being the Basque traditional hallmarks of identity.

ACCOMMODATION

A number of rooms have been reserved in the following hotels, to provide convenient accommodation to attendees: Hotel Silken Indautxu (****), Hotel Ercilla (****), Hotel Mercure Bilbao (****), and Hotel Ibis Bilbao Centro (*).

Alternative affordable accommodation options are also available, for instance: Pohstel–Premium hostel, Pil-Pil Hostel, Bilbao Akelarre Hostel, and others.

Please contact the local organization for more information.

ABSTRACT AND PAPER SUBMISSION AND PAPER PUBLICATION

Participants wishing to present a paper (either oral or poster) at the Symposium will be required to submit an abstract by 5 February 2022.

A collection of submitted abstracts will be provided for all participants at the Symposium. The Council of the International Glaciological Society has decided to publish a thematic issue of the *Annals of Glaciology* on topics consistent with the Symposium themes. Participants are encouraged to submit manuscripts for this *Annals* volume.

IMPORTANT DATES

Opening of online abstract submission	15 December 2021
Abstracts due	5 February 2022
Notification of acceptance	20 February 2022
Opening of online registration	20 February 2022
Early-bird registration deadline	22 March 2022
Deadline for full refund	22 April 2022
Late registration	8 May 2022
Deadline for refund on a sliding scale	8 May 2022
Symposium starts	5 June 2022

Annals of Glaciology volume 64, issue 87
Paper submission deadline: 1 September 2022
Final revised papers deadline: 1 March 2023

SYMPOSIUM ORGANIZATION

Sérgio Henrique Faria (BC3)
Magnús Már Magnússon (IGS)

CULTURAL AND SCIENTIFIC STEERING COMMITTEE (CSSC)
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Cultural Committee: Marcela Brugnach (BC3, Spain), Jaime Jackson (Salt Road, UK), Sally Payen (Salt Road, UK), Neelambari Phalkey (University of Birmingham, UK). More members are in the pipeline; they will be announced on the local website and in the second circular.

Scientific Editors: Carolina Adler (MRI & University of Bern, Switzerland), Christine Schøtt Hvidberg (University of Copenhagen, Denmark), Douglas R. MacAyeal (University of Chicago, USA), Francisco Navarro (Universidad Politécnica de Madrid, Spain), María José Sanz (BC3, Spain), Shin Sugiyama (Hokkaido University, Japan), Martyn Tranter (Aarhus University, Denmark). More scientific editors are in the pipeline; they will be announced on the local website and in the second circular.

LOCAL ORGANIZING COMMITTEE (LOC)
Scientific Coordination: Sérgio Henrique Faria (Chair), Coordinator of Physical and Applied Sciences; María José Sanz (Vice-chair), Coordinator of Social, Life and Environmental Sciences; Marcela Brugnach, Coordinator of Humanities

Administrative Coordination: Ainhoa Azkarate, Communications Manager; Ainara Fernandez, Social Media Manager; Patricia Muñoz Marzagon, Technical Manager

Committee: Nerea Bilbao, Alejandro Cearreta, Nicolás González, Eñaut Izagirre, Susana Jodra, Carmen Marín Ruiz, Ibai Rico, María Santolaria-Otín.

FURTHER INFORMATION
If you wish to attend the Symposium, please **express your interest online** at https://bit.ly/3jCO9HK

The Second Circular will give further information about the general scientific programme, virtual participation, additional social activities, fees, preparation of abstracts and final papers. Members of the International Glaciological Society will automatically receive one, as will all those who have pre-registered.

Information will also be updated on the **local website:** https://iss.bc3research.org/

CONTACT

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INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on

Maritime Glaciers

University of Alaska Southeast
Juneau, Alaska, USA
19–24 June 2022

FIRST CIRCULAR
October 2021
https://www.igsoc.org/symposia/2022/juneau2022/

The International Glaciological Society will hold an International Symposium on 'Maritime Glaciers' in 2022. The symposium will be held at the University of Alaska Southeast in Juneau, Alaska, USA on 19–24 June 2022.

THEME

Glaciers in most parts of the world are located well above treeline. However, in maritime climates it's possible to stand on a glacier and look up at forested valley slopes. Maritime glaciers exist not because of especially cold temperatures, but because of high snow accumulation rates. In places like Southeast Alaska, snow accumulation rates often exceed 5 m per year at high elevations, melting can occur year round and can exceed 10 m per year at low elevations, and persistent rainfall is a significant component of glacier runoff. Temperate ice and wet snow are also characteristics of maritime glaciers. Due to their high mass turnover maritime glaciers respond quickly to climate change, and surging glaciers in maritime climates have shorter surge cycles than surging glaciers found elsewhere. A small percentage of maritime glaciers terminate in water, but these glaciers have outsized impacts on sea level rise due to their large size and susceptibility to rapid change.

The glacier-to-ocean distance is generally small for maritime glaciers, and as a result these glaciers constitute a large portion of their respective watersheds, with important consequences for stream temperature and chemistry and adjacent ecosystems. The short glacier-to-ocean distance also means that glacier runoff in these environments strongly affects the physical and chemical oceanography of near-shore waters, which serves as important habitat for fish, such as salmon, marine mammals, and sea birds. Glacier transition into or out of marine systems has profound impacts on fjord circulation, water properties, and ecosystem evolution. Deglaciation of these landscapes also increases the risk of landslides and landslide-generated tsunamis. The rich marine habitat provided in part by glaciers has sustained humans for centuries, and the peoples living along these coastal waters have important stories and legends related to glacier change. Glaciers continue to be an important component of maritime societies, although today the focus is shifting toward ecotourism.

SUGGESTED TOPICS

We seek papers and presentations that advance the understanding of maritime glaciers and their role in landscape and ecosystem change. Key focus areas include (but are not limited to):

1. Instruments and methods for observing high-accumulation, high-melt glaciers
2. Glacier hydrology and wet firn
3. Glacier runoff and sediment and nutrient export
4. Tidewater and lake-calving glaciers
5. Glacier–ocean–sediment interactions
6. Surging glaciers

7. Hazards associated with landscape change: outburst floods, landslides and tsunamis
8. Impacts on terrestrial and marine ecosystems
9. Social and indigenous perspectives.

PROGRAM
True to tradition, the symposium will include oral and poster sessions, interlaced with ample free time to facilitate the interactions of the participants. Additional activities will include an opening icebreaker, a banquet dinner and a boat trip to Tracy Arm during the mid-symposium afternoon break.

ABSTRACT AND PAPER PUBLICATION
Participants who wish to present a paper (oral or poster) at the Symposium will be required to submit an abstract by 10 January 2022. 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 are encouraged to submit manuscripts for this *Annals* volume.

VENUE
The symposium will be held at the University of Alaska Southeast, a small, public liberal arts university located 15 km from downtown Juneau, Alaska, USA. The university is situated between Auke Lake and Auke Bay, surrounded by old-growth temperate rainforest, and provides stunning views of the surrounding mountains.

LOCATION
Juneau, with a population of about 30 000, is a coastal community nestled in the Pacific Coastal Temperate Rainforest. The Juneau Icefield is accessible from several points along the Juneau road system, and Glacier Bay National Park is about 100 km to the west. The town has over 100 hiking trails of various lengths and difficulties and great access for sea kayaking and fishing. Black bears, deer and porcupines are commonly seen around town, and humpback whales, orcas, harbor seals and sea lions are regular visitors to the marine environment.

Juneau is the ancestral home of the Tlingit people. The modern town of Juneau was founded in 1880 by goldseekers and held three of the world's largest gold mines in the early 20th century. Now closed, traces of these gold mines can be still be found scattered throughout the forests and mountains. Although other nearby mines have opened and play an important role in Juneau's economy, the city also has strong fishing and tourism industries and, as the capital of Alaska, it is home to numerous federal and state agencies. As a result, Juneau is a vibrant community for its size.

SYMPOSIUM ORGANIZATION
Magnús Már Magnússon (International Glaciological Society

LOCAL ORGANIZING COMMITTEE

Jason Amundson (Chair; University of Alaska Southeast), Eran Hood (University of Alaska Southeast), Lynn Kaluzienski (University of Alaska Southeast), Roman Motyka (University of Alaska Fairbanks), Tom Thornton (Alaska Coastal Rainforest Center), Jamie Womble (National Park Service), Andy Bliss (National Park Service)

SCIENCE STEERING AND EDITORIAL COMMITTEE

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IMPORTANT DATES

Opening of online abstract submission	10 January 2022
Abstracts due	19 February 2022
Notification of acceptance	6 March 2022
Opening of online registration	6 March 2022
Early-bird registration deadline	5 April 2022
Deadline for full refund	6 May 2022
Late registration	22 May 2022
Deadline for refund on a sliding scale	22 May 2022
Symposium starts	19 June 2022

Annals of Glaciology volume 64, issue 87

Paper submission deadline	31 October 2022
Final revised papers deadline	31 March 2023

FURTHER INFORMATION

If you wish to attend the Symposium, please **express your interest online** at https://bit.ly/3jETvSV

The Second Circular will give further information about accommodation, the scientific programme, additional activities, preparation of abstracts and final papers. Members of the International Glaciological Society, as well as all those who have expressed an interest, will automatically receive notification of the Second Circular.

Information will also be updated on the IGS conference website, https://www.igsoc.org/symposia/2022/juneau2022/ as it becomes available. A local website will open later in 2021.

Glaciological diary

** IGS sponsored * IGS co-sponsored

2021

7–10 September 2021
Frozen Pasts 5: The 5th International Glacial and Ice Patch Archaeology Symposium
Chico Hot Springs Resort, Montana, USA
Website: https://instaar.colorado.edu/meetings/frozenpasts5/index.html

20–23 September 2021
WAIS Workshop
Sterling, Virginia, USA
Co-hosts: Brooke Medley <brooke.c.medley@nasa.gov>; Lauren Simkins <lsimkins@virginia.edu>

10–15 October 2021
3rd IPICS Open Science Conference: Ice Core Science at the three Poles
Crans Montana, Switzerland
Website: https://indico.psi.ch/event/6697/

13–15 October 2021
****Northwest Glaciologists Meeting**
Virtual meeting: Three half days Wednesday-Friday, 13:00 PDT start (PDT = UTC-7:00)
Meeting website and Zoom registration
Contacts: SFU Glaciology Group <northwestglaciologists2021@gmail.com>

20–22 October 2021
The Cryosphere in a Changing Climate? a scientific symposium in memory of Koni Steffen
Kongresszentrum Davos, Switzerland
Website: https://www.wsl.ch/symposium_KS

4–6 November 2021
****International Glaciological Society Nordic Branch Meeting**
University of Oslo, Oslo, Norway
Contacts: Liss Andreassen (NVE), Regine Hock and Thomas V Schuler (UIO)

5–8 January 2022
Ice Core Early Career Researchers Workshop (ICECReW)
Salt Lake City, Utah, USA and Online
Website: https://icedrill.org/meetings/ice-core-early-career-researchers-workshop-icecrew

25–27 January 2022
IASC Network on Arctic Glaciology meeting and workshop on The Dynamics and Mass Budget of Arctic Glaciers
Szczyrk, Poland
Website: https://nag.iasc.info/workshop

1–4 February 2022
SnowHydro 2022: 3rd International Conference on Snow hydrology
Grenoble, France
Website: https://snowhydro2022.sciencesconf.org/

13–19 February 2022
7th EGU Snow Science Winter School 2022: Snow and its spatial variability
Sodankylä, Finland
Website: https://www.slf.ch/en/about-the-slf/events-and-courses/snow-science-winter-school

14–18 February 2022
International Advanced Training Course on Snow and Avalanches ?Practice meets science?
Davos, Switzerland
Website: https://www.slf.ch/more/training

27 February–4 March 2022
Ocean Sciences Meeting 2022
Honolulu, Hawaii, USA and Online
HL04 Floe-scale sea ice processes: constraints from observations and models. Organizers: Alek Petty <alek.a.petty@nasa.gov>; Georgy Manucharyan <gmanuch@uw.edu>
Website: https://www.aslo.org/osm2022/

14–18 March 2022
XXI Argentine Geological Congress
Puerto Madryn, Chubut, Argentina
Technical Session 18: "Cryospheric Sciences"
Contact coordinators: Darío Trombotto <dtrombot@mendoza-conicet.gob.ar>; Carla Tapia <ctapia@mendoza-conicet.gob.ar>; Noelia Sileo <nsileo@mendoza-conicet.gob.ar>
Website: http://www.congresogeologico.org.ar/trabajos

May 2022
International Firn Workship
Online
Website: https://www.colorado.edu/lab/icesheetclimate/firn-workshop

1–4 May 2022
Year of Polar Prediction (YOPP) Final Summit
Montreal (QC), Canada
Website: https://www.polarprediction.net/meetings-workshops-and-science-sessions/yopp-final-summit/

9–12 May 2022
2nd Symposium on Polar Microbes and Viruses
Tvärminne Zoological Station, Hanko, Finland
Website: https://www.arcus.org/sites/all/modules/civicrm/extern/url.php?u=22128&qid=3787647

6–10 June 2022
****International Symposium on Ice in a Sustainable Society (ISS)**
Bilbao, Basque Country, Spain
Contacts: Secretary General, International Glaciological Society (IGS); Sergio Henrique Faria <sh.faria@bc3research.org>

19–24 June 2022
****International Symposium on Maritime Glaciers**
Juneau, Alaska, USA
Contacts: Secretary General, IGS; Jason Amundson <jmamundson@alaska.edu>

21–26 August 2022
***Cryosphere 2020: International Symposium on Ice, Snow and Water in a Warming World**
Reykjavík, Iceland
Contacts: Secretary General, International Glaciological Society; Þorsteinn Þorsteinsson <thor@vedur.is>

29 August–2 September 2022
14th International Conference on Paleoceanography
Bergen, Norway
First Announcement at https://icp14.w.uib.no/files/2021/03/ICP14_FirstAnnouncement.pdf

5–10 September 2022
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

25–30 September 2022
****International Symposium on Snow Science**
Davos, Switzerland
Contacts: Secretary General, International Glaciological Society (IGS)

4–9 June 2023
****THE International Symposium on Sea Ice**
Bremerhaven, Germany
Contacts: Secretary General, International Glaciological Society (IGS); Christian Haas <chaas@awi.de> & Marcel Nicolaus <marcel.nicolaus@awi.de> Alfred Wegener Institut and Gunnar Spreen <gunnar.spreen@uni-bremen.de> University of Bremen

2–7 July 2023
****International Symposium on the Edges of Glaciology**
Limerick, Ireland
Contacts: Secretary General, International Glaciological Society (IGS); Andrew Fowler, University of Limerick

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

Summer 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>

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

New members

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International Glaciological Society

Secretary General M.M. Magnússon

	Council Members		Concurrent service on Council, from
President	F. Navarro	2017–2020	2017
Vice-Presidents	G. Flowers	2018–2021	2014
	C. Hulbe	2019–2022	2018
	*J. Stroeve	2017–2020	2017
Immediate Past President	D.R. MacAyeal	2017–2020	2010
Treasurer	*A.A. Leeson	2018–2021	2018
Elected Members	*M. Błaszczuk	2019–2022	2019
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	*A. Glazovskiy	2018–2021	2018
	*M.E. Hansson	2019–2022	2019
	R. Hock	2018–2021	2018
	*M. Huss	2019–2022	2019
	*I. Das	2019–2022	2019
	Kang Schichang	2018–2021	2015
	*N.B. Karlsson	2017–2020	2017
	*S. MacDonell	2018–2021	2018
	*D.M. Schroeder	2019–2022	2019
	*A. Treverrow	2017–2020	2017
Coopted Members	R. Bingham		
	G. Leysinger Vieli		

*First term of service on the Council

IGS Committees

Awards	I. Allison (Chairman)
Nominations	D.R. MacAyeal (Chairman)
Publications	G. Flowers (Chairman)

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Seligman Crystal

1963	G. Seligman	1990	C.R. Bentley	2001	G.K.C. Clarke
1967	H. Bader	1990	A. Higashi	2003	K. Hutter
1969	J.F. Nye	1992	H. Röthlisberger	2005	R.B. Alley
1972	J.W. Glen	1993	L. Lliboutry	2007	L.G. Thompson
1972	B.L. Hansen			2009	P.A. Mayewski
1974	S. Evans			2011	A. Iken
1976	W. Dansgaard	1995	A.J. Gow	2012	D.E. Sugden
1977	W.B. Kamb	1996	W.F. Budd	2013	P. Duval
1982	M. de Quervain	1997	S.J. Johnsen	2019	R. Hindmarsh
1983	W.O. Field	1998	C. Lorius	2019	D.R. MacAyeal
1983	J. Weertman	1999	C.F. Raymond	2020	A. Fowler
1985	M.F. Meier	2000	S.C. Colbeck	2020	C. Ritz
1986	G. de Q. Robin	2001	G.S. Boulton	2021	A.Jenkins
1989	H. Oeschger				
1989	W.F. Weeks				

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G.K.C. Clarke	J.W. Glen
V.M. Kotlyakov	M. Kuhn
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Richardson Medal

1993	H. Richardson	2013	A. Weidick
1997	D.R. MacAyeal	2016	T. Chinn
1998	G.K.C. Clarke	2016	E.M. Morris
1999	J.A. Heap	2017	J.M. Palais
2003	C.S.L. Ommanney	2019	J. Oerlemans
2010	T.H. Jacka	2020	C. Hulbe
2012	W.S.B. Paterson	2020	E. Wolff
2013	J.W. Glen	2021	R. Hock

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International Glaciological Society

High Cross, Madingley Road
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MEMBERSHIP

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

ANNUAL MEMBERSHIP FEE 2021

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Supporting members	£277
Contributing members	£137
Retired/partner members	£29
Student members (under 30 years or studying for PhD/MSc)	£26

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ICE

Editor: M.M. Magnússon (Secretary General)

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