



Future of Greenland Ice Sheet Science (FOGSS) workshop 2022 **Summary report**

Organizing committee:

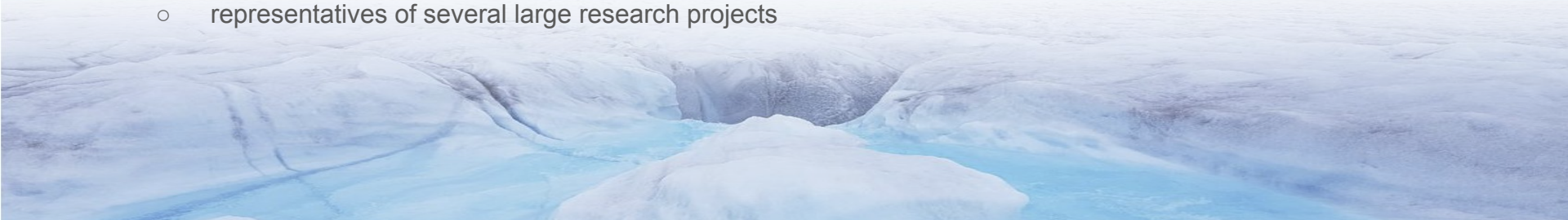
Winnie Chu, Timothy Bartholomaus, Joe MacGregor, Mathieu Morlighem, Von Walden

Introduction



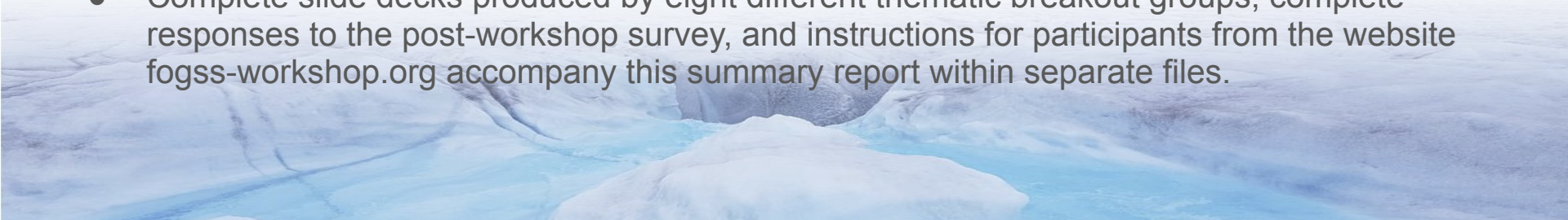
FOGSS represents a refocus on the collaborative, community-driven spirit of early NASA PARCA and NSF GEOSummit workshops. The workshop's mission is to identify and advise on medium-to-long-term priorities for U.S. research on the Greenland Ice Sheet.

- Over three hours on each of three days, April 6-8, 2022, we hosted a virtual (Zoom) workshop. Approximately 100 national and international researchers from career stages ranging from beginning graduate students to senior scientists attended FOGSS 2022.
- Participants accomplished the workshop goal through two primary activities:
 - thematic goal setting within breakout groups for the future of science on and around the Greenland Ice Sheet, and
 - geographically-focused discussion to identify opportunities for collaboration and research synergies.
- Additional presentations added context to the discussion, including from
 - NSF and NASA program officers,
 - the head of Department of Environment and Minerals within the Greenland Institute of Natural Resources, and
 - representatives of several large research projects



Structure and content of this summary report

- Workshop participants worked within breakout groups, each focused on different research themes, and prepared a set of slides focused on charting the future of each theme.
- The organizing committee identified 5 cross-cutting challenges, distilling the feedback from the major thematic groups:
 - a. Decolonizing U.S. research in Greenland
 - b. Better integration of observation & models
 - c. Water remains a unifying unknown
 - d. Sustained, open polar-observations
 - e. Projecting Greenland's contribution to sea-level rise
- Following these 5 challenges, this report presents:
 - a. distilled feedback gained from the post-workshop survey,
 - b. the workshop agenda, and
 - c. statistics regarding workshop participants
- Complete slide decks produced by eight different thematic breakout groups, complete responses to the post-workshop survey, and instructions for participants from the website fogss-workshop.org accompany this summary report within separate files.



Challenge #1: Decolonizing U.S. research in Greenland

Problem: Current U.S. research in Greenland can run roughshod over local interests, with insufficient engagement with local communities or attention to local capacity building.

Solutions:

Near-term

- Mandate U.S. participation in Greenlandic research portals (Isaaffik.org, ArcticHub.gl, g-e-m.dk)
- Establish policy guidance from U.S. funders about engagement with Greenlandic science offices.
- Identify and use a central communication hub to determine what different Greenlandic communities need.
- Identify sustainable infrastructure support and local expertise to foster local networks.

Moonshot

- Establish a permanent U.S. scientific envoy to Greenland to facilitate and coordinate collaborative U.S.–Greenland research activities for the mutual benefit of local communities.



Challenge #2: Better integration of observations and models

Problem: At present, observational and modeling projects are often distinct, and with limited feedback between new observations and modeling needs.

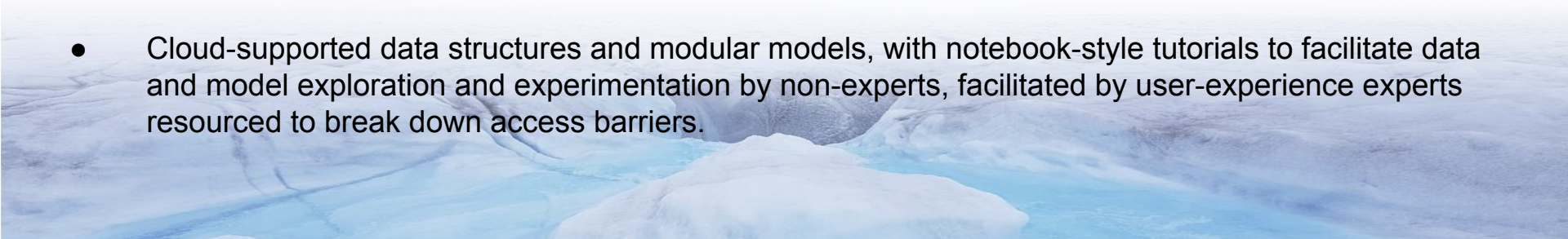
Solutions:

Near-term

- Prioritize efforts that tightly integrate observational and modeling approaches (e.g., Dear Colleague letter).
- Prioritize efforts to test scaling up of individual processes at specific locations to regional or ice-sheet-wide scales (e.g., terminus position prediction).

Moonshot

- Cloud-supported data structures and modular models, with notebook-style tutorials to facilitate data and model exploration and experimentation by non-experts, facilitated by user-experience experts resourced to break down access barriers.



Challenge #3: Water remains a unifying unknown



Problem: Increasing ocean heat transport and meltwater flux drives most change in the Greenland Ice Sheet, yet the processes across these interfaces are hard to observe and not yet well-understood.

Solutions:

Near-term

- Prioritize study of mass and energy fluxes at interfaces (e.g., mélange dynamics and fjord circulation, rainfall and albedo, firn aquifer evolution).
- Prioritize field observations that ground-truth remote sensing observations and numerical models, along with databases of those efforts (e.g., a SUMup for Fjord Properties or Surface Meltwater).

Moonshot

- Identify and realize two new Greenland mega-sites as foci for studies of water fluxes, at sites distinct from Helheim Glacier, e.g., Jakobshavn Isbræ, Petermann Glacier, or Isungata Sermia, in collaboration with local communities.



Challenge #4: Sustained, open polar observations

Problem: Long-term observations of the Greenland Ice Sheet have improved significantly in recent decades, but many needed observations (e.g., ice thickness, bathymetry, mass change from gravity, AWS), are only tenuously available, unobservable from space, or insufficiently validated.

Solutions:

Near-term

- Establish a consensus framework for evaluating remote-sensing data with in situ observations (could this be done via QGreenland?).
- Improved licensing of commercial data for polar observation (e.g., Maxar), with access to non-governmental institutions.
- Identify at-risk, critical cryospheric observations and formulate plans to mitigate them.
- Request history of open science contributions from PIs, as a component of proposals.

Moonshot

- Community consensus time series of ice and water fluxes (e.g. IMBIE for X, where X is ice surface velocity, elevation change, runoff) that combine data from multiple platforms and agencies.

Challenge #5: Projecting Greenland's contribution to sea-level rise

Problem: While ice-sheet models have increased resolution and sophistication, they still do not yet adequately reproduce recent observed changes in ice-sheet mass balance.

Solutions:

Near-term

- Prioritize research on uncertainty quantification to better identify the best opportunities for improvement in the performance of diverse models, e.g., do models need better forcings or better physical process parameterizations?
- Prioritize paleo and modern data acquisition to better constrain paleo/modern ice sheet change.
- Grow the modeler pipeline and treat models as instruments that require maintenance to continue operation.

Moonshot

- Establish an interagency National Center for Sea Level Change Research.



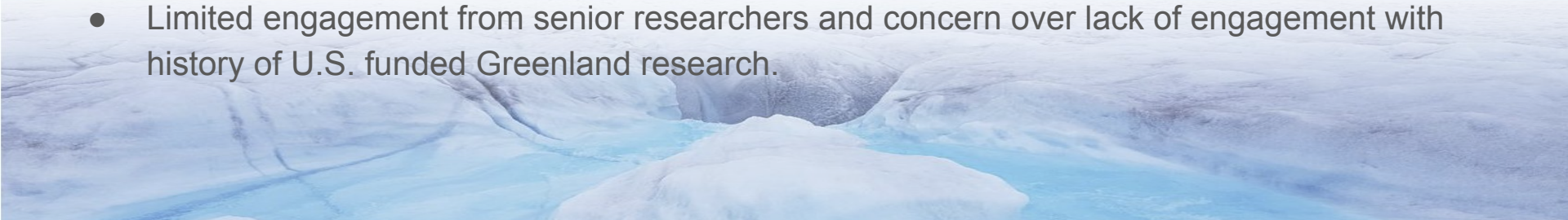
Summary of post-workshop survey feedback

Positive feedback

- The shorter format online meeting was very positively received overall.
- In general, participants highly appreciated the 60-second presentations of “big ideas.”
- Networking periods leveled the playing field for early career researchers.
- “brilliantly executed”; “very informative”; “DEI appropriately prominent”
- The large majority of participants felt that the meeting achieved its goals.

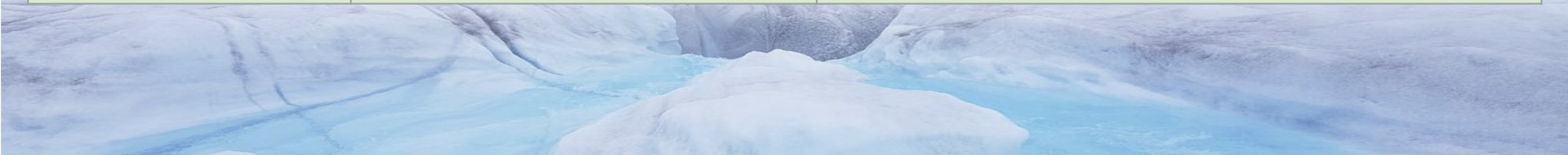
Opportunities for workshop improvement

- Participants generally wanted more time for breakout discussions of discipline priorities.
- Limited engagement from senior researchers and concern over lack of engagement with history of U.S. funded Greenland research.



FOGSS 2022 Schedule: Wednesday, April 6

Time (EDT, UTC-4)	Speaker(s)	Topic
1300–1310	Tim Bartholomaus (Univ. Idaho) Winnie Chu (Georgia Tech.)	Workshop goals
1310–1320	Thorsten Markus (NASA/HQ)	Updates from NASA HQ on Cryospheric Sciences
1320–1330	Renee Crain (NSF/OPP)	Updates from NSF OPP on Arctic Research
1330–1355	Josephine Nymand (Greenland Institute of Natural Resources)	Research in Greenland
1355–1405	BREAK	
1405–1600	All	Still sintering: Big question 1-sliders



FOGSS 2022 Schedule: Thursday, April 7

Time (EDT, UTC-4)	Speaker(s)	Topic
1300–1310	Zoe Courville (USACE/CRREL)	Research at Summit
1310–1320	Fiamma Straneo (SIO)	NNA Project
1320–1330	Leigh Stearns (Univ. Kansas)	Helheim Glacier super-site
1330–1340	Kirsty Tinto (LDEO)	NNA Project
1340–1350	Jason Briner (Univ. Buffalo) Joerg Schaefer (LDEO)	GreenDrill
1350–1415	All	Questions and discussion on future research
1415–1435	Sophie Nowicki (Univ. Buffalo)	Setting the stage of ice sheet unknowns: Modeling the Greenland Ice Sheet
1435–1445	BREAK	
1445–1545	Breakout groups	Discuss / propose / synthesize major points of uncertainty / unknowns to determine what needs to be done to advance understanding of the Greenland Ice Sheet. Begin work on slide decks.
1545–1600	All	Breakout groups report back

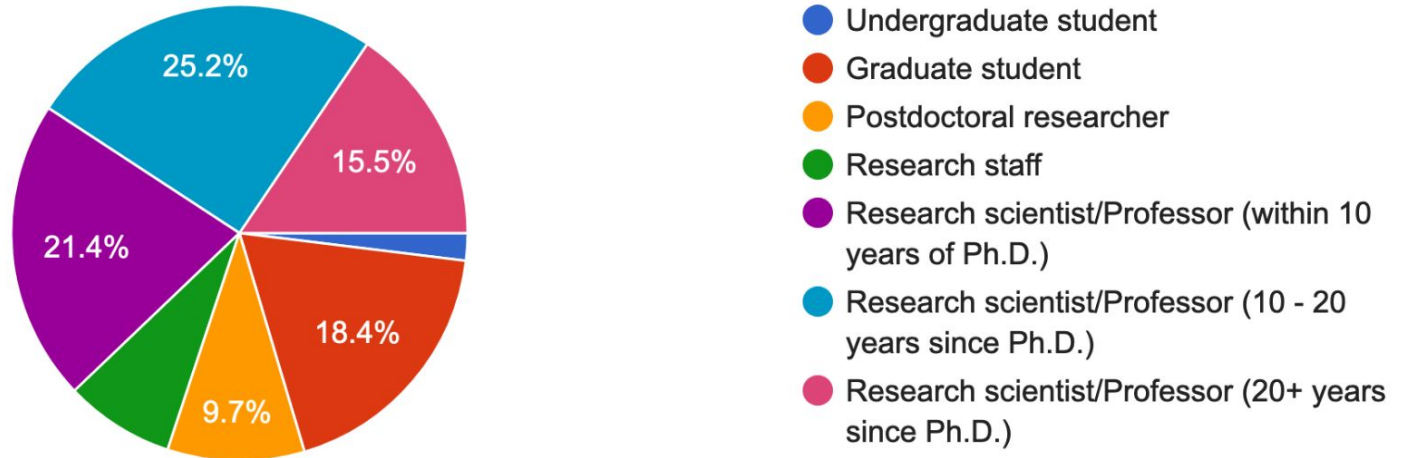
FOGSS 2022 Schedule: Friday, April 8

Time (EDT, UTC-4)	Speaker(s)	Topic
1300–1320	Von Walden (Wash. State Univ.)	Engagement with Greenland's research priorities
1320–1330	Joe MacGregor (NASA/GSFC)	Visualizing major existing field projects
1330–1400	Breakout groups	"Here's what <i>I'd like to do</i> in the next 3 to 5 years and how we can do it. Can we work together?"
1400–1410	BREAK	
1410–1510	Breakout groups	Synthesize within breakout groups and draft deliverable slide decks
1510–1600	Von Walden (Wash. State Univ.) Tim Bartholomaeus (Univ. Idaho) Winnie Chu (Georgia Tech.)	Report out: breakout groups summarize/present slide decks of the big topics necessary to advance understanding of the Greenland Ice Sheet

Composition of participants: Career stage and nationality

Please enter your career stage

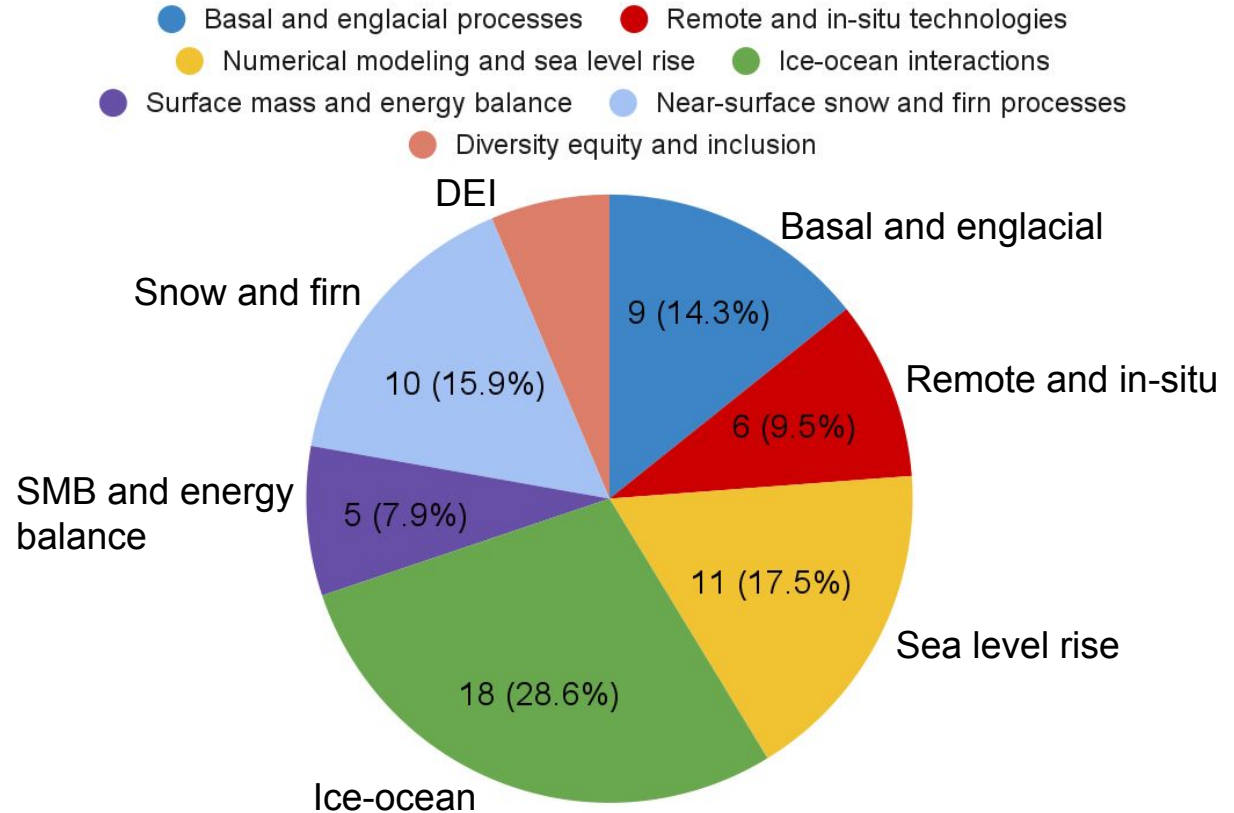
103 responses



Approx. 10% of participants were affiliated with non-U.S. institutions

Participation within thematic breakout groups

Participants self-selected thematic breakout groups in which to meet and respond to a set of prompts. Prompts focused on goal-setting and strategies to advance science priorities. The largest thematic area was ice-ocean interactions, which was split into two breakout groups.



Future plans

- Following what we perceive to be a successful, initial, online workshop in spring 2022, we anticipate holding in-person workshops in future springs.
- With modifications to allow for a hybrid, online/in-person workshop, we anticipate ~2.5 day workshops
 - 2023 is expected at Georgia Tech, in Atlanta, Georgia
 - 2024 is expected at University of Idaho, in Moscow, Idaho
 - 2025 is expected at Dartmouth College, in Hanover, New Hampshire

