Committee on Future Direction for Southern Ocean and Antarctic Nearshore and Coastal Research

Briefing Book

Community Workshop

February 9-10, 2023

NATIONAL ACADEMIES Sciences Engineering Medicine

BRIEFING BOOK
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Future Direction for Southern Ocean and Antarctic Nearshore and Coastal Research

COMMUNITY WORKSHOP

February 9-10, 2023

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Meeting Information

Future Directions for Southern Ocean and Antarctic Nearshore and Coastal Research

Hybrid Community Workshop

The National Academies' Committee on the Future Directions for Southern Ocean and Antarctic Nearshore and Coastal Research is hosting a workshop to gather information from the broader community on the capabilities necessary to support near- and long-term science drivers in the Southern Ocean and Antarctic Nearshore and Coastal research. These capabilities include a proposed Antarctic Research Vessel, other U.S. fleet capabilities, potential partnerships with other countries, and current and emerging tools, technologies, and approaches. This workshop is part of a National Academies consensus study, established to provide guidance to the National Science Foundation's Office of Polar Programs. View the full Study Description HERE.

Sessions in the workshop will be organized focused on the following broad/long-term science questions:

- What is the interaction between Antarctica and Global Sea Level?
- What is the interaction between Antarctica/Southern Ocean and Global Climate and Ocean Circulation?
- How have southern high-latitude biota and ecosystems evolved and how do they respond and contribute to systemic change (on land, ice, ocean, and sea floor)?
- What changes in erosion and hydrology are expected with shifting ice sheets and how will this affect biogeochemical cycles, biota, and hazards?
- How do solid Earth processes influence the high southern latitudes?

We are asking the overview talks to present on why it is imperative to answer these broad science questions and what advancements have been made recently. In contrast, flash talks in session 1, 2, 4, 5, and 6 will speak about specific, high priority, shorter-term science questions and what vessel capabilities or tools/technologies are necessary to fulfill this science. Flash talks in session 3 will focus specifically on emerging tools and technologies.

SESSION OBJECTIVES

- Determine specific high-priority science questions
- Consider the capabilities needed to address these science questions

February 9, 2023
HYBRID OPEN SESSION AGENDA

10:00 am **Welcome and goals**

NAS Auditorium

- Welcome and introductions — Committee Co-Chairs
- Background about project & Objectives for workshop — NSF
- Logistics and Zoom Housekeeping — Staff

SESSION 1: **How do solid Earth processes influence the high southern latitudes?**

10:45 am **Overview on how solid Earth processes affect southern latitudes.**

Christine Siddoway, Colorado College

Panel flash talks: Important short-term science drivers & capabilities:

Panelist 1: Earth Structure Beneath Coastal Antarctica and Implications for Ice Sheet Dynamics

Douglas Wiens, Washington University in St. Louis

Panelist 2: What role does nearshore tectonics and volcanism play in southern ocean and Antarctic systems?

Kurt Panter, Bowling Green State University

Panelist 3: Understanding Earth's magnetic field and its variability near its southern pole.

Stefanie Brachfeld, Montclair State University

SESSION 2: **What is the interaction between Antarctica and Global Sea Level?**

11:30 am **Overview on the interaction between Antarctica and Global Sea Level**.

Natalya Gomez, McGill University

Panel flash talks: Important short-term science drivers & capabilities:

Panelist 1: What is the role of ice sheets in sea level change? How is sea level impacted by changes in ice sheets?

Ted Scambos, University of Colorado Boulder

Panelist 2: What is the interaction between the ice shelf and the ocean?

Adrian Jenkins, Northumbria University

Panelist 3: How can drilling of the small coastal ice rises around Antarctic help us understand marine processes?
Peter Neff, University of Minnesota

12:15 pm **Lunch Break**

SESSION 3: **Relevant capabilities & emerging tools**

1:15 pm **Panel talks:**

1. Matthew Siegfried, Colorado School of Mines
2. Christopher Zappa, Lamont-Doherty Earth Observatory
3. Oscar Schofield, Rutgers University - Developing smart adaptive sensor webs expanding ship based science opportunities.
4. Britney Schmidt, Cornell University
5. Maureen Walczak, Oregon State University - Sampling the Southern Ocean Seafloor: Challenges and Solutions
6. Larry Mayer, University of New Hampshire - Acoustic Mapping of Seafloor, Water Column and Glacial Fronts in Support of Antarctic Science

Panel discussion

2:45 pm **BREAK**

3:00 pm **Breakout Rooms specific to Session 1 and 2 (in-person and virtual)**

Sessions Objectives:

- What are the near- and long-term science priorities from your session?
- What capabilities should be prioritized based on your session? And what are the tradeoffs between costly vs less expensive capabilities?

4:20 pm **BREAK for participants (Rapporteur and Moderator discuss outcome)**

4:30 pm **Breakout sessions report back**

5:15 pm **Adjourn**

February 10, 2023
HYBRID OPEN SESSION AGENDA

9:45 am **Welcome and goals** Committee Co-Chair

NAS Auditorium

- Welcome and introductions
- Zoom Housekeeping

SESSION 4: **What is the interaction between Antarctica/Southern Ocean and Global Climate and Ocean Circulation?**

9:55 am **Overview on how Antarctica and Southern Ocean affect Climate & Circulation**
Sarah Purkey, Scripps Institution of Oceanography

Panel flash talks: Important short-term science drivers & capabilities:
Panelist 1: What role does the Southern Ocean sea ice play in the Earth System? And how does the Southern Ocean sea ice respond to climate variability?
Sharon Stammerjohn, University of Colorado

Panelist 2: How does the Southern Ocean mediate fluxes of heat and carbon between the continent, ocean, and atmosphere?
Alexander Haumann, Alfred Wegener Institute

Panelist 3: What does paleoclimate research tell us about how Antarctica and the Southern Ocean affect climate?
Amelia Shevenell, University of South Florida

Panelist 4: Exploring the intersection of deep ice coring and marine based sedimentary records around Antarctica.
Edward Brook, Oregon State University

SESSION 5: **How have southern high-latitude biota and ecosystems evolved and how do they respond and contribute to systemic change (on land, ice, ocean, and sea floor)?**

10:45 am **Overview on how biota/ecosystems respond/contribute to change**
Eileen Hofmann, Old Dominion University

Panel flash talks: Important short-term science drivers & capabilities:
Panelist 1: How has life adapted to Antarctica and the Southern Ocean environments?
Alison Murray, Desert Research Institute

Panelist 2: How will marine ecosystem structure, biodiversity, and population dynamics be shaped by a changing ocean environment?
David Ainley, H.T. Harvey & Associates Ecological Consultants

Panelist 3: How do marine ecosystem structure, biodiversity, and population dynamics affect biogeochemical cycles and vice versa?
Patricia Yager, University of Georgia

11:30 pm **Lunch**

SESSION 6: **What changes in erosion and hydrology are expected with shifting ice sheets and how will this affect biogeochemical cycles, biota, and hazards?**

12:15 pm **Overview on changes due to altered erosion/sedimentation**.
Sidney Rasbury Hemming, Lamont-Doherty Earth Observatory

Panel flash talks: Important short-term science drivers & capabilities:
Panelist 1: What do sediments document about glacial stability?
Julia Wellner, University of Houston

Panelist 2: What are the nutrients/geochemistry of ice sheet melt and submarine groundwater?
Jon Hawkings, University of Pennsylvania

Panelist 3: How might linking sedimentation from the ice-proximal shelf to the deep sea sediment drifts yield high-resolution process information about sediment budgets & iceberg rafting?
Sean Gulick, University of Texas Austin

1:00 pm **Breakout Rooms specific to Session 4, 5, and 6 (in-person and virtual)**

Session Objectives:

- What are the near- and long-term science priorities from your session?
- What capabilities should be prioritized from your session? What are the tradeoffs between costly vs less expensive capabilities?

2:20 pm **BREAK for participants (Rapporteur and Moderator discuss outcomes)**

2:30 pm **Breakout sessions report back**

3:30 pm **BREAK**

3:45 pm **Interdisciplinary Breakout Sessions (in-person and virtual)**

Session Objectives:

- What are the commonalities and differences in needed capabilities between all sessions? Are the capabilities that each session needs highly specialized or generalized?

4:30 pm **BREAK for participants (Rapporteur and Moderator discuss outcome)**

4:40 pm **Breakout sessions report back**

5:15 pm **Adjourn**

INVITED SPEAKER BIOGRAPHIES

David Ainley is a senior avian ecologist at H. T. Harvey & Associates, Los Gatos, California, living in Marin, California with his family and dog. His first trip to Antarctica was as an undergraduate of Dickinson College, subsequently attaining a PhD from Johns Hopkins University in Animal Behavior and Ecology. His thesis was on Adelie Penguin social behavior. In total he has made 40 trips to Antarctica and the Southern Ocean, including 25 to McMurdo and vicinity. Investigating marine birds and mammals, he has authored/co-authored 4 books and >300 articles, both scientific and popular. He played a central role in designation of the Ross Sea as a Marine Protection Area, and has been involved in recovery of seabirds in Hawaii and California. A mountain peak in Antarctica and a seabird species have been named after him. He was recipient of the American Ornithological Societies 2022 Award for Conservation. With Rory Wilson, they just submitted the final draft of a book, "Aquatic World of Penguins --- Biology of Fish-Birds."

Stefanie Brachfeld is the Acting Vice Provost for Research and Professor of Earth and Environmental Studies at Montclair State University. Dr. Brachfeld's research expertise includes marine geology, Antarctic earth science, paleoclimatology, paleomagnetism, environmental magnetism, and planetary magnetism. Dr. Brachfeld has participated in 11 marine geology and geophysics and paleoceanographic expeditions to Antarctica, the North Atlantic Ocean, and Arctic Ocean aboard the research vessels Nathaniel B. Palmer, Laurence M. Gould, US Coast Guard Cutter Healy, JOIDES Resolution, Marion Dufresne, and the Araon, and served in leadership roles as watch chief on 6 expeditions. She was an invited member of the Antarctic Drilling Program McMurdo Ice Shelf Science Team. Dr. Brachfeld has served as an invited member of advisory boards for NSF-funded facilities and programs including the Institute for Rock Magnetism, Antarctic Marine Geology Research Facility, US Polar Rock Repository, Antarctic Research and Supply Vessel Scientific Advisory Committee, and the Polar Subcommittee of the NSF Geoscience Directorate. She currently chairs the Science Communication subcommittee of the U.S. Advisory Committee for Scientific Ocean Drilling (USAC). She earned her PhD in Geophysics from the University of Minnesota in 1999, and her MS and BS degrees in Geology from the California Institute of Technology and University of Rochester, respectively.

Edward Brook (he/him) is a University Distinguished Professor in the College of Earth Ocean, and Atmospheric Sciences at Oregon State University. Dr. Brook earned his PhD in the MIT/WHOI Joint Program in Oceanography and was a NOAA Climate and Global Change Postdoctoral Fellow at the University of Rhode Island. Dr. Brook's research group investigates records of greenhouse gases and climate from ice cores and he is the Director of the NSF Science and Technology Center for Oldest Ice Exploration (www.coldex.org), which is attempting to extend the time period covered by ice core records of the atmosphere and climate. He is an AAAS and AGU Fellow, and recipient of the Hans Oeschger Medal of the European Geosciences Union.

Adrian Jenkins is a Professor of Ocean Science at Northumbria University. His research focuses on the interaction between the Earth's ice sheets and oceans using both observations and models and with a particular emphasis on Antarctica and the Southern Ocean. He has participated in 14 expeditions to Antarctica working from air-deployed camps on the floating ice shelves or icebreakers operating close to the calving fronts. He has been a leader in the application of Autonomous Underwater Vehicles to study the ocean circulation beneath the ice shelves.

Natalya Gomez is an Associate Professor in the Department of Earth and Planetary Sciences at McGill University and a Canada Research Chair in Ice-Sheet-Sea Level interactions. Her research is focused at

the intersection of solid earth geophysics and climate change science, seeking to understand interactions between climate, ice, ocean and the solid earth and the contribution of the polar ice sheets to past and future global sea level changes. She earned her PhD from Harvard University and did her postdoctoral research at the Courant Institute of Mathematical Science at NYU. She received the American Geophysical Union Cryosphere Early Career Award in 2019 and will receive an Early Career Scientist award this year from the International Union of Geodesy and Geophysics.

Sean Gulick uses geophysical techniques ground truthed by scientific drilling to understand Earth and planetary processes. Current projects range from tectonic and climate interactions in glaciated continental margins from Antarctica to Greenland to Alaska, geohazards and margin evolution of in Alaska, New Zealand, and Haiti, and the geologic processes and environmental effects of the Cretaceous-Paleogene Chicxulub meteor impact. He has sailed on over 30 research cruises using geophysical data and scientific ocean drilling to test hypotheses ranging from how subduction zones initiation, to roles of sediment flux in glaciated margins, to incised river valleys as preservers of sea level history and sand resources, to impact cratering processes and links to life. He is a Research Professor at the Institute for Geophysics, Associate Chair in the Department of Geological Sciences, and Co-Chair of the Center for Planetary Systems Habitability at the University of Texas at Austin.

Alexander Haumann is a Research Group Leader at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research in Germany. He studies the impact of changing sea ice, freshwater fluxes, and ocean mixing and stratification on the ability of the Southern Ocean to take up and release carbon-dioxide and heat. He recently received a Helmholtz Young Investigator Group and an ERC Starting Grant to study the impact of changing Antarctic ice on the ocean and vertical exchange processes that determine the ventilation of upwelling water masses in the Southern Ocean. Previously, Alex worked as an Associate Research Scholar and Postdoctoral Research Fellow at Princeton University and British Antarctic Survey, where he was collaborated in major Southern Ocean research projects, such as the SOCCOM and ORCHESTRA programs. Alex obtained his PhD from ETH Zurich in 2017 and was awarded the ETH Medal and the Prix de Quervain for his dissertation on the Southern Ocean response to recent changes in surface freshwater fluxes. He is a committee member of the IAPSO Early Career Scientists and the CLIVAR/CliC/SCAR Southern Ocean Region Panel.

Jon Hawkings is an Assistant Professor at the University of Pennsylvania. He is an aquatic biogeochemist with a broad interest in the mobilization and cycling of elements through the Earth system. His research primarily revolves around collection and analysis of field samples to better understand chemical weathering and the role of glacial meltwater in the carbon cycle and downstream biogeochemical cycles. He takes particular interest in the potential of glacial meltwater to influence the structure and productivity of ecosystems, subglacial biogeochemical weathering processes and products, and the mobilization of nutrients (macro and micro) and toxic elements in freshwater environments and export to coastal ecosystems. In the past he has also been involved with research ranging from biogeochemistry of supraglacial (surface ice) environments, to ice sheet hydrology (the flow of water and sediment through ice sheet catchments), and water quality in groundwater aquifers.

Sidney R. Hemming is a professor in Columbia University's Department of Earth and Environmental Sciences and a member of the senior science staff at the Lamont-Doherty Earth Observatory of Columbia University. She is a geologist who uses geochronology to study a variety of Earth processes. She is particularly focused on understanding the ice sheet histories of Antarctica's ice sheets. Most of her Antarctic research involves using geochronology of sand grains from marine sediment cores around

Antarctica as well as terrestrial glacial deposits to trace glaciogenic sediment sources in the context of paleoenvironmental changes.

Eileen Hofmann is a Professor and Eminent Scholar in the Department of Ocean and Earth Sciences and a member of the Center for Coastal Physical Oceanography, both at Old Dominion University in Norfolk, VA. Her research interests are in the areas of physical-biological interactions in marine ecosystems, environmental control and transmission of marine diseases, descriptive physical oceanography, and mathematical modeling of marine ecosystems. She has published extensively in marine ecosystem modeling and other areas of marine research and has co-edited nine special issues of journals and two books. Dr. Hofmann's contributions to modeling physical-biological interactions in marine systems were recognized by her election as a Fellow of the American Geophysical Union (AGU) in 2013. She served as the President of AGU's Ocean Sciences section from 2017-2019. She was also a member of the international steering committees for the Global Ocean Ecosystem Dynamics (GLOBEC) program and specifically coordinated the Southern Ocean GLOBEC field program and synthesis phases. From 2010-2015, Dr. Hofmann served as Chair of the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) and in this role, oversaw the development of a new ten-year IMBER Science Plan and Implementation Strategy. She is Co-Editor-in-Chief for the Journal of Marine Systems. Dr. Hofmann received a B.S. in biology from Chestnut Hill College, M.S. and Ph.D. degrees in marine sciences and engineering from North Carolina State University.

Larry Mayer is a Professor and Director of The Center for Coastal and Ocean Mapping at the University of New Hampshire. He received a Ph.D. from the Scripps Institution of Oceanography in Marine Geophysics in 1979 and after being selected as an astronaut candidate finalist for NASA's first class of mission specialists, Larry went on to a Post-Doc at the School of Oceanography at the University of Rhode Island where he worked on the early development of the Chirp Sonar and problems of deep-sea sediment transport and paleoceanography. In 2000 Larry became the founding director of the Center for Coastal and Ocean Mapping at the University of New Hampshire. Larry has participated in more than 95 cruises (over 78 months at sea!) including 14 mapping expeditions in the ice-covered regions of the high Arctic, 10 of them on the USCG Icebreaker HEALY. He is the recipient of the Keen Medal for Marine Geology and an Honorary Doctorate from the University of Stockholm. He was a member of the President's Panel on Ocean Exploration and chaired National Academy of Science studies on national needs for coastal mapping and charting and the impact of the Deepwater Horizon Spill on ecosystem services in the Gulf of Mexico. He is currently the Chair of the National Academies of Science's U.S. Committee for the Decade of Ocean Science, a member of the State Dept.'s Extended Continental Shelf Task Force, the Navy's SCICEX Advisory Committee, and Vice Chair of the Board of Bob Ballard's Ocean Exploration Trust. In 2016 Larry was appointed by President Obama to the Arctic Research Commission, in 2017 he was elected to the Hydrographic Society of America Hall of Fame. In 2018 he was elected to the National Academy of Engineering and in 2019 he was elected as a foreign member of the Royal Swedish Academy of Sciences. In 2020 Larry became the first recipient of the Walter Munk Medal from The Oceanography Society and was elected a Fellow of the American Geophysical Union. Larry's current research deals with sonar imaging and remote characterization of the seafloor as well as advanced applications of 3-D visualization to ocean mapping problems and applications of mapping to Law of the Sea issues, particularly in the Arctic.

Alison Murray is a microbial ecologist with expertise in biological oceanography, molecular biology, environmental genomics and the study of life in extreme environments. She's worked on a number of Antarctic research projects that have taken her from the waters of the Antarctic Peninsula, South Shetland Islands and North-west Weddell Sea, to McMurdo Sound and Lake Vida, in the McMurdo dry

valleys. She's also helped teach a graduate-level training course in Antarctic biology at McMurdo Station on several occasions. Her work has involved studying free-living and host associated microbes, their diversity, ecological patterns, and adaptive capabilities as well as their roles in biogeochemical processes. Recent work has illuminated the diversity of an Antarctic ascidian-associated microbiome, and the genome-encoded biosynthetic pathway of a potential anticancer compound palmerolide A, in a new genus of bacteria.

Peter Neff is an Assistant Research Professor at University of Minnesota. He is a glaciologist and climate scientist working primarily to develop glacier ice core records of past climate, environmental conditions, and atmospheric chemistry. Peter's current research focuses on better understanding recent climate of changing coastal regions in West Antarctica, areas which play a large role in uncertainty for future projections of sea level rise. Peter is also working to capture the last 200-500 years of hydroclimate variability in southwestern British Columbia, Canada, through recovering and developing the southernmost annually-resolved ice core record in North America, from Mount Waddington in the Coast Mountains. Peter is also the Director of Field Research and Data for the Center for Oldest Ice Exploration (COLDEX), a National Science Foundation Science and Technology Center that seeks to find the oldest possible ice core records of past climate preserved in Antarctica. Peter shares widely about ice core climate science via Twitter, TikTok, and Instagram.

Kurt S. Panter is a professor at Bowling Green State University, where his research focuses on field-initiated igneous petrology, geochemistry, and volcanology as it relates to the origin of alkaline volcanoes and their evolution and eruptive environment in Antarctica. He has previously served on the steering committee for the Expert Group on Antarctic Volcanism, part of the Scientific Committee on Antarctic Research (SCAR) and the advisory board for the Polar Rock Repository (NSF funded facility at the Byrd Polar and Climate Research Center) as well as a participant in several NSF sponsored charrettes on infrastructure and scientific drivers for Antarctic research. He helped conceptualize and co-edited a scientific memoir "Volcanism in Antarctica: 200 Million Years of Subduction, Rifting and Continental Break-up" that was published in 2021. Kurt has participated in ten expeditions in Antarctica, including as discipline team leader for the AND-2A drillcore (ANDRILL) and in the investigation of volcanic seamounts (Adare Basin, Ross Sea) aboard the research vessel N.B. Palmer. Kurt received his Ph.D. (1995) and MS (1990) from the New Mexico Institute of Mining and Technology.

Sarah Purkey is a sea-going, large-scale observational physical oceanographer and an assistant professor at Scripts Institution of Oceanography, UC San Diego. Her research is focused on quantifying temperature, salinity, and circulation changes in the deep and abyssal ocean – those regions of the ocean below 2,000 m that are difficult to access with current technology. Her research has shown that the deep ocean has warmed over the past three decades, and this previously unaccounted for deep warming contributes significantly to ocean heat content and sea level rise. Much of her current research is focused on explaining the causes of this deep warming and advancing data collection and measurements in the deep ocean.

Ted Scambos is a Senior Research Scientist at the Cooperative Institute for Research in Environmental Sciences, also at University of Colorado. He earned a B.S. from the University at Stony Brook in 1977, an M.S. from Virginia Tech in 1980, and a Ph.D. from University of Colorado in 1991 in geosciences. Dr. Scambos' research has focused on the use of remote sensing to study the polar regions and the exploration of the effects of climate change on the poles. He has published extensively on ice sheet changes and glacier acceleration, changes in Arctic and Antarctic sea ice, surface conditions on the Antarctic Plateau, and the evolution of icebergs. Dr. Scambos contributes to two ongoing science

analysis blogs, the Arctic Sea Ice News and Analysis report (http://nsidc.org/arcticseaicenews/) and Greenland Today report on ice sheet changes there (nsidc.org/greenland-today).

Britney Schmidt is an Associate Professor in the Astronomy and Earth & Atmospheric Sciences at Cornell University. She and her team develop robotic tools and instruments and use spacecraft to study planets. Exploring Earth's ice shelves and glaciers and the oceans beneath them, Schmidt's team helps to capture the impacts of changing climate on the cryosphere, while understanding analogs for Ocean Worlds like Jupiter's moon Europa. She received a B.S. in Physics from the University of Arizona, and PhD in Geophysics and Space Physics from UCLA. She has conducted seven field seasons in Antarctica and one in the Arctic leading large science and technology programs. Her team's most recent projects have deployed the Icefin vehicle, built in her lab, to explore underneath the McMurdo and Ross Ice Shelf (NASA project RISE UP) and Thwaites Glacier, one of the fastest changing glaciers in Antarctica (NERC-NSF ITGC).

Oscar M.E. Schofield is a distinguished professor and the chair of the Department of Marine and Coastal Sciences at Rutgers, The State University of New Jersey. He is interested in how plankton dynamics structure marine food webs and feedback on the ocean's biogeochemistry. His research focus has combined genetics and biochemistry with the development of new ocean observing technologies (satellites, radars, and autonomous underwater vehicles). He is co-director and co-founder of the Coastal Ocean Observation Laboratory, which has been awarded and managed over fifty million dollars in competitive awards from NOAA, Office of Naval Research, Department of Homeland Security, NASA and the National Science Foundation. Dr. Schofield's research efforts have focused on polar and temperate waters with extensive efforts in the Southern Ocean, with ongoing research along the West Antarctic Peninsula and the Ross and Amundsen Seas. He completed his BA and PhD in Biology at the University of California, Santa Barbara.

Amelia Shevenell is an Associate Professor of Geological Oceanography at University of South Florida College of Marine Science. Dr. Shevenell's research addresses questions related to Earth's climate and Antarctica's ice sheet evolution over the last 65 million years. She and her students generate organic and inorganic geochemical records from marine sediments to reconstruct past ocean temperatures, continental ice volume, and carbon cycling on decadal to million-year timescales. This research is relevant to IPCC concerns that ongoing climate changes are accelerating polar ice cap melting and global sea level rise. Dr Shevenell maintains an active NSF-funded sea-going research program in Antarctica/the Southern Ocean. Dr. Shevenell is actively involved in the International Ocean Discovery Program (IODP), as a scientist and as a member of the JOIDES Resolution Facility Board. She is an Advisory Committee member for the NSF-funded Antarctic Core Collection at Oregon State University. She also serves as an Associate Editor for both Paleoceanography and Paleoclimatology and Oceanography. Dr. Shevenell met her husband, a NOAA-funded research engineer, on a 2001 NB Palmer research cruise to East Antarctica. They have a 15-year-old daughter and show black and yellow Labrador Retrievers.

Christine Siddoway is a Professor and Chair of Geology at Colorado College in Colorado Springs, USA. She investigates the bedrock geology and tectonic development of West Antarctica, using approaches ranging from field geology to airborne geophysics. Her initial work in Antarctica involved 9 field seasons in the ranges bordering the Ross Sea, obtaining the first direct observations of the middle- and upper-crustal structures that accommodated extension in the "onshore" sector of the West Antarctic rift system, and establishing geological ties to Zealandia. Since 2017, Dr. Siddoway's emphasis shifted to the subglacial geology of the West Antarctic Ice Sheet. She contributed her onshore knowledge to the

interpretation of extended crust beneath Ross Ice Shelf, as a PI on the NSF ROSETTA-Ice project (2016-20), and now focuses on central to western MBL, using materials obtained during IODP Expedition 379 that recovered deep sea cores from Amundsen Sea. Over the decades, her NSF awards created numerous polar research opportunities for graduate and undergraduate students, and early-career scientists, including members of groups historically excluded from polar research. Since 1992, Dr. Siddoway has engaged in many direct collaborations with colleagues from Italy, Japan, Australia, New Zealand, Germany, UK, and Canada, supported by NSF and the Scientific Committee on Antarctic Research.

Matthew R. Siegfried is a glaciologist who runs the Mines Glaciology Laboratory, where the team uses satellite remote sensing techniques in combination with field-based and airborne geophysical methods to understand physical processes of Earth's glaciers, ice sheets, and permafrost. He is an assistant professor in the Department of Geophysics at the Colorado School of Mines, is affiliated faculty in the Hydrologic Science & Engineering and Humanitarian Engineering & Science programs and is a faculty fellow at the Payne Institute for Public Policy. He is particularly interested in processes at the ice-bed interface, which lies at the intersection of glaciology, hydrology, geology, microbiology, and oceanography. Dr. Siegfried is committed to maintaining an open discussion of the changing cryosphere, having collaborated with institutions ranging from local elementary schools to the Department of State to facilitate conversations about the local, regional, and global impacts of changes at Earth's poles. He serves as a scientific editor for the Journal of Glaciology, is a co-chair for the joint UNAVCO and Incorporated Research Institutions for Seismology Polar Science and Technology Committee, is a member of the NASA ICESat-2 mission and NASA Decadal Science Incubator Surface Topography and Vegetation science teams and was a member of the final NASA Operation IceBridge Science Team. He received his bachelor's and master's degrees in Earth sciences from Dartmouth College and his Ph.D. also in Earth sciences from Scripps Institution of Oceanography at the University of California, San Diego.

Sharon Stammerjohn is a Senior Research Associate at the Institute of Arctic and Alpine Research of the University of Colorado Boulder. Her research focuses on polar oceanography and climate variability, including ocean-atmosphere-ice interactions and linkages to the polar ice sheets and polar marine ecosystem. She is particularly interested in the mechanisms and sensitivities driving seasonal sea ice changes. Many of Sharon's research projects include interdisciplinary approaches involving field campaigns, satellite remote sensing, and data - model synthesis. The overarching motivation of her research is to improve understanding of how polar systems respond to, and affect, global climate variability and change. She has over 120 peer-reviewed publications and has led or participated in over a dozen polar oceanographic research expeditions. Sharon conducted her PhD at Columbia University, New York and her postdoctoral studies at NASA Goddard Institute for Space Studies, New York. She recently served on advisory committees for NSF OPP and GEO and NOAA's Postdoctoral Fellowship Program, was Editor/co-Editor of the BAMS State of the Climate Antarctica Report (2014-2021), and since 2021 is an advisory member for New Zealand's Antarctic Science Platform.

Maureen Walczak is an Assistant Professor in the College of Earth, Ocean and Atmospheric Sciences at Oregon State University, where she manages the Radioisotope Dating Laboratory as well as the University-National Oceanographic Laboratory System (UNOLS) Marine Rock and Sediment Sampling Group. Her predominant research focus is on high-latitude climate systems on timescales beyond direct human observation, with particular interest in ocean circulation, marine productivity, and interactions between the ocean and glaciers. Dr. Walczak was awarded the Geological Society of America Kirk Bryan Award for Research Excellence (2021) for her investigations into the drivers of abrupt climate change at

the end of the last ice age, and is a member of the American Geophysical Union and The Oceanography Society as well as an elected member of the UNOLS Council. Dr. Walczak holds a masters' degree from the University of Washington School of Oceanography (2006) as well as a PhD in Oceanography from the Oregon State University College of Ocean and Atmospheric Sciences (2011), and completed post-doctoral research as an Australian Research Council Super Science Fellow at the Australian National University in the Research School of Earth Sciences and Department of Nuclear Physics (2011-2015).

Julia Wellner is an Assistant Professor at the University of Houston. Her research interests include Antarctic Ice Sheet history since the Eocene, including geomorphic signatures of ice sheet retreat across the continental shelf, sedimentation patterns in fjords and their relation to oceanographic controls. She also studies Plio-Pleistocne sequence stratigraphy from three-dimensional seismic data, and Holocene climate of the Antarctic. Dr. Wellner is a lead principal investigator on the THOR project. She and her team will investigate sediments deposited in the seas near the Thwaites Glacier and reconstruct past changes in environmental conditions and the glacier's response, adding context to projections of future change. She also served as Co-Chief of IODP Expedition 379 to the Amundsen Sea, which recovered records of ice-ocean interactions along the Antarctic margin. She recently served on the steering committee for "Developing Science Mission Requirements for a New, Globally-ranging U.S. Drilling Vessel.

Douglas Wiens is the Robert S. Brookings Professor in the Department of Earth and Planetary Sciences at Washington University in St. Louis. He obtained his BA Degree in Physics from Wheaton College in 1980, a PhD in Geophysics from Northwestern University in 1985, and has been on the faculty at Washington University since then. His specialization is imaging the earth's interior to constrain geological and tectonic processes. Doug led several ocean bottom seismograph deployments in the Western Pacific to constrain magma production and water cycling in subduction systems, as well as studying the mechanisms of deep earthquakes. He also deployed autonomous seismographs across much of Antarctica, using seismology to help reconstruct the geological history of the Antarctic continent and to provide constraints on the physics of ice flow through the study of glacial seismic signals. Doug has supervised 20 PhD theses, and he was chair of the Department of Earth & Planetary Sciences from 2008-2013. Doug was elected a Fellow of the American Geophysical Union (AGU) in 2007, and he is a past President of the Seismology Section of the AGU. He received the Cody Award in Ocean Sciences from the Scripps Institution of Oceanography in 2014, in recognition for his work on the structure of the earth beneath the seafloor.

Dr. Patricia Yager is a Professor at the University of Georgia Department of Marine Science. Her interdisciplinary research includes oceanography, marine ecology, and biogeochemistry. Her efforts concentrate on the feedbacks between climate and marine ecosystems and include both fieldwork and modeling. Recent projects have investigated the effects of melting ice sheets on Arctic and Antarctic coastal productivity, and carbon sequestration by the Amazon River plume. She has participated in over 20 oceanographic expeditions, mostly international or global-scale US research vessels and icebreakers, served as Chief Scientist on four expeditions, and co-chief Scientist on a fifth. She was awarded a Visiting Professorship (Science without Borders; Ciência sem Fronteiras) in Brazil, and the Antarctic Service Medal. Her research has been funded by the US National Science Foundation, the Gordon and Betty Moore Foundation, NASA, DOE, NOAA, and the Keck Foundation. She currently directs the statewide Georgia Climate Project, supported by the Ray C. Anderson Foundation. She has co-authored >76 peer-reviewed publications and has been cited >5800 times (H-index = 45). She lives in Athens, Georgia (since 1998).

Christopher Zappa is a Lamont Research Professor in and the Associate Director of Ocean and Climate Physics, and a Lecturer in Earth and Environmental Sciences at Columbia University. He attended Columbia University as an undergraduate and earned a Bachelor of Science in Mechanical Engineering

in 1992. Prior to joining Columbia in 2003, he received his Masters in Engineering in 1994 and his PhD in Applied Ocean Physics in 1999 from the University of Washington, Seattle and completed his Postdoctoral Scholar Award at the Woods Hole Oceanographic Institution in 2003. He was an ONR Young Investigator from 2004-2007 and the 2017 Schmidt Ocean Institute 5th Anniversary Impact Award recipient. He was awarded a Fulbright Scholar in 2018 to study unoccupied aerial systems at the University of Napoli, Parthenope.

National Academy of Sciences Building Information

Spring 2023

Address
2101 Constitution Ave. NW,
Washington, DC 20418

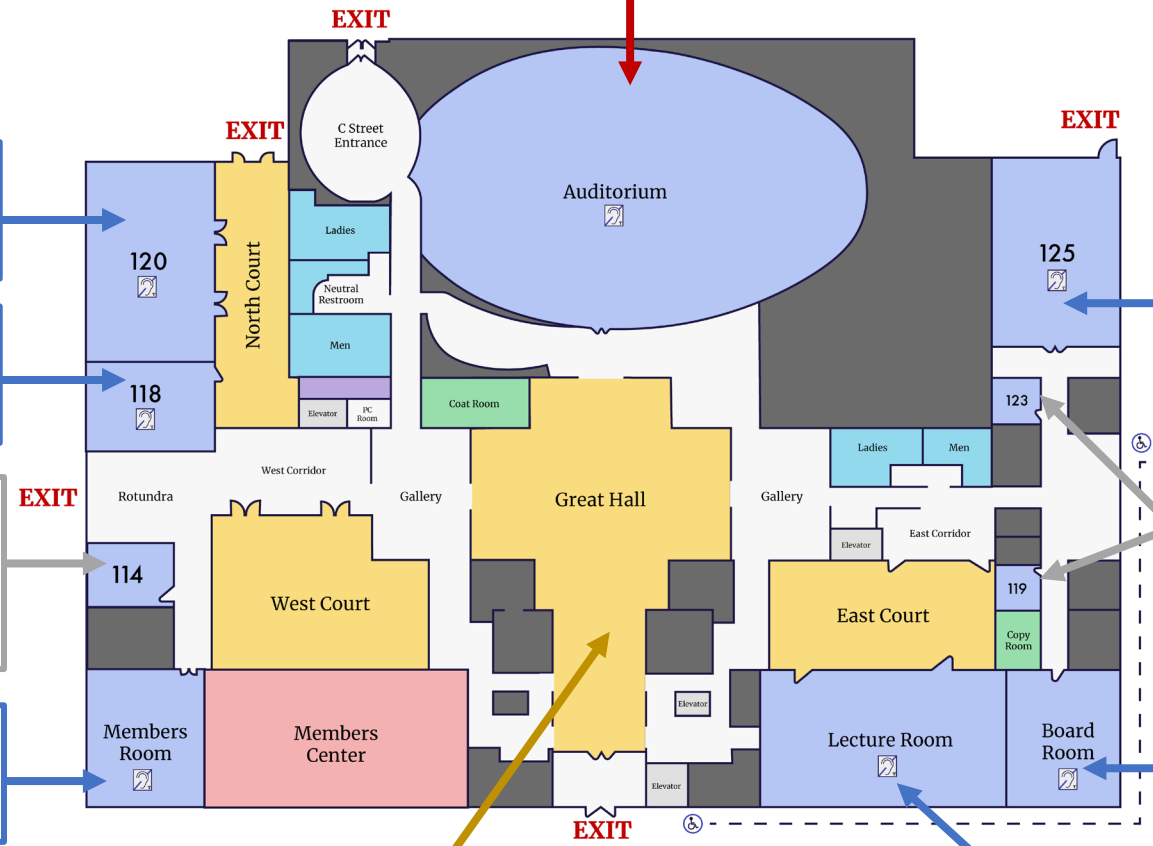
COVID-19 Policy
To prevent infection and spread of the COVID-19 virus, and as an integral measure toward the safety and health of everyone in our buildings, the National Academies require all individuals who enter our facilities to be up to date with their vaccinations against COVID-19 per CDC guidance. Visitors may choose to wear a mask or respirator but are not required to do so.

All visitors to National Academies facilities — including volunteers, Academy members, invited guests, fellows, sponsors, presenters, vendors, contractors, consultants, temporary workers, and other non-staff — must be up to date with their vaccinations against COVID-19 per CDC guidance. Visitors must show their official COVID-19 Vaccination Record Card (or a digital photo of the card) to the security staff at the NAS Building, when they enter the facility. A visitor's vaccination information will not be recorded or stored by the National Academies; the information will simply be verified to allow them to access the facility. Anyone who fails to present a vaccination card (or its copy) will not be allowed access to our facility; no exemptions or exceptions will be accommodated.

Parking
Limited parking is available for meeting participants in the visitors parking area of the NAS building. Parking is provided on a first-come basis, and overflow is directed to public parking garages.

The public parking facilities closest to the NAS Building are Colonial Parking (20th Street, NW, between E and F Streets) and Columbia Plaza (23rd and Virginia Avenue, NW).

Auditorium - Morning and early afternoon presentations



Room 120 – Breakout session

Room 118 – Breakout session

Room 114 – Quiet room for moderating virtual sessions

Members Room – Breakout session

Room 125 – Breakout session

Room 123 and 119 – Quiet room for moderating virtual sessions

Board Room – Breakout session

Great Hall – Breaks and meals

Lecture Room – Breakout session

NATIONAL ACADEMIES *Sciences Engineering Medicine*

PREVENTING DISCRIMINATION, HARASSMENT, AND BULLYING:
POLICY FOR PARTICIPANTS IN NASEM ACTIVITIES

The National Academies of Sciences, Engineering, and Medicine (NASEM) are committed to the principles of diversity, inclusion, integrity, civility, and respect in all of our activities. We look to you to be a partner in this commitment by helping us to maintain a professional and cordial environment. **All forms of discrimination, harassment, and bullying are prohibited in any NASEM activity.** This policy applies to all participants in all settings and locations in which NASEM work and activities are conducted, including committee meetings, workshops, conferences, and other work and social functions where employees, volunteers, sponsors, vendors, or guests are present.

Discrimination is prejudicial treatment of individuals or groups of people based on their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws.

Sexual harassment is unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature that creates an intimidating, hostile, or offensive environment.

Other types of harassment include any verbal or physical conduct directed at individuals or groups of people because of their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws, that creates an intimidating, hostile, or offensive environment.

Bullying is unwelcome, aggressive behavior involving the use of influence, threat, intimidation, or coercion to dominate others in the professional environment.

REPORTING AND RESOLUTION

Any violation of this policy should be reported. If you experience or witness discrimination, harassment, or bullying, you are encouraged to make your unease or disapproval known to the individual at the time the incident occurs, if you are comfortable doing so. You are also urged to report any incident by:

- Filing a complaint with the Office of Human Resources at 202-334-3400 or hrservicecenter@nas.edu, or
- Reporting the incident to an employee involved in the activity in which the member or volunteer is participating, who will then file a complaint with the Office of Human Resources.

Complaints should be filed as soon as possible after an incident. To ensure the prompt and thorough investigation of the complaint, the complainant should provide as much information as is possible, such as names, dates, locations, and steps taken. The Office of Human Resources will investigate the alleged violation in consultation with the Office of the General Counsel.

If an investigation results in a finding that an individual has committed a violation, NASEM will take the actions necessary to protect those involved in its activities from any future discrimination, harassment, or bullying, including in appropriate circumstances **the removal of an individual from current NASEM activities and a ban on participation in future activities**.

CONFIDENTIALITY

Information contained in a complaint is kept confidential, and information is revealed only on a need-to-know basis. NASEM will not retaliate or tolerate retaliation against anyone who makes a good faith report of discrimination, harassment, or bullying.

Updated December 2, 2021

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Background Information

Future Direction for Southern Ocean and Antarctic Nearshore and Coastal Research

Statement of Task

The National Academies of Sciences, Engineering, and Medicine will convene an ad hoc consensus committee that will provide guidance to the National Science Foundation's Office of Polar Programs on future directions for Southern Ocean and Antarctic nearshore and coastal research. The study will:

- Identify the highest-priority science drivers for Southern Ocean and Antarctic nearshore and coastal research, based on prior studies and reports. Consider both near- and long-term science priorities.
- Determine the capabilities that are essential to support these science drivers. In a resource-constrained environment, what are the potential tradeoffs among highly specialized and general capabilities? Or among costly vs less expensive capabilities?
    - Consider the capabilities needed for a proposed Antarctic Research Vessel, but also other U.S. fleet capabilities and potential partnerships with other countries and their fleets.
    - Assess current and emerging tools, technologies, and approaches (e.g., under ice ROVs and AUVs, drones, ship-capable drilling platforms, partnerships with other groups) that can be used to support the science drivers and/or extend ship capabilities in support of the science drivers.
- Note any gaps between the science drivers and the portfolio of capabilities, and discuss how NSF might address them.

A community workshop focused on gathering input on the tasks above will be held toward the beginning of this study and will assist the committee in its information-gathering. It will also provide the Office of Polar Programs with community perspectives that can be used to inform the design of the proposed Antarctic Research Vessel and the portfolio of technologies that expand capability beyond ship-based assets.