

# **Sustaining Ocean Observations to Understand Future Changes in Earth's Climate**

## **Committee**

### **Mary Glackin**

#### **Co-Chair**

Mary Glackin is Senior Vice President, Public Private Partnerships and Director of Meteorological Science and Services at The Weather Company, an IBM Business. In this role, she oversees the company's relationship with members of the international environmental community, including government agencies, academia and other private sector providers. She is also responsible for the company's research agenda as well as forecast operations. Ms. Glackin is retired from the National Oceanic and Atmospheric Administration, where from 2007 to 2012 she was Deputy Under Secretary of Commerce for NOAA Operations in Washington DC. As such, she was responsible for the day-to-day management of operations for oceanic and atmospheric services, research, and coastal and marine stewardship. Before that, she was the Assistant Administrator for NOAA's Office of Program Planning and Integration. Between 1999 and 2002, she served as the Deputy Assistant Administrator for the National Environmental Satellite, Data, and Information Service of NOAA. Ms. Glackin has twice received the Presidential Rank Award (2001 and 2009). She has also received the Charles Franklin Brooks Award for Outstanding Services to the American Meteorological Society (AMS), the NOAA Bronze Medal (2001), the Federal 100 Information Technology Manager Award (1999), the NOAA Administrator's Award (1993), and the United States Department of Commerce Silver Medal (1991). She is a Fellow of the AMS and the National Academy of Public Administration, as well as a member of the National Weather Association and of the American Geophysical Union. Ms. Glackin has a BS degree from the University of Maryland.

## **Robert A. Weller**

### **Co-Chair**

Robert Weller is a Senior Scientist with the Woods Hole Oceanographic Institution, where he formerly served as director of the NOAA Cooperative Institute for Climate and Ocean Research and past Chair of the Physical Oceanography Department. His research focuses on atmospheric forcing of the upper ocean, observation and prediction of upper ocean variability, and the ocean's role in climate. Dr. Weller has been a pioneer in developing tools and technologies that enable scientists to investigate upper ocean processes on scales from meters to tens of kilometers and with accuracy never before available. Dr. Weller has been on multiple mooring deployment cruises and has practical experience with ocean observation instruments. He serves as chair of the U.S. Climate Variability and Change (CLIVAR) Scientific Steering Group and on the WMO/IOC international Ocean Observing Panel for Climate, the NOAA Climate Observing System Council, and the NOAA Environmental Information Services Working Group. He co-chairs OceanSITES, a program under the international Joint Commission on Oceanography and Marine Meteorology, that coordinates sustained time series observations in the global ocean. He is chair of Ocean Research Advisory Panel. He has served on several NRC committees, including the Committee to Review the U.S. Climate Change Science Program Strategic Plan, the Committee on Implementation of a Seafloor Observatory Network for Oceanographic Research, the Committee on Utilization of Environmental Satellite Data, the Board on Atmospheric Sciences and Climate; and he chaired the NRC committee on the Assessment of Intraseasonal to Interannual Climate Prediction and Predictability and co-chaired the NRC committee on a Strategic Vision and Implementation Plan for the U.S. Antarctic Program. Dr. Weller received his A.B. in Engineering and Applied Physics from Harvard University and Ph.D. in Physical Oceanography from Scripps Institution of Oceanography.

## **Edward A. Boyle**

### **Member**

Edward A. Boyle is a professor of Ocean Geochemistry at MIT and Director of the MIT-Woods Hole Oceanographic Institution Joint Program in Oceanography. His research interests include a focus on ocean trace metal chemistry in relation to biogeochemical cycling, anthropogenic inputs, and as a tool for understanding the geological history of the ocean. He has worked on lead and other anthropogenic trace metals in Greenland ice cores and on trace metals in estuaries. Dr. Boyle discovered that iron in the deep southwest Pacific derives from distant hydrothermal vents. Additionally, he has shown that cadmium in some species of benthic foraminifera tracks the cadmium content of the bottom water they grow in, and has applied this finding to sediment cores to trace past changes in ocean deepwater chemistry which are influenced by changing ocean circulation patterns and changes in biogeochemical cycling within the ocean, including mechanisms that influence atmospheric carbon dioxide levels. He is a member of the National Academy of Sciences, and his National Research Council experience includes membership on the Ocean Studies Board from 2010 to 2015, the 2013 Alexander Agassiz Medal Selection Committee, and the Committee on an Ocean Infrastructure Strategy for U.S. Ocean Research and the Marine Chemistry Study Panel. Dr. Boyle received his Ph.D. from the MIT/Woods Hole Oceanographic Institution Joint Program in Chemical Oceanography.

## **Robert B. Dunbar**

### **Member**

Robert Dunbar is the William M. Keck Professor of Earth Sciences at Stanford University. Dr. Dunbar was the founding director of Stanford's Interdisciplinary Ph.D. Program in Environment and Resources. He directed the Stanford Earth Systems program for 9 years. He is also the first J. Frederick and Elisabeth B. Weintz University Fellow in Undergraduate Education and a Senior Fellow at Stanford's Woods Institute for the Environment. He served on the Board of Trustees of the U.S. Consortium for Ocean Leadership from 2009-2016, including as Board Chair for the last 3 years. Dr. Dunbar's research interests link climate dynamics, oceanography and marine ecology with environmental policy and solutions. His research group works on topics related to global environmental change, with a focus on the hydrologic cycle, air-sea interactions, tropical ecosystems, and polar biogeochemistry and glacial history. His lab participated in the ANDRILL program as shore-based and field-based scientists exploring the history of Antarctic climate at Windless Bight (McMurdo Ice Shelf Drilling) and Southern McMurdo Sound. He has participated in over 100 oceanographic research expeditions – most recently to install ocean observing instrumentation in the Chagos Archipelago in April, 2016. Dr. Dunbar received his Ph.D. in Oceanography from the Scripps Institution of Oceanography.

## **Robert Hallberg**

### **Member**

Robert Hallberg is an Oceanographer and the Head of the Oceans and Ice-sheet Processes and Climate Group at NOAA's Geophysical Fluid Dynamics Laboratory, and a Lecturer on the faculty of Princeton University. He has spent many years developing isopycnal (density) coordinate ocean models to the point where they now are valuable tools for coupled climate studies, including extensive work on the robustness of the models' numerical techniques, and on the development or incorporation of parameterizations of a wide range of physical processes. The isopycnal coordinate ocean model that Dr. Hallberg developed provides the physical ocean component of GFDL's ESM2G comprehensive Earth System Model, which was used in the IPCC 5th Assessment Report, and its dynamic core is the basis for version 6 of the Modular Ocean Model (MOM6). Dr. Hallberg has used global-scale numerical ocean simulations to study topics as varied as the dynamics of Southern Ocean eddies and their role in the ocean's response to climate, sources of steric sea level rise, and the fate of the deep plumes of methane and oil from the Deepwater Horizon oil spill. Dr. Hallberg has been actively involved in three ocean Climate Process Teams, studying Gravity Current Entrainment, Eddy-Mixed Layer Interactions, and Internal Wave Driven Mixing. These teams aim to improve the representation of these processes in climate-scale models, based on the best understanding that can be obtained from observations, process studies, and theory. He is currently working on coupling a dynamic ice-sheet and ice-shelf model with high resolution versions of GFDL's coupled climate models for improved prediction of sea-level rise. He has a 1995 Ph.D. in Oceanography from the University of Washington and a 1990 B.A. in Physics from the University of Chicago.

## Patrick Heimbach

### Member

Patrick Heimbach is associate professor at the University of Texas at Austin and fellow of the W. A. "Tex" Moncrief, Jr., Chair III in Simulation-Based Engineering and Sciences. His research focuses on understanding the general circulation of the ocean and its role in the global climate system. As part of the "Estimating the Circulation and Climate of the Ocean" (ECCO) consortium that originated under the National Oceanographic Partnership Program (NOPP), he and his group are applying formal inverse modeling techniques for the purpose of fitting a state-of-the-art general circulation model (the MITgcm) with much of the available satellite and in-situ observations to produce a best possible estimate of the time-evolving three-dimensional state over the past few decades of the global ocean and sea ice cover. ECCO products support global and regional ocean circulation and climate variability research on time scales of days to decades. Emerging research foci are understanding the dynamics of global and regional sea level change, the provision of formal uncertainties along with these estimates and implications for improving the global ocean observing system for climate. Heimbach is a member of the National Academies' Ocean Studies Board. He earned his Ph.D. in 1998 from the Max-Planck-Institute for Meteorology and the University of Hamburg, Germany.

## Mark Merrifield

### Member

Mark Merrifield is a Professor in the Department of Oceanography at the School of Ocean and Earth Science and Technology at the University of Hawaii at Manoa. His research interests include coastal oceanography, surface and internal waves, and sea level variability. He is the director of the Joint Institute for Marine and Atmospheric Research and the University of Hawaii Sea Level Center. Dr. Merrifield received his A.B. in Physics from the University of California, Berkley and Ph.D. in Oceanography from Scripps Institution of Oceanography.

## **Dean H. Roemmich**

### **Member**

Dean Roemmich is a Professor of Oceanography in the Integrative Oceanography Division and the Climate, Atmospheric Science, and Physical Oceanography Section at Scripps Institution of Oceanography, University of California San Diego. He teaches courses on observations of large-scale ocean circulation and advises graduate students in the Physical Oceanography and Climate Science programs. He is a leader in the Argo Program, a global array of 3,000 profiling floats providing data from the subsurface ocean that is necessary to complement and interpret satellite measurements of sea surface height and surface wind. He was a Lead Author of the IPCC 5th Assessment Report's chapter on Ocean Observations. Additionally, he is a member of the NOAA Climate Working Group, the international CLIVAR (Climate and Ocean: Variability, Predictability and Change) Global Synthesis and Observations Panel, and the NASA Ocean Surface Topography Science Team. Dr. Roemmich received his B.S. in Physics from Swarthmore College and Ph.D. in Oceanography from the Massachusetts Institute of Technology, Woods Hole Oceanographic Institution Joint Program.

## **Lynne D. Talley**

### **Member**

Lynne D. Talley is a Professor of Oceanography at the Scripps Institution of Oceanography at the University of California, San Diego. Dr. Talley's expertise and research interests include general ocean circulation, hydrography, theory of wind-driven circulation, and ocean modeling. She is co-PI for the US GO-SHIP program; GO-SHIP is an international repeated decadal survey of the deep ocean's physical and chemical properties. She is head of the observational team in the SOCCOM program that is deploying a network of biogeochemical Argo profiling floats throughout the Southern Ocean. She was a Lead Author on the IPCC 4th and 5th Assessment Reports chapter on Ocean Observations, and on the 5th Assessment Report's Technical Summary and Summary for Policymakers. Dr. Talley has an extensive NRC committee background, having served previously on the Climate Research Committee, Global-Ocean-Atmosphere-Land System Panel, Panel to Review the Jet Propulsion Laboratory Distributed Active Archive Center (DAAC), and committees on Abrupt Climate Change, Climate Change Feedbacks, and Future Science Opportunities in the Antarctic and Southern Ocean. She is a member of the CLIVAR Southern Ocean Region Panel, and the U.S. CLIVAR Southern Ocean Working Group. Dr. Talley was a National Science Foundation Presidential Young Investigator in 1987. Dr. Talley received her Ph.D. in Physical Oceanography from the WHOI/MIT Joint Program in Oceanography. She is a fellow of the American Academy of Arts and Sciences, American Geophysical Union, American Meteorological Society, and Oceanography Society.

## **Martin Visbeck**

### **Member**

Dr. Visbeck is Head of Research Unit, Physical Oceanography at GEOMAR. His current research is concerned with ocean and climate variability and change with particular emphasis on the circulation of the Subpolar North Atlantic, climate-biogeochemical interactions in the tropical ocean, observations of ocean circulation and mixing using modern robotic platforms including profiling floats and gliders, and development of ocean observatories for long-term observations in the water column. Dr. Visbeck received his Ph.D. in Physical Oceanography from Kiel University.

## **Claudia Mengelt**

### **Staff Officer**