Arctic Observing Open Science Meeting

Craig M. Lee[1], Matthew Shupe[2], Cathy Wilson[3], Mia Bennet[4], Elizabeth Hoy[5], Ron Kwok[6], Michael Macrander[7], An T, Nguyen[8], Davis Payer[9], Ted Schuur[10], Sandy Starkweather[11], Leigh Stearns[12] and Helen Wiggins[13]

[1]Applied Physics Laboratory, University of Washington

[2] NOAA Earth System Research Laboratory, University of Colorado

[3]Los Alamos National Laboratory

[4]University of California, Los Angeles

[5]Goddard Space Flight Center

[6]Jet Propulsion Laboratory, California Institute of Technology

[7]Shell Oil

[8]Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology

[9]Arctic Landscape Conservation Cooperative

[10]Center for Ecosystem Science and Society, Northern Arizona University

[11]NOAA Earth System Research Laboratory, University of Colorado

[12]Department of Geology. University of Kansas

[13]Arctic Research Consortium of the U.S.

Significant investments in Arctic observing during the IPY and beyond have produced a broad, multi-disciplinary data set of unprecedented spatial and temporal scope spanning land, ice (ice sheets and sea ice), ocean atmosphere and human systems. The 2015 Arctic Observing Open Science Meeting provided the research community a forum to discuss the advances supported by these sustained, broad, contemporaneous observations and to identify areas for improved integration into an Interagency Arctic Observing Network. Specific goals were:

- Present and document new understanding achieved through Arctic observing.
- Illustrate the breadth and scope of existing Arctic observing activities.
- Strengthen the goals, identity and activities of an integrated Interagency Arctic Observing Network.

Keynote speakers provided examples of scientific objectives and advances in understanding that are achievable only through sustained observing collected by a

network. Thematic sessions focused on specific research areas, including the Terrestrial Arctic, Arctic Atmosphere, Community Based Monitoring, Marine Ecosystems, the Fate of Sea Ice, Ocean Circulation and Mixing, Robust Autonomous Observations, Human Dimensions, Applications to Global Climate Modeling, Ice Sheets and Glaciers and Meeting the Needs of Managers and Decision Makers. Each session was asked to address the following questions:

1. What scientific or operational advances have been facilitated by the network(s) of Arctic observations?
2. How have observing activities contributed to the science needs of mission agencies or stakeholders?
3. What opportunities exist to address new science questions, operational challenges, or questions of Arctic communities through enhanced collaboration and a robust interagency observing system?

Presentations and discussions highlighted achievements of the existing network. Broad, sustained atmospheric measurements have led to an understanding of the sources, sinks and seasonality of trace gasses and found consistent variability in cloud properties across sites and different moisture, energy and aerosol conditions, pointing to paths for consistent representation in models. Distributed measurements in the Arctic Ocean, combined with sustained observations at the three primary gateways, has documented variability in freshwater storage and release, and provided a basis for understanding the underlying mechanisms. Large advances in understanding the processes that govern sea ice variability stem from a loosely-organized network of individual projects. Terrestrial networks span both science and the provision of useful products to decision makers. Networks increasingly include measurements collected by community-based observers, as the interface between communities and research endeavors strengthens.

Open Science Meeting participants also identified important opportunities for the observing network. With increased human activity, decision makers will need data for planning responses to environmental change, such as storm surge, coastal erosion and permafrost melt, and to disasters such as spills. These needs will drive design for some elements of the network. Advances in autonomous platforms and sensors should deployed to complement existing network elements, providing a path to extend temporal and spatial coverage in a cost-effective manner. A comprehensive evaluation of atmospheric reanalyses could be used to define the core atmospheric measurements needed by the larger observing network. Scaling issues were common to many domains, as participants discussed the balance between distributed observing and more concentrated efforts at ‘super-sites’, and the need to understand how to upscale from these. Other common concerns included network optimization, production and delivery of useful products and the establishment of funding models capable of supporting critical, sustained measurements.