Parallel Session Summary

Marine Ecosystems

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Question 1: What scientific or operational advances have been facilitated by networks of Arctic observations?

The scientific community has made significant advances in Arctic marine ecosystem observations during the past decade. New platform and sensor technologies have given the community the ability to collect a limited suite of biological and biogeochemical measurements at similar spatial/temporal scope and resolution as the basic physical observations (e.g. temperature, salinity, velocity). This provides critical building blocks for the design and implementation of broad networks for sustained studies of marine ecosystems and facilitates multidisciplinary investigations of the mechanisms that govern ecosystem response to changes in the surrounding physical environment. Studies can thus more readily address linkages between physical, biological and human systems. Introduction of autonomous platforms and sensors has also highlighted the need to continued in situ observing. Although such efforts are more resource-intensive, they provide complementary data that are critical for the quantitative interpretation of autonomous measurements. Examples of research facilitated by Arctic observing efforts include investigations focused on how changes in sea ice and snow cover, and in upper ocean stratification, impact timing and magnitude or productivity in the Arctic Ocean, and on the Arctic's role in ocean acidification.

Adoption of network-oriented approaches to Arctic observing have been at least as important as the introduction of new technologies. The implementation of international distributed networks (e.g. the Distributed Biological Observatory) have facilitated broad, sustained data collection through thoughtful identification of science and observational priorities, community coordination and protocols that specify open data access. The Distributed Biological Observatory (DBO; http://www.arctic.noaa.gov/dbo/), specifies eight sites that serve as a change detection array and coordinates annual sampling through a variety of national and international efforts. This provides a successful model of international cooperation to sustain extensive, climate-scale observing. The networked nature of recent, sustained Arctic observing activities has also afforded opportunities to collect simultaneous biological and biogeochemical measurements across multiple regions within the Arctic, yielding insights that could not have been achieved by a collection of smaller, regional projects operating asynchronously.

Broad, open data access, supported by dedicated curation and dissemination/discovery efforts, represents a central pillar to network observing in the Arctic. Timely delivery and open access facilitates operational use of Arctic observing network data, such as incorporation into nowcast/forecast models. Open access also promotes broad use of Arctic observations that can lead to analyses and findings well beyond those originally anticipated. Open data access also forms a basis for broad coordination and collaboration, highlighting the benefits of contributing to the larger system.

<u>Question 2:</u> What opportunities exist to address new science questions, operational challenges, or questions of Arctic communities through enhanced collaboration and a robust interagency observing system?

The breakout group discussed new areas of research that might be able to leverage ongoing efforts to implement an Arctic observing system and the underlying technological advances. Identified topics included:

- Colony-based studies of seabirds
- Studies that intentionally exploit the capabilities of autonomous platforms and animal-borne sensors (e.g. tagged marine mammals) to study ecosystem response to a changing Arctic
- Implementation of a sustained, distributed network of autonomous profiling floats instrumented with physical, biological and biogeochemical sensors.
- Enhanced collaboration to improve predictions of subsistence animal phenology
- Cabled observatories
    - Pro – provides real-time time-series data
    - Con – ability to address high-priority science objectives, high cost and lack of flexibility

Several key suggestions were identified to improve the network of Arctic observing efforts in the future:

- Facilitate improved knowledge sharing between communities, scientists, managers, and decision makers
- Accelerate communication of observations and findings to better match the speed with which ecosystem and societal changes are occurring
- Improve engagement with modelers to improve pan-arctic analyses. United States-led Arctic observing efforts concentrate on the shelves, while European efforts tend toward basic ecosystem assessment in the basins. Numerical studies could help integrate these investigations.
- An opportunity to create space following AOOSM to allow more detailed discussions is important.
    - IARPC and meeting space at the Alaska Marine Science Symposium are both good options

Coordination of Arctic observing activities across US agencies was identified as a significant need. The Interagency Arctic Research Policy Committee (IARPC) has

established a web-based platform for collaboration, with several teams formed around topics related to Arctic observing (http://www.iarpccollaborations.org). The teams provide a vehicle to promote coordination and collaboration between Arctic scientists of various backgrounds. (http://www.iarpccollaborations.org).

Shifts in industry needs, such as the cessation of Shell Oil's exploration efforts, can impact the underlying motivation for observing efforts. Although Shell's decision diminishes the immediate need for observations to support exploration and resource extraction, other compelling drivers for broad-scale ecosystem observations remain, including risk assessment for local communities that rely on subsistence hunting and the need to understand how the Arctic's role in the global carbon cycle might respond to climate change.

Question 3: How have observing activities contributed to the science needs of mission agencies or stakeholders?

Due to lack of time, the breakout group did not address this question.