Statement for the 2013 Arctic Observing Summit

The Need for Flagship Arctic Coastal Observatories

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Arctic coastal systems are recognized as one of the most threatened ecosystems on Earth (Lantiut et al., 2011) and represent a nexus for examining change at the interface between marine, terrestrial, atmospheric and social systems. For many arctic coastal areas, near shore ice conditions are changing (AMAP, 2012), erosion of coastlines is increasing (Jones et al., 2009), permafrost is warming (AMAP, 2011), and landscapes are slumping (Shiklomanov et al., 2012) and drying (Lin et al., 2012; Villarreal et al., 2012; Lara et al., 2012) or becoming warmer and greener (Bhatt et al., 2010). The urgency for improving our understanding of how these biophysical changes are interrelated, as well as their potential to impact society, industry, biota, and the fate and transport of carbon, water and energy within the Arctic and beyond is well recognized. Several relatively recent studies highlight these close linkages, especially how changes in sea ice extent can impact terrestrial processes (e.g. Bhatt et al., 2010), which can control coastal erosion (e.g. Aguirre, 2011). In addition, recent work in arctic coastal lagoons has demonstrated that nearshore systems are highly productive and resilient, sustaining benthic populations of invertebrates year-round that support complex food webs (Dunton et al., 1982; Dunton et al., 2012). Nearshore regions in the Arctic are critical to a vibrant coastal fishery (von Biela et al., 2012) and also serve as habitat to thousands of waterfowl representing over 157 species that breed and raise their young over the short summer period (Brown, 2006).

A key to improving our understanding of the arctic coastal system is the need to integrate and synthesize spatio-temporally diverse data from observing platforms spanning multiple disciplines that link nearshore and shelf waters. Constraints of funding and logistics prohibit continuous and widespread observing capacities throughout the Arctic. Yet, several reports appropriately highlight the need for a few well conceived and orchestrated *'flagship observatories'* that support a dense and diverse range of observing programs capable of monitoring environmental change and variability at strategic locations on synoptic time scales (NRC, 2006; SEARCH, 2003). Flagship observatories have proven capacities and efficiencies in the Arctic, as exemplified by the synergistic and complementary information provided by the Distributed Biological Observatory (DBO) with broad scale remote sensing and modeling efforts on the Chukchi Sea Shelf (Grebmeier et al., 2010). However, no such efforts have been employed in the western arctic coastal zone, despite the nature and potential implications of observed changes that have taken place over the past decade.

The establishment of a flagship arctic coastal observatory that is linked to a shelf DBO at one or more strategic locations would provide an invaluable resource for understanding and predicting responses of arctic nearshore systems to climate change. We reiterate the need for a few well-conceived coastal flagship observatories in the Arctic that will (i) improve planning and synergistic interchange across disciplines and existing observing programs, (ii) provide information systems that facilitate transdisciplinary data discovery and integration, (iii) enable synthetic and other studies that explore interrelationships between the various components of the arctic coastal system, and (iv) identify observational gaps, degrees of uncertainty, and exchanges between shelf and terrestrial systems. Flagship coastal observatories are likely to include locations that incorporate a variety of considerations including:

- The presence of relatively high biological production and/or diversity.
- The existence of a range of baseline and historical datasets, including existing discipline-based observatories.
- Areas known to be characterized by strong physical events that drive biological production.
- Proximity to native Inupiat and/or Inuit communities and subsistence hunting.
- The potential for partnerships with local, regional, state or federal groups or agencies.
- Regionally high water inflow from rivers.
- Possibilities for international collaboration.
- Proximity to oil and gas development, either current or planned.
- Proximity to wilderness areas and/or industrialized land/sea scapes, or a range of ecosystem types and gradients.
- Capacity for year round activity and infrastructure for serving a wide variety of disciplinary-based needs.
- Promise for synergistic research activities focused on understanding properties and processes not covered by existing observations.
- Long-term occupation of the observatory (e.g. capacity to exist for the next half century).

The development of flagship coastal observatories in the Arctic should encompass a coordinated effort that links physical events with biological responses across temporal and spatial scales. We need to track ecosystem changes with sea ice retreat and changing conditions in adjacent watersheds. Through focused study of selected areas, we will better understand how climate change is affecting the arctic estuarine environment which serves as a refuge for many species, including migratory fish and waterfowl, many of which are critically important to the subsistence lifestyle and culture of arctic indigenous peoples.

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