Parallel Session Summary

Ice Sheets and Glaciers

Session Chairs: Leigh Stearns and Mark Fahnestock

Overview. Arctic glaciers and ice sheets have undergone large changes in the past decades, doubling their contribution to sea level rise. However, high-resolution and long-term observation networks are needed in order to understand the physical processes driving these changes. In particular, large questions remain concerning the interaction between atmosphere-ice sheet, and ocean-ice sheet processes. Observing platforms that can measure ice dynamics and the evolution of subglacial discharge or fjord circulation will help address these uncertainties. The glaciology community has very few long-term observing networks, yet there is a great need for ground-based measurements that operate in concert with remote sensing and airborne campaigns.

Because the glaciology community does not have a strong presence in the current AON framework, we found it hard to address the specific questions outlined for each session.

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

Instead, our discussion revolved around these alternate questions.

<u>Question 1:</u> What are the advantages of having a network as opposed to smaller projects?

Since ground-based monitoring of ice sheet and glacier dynamics is fairly scarce, collaboration and data sharing tend to be strong. However, it is difficult to compare observations from different glaciers/time periods/scales of measurements because each glacier is unique, even over short time periods. A network of observations allows for a direct comparison between different processes occurring coincidentally. Networks allow for interdisciplinary observations that are often not feasible in single PI grants.

One additional limiting factor in modeling and understanding glacier change that can benefit from shared measurement campaigns is improved knowledge of outlet glacier bed geometry and fjord bathymetry. For many glacier systems in Greenland, Arctic Canada, and Alaska, the bed is poorly known, fundamentally limiting efforts to model evolving flow.

<u>Question 2:</u> What opportunities exist to address new science questions?
Our group was most excited about developing observational networks to address two main science questions: "What is the freshwater budget of ice sheets (Can we close the freshwater budget?)" and "How does water move from the ice sheet to the open ocean"? These are two fundamental glaciology questions that are difficult to address without an interdisciplinary network of observations. These questions give us specific targets to address processes related to surface mass balance, plume dynamics, characterization of subglacial discharge, and freshwater budgets.

In addition, a network focused on understanding the processes of how meltwater gets to the ocean would complement several currently funded projects aimed at understanding ice-ocean interactions. If co-located, these complimentary networks could yield great insight into the full trajectory of a water molecule – as it falls on the ice sheet as snow, melts, is transported to the base of the ice sheet, travels subglacially through cavities or tunnels, emerges as a subglacial plume, and circulates through the fjord. An observational network is the only way to feasibly connect all this interdisciplinary work.