

Theme 2 – Observations of Arctic change

- Observations of Arctic change (Perovich & Gascard)
- Design and optimization of an integrated Arctic observing system (Uttal & Eicken)
- Arctic change and natural variability (Murray & Tweedie)
- Understanding Arctic change and projection of future state of the Arctic system (Tjernström & Marshall)
- Responses to Arctic change (Hamilton & Forbes)

Understanding Arctic change

- “Polar Express” flushed large amount of multiyear ice out of Arctic, resulting in a younger ice cover less resilient to summer ice loss (Nghiem)
- Aircraft-based ice thickness surveys becoming more viable option to fill ice-thickness gap & show shift in ice thicknesses to thinner level ice (Haas)
- Radiation budget affected by reduction in Arctic sea ice age, with younger ice showing lower albedo (Tschudi)
- Blobs of warm North Atlantic water circulating at depth; some of this heat ($<2 \text{ W m}^{-2}$) returned to the ice cover (Polyakov)

Understanding Arctic change

- Current best estimate for loss of perennial Arctic sea ice cover is by roughly 2040 (Wang & Overland)
- GCM studies indicate that loss of perennial sea ice is reversible (50-100 yr time scale) if greenhouse gas forcing returns to 20th-century levels (Holland)
- Arctic haze and black carbon levels are decreasing (relative to the 1980s) (Stone et al.)

Observing system design & optimization

- Circumpolar Biodiversity Monitoring Project has been successful in compiling biodiversity data through strong pan-Arctic collaboration; value of index parameters (Gill)
- Autonomous platforms have made significant advances during IPY, with potential to transform key aspects of ocean observing networks (Lee et al.)
- Explorations with early-stage Arctic social system model highlight data shortcomings and may aid in observation planning (Berman)
- Time is ripe to explore integration of systems by creating a network of networks

Arctic change and natural variability

- Lake Ahtna megaflood one of largest on record, indicates potential role of (supra-)glacial floods as extreme events
- Large-scale disturbances can cause large drops in land-surface albedo and thermo-karst development
- Beaufort Sea trawls reveal northward movement of potentially commercially viable crab and fish species

Arctic change and natural variability

Work needed on –

- Response times in glaciers – controlling factors, understanding of simultaneous advance and retreat scenarios etc.
- Role of additional climate drivers to explain multi-decadal time scale variations to improve predictions on decadal timescales for northern communities
- Reconcile bottom-up/top-down estimates of methane effluxes (e.g., isotope studies, modeling)
- Across all disciplines, there is a need for sustained funding to allow for detection of change in addition to variability

Responses to Arctic change

- If Yamal development follows “best practices” & agreements, indigenous culture resilient
- Arctic change → hybridization & evolutionary change among marine mammal species.
- Herbivores modify the impacts of warming on vegetation
- Circumpolar human-dimensions database integrated with EASE-grid physical data

Responses to Arctic change

- Arctic climate change affects ecosystems in complex ways
 - Survival of specialized Arctic species & ecosystems
 - Species interactions, including herbivore/vegetation
 - Evolution as species' density and contacts change
 - 'Ice conveyor' transports pollutants rapidly to distant regions
- Warming accelerates industrialization that is altering ecosystems and social systems.
 - Traditional cultures coexist uneasily with rapid, large-scale development.
 - Local/traditional knowledge need to find common ground with science.
 - Invasive species introduce new troubles

Quote of the day

The Arctic is important, but the way we think about the Arctic is more important.

- Øystein Kristiansen