Arctic atmospheric observations for predictability studies during Polar Prediction Project

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&
many inputs from our colleagues

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Radiosondes provide important information
Arctic radiosonde observing network

✓ improvements of weather & sea-ice forecasts over NSR
  ➢ strong winds, high waves, icing caused by Arctic cyclones

✓ understanding the linkage between Arctic and mid-latitudes
  ➢ extreme events over Eurasia (e.g. severe winter)

Arctic Research Collaboration for Radiosonde Observing System Experiment

Additional Observations

Modeling

Data sparse area

Better predictions
International framework (PPP/YOPP)

◆ **Polar Prediction Project (2013–2022):** PPP
  • Initiated by World Meteorological Organization (WMO) in 2013
  • Mission: Promote cooperative international research enabling development of improved weather and environmental prediction services for the polar regions, on time scales from hours to seasonal

◆ **Year of Polar Prediction (mid–2017 to mid–2019):** YOPP
  • Mission: Enable a significant improvement in environmental prediction capabilities for the polar regions and beyond, by coordinating a period of intensive observing, modeling, verification, user-engagement and education activities
Combination of observations and modelling

✓ Frequent radiosonde obs. from ships & land stns.
   RVs Mirai & Polarstern, Ny-Alesund, etc.
   ➢ Improvements of NWPs and reanalyses

✓ Data assimilation (DA)
   Observing System Experiment (OSE)
   ➢ Evaluating the effect of intensive observations
   ➢ Assessing the cost-benefit observing frequency
   ➢ Proposing a sustainable Arctic observing network
Ensemble reanalysis approach

Global observations

Additional Obs. (radiosondes)

Control Reanalysis

Reanalysis w/o extra obs

Data assimilation

Atmospheric forecast

Sea-ice forecast

Predictability of extreme events

Predictability of sea ice over NSR

JAMSTEC ALERA2 Observing system experiments

Inoue et al. (2009)
Inoue et al. (2013)

Yamazaki et al. (2015)

Ono et al. (2016)
Application to forecasting Arctic cyclones

Special observations from RV Polarstern improved the forecast skill of the great Arctic cyclone on Aug. 6, 2012.

Central pressure was well predicted if observation data was used. Central pressure did not develop w/o observations.

Yamazaki et al. (2015 JGR-A)
GTS status in NCEP ADP Global Upper Air Observations

→ 22 launches per day during ARCROSE

ARCROSE 2013 & 2014
Estimation of cost-benefit observing frequency

6-hourly observations (4 launches per day) are effective

Inoue et al. (2015, Sci. Rep.)
Pre-YOPP ARCROSE activities in 2015

Radiosondes from **RV Lance**, **Eureka**, **Jan Mayen** and **Bear Island** are suitable data set for predictability studies of cold extremes over Eurasia and North America.

**East Asia** (9 Feb. 2015)

**North America** (15 Feb. 2015)
Deepening of a cyclone over the North Atlantic is strong in CTL compared with OSE.
Cold air mass reached at Georgia in CTL.

Sato et al. (2016, in prep.)
Japanese flagship Arctic project

Arctic Challenge for Sustainability

◆ ArCS mission:
To elucidate the climate and environment changes, clarify their effects on human society, and provide the accurate projections and environmental assessment for the internal and external stakeholders so that they can make appropriate decisions on the sustainable development of the Arctic region.

Theme 1: Predictability study on weather and sea-ice forecasts linked with user engagement (PI: Jun Inoue)

http://www.arcs-pro.jp/en/
Schedule of RV Mirai in 2017, 2018 & 2019

- **Sep. - Oct. 2017 (PI: Takashi Kikuchi)**
  - Predictability studies of Northern Sea Route
  - Chukchi and Beaufort Seas
  - Possible to collaborate with other ships and stations (e.g. Ny-Alesund)

- **Nov. – Dec. 2018 (PI: Jun Inoue)**
  - Predictability studies of weather extremes at mid-latitudes
  - Fixed point observation over Bering Sea
  - Possible to collaborate with other stations (e.g. Ny-Alesund)

- **Oct. - Nov. 2019 (PI: Jun Inoue)**
  - Collaborative cruise for MOSAiC
  - Marginal ice zone in Chukchi Sea