KPOPS

The Korea Polar Prediction System for Climate Change and Weather Disaster

Principal investigator

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Areas of contribution

Polar atmospheric processes

Modelling and forecasting

Polar-lower latitude linkages

Observations

Data assimilation

Summary

KPOPS is a 4-year project funded by the Korea Polar Research Institute (KOPRI) that aims to achieve predictability of Arctic-midlatitude climate change and weather disasters by enhancing Arctic atmospheric observations and by improving climate/weather forecast models. KPOPS is also a name of the models to be developed, which includes both the global climate model (KPOPS-Climate) and the weather forecast model (KPOPS-Weather).

Description

KPOPS is a 4-year project (2016 to 2019) funded by the Korea Polar Research Institute (KOPRI) that aims to achieve predictability of Arctic-midlatitude climate change and weather disasters by enhancing Arctic

atmospheric observations and by improving climate/weather forecast models. KPOPS is also a name of the models to be developed, which includes both the global climate model (KPOPS-Climate) that have targeting time scales of subseasonal to seasonal and the weather forecast model (KPOPS-Weather).

The objectives of KPOPS are three-fold. The first objective is to develop a boundary layer/cloud microphysics scheme for improving the model performance in the Arctic. To achieve this objective, we establish the Ny Alesund-based cloud and boundary layer observing infrastructures and enhance the Korean icebreaker research vessel IBRV Araon-based meteorological observations. At Ny Alesund, we aim to operate a four-season boundary layer wind observing instrument (Doppler Wind Lidar) and perform special observations of cloud microphysical properties. On IBRV Araon, we continue to perform the surface meteorological observations, the upper-air sounding by launching the radiosonde, and the Lidar remote sensing of clouds and aerosols. In addition, the data are used to study the aerosol-cloud interaction in the Arctic. The next objective is to operate polar weather and climate prediction systems (KPOPS-Climate and KPOPS-Weather). KPOPS will improve the predictability of the Arctic-Eurasia teleconnection and also provide the weather and sea ice information during the Arctic ship operation. The final objective is to study the Arctic-midlatitude teleconnection, especially for the east Asian region. Whether there is a physical linkage between the Arctic and the climate/weather extremes over east Asia is continuously investigated with our improved model and other multi-model data.

The current version of KPOPS-Climate is based on NCAR CAM5 and CLM4 with a land initialization module and a statistical sea-ice prediction model. The NCEP CFS seasonal forecasts are used to prescribe sea-surface temperature and the statistical prediction model provides the forecast of Arctic sea-ice concentration to provide the sea ice boundary condition. Further plans include development towards a coupled prediction system (with the ocean and sea ice components of the NCAR CESM), sea-ice initialization module, replacement of the dynamic core and convection scheme of the atmospheric model and observation-based improvement of a boundary layer/cloud microphysics scheme. The current version of KPOPS-Weather is based on a polar WRF model and WRF data assimilation. The NCEP GFS forecast data are used to force this model. When the Araon radiosonde observation is ready and off-line (i.e., not used by the NCEP GFS forecast), the data assimilation system produces an updated analysis with the Araon radiosonde observation to be used as the initial condition of the next forecast step. In parallel with the KPOPS-Climate, further plans include ocean and sea-ice coupling and additional physics options of convection and cloud microphysics.

The project period matches well with the Year of Polar Prediction (YOPP) as YOPP was our target international flagship activities when planning this project. By sharing our observation and model data with the YOPP partners, our plans for enhancing Arctic observations and model predictions pursue an active contribution to YOPP.

Timeline

2016-01-01 - 2019-12-31

Regional emphasis

Northern hemisphere: Yes

Southern hemisphere: No

Further specification

Ship-borne observation: Chucki Sea, East Siberian Sea, and Beaufort Sea
Land observation: Ny Alesund
Model: Pan-Arctic and Eurasia

Key project deliverables

- Radiosonde sounding, ship-borne meteorological variables, Lidar data (Doppler Wind Lidar, Micro Pulse Lidar), etc.
- Polar weather and climate prediction systems with improved boundary layer/cloud microphysics schemes
- Improved predictability of the weather and climate extremes over East Asia originating from the Arctic-midlatitude teleconnection
- Regional model prediction for the Arctic while Korean IBRV Araon is operating in the Arctic Ocean

Data management

Korea Polar Data Center (http://kpdc.kopri.re.kr) and the YOPP online data archive centre

Is data provided to WMO Global Telecommunication System

Yes

Real-time provision

by the GTS and/or by direct upload on the YOPP data repository

Timelines

Location	Latitude	Longitude	Start date	End date	Activity
Chukchi, East Siberian and Beaufort seas	70~80N	170E-130W	2017-08-08	2017-09-12	Ship-borne observations of surface and upper-air meteorological variables
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Ny Alesund	78.9N	11.9E	2017-09-15	2017-09-28	Tether-sonde observation of size distribution and number concentration of clouds and aerosols (Note: Exact date is not yet determined.)