JANUS

Joint Arctic research on New and Unusual States

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Areas of contribution

User-aspects and verification

Polar atmospheric processes

Oceanic processes

Modelling and forecasting

Polar-lower latitude linkages

Observations

Sea ice processes

Data assimilation

Data archiving

Outreach
Summary

The JANUS project is a Japanese joint research project to understand the uncertainty of the state of the `New Arctic'. JANUS focuses on the water cycle in the Arctic in particular. To understand the conditions of the new and unusual Arctic, the effects of snow/rain on sea ice, precipitation systems including clouds and aerosols over the land and ocean, and their impact on the oceanic structure will be investigated by both observations and numerical models. A challenging goal of the JANUS project is to understand an impact of latent heat release from condensation in the Arctic on atmospheric circulations in the mid-latitude through a development of a global non-hydrostatic cloud resolving model tuned for the `New Arctic'. This provides new insight into understanding the linkage between the Arctic climate change and mid-latitude extreme weather events. JANUS research activities consist of (1) enhancing the observation network based at Ny-Alesund and the Japanese research vessel (RV) Mirai, (2) participating in the MOSAiC drift, (3) modeling efforts by using a data assimilation system and cloud resolving models, and (4) archiving the aforementioned data. The year-round field program with RV Polarstern and the related distributed observing network will provide a comprehensive data set, improving our cloud resolving models and providing us a chance to participate in the regional model intercomparison project (Arctic CORDEX).

Description

The JANUS project consists of three research components:

1. Field activities at RV Mirai and Ny-Alesund
On RV Mirai, we will conduct 6-hourly radiosonde observations, CTD casts, polarimetric scanning C-band Doppler radar observations, aerosol samplings using SP2 and other instruments, and CO2 measurements in the atmosphere and ocean. We are also testing special radiosonde observations with the Cloud Particle Sensor (CPS sondes made by Meisei Electric Co., Ltd.) during the cruise to obtain vertical profiles of cloud particle size distribution and concentration. The cruise period in the Arctic Ocean is scheduled from mid of October 2019 to early November 2019, which would be the beginning of the MOSAiC drift. Dr. Inoue (NIPR) will serve as a cruise leader. The ship time has been secured by the Japanese Arctic research project (ArCS). The data obtained by RV Mirai which covers the ocean to the atmosphere at a fixed point over the ice-free Arctic Ocean would be a suitable validation data set for the Arctic CORDEX.

At the Japanese station in Ny-Alesund, intensive aerosol measurements will be scheduled in collaboration with the Cold-air Outbreaks in the Marine Boundary Layer Experiment (COMBLE) project. Dr. Tobo (NIPR) has started to observe ice nucleation particles (INP) concentration on Mt. Zeppelin. His original filter-based collection technique of immersion freezing will provide the data that describe the upstream/downstream INP conditions from RV Polarstern during the MOSAiC drift. An Optical Particle Counter (OPC) and an Optical Particle Sizer (OPS) will be used to collect coarse particles.

2. Field activities around RV Polarstern:
When JANUS is funded, we will send two researchers to RV Polarstern. Dr. Nomura (Hokkaido University) is a biogeochemist who is an expert in CO2 exchange process between sea ice and atmosphere. He has already participated in considerable discussion of his participation on the ship with the Bio-Geochemistry team members. He is responsible for CO2 flux measurements using gas chambers during the leg-5. Dr. Kawaguchi (The University of Tokyo) is a physical oceanographer who is an expert in measuring the ocean turbulence in
the Arctic Ocean. He has also participated in discussions with the Ocean team members. He is responsible for turbulent heat flux measurements under the sea ice, including the operation of CTD/ADCP/water-sampling.

3. Numerical Experiments
The JANUS project uses three types of numerical models. One is a data assimilation system (ALEDAS2: Dr. Yamazaki) based on a GCM developed by JAMSTEC, which can provide ensemble atmospheric reanalysis products and can evaluate impacts of extra observations (e.g., radiosondes, drifting buoys) on atmospheric circulations by data denial experiments. This component is very important to understanding the predictability of extreme weather events in the Arctic and beyond. This predictability study is linked with the goal of the Year of Polar Prediction (YOPP). The second numerical model is a global cloud resolving model (NICAM: Dr. Nasuno) and its coupled version (NICOCO: Dr. Kubokawa) which have been developed by JAMSTEC and The University of Tokyo. NICAM provides the daily predictions for field campaigns (e.g. RV Mirai), and will be validated and improved using the obtained data, including MOSAiC observation data. NICOCO will be used to understand physical mechanisms of air–ice–sea interactions under extreme weather events, such as Arctic cyclones. The last numerical model is a regional cloud resolving model (NHM-SMAP: Dr. Niwano) which was developed by Meteorological Research Institute, Japan Meteorological Agency. This model also provides daily forecast data to RV Mirai, and would be validated by the obtained MOSAiC data.

NICOCO and NHM-SMAP have been already nominated as the Arctic CORDEX modeling components. NICOCO is a global non-hydrostatic cloud resolving model with a full dynamical ocean, while NHM-SMAP is a regional cloud resolving model with a snow metamorphism and albedo process. Both unique features would be compared with other models under the Arctic CORDEX framework.

**Timeline**

2018-07-01 - 2023-03-31

**Regional emphasis**

Northern hemisphere: Yes

Southern hemisphere: No

**Further specification**

Focused areas: The MOSAiC drift, Ny-Alesund, Chukchi Sea, and mid-latitudes in NH

**Key project deliverables**

We will conduct 6-hourly radiosonde observations on GTS by RV Mirai.
Cruise periods:
24 October 2018 to 7 December 2018 (cruise leader: Dr. Inoue)
early October 2019 to end of November 2019 (cruise leader: Dr. Inoue)

We can also offer opportunities to deploy surface drifters (e.g. SVPs) during RV Mirai cruises in 2018 & 2019.

Experimental forecasts by NICAM and NHM-SMAP will be available during RV Mirai cruises.

Radiosonde profiles and CTD casts can be used for model verification.
E.g. the data obtained in 2014 by RV Mirai will be used for the Arctic CORDEX project.

The data denial experiments will be conducted focusing on SOPs using JAMSTEC ALERA2 system.
A global model used in Japan Meteorological Agency (JMA) could be also used for OSEs.

Data management

The data collected by JANUS researchers during the MOSAiC drift will primarily be archived at PANGAEA.
The other data (RV Mirai, Ny-Alesund, and model outputs) will be provided to the Arctic Data Archive system
(ADS: https://ads.nipr.ac.jp/portal/index.action: Dr. Yabuki), Data and Sample Research System for Whole
Cruise Information in JAMSTEC (DARWIN: http://www.godac.jamstec.go.jp/darwin/e), and other sites (e.g.
ALERA2 OPeNDAP: http://www.jamstec.go.jp/esc/fes/dods/aler2). The data collected by RV Mirai in its
previous cruise in 2014 will be used for a case study in the Arctic CORDEX as a pre-MOSAiC case study. The
data are already available for public use in DARWIN

Is data provided to WMO Global Telecommunication System

Yes

Real-time provision

Radiosonde data from RV Mirai will be sent to GTS.

Other information

The JANUS research proposal has been partly funded as Grants-in-Aid for Scientific Research (A) (4 years
from 1 April 2018 to 31 March 2022).
On 17 April 2018, we will have an additional interview from the Japan Society for the Promotion of Science
(JSPS) committee to be upgraded as the 5 years full research project.
The YOPP endorsement will be very important for an acceptance of the JANUS full proposal.