

Summary of the R/V Mirai Arctic Ocean cruise in 2017

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Under the Arctic Challenge for Sustainability (ArCS) Project, the R/V Mirai is used to collect meteorological and hydrographic data including marine biogeochemical samples in the northern Bering Sea and the Arctic Ocean from 23 August to 1 October 2017. During the cruise, the following 9 studies will be carried out.

Studies on board:

- Predictability study on weather and sea-ice forecasts linked with user engagement (NIPR)
- Ship-borne observations of trace gases/aerosols over the Arctic (JAMSTEC)
- Observational study on environmental changes in the Pacific Arctic Ocean with intensive surveys in the shelf slope area (JAMSTEC)
- How plankton responses to multi stressors such as ocean warming and acidification? (JAMSTEC)
- Response of phytoplankton community under environmental change (Hokkaido Univ.)
- Comparison of zooplankton with differences in net mesh-size, spatial distribution of zooplankton and standing stock and material flux role of Appendicularians (Hokkaido Univ.)
- Seasonal distribution of krill-eating top predators and their prey in the Chukchi Sea during fall (Hokkaido Univ.)

Studies not on board:

- Ship-board observations of atmospheric greenhouse gases and related species in the Arctic Ocean and the western North Pacific (NIES)
- Spatial and temporal changes of seawater CO₂ and CH₄ in the western Arctic Ocean (JAMSTEC)

Planned activities in the northern Bering Sea and the Arctic Ocean are shown in Figure 1. In mid-August just before the 2017 cruise, the sea ice in the intended work area retreats further north compared with that of 2016 (Figure 2). Although the planned activities may be changed due to the sea ice, weather and other conditions, we will try to complete the observations in some focused areas. In such areas, physical, chemical, and biological processes are sustaining unique marine environment and ecosystem that might be influenced by the recent Arctic warming and sea ice reduction. For example, a biological hotspot off Pt. Hope is maintained by nutrient supplies from the Bering Sea in spring blooms and by nutrient regeneration at the bottom in fall blooms. In the previous 2016 cruise, we deployed a mooring with physical, chemical, and biological sensors off Pt. Hope. The mooring data combined with detailed hydrographic and biogeochemical surveys using the R/V Mirai could shed light on the dynamics of biological hotspot and ongoing ocean acidification in this site.

Other focused area is the Barrow Canyon, where we have deployed moorings to monitor the flux of warm water from the Pacific Ocean that may impact the sea ice distribution in the Canada Basin. The water also plays an important role in the biogeochemical cycles, and therefore, we attached chemical and biological sensors to the mooring for the first time in the last year. This year we will recover the moorings and conduct multidisciplinary intensive observations to understand the shelf-basin interaction and its impact on ecosystem in response to meteorological and climate conditions.

In the basin area, the sea ice has been drastically decreasing. We found that oceanographic and biological responses to the sea ice loss are quite different between the Alaskan and Siberian sides of the region. However, on the Siberian side, data are still lacking because of heavy sea ice conditions and many biogeochemical processes may remain unknown. This year the extent of summer sea ice in the Arctic may be the lowest on record, and thus we could have a good opportunity to revisit to the Siberian side since the late 2000s. At an ice-edge area, we also have a plan to approach to the ice edge by a small working boat and conduct unique surveys using UCTD, fluorometer, water sampler, and plankton net with visual inspections of sea birds to examine the ice-edge marine environment and ecosystem. In the presentation, we will show some preliminary results obtained from the cruise in this year.

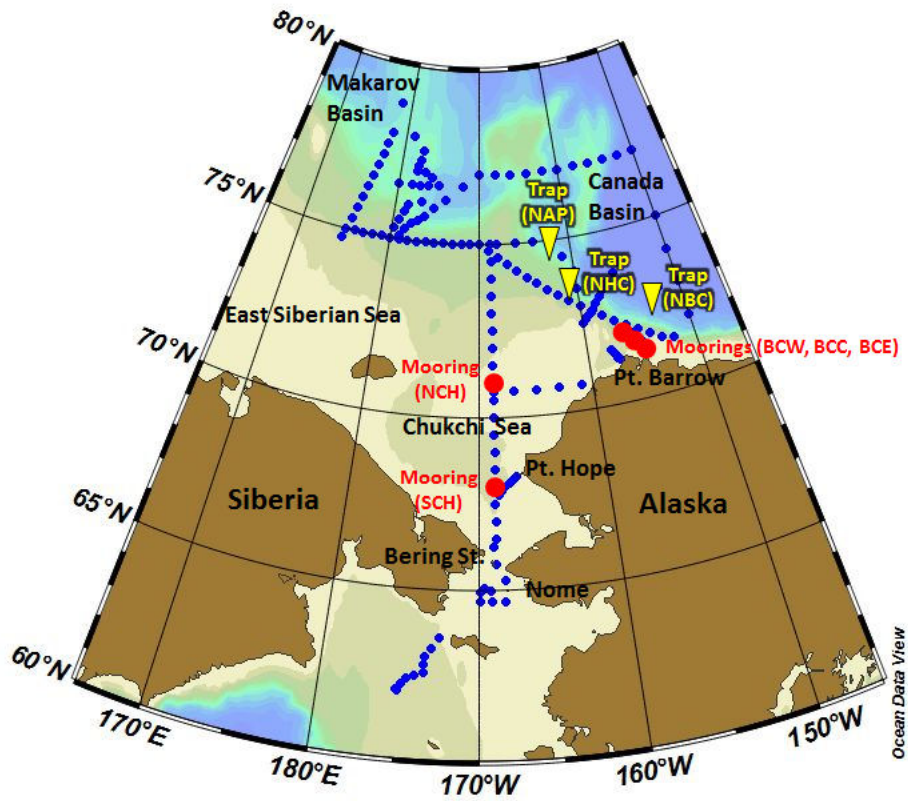


Figure 1. The geographical area of the intended work and the locations of sampling stations in the northern Bering Sea and the Arctic Ocean. Planned points of stationary observations are represented by dots. Locations of moorings and sediment traps are represented by circles and triangles, respectively.

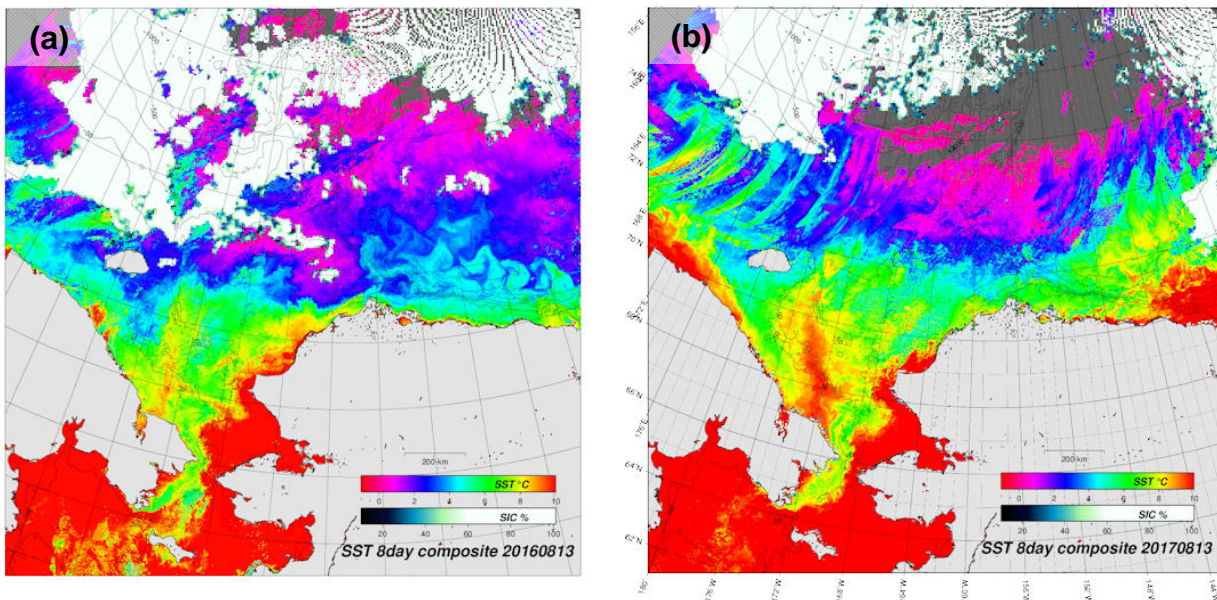


Figure 2. 8-day composites of Aqua-MODIS and NPP-VIIRS sea surface temperature and AMSR-2 daily sea ice concentration on (a) 13 August 2016 and (b) 13 August 2017.