

## Interpretation of both-polar environmental variability through the investigation of sea ice variability

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Sea ice area has been continuously monitored by satellite observations since 1970's. Long-term record of sea ice area to date reveals prominent difference between sea ice areas in the Arctic Ocean and the Southern Ocean. Drastic sea ice reduction has been observed, especially after 1990's in the Arctic Ocean, while sea ice area has gradually increased in the Southern Ocean. Although sea ice variability is considered to be the response to recent climate change, no detailed mechanisms controlling these different results is explained. To understand sea ice variability, which is one of the key mechanisms for global climate variability, the integrated/multidisciplinary investigation is quite indispensable for both polar oceans, where shows different sea ice dynamics. Sea ice variability is affected by the variability of atmosphere, ice sheet and ocean. Also sea ice variability modulates the variability of atmosphere, ice sheet, ocean and ecosystems. The atmosphere-ice-ocean system with their complicated interaction is still unclear, even the research for each process has been carried out. Resolving the mechanisms of this complicated system could contribute to forecasts of climate variability/weather/ice-navigation and conservation of ecosystem. However, few research groups cannot do this kind of effort. Hence, interdisciplinary and comprehensive research activity is needed.

Until now, the investigations in both polar oceans using available satellite observations, numerical simulation, and ice-strengthened vessel have been conducted in Japan. However, observations of the atmosphere above sea ice, the ocean underneath sea ice and ice sheet close to sea ice are big challenges for us due to the existence of sea ice. To overcome this situation, installation of Japanese own icebreaker, which can conduct direct measurements in sea ice area, is most effective solution.

Currently, Japanese research activities are usually conducted on the other country's icebreaker because Japan does not have our own icebreaker. However, the utilization of academic icebreaker will enable us to conduct interdisciplinary observational research covering the atmospheric science, glaciology, oceanography, and submarine geology. Furthermore, interdisciplinary observational research with icebreaker in both polar oceans will contribute to the interpretation of earth environmental variability through the investigation of sea ice variability. Installation of icebreaker, which is needed for breakthrough in polar science and the study of climate change, will open the door which leads to a new stage of global climatic and environmental science.

Keywords: both polar oceans, sea ice variability, atmosphere-ice-ocean system, research icebreaker