

Abrupt changes and interactions of polar oceans and ice sheets as a research subject in Master Plan 2020

*Shin Sugiyama^{1,2}, Yasushi Fukamachi^{1,2}, Kay I. Ohshima^{1,2}, Shigeru Aoki¹, Teruo Aoki³, Michiyo Yamamoto-Kawai⁴, Takashi Kikuchi⁵, Daisuke Hirano¹

1. Institute of Low Temperature Science, Hokkaido University, 2. Arctic Research Center, Hokkaido University, 3. Okayama University, 4. Tokyo University of Marine Science and Technology, 5. Japan Agency for Marine-Earth Science and Technology

Ice sheets and polar oceans are fundamental components of unique environments in the Antarctic and Arctic regions. The Antarctic ice sheet, which stores ~90% of entire ice on the globe, is interacting with the surrounding Southern Ocean characterized by Antarctic Circumpolar Current and Coastal Current. In the Arctic, the Greenland ice sheet is situated at a corner of the Arctic Ocean, discharging freshwater and sediments into the ocean from numbers of outlet glaciers. Both in the Antarctic and the Arctic, changes in the ocean are affecting mass balance of the ice sheets, and in turn physical and chemical conditions of the ocean are influenced by freshwater discharge from the ice sheets. Further, the changes in the oceans and ice sheets affect not only on polar systems, but also give impact on global environments, such as sea level rise and thermohaline circulations. Thanks to recent advance in remote sensing and numerical modelling techniques, as well as increasing amount of field data collected in the field, overview of the ocean and ice sheet systems is progressively understood. However, changes at the deeper regions in the ocean and the interior of the ice sheets are difficult to observe, and processes occurring at the ice-ocean interface are complex. Thus, further effort is needed to better understand recent changes in the polar oceans and ice sheets, mechanisms connecting the ocean to the mass change of the ice sheets, consequences of ice sheet changes to the polar oceans, and how these interactions between the ocean and the ice sheets drive global environmental changes. With this background, we present recent progress in the understanding of the polar oceans and ice sheets, and propose techniques, instruments, facilities and observational platforms, which are needed to tackle the problems for the next 5-10 years. For example, construction of a new icebreaker for operation both in the Arctic and Antarctica should help a breakthrough in the field of polar science. Development and utilization of AUV (autonomous underwater vehicle) and ROV (remotely operated vehicle) would be strong tools for understanding of the key processes of glacier-ocean interaction. The objective of the presentation is to stimulate discussion among the polar, ocean and ice sheet researchers to develop a research plan for Master Plan 2020 to be called by Science Council of Japan.

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