Towards sustained ice–ocean observation network of East Antarctica

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Along with the anthropogenic climate change, changes in overturning circulations and ice mass of the Southern Ocean and Antarctic Ice Sheet are listed as the problems with huge social implications. In Amundsen Sea, West Antarctica, accelerations of basal melting of ice shelves and loss of ice mass have been observed. More recently, ice discharge of the Totten Glacier, East Antarctica, is shown to be accelerating, and a pathway of substantially warm water access has been discovered beneath the ice shelf. The ice mass behind the Totten Glacier is estimated to be 3.5 m of global sea level equivalent, and the bed rock configuration reveals a vulnerability of the maritime ice sheet instability. The acceleration of freshwater discharge can affect sea ice production and subsequent dense water formation. With the growing awareness on the importance of ice-ocean interaction and long-term variabilities off the East Antarctic Coast, observations at the ice-ocean boundaries above and underneath the sea ice and continental ice are indispensable.

Under the project called ROBOTICA for the 9th six-year plan (2016-2022) of the Japanese Antarctic Research Expedition, we are implementing broad oceanographic and cryospheric surveys using new technologies like tethered/moored profiling platforms, Remotely Operated Vehicle (ROV) and ice radars, together with the conventional observational methods. The observations here will help revealing the ongoing oceanic and cryospheric changes and set the baselines for the future changes.

Under the GRAntarctic (2017-2022) frame work, we start developing a new Autonomous Underwater Vehicle (AUV), suitable for under-ice survey of Antarctica. The AUV is designed to operate in the following 3 modes; Seafloor Tracking mode (bathymetry, imagery), Ice Tracking mode (ice shape, imagery), and Constant Depth mode (water survey).

Development of appropriate instruments and platforms of this kind is an urgent task, given the rapid progress of the environmental changes in the ice-covered ocean. To fully utilize this instruments, the basic ability required for a mother icebreaker is high, since she needs to cope with the requirements as a platform of various state-of-the art technologies in ice-covered ocean. Moreover, flexible operation from a long-term perspective such as revisiting the sites some years later will be effective.

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