砕氷船を用いた国際海氷・海洋観測について

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International sea ice and oceanographic research using icebreaker

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Polar ocean studies, particularly, biogeochemical study, have been largely restricted to open, ice-free areas of the ocean. This is mainly due to the fact that the presence of sea ice hampers ship-born observations. However, recent icebreaker cruises have added new data from ice covered seas [*Fransson et al.*, 2011] and polynyas [*Else et al.*, 2013] for biogeochemical cycles including the interaction with the atmosphere. Although effects of sea ice formation and melting on the physical, chemical and biological processes of polar oceans have been highlighted [e.g., *Rysgaard et al.*, 2011], processes related to the freezing and melting of sea ice still represent large unknowns. So far, we have joined the international sea ice and oceanographic research projects using icebreaker: 1). ARISE: Antarctic Remote Ice Sensing Experiment on R/V *Aurora Australis*, 2003 spring, off East Antarctica, 2). SIPEX: Sea Ice Physics and Ecosystem eXperiment on R/V *Aurora Australis*, 2007 spring, off East Antarctica, 3). ICE11: Centre for Ice, Climate and Ecosystems cruise on R/V *Lance*, 2011 spring, north of Svalbard, High Arctic, 4). SIPEX2: Sea Ice Physics and Ecosystem eXperiment-2 on R/V *Aurora Australis*, 2012 spring, off East Antarctica, and 5). AWECS: Antarctic Winter Ecosystem Climate Study on R/V *Polarstern*, 2013 winter, Weddell Sea. For these cruises, we focused on the physical [*Tamura et al.*, 2006] and biogeochemical process [*Nomura et al.*, In revision] in the ice covered seas in the both hemispheres. For the next step, we have a cruise plan in 2016 summer to improve the knowledge and understanding of the retreating summer ice edge and Marginal Ice Zone (MIZ) in the Southern Ocean by R/V *Aurora Australis* to integrate data from *in situ* sensing platforms, remotely-sensed observations, and integrated process models to develop a comprehensive, quantitative picture of open-ocean, ice edge and MIZ processes, interactions and feedbacks as the ice retreats.

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