

Global mapping and monitoring of sea ice production

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【Outline of survey】

Deep ocean circulation is driven by density differences: water sinks in dense water formation areas and then gradually upwells in other areas. Saline water rejected during sea ice formation is the main source of dense water, and thus sea ice production is a key factor in deep ocean circulation. Due to the logistic difficulties of direct observations, climatologies of sea ice production and its interannual variability have yet to be presented. We will conduct mooring observations in high sea ice production areas (coastal polynyas) in the Antarctic, Arctic and Okhotsk Seas to acquire a continuous dataset of sea ice thickness/drift and ocean temperature/salinity, which has not been obtained concurrently in the past. Using these validation data, we will develop an algorithm to estimate and provide global mapping of sea ice production from satellite data. We plan to establish a monitoring system for sea ice production by combining continuous mooring and satellite observations. We will also clarify the relationship between the variability of sea ice production and deep ocean circulation.

【Expected results】

From direct observations we can clarify a previously unknown formation area of Antarctic Bottom Water suggested by our preliminary study. The dataset in this project enables us to discuss how sea ice variability is linked with recent freshening and density decreases in Antarctic Bottom Water and Okhotsk Sea Intermediate Water, and the associated weakening of overturning in the deep ocean. Changes in deep ocean circulation will greatly affect global climate and ecosystems. This is the first global mapping of sea ice production, which can be used for comparison/validation with coupled ocean-ice-atmosphere models. The mapping also provides surface heat and salt flux conditions in the sea ice covered regions, which have not been clearly understood.

【References by the principal investigator】

- Tamura, T., K. I. Ohshima, and S. Nihashi, Mapping of sea ice production for Antarctic coastal polynyas, *Geophys. Res. Lett.*, 35, L07606, doi:10.1029/2007GL032903, 2008.
- Ohshima, K.I., T. Watanabe, and S. Nihashi, Surface heat budget of the Sea of Okhotsk during 1987-2001 and the role of sea ice on it, *J. Meteor. Soc. Jpn.*, 81, 653-677, 2003

【Term of project】 FY2008—2012

【Budget allocation】

162,400,000 yen (direct cost)

【Homepage address】

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