

【Grant-in-Aid for Scientific Research(S)】

Integrated Science and Innovative Science (New multidisciplinary fields)



Title of Project : Elucidation of thermohaline/biogeochemical circulation systems connecting the Sea of Okhotsk with subarctic North Pacific Ocean

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Research Area : New interdisciplinary fields, Environmental science

Keyword : Ocean thermohaline circulation

【Purpose and Background of the Research】

One of primary processes that foster abundant production in the Oyashio area is due to the fact that dissolved iron is transported from the northwestern continental shelves in the Sea of Okhotsk to the remote Oyashio area. The iron transportation is made with thermohaline circulation in the Sea of Okhotsk driven by dense shelf water (DSW), which is formed when sea ice is produced over the northwestern shelf. DSW production and intensity of thermohaline circulation depends on competitive processes between fresh water input from Amur River and saline water from the North Pacific Ocean. However, estimation of the saline water transport, which is a key parameter for determining the thermohaline circulation intensity, has been lacking because there are almost no in-situ measurements in the area spanning between the East Kamchatka Current and the eastern Sea of Okhotsk. In this project, we will conduct intensive observations in this data-vacant area to elucidate subtle and miracle mechanisms of the iron transport system from the Sea of Okhotsk to the North Pacific Ocean. Specifically:

- (1) Measurement of thermohaline transport in the area of the East Kamchatka Current and the eastern Sea of Okhotsk.
- (2) Quantitative description of iron circulation in the North Pacific by investigating a potential source of iron off the Kamchatka Peninsula.
- (3) Elucidating entire system of thermohaline and material circulation spanning between the Sea of Okhotsk and the North Pacific Ocean.

【Research Methods】

Intensive observations will be conducted in the eastern Sea of Okhotsk and the East Kamchatka Current areas in 2011 and 2012 using Russian vessels. The observations include:

- Measurements of thermohaline transport by mooring systems that measure temperature, salinity and current velocity.
- Lagrangian measurement of temperature and salinity by profiling floats.
- Measurements of various nutrients and biological parameters in several sections across

the East Kamchatka Current by Russian vessels, including iron transport processes originating from the continental shelves off the Kamchatka Peninsula.

Based on the above in-situ observations, numerical simulations, hydrographic dataset produced by a Russian institution and satellite measurements are integrated to elucidate entire system of thermohaline and material circulation spanning between the Sea of Okhotsk and North Pacific Ocean.

【Expected Research Achievements and Scientific Significance】

It is the scientific merit of this project that is to elucidate thermohaline circulation processes whose strength is controlled by the consequence of competitive processes between fresh water input from Amur River and saline water flux from North Pacific. Our target is to understand the miracle processes of the Okhotsk thermohaline circulation quantitatively which fosters abundant fishery resources of this area. We are convinced that completion of this project, which concludes the Japanese-origin, decade-long exploration of this miracle system, will be a first step for further understanding of the earth system in depth.

【Publications Relevant to the Project】

Wakatsuchi, M., 2009, A mystery of rich ocean. Trends in the Sciences (JSC Forum), 54-59, December issue.

Ohshima, K.I., T. Nanowatari, S. Riser, M. Wakatsuchi (in press), Seasonal variation in the in- and outflow of the Okhotsk Sea with the North Pacific, *Deep-Sea Res., II*.

【Term of Project】 FY2010-2014

【Budget Allocation】 167,700 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.woc.lowtem.hokudai.ac.jp/>