Optical tracer method to distinguish fresh water sources in the Pacific Arctic region

*Amane Fujiwara[1], Atsushi Matsuoka[3], Shigeto Nishino[1], Hisatomo Waga[2], Toru Hirawake[2], Takashi Kikuchi[1]

1. Japan Agency for Marine-Earth Science and Technology, 2. Faculty of Fisheries Sciences, Hokkaido University, 3. Takuvik Joint International Laboratory, Université Laval

Recent freshening of the Arctic Ocean caused notable changes in ocean environment and circulations. Both increases in sea ice melt water and river discharge are known to have a large effect on the freshening. Chemical tracers, oxygen isotope ratio and total alkalinity (TA), are used to distinguish fresh water sources to understand their contribution to the freshening and distribution of the water masses. However, estimation of fresh water sources using chemical tracers has a disadvantage in high frequent sampling, because it takes considerable time to measure. In this study, we propose a method to discriminate water sources using absorption of CDOM (a_{CDOM}) for the Pacific Arctic region.
We obtained salinity, TA, and a_{CDOM} at 443 nm ($a_{CDOM}(443)$) from the seven cruises of R/V Mirai conducted in the Pacific Arctic region during late summer. Fraction of sea ice melt water (f_{SIM}) and other fresh water (f_{OF}) were calculated from their known end-member values of salinity and TA. We identified a $_{CDOM}(443)$ end-member values of f_{SIM} and f_{OF}, which were unknown, applying a least-square method to the relationship between fresh water fraction and $a_{CDOM}(443)$. Thus, f_{SIM} and f_{OF} became retrievable from salinity and $a_{CDOM}(443)$ instead of TA. We also evaluated the accuracy of the optical tracer method comparing fresh water fraction values calculated from chemical and optical tracers, and obtained equivalent results to the chemical tracer method. Estimation of fresh water sources with higher frequent monitoring using a_{CDOM} might advance the comprehension of ocean circulation and related chemical- and biological system in the Arctic.

Keywords: absorption of CDOM, Pacific Arctic region, fresh water sources

