

The spatiotemporal chlorophyll-a distribution under the influence of the changing Arctic ice-ocean circulation

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Recently, drastic sea ice reduction and changes in ocean circulation have been observed in the western Arctic Ocean. Changes of oceanic physical environment have an impact on both climate system and marine ecosystem. In the western Arctic Ocean, phytoplankton biomass is a key parameter to understand the whole ecosystem, because of short food chains. In this study, we investigated recent changes in the spatio-temporal chlorophyll-a (chl-a) distribution in the western Arctic Ocean, using hydrographic/biogeochemical datasets from R/V Mirai cruises and the SBI (Western Arctic Shelf-Basin Interactions Project) database, and satellite multi-sensor remote sensing.

Satellite ocean color sensors, SeaWiFS and MODIS show northwestward long distance transport of high chl-a waters from Barrow Canyon and from the estuary of the Mackenzie River to the Canada basin in 2007 and 2008. This basin-ward transport was due to the intensified Beaufort clockwise ice-ocean circulation, which was confirmed by the AMSR-E ice motion dataset. On the other hand, in-situ measurements revealed the increased chl-a values in the surface layer (5-50m water depth) over the Northwind Ridge (NWR) and Chukchi Plateau (CP) in 2004 and 2008, when wide open water was formed. In 2008, relatively high chl-a was also found at northern Chukchi shelf-slope. Those results indicate that chl-a at NWR and CP was increased due to both increased light availability and increased horizontal advection from the Chukchi Sea shelf via canyons. Future response of primary productivity to the Arctic ice-ocean-climate system also will be discussed.