Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

ACG031-05 Room: 301B Time: May 28 09:58-10:11

Transportation of colored dissolved organic matter (CDOM) from the northeastern Bering Sea to Chukchi Sea

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Abrupt reduction of sea-ice in the western Arctic Ocean was observed in 2007. It is suggested that the sea-ice retreat was attributed to inflow of warm Pacific Summer Water (PSW) driven by the Alaska Coastal Current (ACC), which flows along coastal line of Alaska and has high temperature and low salinity. The ACC also transports freshwater contained terrestrial organic materials to the Chukchi Sea due to running through the estuary of Yukon River mouse. Hill (2008) reported that light absorption by high concentration of colored dissolved organic matter (CDOM) in the freshwater represented a significant factor in the heat budget of surface Chukchi Sea and had the potential to account for 48 % of the springtime ice melt driven by water column heating. Hill (200 8) also expected that source of CDOM in the northern Chukchi Sea in spring and summer was not the freshwater from Yukon River. However, distribution of CDOM between Yukon River mouse and Chukchi Sea in a same season has not been investigated. Therefore, we examined the CDOM distribution in these areas.
Data were collected in July and August 2007 (summer) and in June and July 2008 (spring) by T/S Oshoro-maru in the Chukchi shelf and northeastern Bering Sea. Profiling of temperature and salinity and water sampling were carried out with a CTD. Chlorophyll a concentration (chl-a) and nutrients of the water sample were also analyzed. Profiles of absorption coefficients by CDOM (a_{CDOM}) were collected with in situ spectral absorption and attenuation meter (ac-s, WET Labs, Inc.) attached 0.2 um capsule filter (Pall, Inc.) to inlet of reflecting tube. The definition of ACC is water mass with temperature > 6 oC and salinity < 32 psu, which is characteristics of Pacific Summer Water (PSW: salinity range $31.0 < S < 32.0$). We then examined the distribution of a_{CDOM}in the ACC and relationship between $a_{CDOM}$and the other parameters to find sources of CDOM and its impact on surface ocean heating.
The a_{CDOM}in 2007 (summer) were high (> 0.11 m^{-1}) in both surface waters of Yukon River mouse and northern Chukchi Sea. These water mass had the characteristics of ACC. In the Bering Strait, however, a_{CDOM}were relatively low and the characteristics of water mass was different from those of ACC. In contrast, aCDOM in 2008 (spring) were low (about 0.065 m^{-1}) except high value around Yukon River mouse (about 0.11 m^{-1}). These results suggested that freshwater from the Yukon River was possibly transported to the surface Chukchi Sea in summer. Therefore, a_{CDOM}may accelerate sea-ice reduction, if the ACC maintain high temperature due to heat from absorbed energy by CDOM. Moreover, nutrients were depleted and chl-a concentration was very low in the surface water Yukon River mouse in summer of 2007. Therefore, sunlight energy was converted to heat by the CDOM absorption with little use for photosynthesis. However, spatial feature of CDOM obtained from these results were limited. Further research using satellite remote sensing will be required to reveal the impact of CDOM on sea-ice retreat.

Keywords: CDOM, Light absorption coefficient, Alaska Coastal Current