B10-P05

SPATIAL AND TEMPORAL DISTRIBUTIONS OF HIGH TURBIDITY OCEAN WATER OFF THE NORTHWESTERN GREENLAND COAST

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A large number of outlet glaciers discharge turbid freshwater from the Greenland ice sheet to the ocean. The magnitude and timing of the freshwater discharge give impact to the coastal marine environment. For instance, an increase in glacial meltwater inflow to the ocean results in the formation of dense phytoplankton blooms in surface waters. Recent observation off the western Greenland coast revealed high turbidity plume in the upper layer (0–150 m) within 1 km from the glacier front. Despite its importance in the environment near the Greenland coast, only a few observational data are available on such turbid water from the Greenland ice sheet. On the other hand, remote sensing reflectance at the wavelength of 555 nm (Rrs555) is commonly used in other regions to analyze the distributions of turbid water in the ocean.

Here, we report spatial and temporal distributions of high turbidity water off the northwestern Greenland coast (76–78°N, 65–75°W) based on remote sensing data analyses. Rrs555 was used to locate high turbidity area generated by the inflow of turbid glacial water. Satellite data used for this study were obtained from the NASA Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua multispectral platform. The data has a spatial resolution of 4 km and temporal resolution of 8 days. By analyzing this data set, spatial extent of high turbidity area (Rrs555>0.0070 sr^{-1}) was determined from 2002 to 2014. High turbidity area was generally distributed near the coast where many outlet glaciers terminate in the ocean and on the land. The annual maximum extent of high turbidity area largely varied from year to year (4400±2010 km^2). The area extended to greater than 7000 km^2 in 2003, and then it shrank to below 1500 km^2 in 2004. The maximum extent of high turbidity area was correlated with the summer (June, July and August) mean temperature recorded at Qaanaaq Airport (77°28'N, 69°14'W; z=16 m a.s.l.) (R=0.72, p<0.01), whereas the correlation with 8-day mean wind stress was poor (R<0.1). These results suggested that the source of the observed turbid water was the discharge of glacial meltwater rather than re-suspension of sediments by wind mixing.