

NUTRIENTS IN MELT PONDS AND SNOWS ON ARCTIC SEA ICE DURING 2014 SEA ICE CAMP

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ABSTRACT

Melt ponds are the most distinctive summertime feature of Arctic sea ice, which are formed by melting snow and surface sea ice due to surface melt driven by increased short-wave radiation absorption in summer. Although considerable effort has been devoted to investigate physical processes and feedbacks of melt ponds, relatively little is known about biogeochemical properties of melt ponds. To examine chemical components of nutrients (NH_4 , NO_2+NO_3 , PO_4 and SiO_2) in different types of melt ponds (i.e., closed and opened ponds) and differences of nutrients in between melt ponds and snows near melt ponds, a total of 36 melt ponds and snow samples were collected at two different sea ice stations located in northern part of the Chukchi Sea during the ARA05B cruise aboard Korean icebreaker *Araon*. In the closed melt ponds (salinity \approx zero), NH_4 and NO_2+NO_3 showed high concentrations, whereas PO_4 concentrations were low and SiO_2 was not detected. In contrast, in the opened ponds (salinity \approx surface seawater), both nitrogen species were depleted as those in surface seawater, while PO_4 and SiO_2 concentrations were as high as those in surface seawater. In snow samples, mean NH_4 concentration was about 9 times higher than that of NO_2+NO_3 , probably due to NO_2 and NO_3 losses in snows by photolysis. Likewise SiO_2 in the closed ponds, SiO_2 in snow samples was not detected. From these results, it was suggested that not only salinity, but also nitrogen species, especially NH_4 , and SiO_2 can be used as an indicator to distinguish between the closed and opened ponds, and that high NH_4 concentrations in the closed ponds were derived from snows. In addition, all nutrients species concentrations in surface and deep waters of the opened ponds showed large differences, suggesting that the melt pond waters were strongly stratified. Although no statistically significant relationships were found between chlorophyll a and nutrients variation trends, chlorophyll a concentrations in both types of melt ponds were higher than those in surface seawater, implying that additional nutrients supplied to the melt ponds from snows might contribute to more high biological activities in the melt ponds. Considering that the Arctic Ocean is currently experiencing rapid environmental change, such as warming and decreases in sea ice concentration and thickness, the role of melt ponds could be important. Further studies on biogeochemical cycles in the melt ponds therefore are required to improve understanding of the Arctic marine ecosystem more clearly.