Seasonal change in the relationship between pH and AOU in the Ariake Sound and the Amakusa-nada

*Koichi Hideshima[1], Ryo Nakayama[1], Shigenobu Takeda[2]

1. Faculty of Fisheries Nagasaki University, 2. Graduate School of Fisheries and Environmental Sciences Nagasaki University

The absorption of increasing atmospheric CO2 by the ocean causes decline in the pH of sea water, which is termed ocean acidification. Responses to the acidification in coastal and marginal seas are highly complex and the process remains far less understood compared with the situation in the open ocean. In this study, we conducted field observations of pH in the productive and semi-enclosed Ariake Sound, and the open Amakusa-nada, which is located in the west of the Ariake Sound, in western Kyushu, Japan. Relationship between pH and apparent oxygen utilization (AOU) were analyzed using data collected during spring to autumn in 2016-2017, because carbon and oxygen cycles are tightly linked through photosynthesis, respiration and remineralization.

Vertical seawater samples were collected on 3 cruises at Amakusa-nada in June, August and October 2016, and 2 cruises along a transect from inner part of the Ariake Sound to the Amakusa-nada in May and September 2017. The pH of seawater was determined using a glass/reference electrode cell on the total hydrogen ion concentration pH scale. Temperature, salinity and dissolved oxygen (DO) data obtained by CTD sensors were used for calculation of AOU.

In the Ariake Sound, low pH (<7.9) waters were observed near the bottom in the inner area both in May and September. There was the correspondence in distribution between low pH and low DO waters, as well as high pH and high chlorophyll waters. In the Amakusa-nada, the low pH values, as low as <7.6, were measured in the deep water throughout the observation period. An inverse relationship between pH and AOU was obtained from the field data collected in the Ariake Sound and the Amakusa-nada, suggesting that the release of CO2 by biological decomposition of organic matter in the water column is playing a major role in lowering the pH of seawater. The observed decrease in pH for each unit increase in AOU (Δ pH/AOU) was different between the inner part of the Ariake Sound and the offshore area in September. When AOU values of the intermediate and deep waters were below ca. 100 μmol/L, the ΔpH/AOU showed increasing trend from spring to autumn in the Amakusa-nada. These results suggest that seasonal change in the quality of decomposing organic matters could have influence on the relationship between pH and AOU in the Amakusa-nada.

Keywords: pH, Oean acidification, AOU

