Modelling the impact of riverine and atmospheric nitrogen inputs on the marine biogeochemistry

*Maki Noguchi Aita[1], Michio Watanabe[2], Tomohiro Hajima[3]

1. Research and Development Center for Global Change, Japan Agency for Marine-Earth Science and Technology, 2. Project Team for Risk Information on Climate Change, Japan Agency for Marine-Earth Science and Technology, 3. Department of Integrated Climate Change Projection Research, Japan Agency for Marine-Earth Science and Technology

Nitrogen in the ocean plays a key role in primary production, and biological activities, such as assimilation of phytoplankton and decomposition of organic matter are well studied. However, nitrogen cycle of the basin scale is still unclear because of the quite long time scale of the processes such as denitrification, sediment processes, and advection caused by meridional overturning circulation. Furthermore, the impact of the atmospheric and riverine nitrogen input has not been clarified. Human activities will change the nitrogen cycle in the ocean shifting riverrine and atmospheric nitrogen inputs, so that it is required to study the nitrogen balance in the whole ocean. To evaluate the nitrogen cycle in the ocean, we created a marine biogeochemical model including processes such as nitrogen fixation, denitrification, atmospheric and riverine nitrogen input, then embedded it into an Earth System Model: MIROC-ESM 5.9 developed by Program for Risk Information on Climate Change, JAMSTEC. We spun up MIROC-ESM for 800 years and analyzed the results of the last 10 simulated years. The model results showed that riverine nitrogen and atmospheric nitrogen inputs changes the production of phytoplankton about 20% and 10%, respectively, especially in the subtropical region of the eastern North Pacific and equatorial region of the western Atlantic Ocean. Riverine nitrogen input changed nitrate concentration up to ±2.5 umol L^{-1} in the high latitudes such as the subarctic and polar regions (excluding the coastal regions). Our results showed the importance of riverine and atmospheric nitrogen inputs to the basin-scale nitrogen cycle.

Keywords: Nitrogen cycle, riverine nitrogen input, atmospheric nitrogen deposition, marine biogeochemistry, Earth System Model

