Multi-model analysis of ocean acidification in the subsurface layers of the North Pacific

*Michio Watanabe[1], Michio Kawamiya[1]

1.Japan Agency for Marine-Earth Science And Technology

Ocean acidification is one of the major threats for marine calcifying organisms such as precious corals. They live in the mesophotic waters at a depth of 80–300 m near Japan and are known as habitat-forming species with an important structural role in mesophotic habitats of continental slopes, sustaining biodiversity hotspots. Using the outputs of projections under the highest emission scenario of the Representative Concentration Pathways performed by Earth System Models (ESMs), we evaluate the ocean acidification rates in the middle layers of the North Pacific, where the strongest sink of atmospheric CO_2 is found in the mid-latitudes. The mixed layer depth in the Kuroshio Extension region reaches ~200 m during winter due to the strong wind forcing and cooling. Consequently, the low potential vorticity (PV) water mass called the Subtropical Mode Water is formed. This mode water shows large dissolved inorganic carbon (DIC) concentration increase, and is advected southwestward, so that, in the Izu-Ogasawara region, DIC concentration increases and ocean acidification occurs faster than in adjacent regions. The ESMs simulate that pH in the middle layers of the Izu-Ogasawara region decreases by 0.3~0.4 from 2006 through 2100. We find that the ESMs with a deeper mixed layer during winter in the Kuroshio Extension region show the large increase in DIC concentration within the Izu-Ogasawara region. For a reliable projection of the ocean acidification in the middle layers of the Izu-Ogasawara region, an ESM should well reproduce the mixed layer deepening during winter in the Kuroshio Extension region.

Keywords: ocean acidification, CMIP5, Earth System Model

