

Basin-wide mapping of sea surface nutrients in the North Pacific

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National Institute for Environmental Studies is operating ocean surface pCO₂ observation using volunteer observation ship in the Pacific. Thanks to collaboration of shipping companies, we have successfully continued Japan-North America route since 1995 and Japan-Oceania route since 2006. On board personnel are taking seawater samples for discrete measurement of nutrients. The program is joint study with Pacific-rim partners, Institute of Ocean Sciences (IOS, Canada), National Institute of Water and Atmospheric Research (New Zealand) and Commonwealth Scientific and Industrial Research Organization (Australia).

Nitrate, nitrite, ammonium, phosphate, and silicate in frozen samples are colorimetrically measured at on shore laboratory, and more than 8000 surface samples have already been analyzed. The data were combined with those by ship-of-opportunity program of IOS and with surface nutrient data included in PACIFICA (Pacific Ocean Interior Carbon dataset). This study produced 120 monthly maps of sea surface nutrient (NO₃⁻+NO₂⁻, PO₄³⁻ and Si) concentrations for the North Pacific from 2001 to 2010 using a neural network method with self-organizing map of temperature, salinity, chlorophyll-a and mixed layer depth. Spatial resolution is 1 by 1 degree for longitude and latitude. Correlation coefficients between the estimation and the observation were greater than 0.8, and root-mean-square differences were 1.8 μmol kg⁻¹ for NO₃⁻+NO₂⁻, 0.14 μmol kg⁻¹ for PO₄³⁻ and 3.6 μmol kg⁻¹ for Si. Seasonal decrease of nutrient reflects surface productivity and has strong difference in western and eastern subarctic Pacific. The maps also showed spatial difference in the stoichiometric ratio of seasonal decreases for nutrients. The ratio of Si to NO₃⁻+NO₂⁻ was larger in western subarctic Pacific and the Bering Sea than in eastern subarctic Pacific, suggesting different prevalence of diatoms. Impact of Pacific Decadal Oscillation on concentration of each nutrient was observed similar to dissolved inorganic carbon [1].

[1] Yasunaka et al (2014) *GRL* **41**, in press.