Temporal and Spatial Variation of N₂O Concentration in Atmosphere and Seawater in the Coastal Area

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N2O (nitrous oxide) is one of the greenhouse gas reduction target listed in the Kyoto Protocol. Atmospheric N2O concentration is lower than CO₂ approximately 1/1000. However, compared to CO₂, Atmospheric N₂O has a longer lifespan. In addition, the contribution of N₂O to the greenhouse effect is higher than that of CO₂ for the long period. N₂O in seawater is accumulated in the middle and the bottom layer in an open sea. Compared with an open sea, N₂O generated near bottom layer is direct spread to the atmosphere in the coastal area. N₂O concentration in the coastal area has not been enough study because of the small percentage of coastal sea areas in the ocean. Therefore, N₂O in coastal area cannot be disregarded for considering a global warming issue. Reduction of N₂O concentration data in the coastal area, the exchange between the sea water-atmosphere and the mechanism in seawater, is needed. From the background, the purpose of this study is to clarify a behavior of N₂O by observing temporal and spatial variation of N₂O concentration in the coastal area.

First of all, we measure N₂O concentration in atmosphere and seawater above the Seto Inland Sea, the southern offshore areas of Shikoku Island and the east coast of Kyusyu Island using training vessel "Fukaemaru" from 6 to 11 March and 3 to 9 September, 2009. At one time, we observe seawater temperature, salinity, dissolved oxygen, general meteorological element, etc. These are the indices of characteristics of thermohaline and seawater mixing. The factor of temporal and spatial variation of N₂O concentration in seawater is made clear from correlation with each index. Each water mass were categorized by the T-S diagram for every the thermohaline and the

mixed characteristics. We considered for the correlation between N₂O concentration in seawater and salinity or dissolved oxygen concentration for every water mass. And we revealed that N₂O in seawater is influenced by mixing of the water mass, generating by the biological activity.

As a result of the observation in March, the average of N2O concentration in the atmosphere was 314.4ppb, and the average of N2O concentration in seawater was 302.5ppb. In September, the average of N2O concentration in the atmosphere was 282.7ppb, and the average of N2O concentration in sea water was 232.1ppb. N2O concentration in sea water had negative correlation between salinity in the Osaka Bay and the Kitan Straits in March and September, 2009. Moreover, in the inner part of Osaka Bay in which high-concentration N2O was observed, dissolved oxygen concentration was in 118.5% and the state of supersaturation. High concentration N2O of the Osaka Bay was generated by the biological activity. Low salinity water of river mouth and high salinity water of open sea in the Osaka bay. These results suggest that, and between Osaka Bay to the Kitan Straits, N2O concentration in seawater was influenced by water mixing and disappearance to the atmosphere, biological generating. N2O concentration in seawater had negative correlation between salinity via Bungo Channel to Bisan Seto from the Shikoku southern coast. These results lead us to the conclusion that N2O concentration in that area is decided by water mixing between high-concentration N2O water generated in the Seto Inland Sea and open sea water.

Keywords: N2O; global warming; the coastal area.

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References

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