

Atmospheric Nitrogen Deposition to the Eastern Indian Ocean and Its Implication for Primary Production

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Anthropogenic nitrogen emissions to the atmosphere have increased significantly in South Asia due to the economic growth, and the deposition of nitrogen compounds to the Indian Ocean may impact on marine primary production and the carbon cycle. However, atmospheric observations covering a wide area of the Indian Ocean have been limited, and the effects of atmospheric nitrogen compounds resulting from human activities in the South Asian region on the marine ecosystem are not accurately evaluated.

In this study, gas, aerosol and rainwater samples were collected along the 88 degree east transect during the R/V Hakuho Maru KH-18-6 cruise in boreal autumn 2018, to evaluate the ocean fertilization effect of atmospheric nitrogen deposition to the Bay of Bengal and the Southeast Indian Ocean.

Backward trajectory analysis suggested that the Bay of Bengal was strongly influenced by anthropogenic pollutants from the Indian subcontinent, whereas, the south of the equator was under the influence of pristine marine airmasses. The average concentration of nitrogen compounds in the gas, aerosol and rainwater samples showed a clear north-to-south gradient, except for gaseous ammonia. The average dry deposition flux of nitrogen compounds was estimated to be $4.0 \text{ mgN m}^{-2} \text{ d}^{-1}$ and $1.7 \text{ mgN m}^{-2} \text{ d}^{-1}$, respectively, in the Bay of Bengal and Southeast Indian Ocean. If the receiving waters are nitrogen limited and all of the nitrogen from the atmosphere is used by the phytoplankton, the maximum carbon uptake would be $31 \text{ mgC m}^{-2} \text{ d}^{-1}$ and $13 \text{ mgC m}^{-2} \text{ d}^{-1}$ in each ocean area. In the case of rain events, it was found that about 10 times as much nitrogen as dry deposition was deposited in the ocean at the maximum. The effect of the sporadic nutrient supply on the actual primary production will also be discussed.

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