

Numerical analysis of nitrogen deposition from atmosphere on East Asian oceans

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Introduction

Rapid economic development in East Asia has been accompanied by increases in NO_x emissions from anthropogenic sources; it is expected that the atmospheric input of nitrogen compounds into oceans will have a considerable effect. In this study, the atmospheric input of anthropogenic total reactive oxygenated nitrogen (NO_y) to ocean regions in East Asia during 2002–2004 was revisited with an updated regional chemical transport model and the latest emissions inventory [1]. The updated model treats both fine- and coarse-mode nitrate (NO₃⁻). Coarse-mode NO₃⁻ is produced by the reaction of nitric acid (HNO₃) and sea salt.

Discussion on Results

The modeling system reproduced the atmospheric concentration and wet deposition amount of NO₃⁻ compared with observations. The fraction of coarse-mode NO₃⁻, defined as the ratio of coarse-mode NO₃⁻ to the sum of fine- and coarse-mode NO₃⁻, was also well captured. NO_y deposition amounts over marginal seas and open oceans were 733 and 730 Gg-N/yr, which respectively increased by 1.6- and 2.2-fold including coarse-mode NO₃⁻. Anthropogenic NO_x emissions from China were 5377 Gg-N/yr, and 3060 Gg-N/yr was exported from China; therefore, the total deposition amount over ocean regions in East Asia (1463 Gg-N/yr) was corresponded to the almost half (48%) of the export amounts.

Coarse-mode NO₃⁻ originated with the reaction of mineral dust were not exactly treated in the current modeling system. Based on the observed results during the dust and non-dust year, 27% increase of NO_y deposition over marginal seas were estimated. This results also supported the significant impact of NO_y deposition over East Asian oceans as atmospheric input.

[1] Itahashi *et al.* (2016) *submitted to Geophys. Res. Lett.*