Atmospheric Dry Deposition of N, P and Fe to the Bay of Bengal

BIKKINA SRINIVAS[1], M.M. SARIN[1], A. KUMAR[1] and R. RENGARAJAN[1]

[1] *Physical Research Laboratory, Ahmedabad-380 009, INDIA*

Atmospheric supply of nutrients (N, P & Fe) to the marine boundary layer (MBL) has gained considerable interest in the recent years due to rapid increase in their anthropogenic sources and possible impact on the ocean surface biogeochemistry. As a part of the National Programme on integrated campaign of aerosols and trace gasses radiation budget (ICARB-2009), concentrations of dissolved inorganic Nitrogen (DIN = NO_3^- + NH_4^+), Phosphorous (DIP = PO_4^{3-}) and water-soluble-Fe (Fe_{ws}) have been studied in aerosol samples (PM_{10}) collected over Bay of Bengal. The measured concentrations and dry-deposition fluxes show significant spatio-temporal variability over north and south Bay of Bengal (N-BoB & S-BoB). The air-mass-back trajectory analysis indicates that transport to the N-BoB is dominated by the outflow from Indo-Gangetic Plain (IGP) where as S-BoB is influenced by the transport of pollutants from south-east Asia (SEA). In N-BoB, dry-deposition fluxes of DIN vary from 7 to 119 µmol-N/m^2/day (mean: 51±33 µmol-N/m^2/day), DIP as 1.4-3.3 µmol-P/m^2/day (mean: 2.5±0.6 µmol-P/m^2/day) and that of Fe_{ws} vary from 199 to 2442 nmol-Fe/m^2/day (mean: 1185±833 nmol-Fe/m^2/day). In contrast, atmospheric deposition fluxes of DIN (mean: 27.7±14.8 µmol-N/m^2/day), DIP (mean: 2.1±1.0 µmol-P/m^2/day) and Fe_{ws} (mean: 565±441 nmol-Fe/m^2/day) are lower over the S-BoB. The enhanced supply of Fe_{ws} to Bay of Bengal is attributed to its dominant source from biomass burning and fossil-fuel combustion. The nutrient ratios N:Fe, N:P and P:Fe, in dry-deposition, over Bay of Bengal center around 81.1±84.0, 17.4±11.2, and 5.5±5.1 respectively; and N:P ratio in atmospheric deposition is comparable to their marine Redfield ratio. A comparison of the data from Bay of Bengal suggests that the flux ratios of N:Fe, N:P are significantly lower and whereas P:Fe ratio is higher than those over north Atlantic (Baker et al., 2003). These differences are attributed to lower deposition flux of N (only DIN is considered) and efficient neutralization of NO_3^- by the mineral dust. These results emphasize the need for sustained observations over the marine regions influenced by the anthropogenic inputs vis-à-vis supply of Fe associated with mineral dust.

References

[1] A. Baker et al., 2006. GRL,VOL. 30, NO. 24, 2296, doi:10.1029/2003GL018518, 2003.