Atmospheric Deposition of N, P and Fe to the Northern Indian Ocean

A THESIS

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by

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D E C L A R A T I O N

I, **Bikkina Srinivas**, S/o Mr. Bikkina Bhishmudu, resident of E-202, PRL residences, Navrangpura, Ahmedabad – 380009, hereby declare that the research work incorporated in the present thesis entitled ***"Atmospheric Deposition of N, P and Fe to the Northern Indian Ocean"*** is my own work and is original. This work (in part or in full) has not been submitted to any University for the award of a Degree or a Diploma. I have properly acknowledged the material collected from secondary sources wherever required.

I solely own the responsibility for the originality of the entire content.

Date: 9th July 2012 (Bikkina Srinivas)

C E R T I F I C A T E

I feel great pleasure in certifying that the thesis entitled "**Atmospheric Deposition of N, P and Fe to the Northern Indian Ocean"** embodies a record of the results of investigations carried out by **Bikkina Srinivas** under my guidance.

He has completed the following requirements as per Ph.D. regulations of the University

(a) Course work as per the university rules

(b) Residential requirements of the university

(c) Presented his work in the departmental committee

(d) Published/accepted minimum of one research paper in a referred research journal.

I am satisfied with the analysis of data, interpretation of results and conclusions drawn.

I recommend the submission of thesis.

Date:9th July 2012

Name and designation of supervisor
Manmohan Sarin,
Senior Professor

Countersigned by
Head of the Department

Dedicated to
My parents, brother and my mentors'

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ABSTRACT

The continental outflow from south and south-east Asia to the Northern Indian Ocean is a conspicuous feature during the late NE-monsoon (January-April). The prime focus of this thesis is to assess spatio-temporal variability in the atmospheric abundances of chemical constituents over the Bay of Bengal (BoB) and the Arabian Sea (ARS). This thesis also addresses on the air-sea deposition of nutrients, their dry-deposition fluxes, fixation rates and contribution to the Primary Production (PP). Relatively high concentrations of nutrients (NO_3^-, NH_4^+, N_{Org}, PO_4^{3-} and Fe_{ws}) over the BoB suggest that impact of anthropogenic sources is significantly pronounced over this oceanic region. The concentration of N_{Inorg} (mainly as NH_4^+-N over the BoB and NO_3^--N over the ARS) dominates (> 80 %) the N_{Tot} (N_{Inorg}+N_{Org}). However, deposition of N_{Org} near coastal regions can be significant as projected by the models. Significant linear relationship among P_{Inorg}, nss-K^+, Fe_{ws}, OC and EC together with analysis of air mass back trajectories suggest their contribution from biomass burning emissions in the Indo-Gangetic Plain. The fractional solubility of aerosol-Fe (Fe_{ws} (%) = Fe_{ws} / Fe_{Tot}*100) over the BoB and the ARS varied from 1.4-24 and 0.02-0.4 %, respectively during the study period. The large variability in Fe solubility over the BoB is attributed to the type of mineral dust and contribution from combustion sources. The dry-deposition fluxes are relatively high over the BoB (N_{Tot}, P_{Inorg} and Fe_{ws} are 2-167, 0.5-4.8 and 0.02-1.2 µmol m^{-2} d^{-1}, respectively) compared to those over the ARS (N_{Tot} and P_{Inorg}: 0.2–18.6 and 0.3-0.9 µmol m^{-2} d^{-1}, respectively; Fe_{ws}: 0.7-15.3 nmol m^{-2} d^{-1}). The air-sea deposition of N and P is of comparable magnitude with their supply via rivers. The high enrichment factors of Pb, Cd and Cu over the BoB reemphasize the dominance of anthropogenic sources.

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