Aerosol Radiative Forcing Over Bay of Bengal: Anthropogenic Versus Natural

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Even though perturbations due to anthropogenic aerosols on radiative equilibrium of Earth-Atmosphere system are the major source of uncertainty in climate impact assessments, accurate estimations of radiative impacts are rather limited over global as well as regional scale. Large uncertainties in the estimation of radiative forcing of anthropogenic aerosols arise mainly because of limitations in retrieving the fractional contribution of anthropogenic aerosols to the optical properties of composite aerosols using satellite and in situ techniques. Hence it is essential to use synergy of different measurement techniques to estimate the fractional contribution of anthropogenic aerosols and their radiative implications. On the backdrop of this, concurrent measurements of the physical, optical and chemical properties of Bay of Bengal (BoB) aerosols, made onboard extensive ship-cruises and aircraft sorties during Integrated Campaign for Aerosols, gases and Radiation Budget (ICARB) of March-April 2006, and satellite (MODIS)-retrieved AODs and derived parameters, were synthesized following a synergistic approach to delineate the anthropogenic fraction to the composite aerosol parameters and its spatial variation. Generally, it is believed that the anthropogenic aerosols dominate over the oceanic regions lying in the outflow of highly populated and industrialized continental locations; such as northern BoB which lies in the downwind of Indo - Gangetic Plain (IGP) and East Asia. Quite interestingly and contrary to the general belief, our studies revealed that, despite of the very high aerosol loading (in the MABL as well as in the vertical column) over the northern BoB and a steep decreasing gradient towards the southern latitudes, the anthropogenic fraction showed a steady increase from North to South (where no obvious anthropogenic source regions exist). Consequently, the direct radiative forcing due to anthropogenic aerosols remained nearly constant over the entire BoB with values in the range –3.3 to –3.6 Wm-2.