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Title: Aerosol Properties over the Arabian Sea during the Pre-monsoon ARMEX-II Experiment

Abstract: Atmospheric aerosols play a significant role in earth radiation budget directly through scattering and absorbing the incoming solar radiation and indirectly by modifying the cloud microphysics. To understand the aerosol properties over Arabian Sea, during the Second Phase of Arabian Sea Monsoon Experiment (ARMEX-II) from 14 March 2003 to 10 April 2003 (the pre-monsoon cruise) different instruments have been carried on the cruise (SK-190) for making measurements on aerosol properties over the Arabian Sea. The 14-stage Low Pressure Impactor (LPI) and hand held Optical Particle Counter (OPC) are used for making measurements on aerosol concentration and size distribution in the oceanic environment over the Arabian Sea. LPI provides an average mass-size distribution for the duration of sample collection. Three sets of aerosol measurements were carried out using LPI in the ARMEX cruise at different regions over the Arabian Sea. The optical particle counter (OPC) was operated regularly on everyday during ARMEX cruise from the bow side (where the LPI is operated) of the ship by holding the instrument in the hand. The OPC measures the instantaneous aerosol particle counts obtained in 5 size bins (r > 0.15 mm, r > 0.25 mm, r > 0.5 mm, r > 1.5 mm and r > 2.5 mm). The mean prevailing wind pattern at 1000 mb level (near the surface) for March 2003 over this region is North-North easterly. The maximum wind speed was always less than 6.5 m s-1. In the other region, the wind speeds were always less than 4 m s-1. A significant high in wind speed is observed in the mid Arabian Sea followed by a convergence along the west coast. The atmospheric RH in the cruise region was between 60-75%. The study shows the dominance of sub-micron particles (0.15-0.25 mm) near the Cochin coast and it shows a decreasing trend with increasing distance from the coast up to ~50 km and then increases reaching a high value around 72E. However the particles with r >1 mm shows an increase with increasing distance from Cochin coast reaching a maximum around 50 km followed by a sharp decrease. The number-size distributions from OPC during the LPI sampling period are averaged to obtain the mean number-size distribution. A fairly good agreement is observed between the number size distribution derived from LPI measured mass size distribution and those measured using the OPC. These observed size distributions in the oceanic environments are relatively flatter than those obtained over the continental site Trivandrum. The sub-micron mode in ASD is less pronounced in the oceanic environment. The ASD shows the presence of three distinct modes in size spectra; a fine mode (~0.05 mm) dominated by the continental component, an accumulation mode (~0.5 mm) dominated by long-lived oceanic aerosols and a coarse mode (~5 mm) dominated by nascent oceanic aerosols. Number-size distribution obtained from LPI and OPC compares favourably in the over lapping size range.

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