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Chemical, microphysical, and radiative effects of Indian Ocean aerosols

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[1] Extensive and long-term multistation measurements of aerosol properties and radiative fluxes were carried out in the haze plume off the South Asian continent. These experiments are carried out at Kaashidhoo Climate Observatory (KCO) (4.95˚N, 73.5˚E), Minicoy (8.5˚N, 73.0˚E), and Trivandrum (8.5˚N, 77.0˚E). In addition, the top of the atmosphere fluxes were measured simultaneously by the CERES radiation budget instrument. Long-term observations (more than 15 years) over Trivandrum show that there is a gradual increase in aerosol visible optical depth from ~0.2 in 1986 to ~0.4 in 1999. Pre- and post-monsoon aerosol characteristics are examined to study the seasonal variations. The impact of aerosols on short-wave radiation budget is estimated using direct observations of solar radiation using several independent ground-based radiometers and satellite data as well as from modeled aerosol properties. It was observed that ''excess absorption'' is not needed to model diffuse fluxes. The lower atmospheric heating due to absorbing aerosols was as high as ~20 W m^{-2} which translates to a heating rate perturbation of ~0.5˚K/day. The effect of aerosol mixing state (internally and externally) on aerosol forcing appears to be negligible. A sensitivity study of the effect of aerosols over land in contrast to that over the ocean shows an enhancement in lower atmosphere heating by about 40% simultaneous with a reduction of ~33% in surface cooling. Increasing sea-surface winds increase aerosol cooling due to increased sea salt aerosol concentrations, which can partly offset the heating effect due to absorbing aerosols.
INDEX TERMS: 0305 Atmospheric Composition and Structure: Aerosols and particles (0345, 4801); 1610 Global Change: Atmosphere (0315, 0325); 1704 History of Geophysics: Atmospheric sciences; 4801 Oceanography: Biological and Chemical: Aerosols (0305); *KEYWORDS:* aerosols, radiative forcing, climate, chemical composition

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