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Source Region and Sector Contributions of Atmospheric Soot Particle in a Coalfield Region of Dhanbad, Eastern part of India

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Abstract

Black carbon (BC) aerosols affect the Earth's climate directly by interacting with the solar radiation and indirectly by modifying the lifetime and optical properties of clouds. However, our understanding of BC aerosols and their impacts on the climate are limited by lack of in situ measurements of BC, especially in the developing world. This study reports measurements of BC from Dhanbad, a coalfields area of eastern India, we analyze BC data at 370 and 880 nm during 2013 to gain insight into the emission sources affecting the study area. Our analysis indicates significantly higher absorption at the lower wavelength (ultraviolet). We estimate that ~33% of BC at Dhanbad comes from biomass/biofuel combustion and the remaining 67% from the fossil fuel combustion. Higher concentrations of BC_{370nm} (>12 μg m^{-3}) were observed when the air masses affecting Dhanbad originated far away in countries like Iran, Afghanistan, Pakistan, Oman, United Arab Emirates and passed over the Indo-Gangetic Plains (IGP) prior to arriving at the observation site. The source regions affecting BC_{880nm} were localized over the IGP but BC_{880nm} concentrations are 33% lower (~8 μg m^{-3}) than BC_{370nm}. The cluster analysis showed that the largest fraction (35 and 29%) of the air masses arriving at Dhanbad passed through the boundary layer of the central IGP and north-west IGP region during the post-monsoon season. Average values of BC_{370nm} (16.0 and 20.0 μg m^{-3}) and BC_{880nm} (9.5 and 10.0 μg m^{-3}) in the IGP influenced air masses were significantly higher than those arriving from other source regions. The Weather Research and Forecasting model coupled with Chemistry (WRF-Chem) model were applied to