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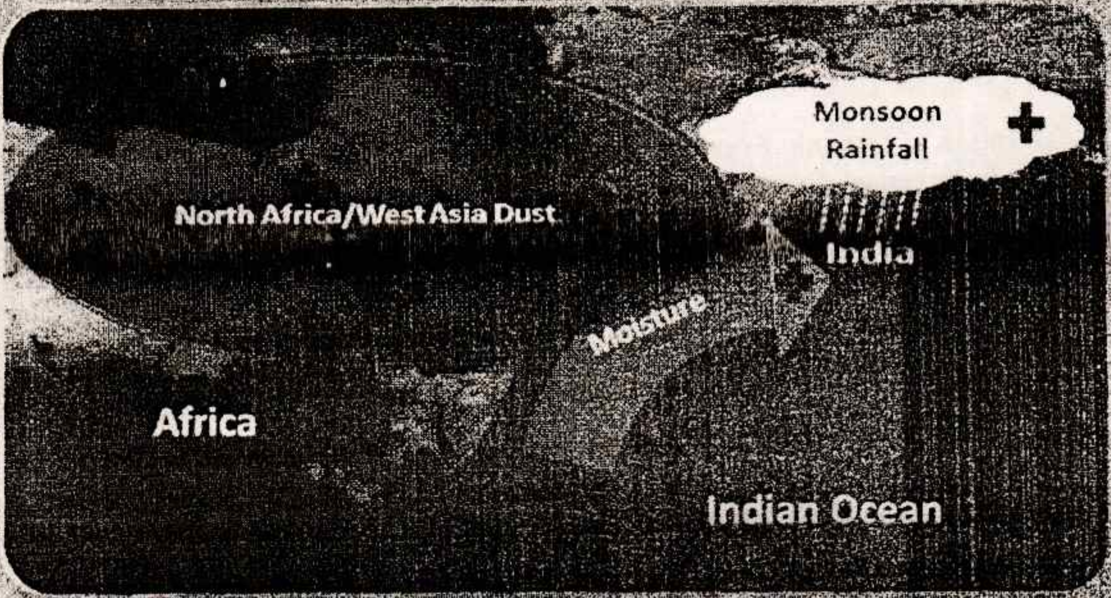

Interaction between west-Asian dust aerosols and Indian monsoon rainfall on short time-scales. (Courtesy: Vinoj et al., 2014; Nature Geoscience; http://dx.doi.org/10.1038/ngeo2107)

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Temporal Characterization of Black Carbon Aerosols and their Contribution to Radiative Forcing over Dibrugarh

Jhuma Biswas, Tamanna Subba, Binita Pathak, P. K. Bhuyan
Centre for Atmospheric Studies, Dibrugarh University, Dibrugarh-786004, Assam, India

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Introduction

The earth's climate is controlled by the amount of solar radiation intercepted by the planet and the part of the energy that is absorbed. Among different climate forcing agents similar to atmospheric Ozone, Green House Gases, etc. atmospheric aerosols are one of the vital constituents of the earth's atmosphere which contributes to global climate change, but with utmost uncertainty. Aerosols can influence climate directly by scattering and absorbing a fraction of incoming solar radiation and indirectly by modulating the earth's radiation budget through their impact on cloud life cycle, cloud droplet size distribution and cloud liquid/ice water content and semi directly by evaporating the clouds. Most aerosols such as sea salt particles, sulfates, nitrates, organic carbons (OC) etc can directly reflect sunlight back into space and hence enhancing planetary albedo (reflectance) and leading to a negative surface forcing (cooling) but the attendance of some absorbing aerosols such as Elemental Carbon (EC) or Black Carbon (BC) can alter the sign of forcing from negative to positive (heating). BC is the largest absorber of solar radiation in the atmosphere both in shortwave and long wave region and is recognized to be the second most powerful contributor to climate change next to carbon dioxide which is produced mostly as a result of partial combustion of fossil fuels such as coal, diesel, petrol etc. as well as because of usage of bio fuel and biomass burning. Study of BC aerosols are gaining considerable significance due to its ability to absorb solar radiation, heat the atmosphere and Influence the air quality and climate on local, regional and global scales. BC emission from NE-India has significant effect on BC contamination over South-east Tibetan Plateau (Cao et al., 2010).

The contribution of aerosols in affecting the surface temperature by modifying the balance between incoming and outgoing radiative energy fluxes which causes climate change is evaluated by radiative forcing of the atmosphere. Tropospheric BC aerosol which mainly absorbs incident solar radiation leads to positive radiative forcing. The present study aims at the temporal characterization of BC aerosols and their contribution to radiative forcing over Dibrugarh (27.3°N, 94.6°E, 111 m amsl) for the period March, 2008-March, 2012. The study location is scattered all over with tropical vegetation and surrounded by some oil and natural gas fields. The unique peculiarity of the study location is such that it is surrounded by the vast Himalayan range and Tibetan Plateau to the north, Garo-Khasi-Jayantia and Naga hills to the south and mountains of Yanan to the east, but is open to the west side towards the Indo-Gangetic plains (IGP) which allows transport of aerosols to the study location from pollutant regions of IGP (Gogoi et al., 2009; Pathak et al., 2012). Some more details of the study location and meteorology have been described by Pathak et al. (2013) and references therein.

Methodology

Intrumentations

The near-surface aerosol mass concentration of composite aerosols, BC mass concentration and spectral aerosol optical depths (AODs) are measured by Quartz Crystal Microbalance (QCM) Impactor (model PC-2, California Measurements Inc., USA), Aethalometer (model AE 31-ER, Magee Scientific, USA) and a 10 channel Multiwavelength solar radiometer (MWR) respectively for the period March, 2008-March, 2012 over Dibrugarh. The QCM provides aerosols mass concentration collected at 10 different stage as a function