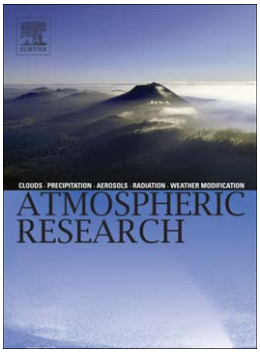

Characteristics of absorbing aerosols during winter foggy period over the National Capital Region of Delhi: Impact of planetary boundary layer dynamics and solar radiation flux

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PII: S0169-8095(17)30003-0
DOI: doi:10.1016/j.atmosres.2017.01.001
Reference: ATMOS 3857

To appear in: *Atmospheric Research*

Received date: 2 May 2016
Revised date: 6 October 2016
Accepted date: 3 January 2017

Please cite this article as: Tyagi, S., Tiwari, S., Mishra, A., Singh, S., Hopke, Philip K., Singh, Surender, Attri, S.D., Characteristics of absorbing aerosols during winter foggy period over the National Capital Region of Delhi: Impact of planetary boundary layer dynamics and solar radiation flux, *Atmospheric Research* (2017), doi:10.1016/j.atmosres.2017.01.001

Characteristics of absorbing aerosols during winter foggy period over the National Capital Region of Delhi: Impact of planetary boundary layer dynamics and solar radiation flux

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Abstract

Severe air pollution in the northern India coupled with the formation of secondary pollutants results in severe fog conditions during the winter. Black carbon (BC) and particulate matter ($PM_{2.5}$) play a vital role within the planetary boundary layer (PBL) to degrade atmospheric visibility. These species were continuously monitored during the winter of 2014 in the National Capital Region (NCR) of Delhi. The average BC concentration was 8.0 ± 3.1 μg/m^3 with the January mean (11.1 ± 5.4 μg/m^3) approximately two times higher than February (5.9 ± 2.1 μg/m^3). The average $PM_{2.5}$ concentration was 137 ± 67 μg/m^3 with monthly area-average maximum and minima in December and February, respectively. Higher concentrations of BC at 10:00 local standard time LST (8.5 μg/m^3) and 22:00 LST (9.7 μg/m^3) were consistently observed and assigned to morning and evening rush-hour traffic across Delhi. Daily average solar fluxes, varied between 17.9 and 220.7 W/m^2 and had a negative correlation (r = - 0.5) with BC during fog episodes. Ventilation coefficient (VC) reduced from 'no fog' to fog phase over Palam Airport (PLM) (0.49) times and Hindon Airport (HND) (0.28) times and from fog to prolonged fog (> 14 hr) phase over PLM (0.35) times and HND (0.41) times, respectively, indicating high pollution over the NCR of Delhi. Ground measurements showed that daily mean aerosol optical depth at 500 nm (AOD_{500}) varied between 0.32 and 1.18 with mean AOD_{500} nm being highest during the prolonged fog (> 14 hr) episodes (0.98 ± 0.08) consistent with variations in $PM_{2.5}$ and BC. Angstrom exponent (α) and Angstrom turbidity coefficient (β) were found to be greater than 1 and 0.2, respectively, during fog showing the dominance of fine mode particles in the atmosphere.