Driving factors for aerosol decadal variability at a background station of 2180m altitude

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Atmospheric aerosols still pertain larger uncertainty than the greenhouse gases in the estimation of total radiative forcing (IPCC, 2013). In the past decades research work on this point has been carried out to minimize this uncertainty. One amongst top emitters is India, and having long-time series data of aerosol properties and their variability in this region is very important. In India, Himalayan region observatory stations represent suitable locations to study tropospheric baseline conditions, and are also appropriate sites to perform observations of aerosol parameters. Nonetheless, the impact of climate imbalance has been observed repeatedly during the last few years in the region through disturbances in monsoon circulation and extreme weather events etc.

Continuous measurements of atmospheric aerosols have had been carried out at the regional background observatory in Mukteshwar, Uttarakhand. This aerosol measurements station has the longest time-series data of about ten years (2005-2014) in the proximity to the central Himalayas in India. The measured parameters include the particle mass concentration (PM_{10}, $PM_{2.5}$), total particle number concentration (TNC), aerosol number size distribution and optical properties (absorption and scattering coefficients). The surface meteorological observations were also done. The planetary boundary layer height using ECMWF data and 5-day back trajectories using HAYSPLIT model were calculated. Moreover, the BC concentration, absorption Ångström exponent (α) and single-scattering albedo (SSA) were also estimated.

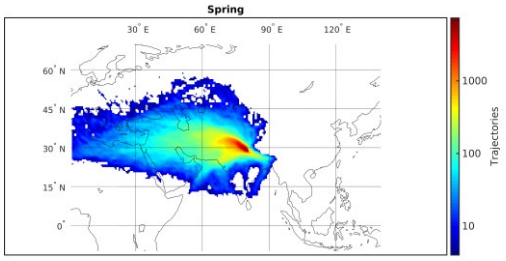

Figure 1. Trajectories for the months of March to May (Spring season) in the period of 2005-2014.

In general at this site the trajectories were of north-westerly origin (Figure 1), but during monsoon season the trajectories were from south-east and south-west. It appears that the topography, boundary layer dynamics and long-range transport of aerosols have a dominating role to aerosol loading in this region (Figure 2). The computational simulations with aerosol-climate model ECHAM6-HAM2 using ECLIPSE emission inventory were also carried out and compared to the observations. The simulated concentrations of BC, OC and SO_4 are depicted here (Figure 3). Further, work is in progress to examine the driving factors for the inter-annual variability and the trend.

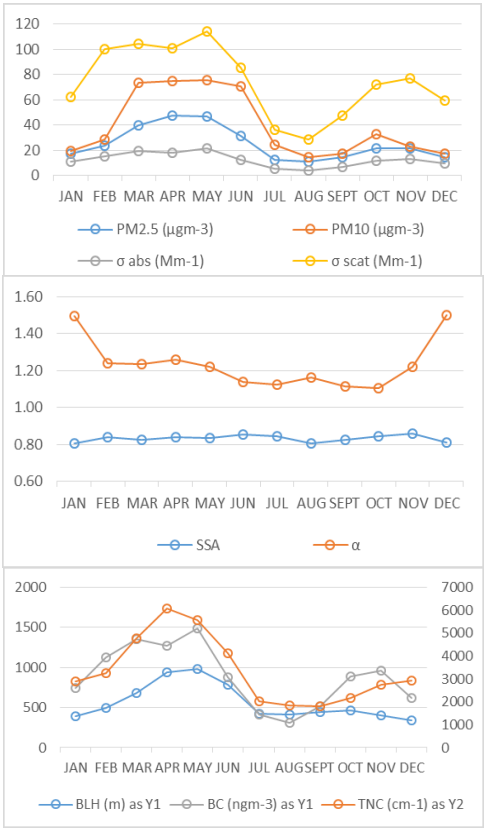

Figure 2. Monthly-mean variability of aerosol properties in the period of 2005-2014.

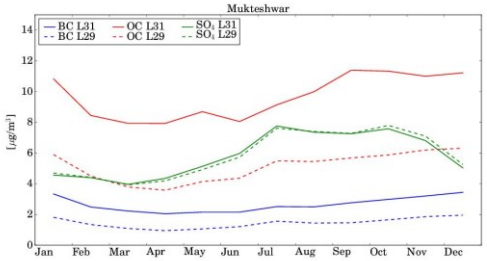

Figure 3. Model simulations for the period of 2005-2014 (dotted line for elevation at par to station).

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IPCC, 2013. *Summary for Policymakers. Climate Change 2013: WG I, Fifth AR*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.