Aerosol Characteristics Over Manora Peak, Nainital: a High Altitude Location in Central Himalayas

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We present the results obtained from the collocated measurements of various aerosol parameters at a high altitude location Manora Peak, Nainital (29.36^{O}N; 79.45^{O}E, altitude ~ 1960 m msl), in Central Himalayas. Being a high altitude the site is reasonably away from the pollution and virtually unaffected by the anthropogenic activities; hence measurement of aerosols from so-called free troposphere is an indicator of background level for different aerosol properties as far as the aerosol characterization is concerned. Such a unique location with a natural advantage of high altitude also demands the regular measurements of aerosols to understand the various atmospheric processes. In this perspective the study of optical, physical and chemical properties of aerosol particles is carried out at Manora Peak. The important parameters of aerosols, which are measured for their characterization point of view, are spectral aerosol optical depths (AODs), mass and number concentrations of composite aerosols, BC mass concentration, number-size distribution of sub- and super- micron aerosols, total suspended particulate matter (TSPM), total columnar ozone and water vapor content, meteorological parameters, traces gas measurements etc.

Extensive analysis of spectral AODs over Manora Peak reveals that AOD (at 500 nm) are very low (<0.1) during winter and increased steeply to reach high values (~0.5) in summer. Occasionally the AODs are of a magnitude comparable to the Antarctic environment during the winter season while they are typical of continental regions in summer season. On some occasions, higher AOD values (> 0.5) are also observed which may be due to the combination of aerosol loading by the wind-blown dust particles that are originated at far off regions during intense dust episode, reaching to the elevated site through long range transport phenomenon and updraft of pollutants from valley regions below the observing site through the strong convective eddies leading to increased vertical mixing that brings up the pollutants to higher levels during summer. The columnar size distribution (CSD), retrieved from the spectral AODs over the observing site indicates the bimodal nature of the aerosol particles. The inferred SSA values are found to be varying in the range of 0.87–0.94 over the site. The study also reveals that the boundary layer dynamics over the experimental site plays an important role in producing the forenoon to afternoon variability in the observed values of spectral AODs, BC mass and composite aerosols number concentrations.