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Natural and anthropogenic induced variation in aerosol extinction profile observed over Ahmedabad in western India

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Measurements of extinction profile of aerosols and cloud structures are being carried out at Ahmedabad (23°2' N, 72°33' E) using a Micro Pulse Lidar (MPL) for more than two years. Ahmedabad is an urban site situated in a semi-arid region of western India and has a population about 5 million people. It is an ideal site to study naturally produced soil derived dust particles as well as the impact of anthropogenic influence. Our study shows strong seasonal dependence in the measured extinction profiles. Figure 1 shows aerosol optical depth (AOD) obtained by integrating extinction profiles for two altitude ranges, between 0 to 1 km (shown by circles) and another above 1 km (shown by squares). The AOD value above 1 km is found to be highly variable with season. The observed variation is both due to seasonal variation in relative humidity (RH) over this place as well as due to an increase in the vertical extent of aerosol distribution during summer. Within a year RH over Ahmedabad varies from about 30 to 80 % from dry to wet season. Also during summer, which is also the monsoon season for Ahmedabad, significant amount of aerosols reach free troposphere from boundary layer. As the atmospheric residence time of aerosol is more in free troposphere than in boundary layer, there is an overall increase in the atmospheric aerosol burden. However, while AOD above 1 km shows strong seasonal dependence there is no systematic variation in AOD with season observed below 1 km. Since the anthropogenic activities or per capita energy consumption does not vary significantly with season over Ahmedabad, there is no direct contribution from anthropogenic sources to the observed seasonal variation. While the freshly produced soot particle and fugitive dust particles are not hygroscopic, the anthropogenically produced sulfate particles, and the possible intrusion of sea salt particles brought in by the SW monsoon wind are hygroscopic, which contribute to an increase in aerosol extinction by growth under the influence of high RH observed above 1 km during the summer monsoon.

Keywords: Lidar; Aerosol; Aerosol Optical depth; AOD; extinction; profile; Ahmedabad

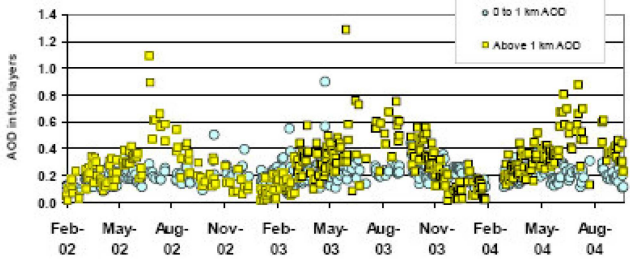

Figure 1 Aerosol optical depth obtained by integrating extinction profile in two layers.