Atmospheric aerosols variability at regional background, foothills of central Himalayas

R.K. Hooda[1,2], A.-P. Hyvärinen[1], N. Kivekäs[1], E. O'Connor[1], E. Asmi[1], H. Lihavainen[1]
[1]Finnish Meteorological Institute, Helsinki, Finland
[2]The Energy and Resources Institute, Delhi, India
Keywords: Himalayas, aerosol, trend, new particle formation.
Presenting author email: rakesh.hooda@fmi.fi

Aerosols have had been identified as one of the main reasons for current and future regional climate change in India and elsewhere in Southern Asia. Predicting how the monsoon cycle changes with changing global climate and anthropogenic aerosol emissions is utmost challenging due to several uncertainties such as the spatial and temporal distributions of aerosols and their direct/semi and indirect effects on clouds and precipitation. Measurements to atmospheric composition at higher altitudes can play a relevant role in the climate change studies. This happens through the detection of a wide range of phenomena and processes, including changes in the average concentrations, variability and seasonality of atmospheric compounds as well as possible variations in the impact from pollution hot-spots (Baltensperger *et al*., 1997).

For these reasons and with the purpose to better characterize the aerosol properties as well as the processes influencing the background troposphere in India, continuous measurements of several aerosol parameters have had been carried out at the regional Supi Station of Mukteshwar (29°.26'N, 79°.37'E, 2180m a.s.l), in the central Himalayas (Hyvarinen *et al*., 2009). Aerosol measurements data of high time resolution from Mukteswar was analyzed in order to determine the surface concentration levels and other properties of aerosols, including their seasonal cycle. Here, we present only yearly trend of particle number concentration using DMPS (Differential Mobility Particle Sizer) in the diameter size range 10-800nm and cumulative values of $PM_{2.5}$ and PM_{10} (real-time analyser) for the period of 2005–2014 years.

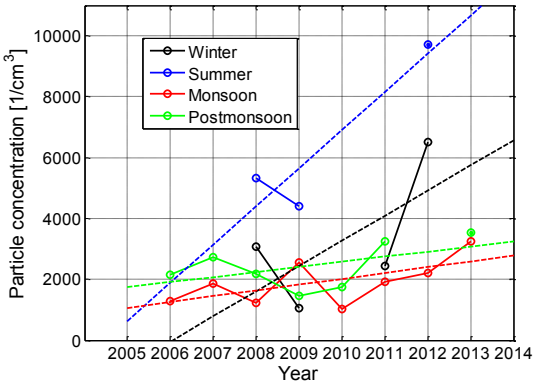

Figure 1. Total number concentration variability during 2005 to 2014.

The 1-hour average particle number concentration was in range of 220–46750 cm^{-3}, with a mean of 3925 cm^{-3} through data coverage of about 70% during the period 2005–2014. Our preliminary analysis shows an increment of about a one particle per day over the years. The hourly averaged total number concentration showed an increasing trend of aerosols at Mukteshwar with a high seasonal variability (Figure 1). Particle number concentrations were highest during summer when new particle formation was observed, a typical example of regional event (Figure 2).

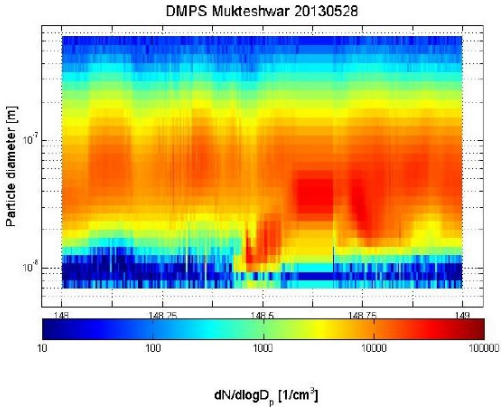

Figure 2. Particle formation event observed in May 2013.

The 1-hour average concentrations of PM_{10} and $PM_{2.5}$ were 37 and 24 μgm^{-3} (Table 1). Particulate matter data showed a very high seasonal variability but not a clear increasing trend. However, the percentage contribution of $PM_{2.5}$ to PM_{10} increased over the years (Panwar *et al*., 2013).

Table 1. Particulate matter variations (2005– 2014).

	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
Mean	24	37
Range	(1 – 353)	(1 – 679)

A comprehensive statement about trend of concentrations and aerosol physical and optical properties for Mukteshwar will be presented.

This work was supported by the Ministry of Foreign Affairs of Finland.

Baltensperger, U., Gaggeler, H.W., Jost, D.T. et al. (1997). *J. Geophys. Res*. **102**, 19707–15.
Hyvarinen, A.P., Lihavainen, H., Komppula, M. et al. (2009). *J. Geophys. Res.* **114,** D08207.
Panwar, T.S., Hooda, R.K., Lihavainen, H. et al., (2013). *Environ. Monit. Assess.* DOI 10.1007/s10661-012-2902-8.