Continuous Aerosols Observations at the High Altitude Himalayan Nepal Climate Observatory – Pyramid (5079 m a.s.l.)

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Intense anthropogenic emissions over the Indian sub-continent lead to the formation of pollution layers with high concentration of aerosol that can be transported to the high altitude regions of the Himalaya. At the Nepal Climate Observatory – Pyramid (NCO-P, 5079 m a.s.l.) continuous observations of climate relevant aerosol properties including mass and number concentrations, size distribution, chemical composition, in-situ optical properties and vertical integrated parameters (AOD) started in March 2006. The NCO-P site is ideally located to provide a detailed characterization of the South Himalayas free troposphere. Concentrations in the range of 1-2 μg m^{-3} characterize the PM1 background, of which 10% is accounted for by BC.

The Himalayas pristine conditions are affected by significant transport of pollutants by local/regional and synoptic scale circulation. Surprisingly high pollution levels (i.e. PM1 around 60 μg m^{-3} and BC up to 5 μg m^{-3}) were observed during pre-monsoon, suggesting that Himalayan valleys could represent a "natural chimney" by which pollutants within the Asian Brown Cloud can be directly vented to high Himalayas and to the middle/upper troposphere. At the interface between clean tropospheric air and more polluted air coming from the Khumbu valley, aerosol concentrations are driven by intense ultrafine particle events that occur in more than 35% of the days. Aerosol properties are also affected by dust transport events (53 over two years) which are more frequent during pre-monsoon (with a maximum of PM10 of 15.6 μg m^{-3} in April 2007) and winter seasons, but with intense episodes also observed during monsoon break periods. All these processes concur in determining the aerosol variability at the NCO-P which, for most of the observed parameters, is characterised by maximum values during the pre-monsoon period and minima during monsoon. Because aerosol particles interact with the incoming solar radiation, presence of elevated concentration of light absorbing and diffusing material may impact the local energy balance.

In this work, aerosols observations at the high altitude Himalayan NCO-P will be presented also providing a summary about the principal scientific results achieved in these first years of continuous activity and an estimate of radiative forcing due to absorbing aerosol transported from regional to long-range distances.