Two-years black carbon observations at Nepal Climate Observatory at Pyramid (Nepal, 5079 m a.s.l.).

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Carbonaceous aerosol plays a complex role in atmospheric radiative balance; in particular black carbon, primary produced by fossil fuel combustion and biomass burning, both absorbs and reflects incoming solar radiation, thus heating the lower troposphere and cooling the surface. Moreover absorbing aerosol not only affects the energy budget of the atmosphere, but deposits to snow surfaces, absorbs light, thus decreasing the albedo of the snow and modifying the energy budget of snow surfaces. This in turn affects snow melting, the duration of the snow cover and the seasonal availability of water.
The vertical mixing induced by orographic winds is very efficient in the Himalayan valleys, because of the more intense solar radiation compared mid latitude mountain ranges. In addition, due to the intense anthropogenic emissions in the boundary layer, strong vertical transport may lead to very intense export of pollutants into the free troposphere. Because the Himalayas is a strong receptor of the Indian/Pakistan/Nepal source areas, where pollutants are stacked up against the slopes of the mountain range, such a recirculation pattern may have severe consequences on the regional climate, in particular due to the presence of absorbing aerosols, especially in case this material reaches the free troposphere where lifetime is considerably increased.
Thus the Himalayas range is an ideal location to investigate atmospheric composition changes, nevertheless, due to technical and logistic difficulties, only few continuous observations of atmospheric constituents are available in this area. A new high elevation station started measurements of black carbon and other aerosol parameters and gas concentrations in the Khumbu valley at 5079 m a.s.l. The station started measurements in February 2006, installed in the framework of the Ev-K2-CNR “SHARE-Asia” (Stations at High Altitude for Research on the Environment) and UNEP “ABC” (Atmospheric Brown Clouds) projects.
In this work, we present an analysis of black carbon and aerosol mass (PM-10 and PM-1) variations during the firsts two years of measurements at the Nepal Climate Observatory at Pyramid with the aim to identify background and polluted conditions.
The seasonal behaviour of black carbon clearly shows a minimum in summer monsoon season with an averaged concentration of 52 ng m-3 (standard deviation of 62 ng m-3); the seasonal maximum appears in pre-monsoon season with an averaged concentration of 340 ng m-3 (standard deviation of 415 ng m-3). During this season black carbon values reached sometime very high levels grazing of 5 μg m-3 on 30 minutes base, showing very high polluted conditions even at 5000 m. Aerosol mass, as well as accumulation particle number show very similar seasonal trends. This behaviour reflects the transports of very polluted air masses and the increase of planetary boundary layer high during spring and the accumulation of aerosols and pollutants in the Indian sub-continent due to more intense anthropogenic emissions combined with the weaker winter circulation.
On the contrary coarse and ultrafine (Aitken and nucleation fraction) particles are more influenced by dust transport and nucleation processes, thus they show very weaker seasonal cycles.

An analysis of air mass origin will be performed in order to identify the major source areas of pollution, biomass burning and dust.

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