

Seasonal variation of ozone and black carbon observed at Paknajol, an urban area in the Kathmandu Valley, Nepal

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The Kathmandu Valley in the Himalayan foothills, considered as one of the global “hot spots” for what concerns air pollution, is currently facing severe air quality problems due to rapid urbanization processes, dramatic land use changes, socioeconomic transformation and high population growth. In this work, we present the first full year (February 2013 – February 2014) analysis of simultaneous measurements of two short-lived climate forcers/pollutants (SLCF/P), i.e. ozone (O_3) and equivalent black carbon (BC), and aerosol number concentration at Paknajol ($27^{\circ}43'4''$ N, $85^{\circ}18'32''$ E, 1380 m a.s.l.), in the city center of Kathmandu. These observations were carried out in the framework of the SusKat-ABC (A Sustainable Atmosphere for the Kathmandu Valley – Atmospheric Brown Cloud) campaign in Nepal. The diurnal behavior of BC and aerosol number concentration indicated that local pollution sources represent the major contribution to air pollution in this city. In addition to photochemistry, the planetary boundary layer (PBL) dynamic plays an important role in determining O_3 variability, as suggested by the analysis of seasonal changes of the diurnal cycles and the correlation with meteorological parameters and aerosol properties. Especially during pre-monsoon, high values of O_3 were observed during the afternoon/evening. This could be related to mixing and entrainment processes between upper residual layers and the PBL. During this season, the high O_3 appeared well related to the impact of major open vegetation fires occurring in Nepal. On a synoptic-scale perspective, westerly and regional atmospheric circulations appeared to be especially conducive for the occurrence of the high BC and O_3 values. The very high values of the SLCF/P, detected during the whole measurement period, indicated persisting adverse air quality conditions, dangerous for the health of over 3 million residents of the Kathmandu Valley, and the environment. Consequently, all of this information may be useful for implementing control measures to mitigate the occurrence of acute pollution levels in the Kathmandu Valley and the surrounding area.