Sunphotometry of the 2006–2007 aerosol optical/radiative properties at the Himalayan Nepal Climate Observatory-Pyramid (5079 m a.s.l.)

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In spite of being located at the heart of the highest mountain range in the world, the Himalayan Nepal Climate Observatory (5079 m a.s.l.) at the Ev-K2-CNR Pyramid is shown to be affected by the advection of pollution aerosols from the populated regions of southern Nepal and the Indo-Gangetic plains. Such an impact is observed along most of the period April 2006–March 2007 addressed here, with a minimum in the monsoon season. Backtrajectory-analysis indicates long-range transport episodes occurring in this year to originate mainly in the west Asian deserts. At this high altitude site, the measured aerosol optical depth is observed to be about one order of magnitude lower than the one measured at Ghandi College (60 m a.s.l.), in the Indo-Gangetic basin. As for Ghandi College, and in agreement with the in situ ground observations at the Pyramid, the fine mode aerosol optical depth maximizes during winter and minimizes in the monsoon season. Conversely, total optical depth maximizes during the monsoon due to the occurrence of elevated, coarse particle layers. Possible origins of these particles are wind erosion from the surrounding peaks and hydrated/cloud-processed aerosols. Assessment of the aerosol radiative forcing is then expected to be hampered by the presence of these high altitude particle layers, which impede an effective, continuous measurement of anthropogenic aerosol radiative properties from sky radiance inversions and/or ground measurements alone. Even though the retrieved absorption coefficients of pollution aerosols were rather large (single scattering albedo of the order of 0.6–0.9 were observed in the month of April 2006), the corresponding low optical depths (~0.03 at 500 nm) are expected to limit the relevant radiative forcing. Still, the high specific forcing of this aerosol and its capability of altering snow surface albedo provide good reasons for continuous monitoring.

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