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Transport of mineral dust to Nepal Climate Observatory – Pyramid (5079 m a.s.l., South Himalayas)

Rocco Duchi (1), Paolo Cristofanelli (1), Angela Marinoni (1), Francescopiero Calzolari (1), Stefano Decesari (1), Paolo Laj (2), Elisa Vuillermoz (3), Michael Sprenger (4), and Paolo Bonasoni (1)

(1) ISAC-CNR, Bologna, Italy , (2) Lab. de Glaciologie et Géophysique de l'Environment, St. Martin d'Hères Cedex, France, (3) EV-K2-CNR Commitee, Bergamo, Italy, (4) ETH, Zurich, Switzerland

Desert dust is one of the greatest sources of natural aerosol in atmosphere, representing about 37% of the total (natural and anthropogenic) emission of atmospheric primary aerosols. Mineral dust can impact climate through many complex processes, i.e. by scattering and absorbing solar and infrared radiation and by affecting the variability of cloud aerosol optical properties. Moreover, mineral dust can also affect the concentrations of other climate-altering species (e.g. surface ozone) in troposphere.
South Asia is a region frequently affected by major dust transport from Africa and Asia. In particular, these "dust clouds" can reach the Himalayas also mixed with the heavy anthropogenic pollution present within the so-called Asian Brown Cloud.
With the purpose to define the frequency of long-range mineral dust transport towards the Himalayan range and to evaluate their influence on the atmospheric aerosol background level, in this work we analyse the first 2-year (from March 2006 to February 2008) of coarse (Dp > 1 micron) aerosol number concentration observed at the WMO - GAW station "Nepal Climate Observatory – Pyramid" (NCO-P, 5079 m a.s.l., Nepal). This measurement station, part of UNEP-ABC and EV-K2-CNR SHARE projects, is not far from the Everest Base Camp and the observation here conducted can be considered representative for the South-Eastern slope of the Himalayan range.
During the investigated period we detect more than 80 days/year as possibly affected by mineral dust transport. As deduced by the NCO-P measurements, these events significantly influenced the seasonal variation of coarse aerosol number concentration as well as the number and volumetric aerosol size distribution over South Himalayas. Due to the combination of the large-scale westerly circulation and the higher frequency of dust out-breaks, the majority of the identified events occurred during the pre-monsoon season. Although of lesser intensity and frequency, a significant amount of dust transports were also observed during the winter season, while during summer major monsoon mineral dust transport occurred mainly during monsoon break episodes.
The analysis of the 3D back-trajectories ending at the NCO-P and calculated by the LAGRANTO model, permitted to identify the possible source areas for the mineral dust: the Thar Desert, the arid areas in the Indo-Gangetic plains, the Tibetan Plateau as well as the Arabian peninsula and the North Africa.