Geophysical Research Abstracts
Vol. 18, EGU2016-15859, 2016
EGU General Assembly 2016

10-year record of atmospheric composition in the high Himalayas: source, transport and impact

Paolo Bonasoni (1), Paolo Laj (2), Angela Marinoni (1), Paolo Cristofanelli (1), Michela Maione (3), Davide Putero (1), Francescopiero Calzolari (1), Stefano Decesari (1), Maria Cristina Facchini (1), Sandro Fuzzi (1), Gianpaolo Gobbi (4), Karine Sellegri (5), Gianpietro Verza (6), Elisa Vuillermoz (6), and Jgor Arduini (3)

(1) CNR, ISAC, Bologna, Italy , (2) CNRS, LGGE, Grenoble, France, (3) Urbino University, Urbino, Italy, (4) CNR, ISAC, Rome, Italy, (5) Laboratoire de Meteorologie Physique, CNRS/University of Clermont-Ferrand, Clermont-Ferrand, France, (6) Ev-K2-CNR, Bergamo, Italy

South Asia represents a global “hot-spot” for air-quality and climate impacts. Since the end of the 20th Century, field experiments and satellite observations identified a thick layer of atmospheric pollutants extending from the Indian Ocean up to the atmosphere of the Himalayas. Since large amount of short-lived climate pollutants (SLCPs) - like atmospheric aerosol (in particular, the light-absorbing aerosol) and ozone - characterize this region, severe implications were recognized for population health, ecosystem integrity as well as regional climate impacts, especially for what concerns hydrological cycle, monsoon regimes and cryosphere.
Since 2006, the Nepal Climate Observatory – Pyramid (NCO-P, 27.95N, 86.82 E, 5079 m a.s.l.), a global station of the WMO/GAW programme has been active in the eastern Nepal Himalaya, not far from the Mt. Everest. NCO-P is located away from large direct anthropogenic pollution sources. The closest major urban area is Kathmandu (200 km south-west from the measurement site). As being located along the Khumbu valley, the observations are representative of synoptic-scale and mountain thermal circulation, providing direct information about the vertical transport of pollutants/climate-altering compounds to the Himalayas and to the free troposphere.
In the framework of international programmes (GAW/WMO, UNEP-ABC, AERONET) the following continuous measurement programmes have been carried out at NCO-P: surface ozone, aerosol size distribution (from 10 nm to 25 micron), total particle number, aerosol scattering and absorption coefficients, equivalent BC, PM1-PM10, AOD by sun-photometry, global solar radiation (SW and LW), meteorology. Long-term sampling programmes for the off-line determination of halogenated gases and aerosol chemistry have been also activated. The atmospheric observation records at NCO-P, now representing the longest time series available for the high Himalayas, provided the first direct evidences about the systematic occurrence of pollution transport and high rate of new particle formation events in this region.
Here we provide an overview of the main scientific results obtained during these ten years of research. In particular, we will discuss the impact of atmospheric transport and monsoon variability on atmospheric composition by disentangling the role played by mountain breeze system and synoptic-scale transport. We will provide specific information about the role of stratospheric intrusions, long-range mineral dust transport and open biomass burning emissions in determining the variability of ozone, aerosol and equivalent black carbon concentrations. The effect of particle nucleation processes on aerosol number concentrations will be shown. Finally, we discuss the climatic impact of aerosols observed at NCO-P both in terms of direct atmospheric radiative forcing and black carbon deposition on Himalayan snow.