Geophysical Research Abstracts
Vol. 12, EGU2010-13626, 2010
EGU General Assembly 2010

A study of the correlation between tropospheric ozone and back carbon at the NCO-P (5079 m a.s.l.), a remote mountain site in the South Himalayas

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Tropospheric ozone (O_3) is a major greenhouse gas with an estimated anthropogenic radiative forcing of + 0.35 W/m^2. In the troposphere the main source for O_3 production are due to photochemical reactions involving primary pollutants (such as CO, hydrocarbons and NO_x) derived from combustion of fossil fuels and biomass burning (both anthropogenic and natural). Moreover, stratospheric O_3 can be injected in the lower troposphere due to stratospheric air mass intrusions, which represents the major natural source of O_3in the free troposphere.

Black Carbon (BC) is a primary aerosol that strongly absorbs solar radiation, leading to a direct atmospheric radiative forcing as much the 55% of the CO_2 forcing. BC is resulting by incomplete combustion of fossil fuels and biomass.

Due to their prominent roles on air-quality determination and regional climate modification, continuous measurements of $O_3$and BC have been conducted since March 2006 at the WMO - GAW station "Nepal Climate Observatory – Pyramid" (NCO-P), an high altitude monitoring station situated in the South Himalaya (27.95N, 86.82E, 5079 m a.s.l.), within 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, with the purpose of better elucidate their variability in the high Himalayas region, we investigated the O_3-BC correlation at NCO-P during two year of measurements (March 2006 – February 2008). This activity contributes to better identify the origin of the air masses reaching the measurement site, possibly evaluating also their "chemical" evolution.

Through the analysis of the O_3vs BC we identified three relationship: (1) positive correlation with simultaneous increase of BC and O_3, (2) negative correlation with increasing $O_3$and decreasing BC, (3) negative correlation with increasing BC and decreasing O_3.

As supported by the analysis of specific case studies, we related the first scenario (high O_3, high BC) to the transport of polluted air-masses in which photochemical O_3production has occurred. We consider this scenario linked to the transport of polluted air-masses on a regional scale and possibly influenced by Asian Brown Cloud. The second scenario (high O_3, low BC) is indicative of clean air-masses transported from the Lower Stratosphere/ Upper Troposphere (LS-UT episodes). For the third scenario (low O_3, high BC) we hypothesized the transport from the Khumbu Valley of freshly polluted air-masses not sufficiently aged as to permit ozone production.