H-P-4

INFLUENCE OF MAJOR DUST STORMS ON THE OZONE COLUMN AND CLIMATIC CONDITIONS OF THE INDO-GANGETIC PLAINS

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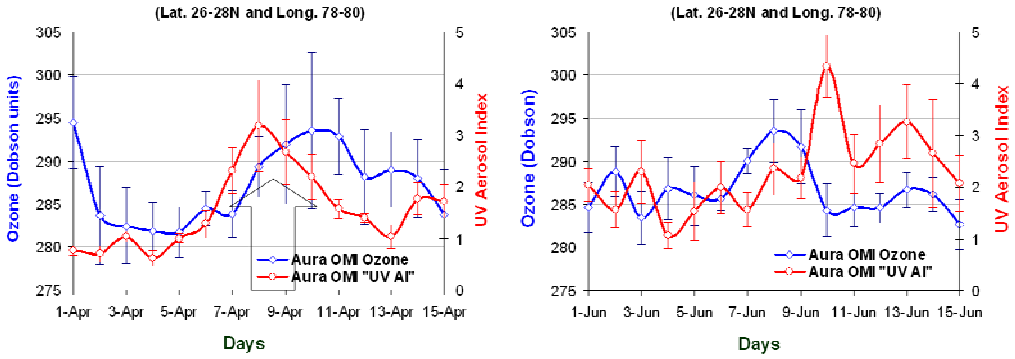
The western and central parts of the Indo-Gangetic (IG) Plains are affected by several major dust storms during the summer or pre-monsoon (April-June) season. Recently, multi-sensor studies of these dust storms using multi-year ground, satellite and model data have lead to a better understanding of origin, optical and chemical characteristics and influence on the radiation budget over the IG plains [*Prasad et al., 2007a,b*]. These dust storms invariably originate from western arid and semi-arid regions as far as Africa and are transported to the IG plains and beyond depending upon the meteorological parameters. Besides, degrading the air quality of cities, these dust storms are also found to influence the total column water vapor in the atmosphere and its vertical distribution. We have studied changes in the vertical profile of the atmosphere across the IG plains and up to Himalayas during these dust storms using ground (radiosonde) and satellite (Atmospheric InfraRed Sounder - AIRS) data. Sometime, dust storms reaching to the Himalayan region, deposit large amount of dust over the snow layers especially in the western part of the Himalayas which in turn influence snow and glaciers. The snow and glaciers in the Himalayan region are extremely important since main rivers flowing across the IG plains originate from the Himalayan region.

Detailed analysis of Aerosol Index (AI) and the total ozone column (TOC) from Aura Ozone Monitoring Instrument (OMI) and Total Ozone Mapping Spectrometer (TOMS) show increase in TOC up to 25 DU in the western and central parts of IG plains during dust storms. TOMS and AURA UV AI is good for monitoring of transport of mineral dust aerosols, both over land and ocean. OMI AURA and TOMS derived UV AI uses shorter wavelengths where Rayleigh scattering is stronger and surface reflectivity is less. Due to less surface reflectivity, it is possible to detect aerosols over highly reflective surface (over Thar desert and arid regions towards west of the IG plains), which was not possible using Moderate Resolution Imaging Spectroradiometer (MODIS) that gives AOD in visible and IR range.

The time series and spatial distribution of OMI AI and total column ozone have been obtained over Middle East (source) and the IG plains (sink) during the summer season (2005 and 2006) to study transport of dust storms from the west to east and its association with observed increase in column ozone, with a time lag, over the IG plains. The controlled lab and field experiments with dust particles and ozone suggest that the ozone breaks down in the presence of dust. Some of the studies over Italy and other countries have shown low ozone column during episodes of high aerosol concentrations caused by dust storms [*Bonasoni et al., 2004*]. However, it is observed that dust and high speed wind

during major dust storms transport and increase ozone column with a time lag over the IG plains (Figure 1). The westerly winds transport ozone to the IG plains associated with dust storms. High NOx (OMI and Scanning Imaging Absorption Spectrometer for Atmospheric Chartography - SCIAMACHY) and CO (Measurements of Pollution in the Troposphere - MOPITT) concentration, especially over the IG plains during summer is expected to influence ozone concentration during dust storms due to higher temperature, water vapor and changes in the vertical stability of the atmosphere and increased concentration of other reactive gases. The present study indicates that the dust storms from western arid regions directly and indirectly influence the hydrology, atmosphere and climatic conditions of the IG plains. The complexities of interaction in the vertical column of the atmosphere between various components over the IG plains during and after dust storms need further investigations.



References

1. Bonasoni, P., P. Cristofanelli, F. Calzolari, U. Bonafe, F. Evangelisti, A. Stohl, S. Z.Sajani, R. van Dingenen, T. Colombo, and Y. Balkanski, 2004: Aerosol-ozone correlations during dust transport episodes. *Atmospheric Chemistry And Physics*, 4, 1201-1215.

2. Prasad, A. K., S. Singh, S. S. Chauhan, M. K. Srivastava, R. P. Singh, R. Singh, and B.Holben, 2007a: Aerosol radiative forcing over the Indo-Gangetic plains during major dust storms, *Atmospheric Environment*, doi:10.1016/j.atmosenv.2007.03.060.

3. Prasad, A.K., and R.P. Singh, 2007: Changes in aerosol parameters during major dust storm events (2001-2005) over the Indo-Gangetic basin using AERONET and MODIS data. *Journal of Geophysical Research*, Volume 112, No. D9, D09208, Paper No. 10.1029/2006JD007778.

4. Singh, R. P., S. Dey, S. N. Tripathi, V. Tare, and B. Holben, 2004b: Variability of aerosol parameters over Kanpur, northern India. *Journal Of Geophysical Research-Atmospheres*, 109, D23206.