

Long-term MAX-DOAS measurements of nitrogen dioxide and formaldehyde from the North-West Indo-Gangetic Plain

Vinod Kumar (1), Steffen Beirle (1), Vinayak Sinha (2), Steffen Dörner (1), Sebastian Donner (1), Abhishek Kumar Mishra (2), and Thomas Wagner (1)

(1) Max Planck Institute for Chemistry, Mainz, Germany, (2) Department of Earth and Environmental Sciences, Indian Institute of Science Education and Research Mohali, Sector 81, S.A.S. Nagar, Manauli PO, Punjab, 140306, India

The Indo-Gangetic plain (IGP) is a demographically important region of the world associated with large anthropogenic emissions of VOCs and other trace gases. Satellite observations have revealed an increasing trend in both nitrogen dioxide (NO_2) and formaldehyde (HCHO) vertical column densities over the IGP. While satellite data provides large spatial and temporal coverage, it needs to be validated using ground-based measurements. Differential Optical Absorption Spectroscopy (DOAS) technique provides an excellent way to compare the column densities retrieved from satellite and ground. Multi-Axis DOAS (MAX-DOAS) technique utilizes passive remote sensing using spectra of scattered sunlight.

We present the first multi-year (2013 - 2017) MAX-DOAS measurements of NO_2 and HCHO from Mohali, India; a regionally representative site located in the north-west Indo-Gangetic plain. NO_2 and HCHO column densities are compared with OMI satellite data. The retrieved NO_2 mixing ratio is also compared with the in situ measurements performed using a chemiluminescence based NO_2 trace level analyzer. While NO_2 measurements provide a measure of the direct emission from the anthropogenic sources, HCHO measurements provide information of both direct emission and photochemical sources, which further help in constraining the emission of non-methane VOCs. By analysing the seasonal patterns of these measurements for different years, we also estimate the varying strength of the sources of HCHO in different periods of the year.