

MAX-DOAS observations of tropospheric HCHO and comparisons

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Formaldehyde (HCHO) plays a significant role in atmospheric photo-oxidation pathways, and is likewise a key aerosol precursor. A kind of passive differential optical absorption spectroscopy system called MAX-DOAS was used in the recent decade to measure tropospheric trace gas. At present, the MAX-DOAS technique has been applied on the NO₂, SO₂, BrO, and HCHO inversion. In this study, the HCHO column density information is inversed from MAX-DOAS observation. The HCHO slant column densities (SCDs) inversed by AIOFM were compared with the other similar DOAS instruments from the groups all over the word in second Cabauw Intercomparison campaign for Nitrogen Dioxide measuring Instruments (CINDI-2). Calibration for elevation and azimuth angles was operated by using white linear light source and xenon lamp. The azimuth angles error is -0.58° and elevation angles error is -0.48°. The spectral resolution is around 0.5nm in the wavelength range of 290nm-420nm, and the wavelength used for retrieval HCHO slant column densities (SCDs) in ultraviolet is 336.5-359nm. HCHO dSCDs were calculated by QDOAS using Sequential reference at elevation 90°. The correlation coefficient of HCHO SCDs at azimuth 287° obtained by AIOFM and other groups mean value is 0.94, indicating a good correlation about the instruments. Furthermore, the HCHO vertical column densities (VCDs) were used to verify the ERA-Interim model data, covering a three-month period from October to December 2014 at the University of Chinese Academy of Science in Huairou District of Beijing. The average value of the data from MAX-DOAS at 7:30 to 8:30 LT was selected for compared with the ERA-Interim reanalysis data at 0:00 UTC of grid 0.125° × 0.125° (local time = UTC +8). The correlation coefficient of MAX-DOAS observations and ERA Interim model is 0.706 indicating the good consistency with the model underestimates approximately 1.56 molec/cm² HCHO VCD than MAX-DOAS observations. The effective cloud fractions (eCF) is divided into 0 < x ≤ 0.1, 0.1 < x ≤ 0.3, 0.5 < x ≤ 0.7, and 0.7 < x ≤ 1 to identify the impact to MAX-DOAS and model by cloud. The correlation coefficient R² is 0.66 ± 0.04, indicating the correlation of MAX-DOAS observations and ERA Interim model is little affected by the cloud.