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Validation of MAX-DOAS Cloud classification technique by other techniques based on three years observations in Wuxi, China

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Multi-Axis-Differential Optical Absorption Spectroscopy (MAX-DOAS) observations of trace gases can be strongly influenced by clouds and aerosols. Thus it is important to identify clouds and characterise their properties. In the former work (Wagner et al. 2013) we found the colour index, radiance and O4 absorption from MAX-DOAS measurements are sensitive to the properties of cloud and aerosol and built a sophisticated classification scheme. In this work we further improved the identification of clouds and aerosol for each elevation sequence of MAX-DOAS based on three years of measurements (2011 to 2013) in Wuxi, China (31.57°N, 120.31°E). The cloud classification results were verified by comparing with other cloud or aerosol data sets such as the aerosol optical depth (AOD) from the AERONET Taihu monitoring site (31.42° N, 120.22° E), MODIS Level 2 cloud products and cloud parameters in level 2b productions of OMI and GOME-2 from TEMIS. We find good agreement with the MAX-DOAS cloud classification using statistical analyses. Based on the results of MAX-DOAS cloud classification, we investigate the influence of clouds and aerosol to the MAX-DOAS measurements of the NO_2 tropospheric vertical column density. We compare the influence of clouds and aerosols on the atmospheric light paths with their influence of the NO_2 photolysis and thus on the partitioning between NO_2 and NO.