



Analysis on the Characteristics of Tropospheric NO₂ in Xianghe from MAX-DOAS Measurement

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Based on the measurement by Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) and 32-meter Meteorological Tower (temperature, relative humidity, wind direction and speed) at Xianghe Station (117.0°N, 39.77°E) of Atmospheric Comprehensive Observatory, Institute of Atmospheric Physics, Chinese Academy of Sciences from March 2010 to February 2012, the tropospheric NO₂ Vertical Column Density (VCD) of Xianghe was retrieved, and then its mean diurnal cycle, seasonal characteristics and the underlying mechanism were analyzed. MAX-DOAS is an effective technique to measure NO₂ VCD, which can be well retrieved from wavelength intervals of 455-485 nm in the visible and 330-370 nm in the UV. NO₂ VCD in Xianghe has a remarkable seasonal signature, with the highest mean value reaching 4.5×10^{16} molecules•cm⁻² in winter, while the lowest one equal to or below 2×10^{16} molecules•cm⁻² occurring in summer. With respect to spring and autumn, the value of NO₂ VCD slightly swings above and below 3×10^{16} molecules•cm⁻². The monthly mean NO₂ VCD is approximately 5×10^{16} molecules•cm⁻² in November and 1.5×10^{16} molecules•cm⁻² in July, which is respectively the maximum and minimum of the whole year. The obvious seasonal variation is in part explained by different source emissions in different seasons, especially the combustion of fossil fuel in winter. Furthermore, there is a close relationship between the fluctuation of NO₂ VCD and solar radiation intensity, atmospheric stability and wind. Due to the high-emission source of NO₂ in Tangshan located directly east of Xianghe, the higher the east wind speed, the higher NO₂ concentration; on the contrary, strong winds from the other directions will lead to reduced levels of NO₂. The diurnal cycle of NO₂ VCD has distinct feature in each season: NO₂ VCD remains virtually unchanged within a day during spring and summer; in autumn, the concentration exhibits unimodal distribution with a peak at noon; however, in winter the maximum and minimum concentration appears at noon and twilight respectively.