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Spatial and temporal variability in Athens observed by MAX-DOAS

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Multi Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) observations provide valuable information on tropospheric absorber amounts and their vertical distribution by analysing measurements of scattered sunlight taken at different elevation angles. This information can be used to estimate surface mixing ratios, mixing heights, and tropospheric columns. Recent developments in instrumentation now also allow scanning in the azimuthal direction, giving some insight into the horizontal variability of trace gas distributions. This is of particular interest in the vicinity of localised sources and in cities.

In this study, 18 months of MAX-DOAS observations in Athens (38.05°N, 23.9°E) have been analysed for tropospheric NO_2 amounts. The instrument is operated at the NOA observatory on Penteli Hill at the outskirts of Athens in about 500 m altitude. From this point, 8 viewing directions covering various locations of interest including rural areas, the city suburbs and the city centre are scanned routinely, and strongly varying temporal and spatial variations can be observed. The data show clear signals of the weekly cycle, pollution reduction during summer break and repeating spatial patterns linked to meteorology and the build-up and transport of NO_2 from the main city area.

In addition to these interesting geophysical findings, the observed gradients also pose challenging questions with respect to the assumptions usually made in the analysis of MAX-DOAS measurements, and these will be discussed as well.