



Comparison of tropospheric NO₂ columns from ground based MAX-DOAS systems with satellite retrievals: A case study in the greater area of Thessaloniki.

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Phaethon is a low-cost ground-based MAX-DOAS system that is used to acquire fast direct solar irradiance and sky radiance spectrally resolved measurements in the region 300-450 nm and deliver total and tropospheric columns of atmospheric trace gases. Phaethon, which comprises a cooled miniature CCD spectrograph (AvaSpec-ULS2048LTEC) and a 2-axes tracker, was designed for easy deployment at different sites to address specific air quality problems and to support satellite validation studies at locations of particular scientific interest. In the framework of the Optimization and expansion of ground infrastructure for the validation of satellite-derived column densities of atmospheric species, AVANTI project, three Phaethon systems have been deployed in the greater area of Thessaloniki, Greece, within an area of about 15 km by 30 km, comparable to the size of a satellite pixel, with the aim to link modeling of tropospheric trace gases with satellite products. The locations of the three systems are characterized by diverse local atmospheric pollution loadings representing urban, industrial and rural conditions. The systems have been first operated for a few days in parallel at the station in the University campus to establish their inter-comparison behaviour and possible systematic differences. Tropospheric NO₂ columns derived at these different locations are presented and compared with the “area-averaged” columns derived from OMI/Aura and GOME-2/MetopA and /MetopB satellites. During days with high levels of NO₂ at the urban site, the measurements at the rural site compare better with the satellite products. This finding has been attributed to the fact that the satellite products are representative of the average pollution levels in the sub-satellite pixel area which, in the case of Thessaloniki, corresponds mostly to rural conditions. This validation campaign precedes a full-scale validation to be performed within the EU FP7 Monitoring and Assessment of Regional air quality in China using space Observations, Project Of Long-term sino-european co-Operation, MarcoPolo project, where one of the Phaethon systems is to be relocated and operationally established for about one year in the Guangzhou region in China.