



Concentrations and vertical profiles of NO₂, NO₃, O₃, SO₂, HCHO and HONO observed with LP-DOAS over a pine forest during DOMINO 2008

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Oxidation mechanisms in ambient air at different environments are still of mayor research to understand the involved chemical processes, to improve model calculations and estimate sources and sinks. However different environments feature different properties which are often not well understood. During the DOMINO campaign in southern Spain, in November/ December 2008 measurements were performed over a low-density pine forest. Thus soil emissions and deposition of the sandy ground may also have an important impact on the observed trace gas concentrations.

We applied the well established longpath (LP-) Differential Optical Absorption Spectroscopy (DOAS) technique to observe the average concentration of tropospheric trace gases along a light path of 4800m (single path, total path was 9600m) directly measuring over the canopy. Three retro reflector arrays were installed on a tower at 20m, 39m and 70m height. The instrument, which was located at 9m height, was measuring successively to the different retro reflector arrays in the wavelength range between 290 to 685nm. Thus this setup allowed determining the trace gas concentrations of NO₂, NO₃, O₃, SO₂, Formaldehyde, HONO, Glyoxal, H₂O, IO and BrO from which Glyoxal, BrO and IO were always below the detection limit of 80, 1 and 1 ppt respectively. From the different measurement paths the vertical distribution of the trace gases was derived in three self defined layers 9-20m, 20-39m and 39 to 70m height.

Even if the measurement site was located in the nature preserve Parque Natural del Entorno, we regularly observe increased pollutants from urban emissions mainly from Huelva (~23km distance) for north-westerly and from Sevilla(~ 75km distance) for north-easterly winds. Especially high SO₂ concentrations up to 20ppb are correlated to air masses from Huelva and most likely originate from the refinery there.

The data show that the trace gases NO₂, Formaldehyde and H₂O were well mixed within the lowest 70m. The concentration of NO₂ show strong fluctuations and reach values up to 16ppb. Formaldehyde concentrations feature a daily maximum up to 3.5ppb and indicate strong local, but well distributed sources of Formaldehyde and its precursors in this environment. Opposite to NO₂ and Formaldehyde, O₃ and SO₂ display an increasing gradient with height. The gradients are used to estimate the deposition rates of these gases. Thereby the ozone concentration varies between 20 and 60 ppb. NO₃ feature even a stronger gradient in the nights with stable stratification. Opposite HONO is characterised by a weak negative gradient with peaks around midnight. This indicates a weak HONO source at the pine forest.

The given results give insights about the concentration and chemical processes above a pine forest which will be discussed.