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LIF measurements of HO_x radicals in the lower troposphere aboard the Zeppelin NT during the PEGASOS campaign 2012

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The hydroxyl (OH) and hydroperoxy (HO_2) radicals are key compounds for the degradation of pollutants in the atmosphere. Therefore, accurate and precise measurements of HO_X radicals (= OH + HO_2) at different altitudes and in different regions are necessary to test our understanding of atmospheric chemical processes. The planetary boundary layer (PBL) is of special interest as it is chemically the most active part of the atmosphere. Until today there is a general lack of measurements investigating the distribution of radicals, trace gases, and aerosols in the PBL with high spatial resolution.

Here, we present results of two measurement campaigns performed from May – July 2012 in the metropolitan area of Rotterdam, the Netherlands, and in the Po valley region in Italy as part of the **P**an-**E**uropean **G**as-**A**ero**SO**ls-climate interaction **S**tudy (PEGASOS). We used the Zeppelin NT as an airborne platform for measurements of HO_X radical concentrations and total OH reactivity applying a remotely controlled Laser Induced Fluorescence (LIF) instrument. In addition a comprehensive set of other trace gases (O_3, CO, NO, NO_2, HCHO, HONO), photolysis frequencies, particle number concentration, and meteorological parameters were measured. The airship Zeppelin NT allowed us to perform unique flight patterns, including localized height profiles up to 900 m above ground and transect flights at low flight speeds.

We present measured data for the HO_X radical concentrations and the total OH reactivity along with a model analysis of the radical chemistry. Maximum daytime concentrations were $2.0\times10^7 cm^{-3}$ for OH and $1.5\times10^9 cm^{-3}$ for HO_2. Typical values for the total OH reactivity were smaller than 10 s^{-1}. During the morning hours, vertical gradients in radical and trace gas concentrations were observed indicating a layered atmospheric structure. The vertical gradients vanished after sunrise due to enhanced convective mixing of the PBL.