



Total OH reactivity measurements aboard the Zeppelin NT during the PEGASOS campaign 2012: Contributions of substance classes to the total OH reactivity

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The hydroxyl (OH) radical is the main oxidant of atmospheric trace gases. The quantification of its sources and sinks is necessary to fully comprehend the OH concentration. Due to difficulties quantifying all the individual compounds contributing to the OH loss, the direct quantification of the OH loss termed as the total OH reactivity is a crucial approach to establish the budget of OH. Especially in forested areas, where OH reactivity is dominated by highly reactive organic compounds, the directly measured total OH reactivity could not be explained by individual trace gas measurements in recent field campaigns. This difference is termed 'missing reactivity'.

Here, we present OH reactivity data together with data of volatile organic compounds (VOC) and other individual sinks of OH measured on board of the Zeppelin NT in summer 2012. The campaign was part of the Pan-European Gas Aerosols-climate interaction Study (PEGASOS) and was performed from May to July 2012 in the area of Rotterdam (the Netherlands) and Bologna (Italy). Total OH reactivity and VOC were analyzed together with OH, HO₂, CO, formaldehyde, NO_x, HONO, ozone, photolysis frequencies, particle number concentrations and meteorological parameters. For these measurements the Zeppelin NT was flying at a low speed (50 km/h) and between altitudes of 100 and 900 m above ground which enabled the investigation of the vertical structure of the lower troposphere where most of the trace gas degradation takes place.

On average, the total OH reactivity was $6.1 \pm 1.2 \text{ s}^{-1}$ over the area of Rotterdam and $3.8 \pm 1.4 \text{ s}^{-1}$ over the region of Bologna. During almost the entire campaign, the measured total OH reactivity could be explained by the contributions of VOC and other measured species. Only measurement in the nocturnal boundary layer, where anthropogenic emissions were enriched, showed missing reactivity which could not be related to measured compounds.

Oxygenated volatile organic compounds (OVOC) contributed the major part of the total OH reactivity measured with a fraction of 30% over the Rotterdam Area and 40% over the area of Bologna. In the morning hours when layered structures had been built up over night, large gradients of the total OH reactivity were measured. The relative contribution of OVOC was especially large in the residual layer which was decoupled from emissions from the ground.

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