

Observation and modelling of the OH, HO₂ and RO₂ radicals at a suburban site of Beijing (Huairou) in winter 2016

Zhaofeng Tan (1), Keding Lu (1), Xuefei Ma (1), Bohn Birger (2), Sebastian Broch (2), Hendrik Fuchs (2), Andreas Hofzumahaus (2), Frank Holland (2), Xin Li (1), Yuhan Liu (1), Anna Novelli (2), Franz Rohrer (2), Min Shao (1), Haichao Wang (1), Yusheng Wu (1), Limin Zeng (1), Astrid Kiendler-Scharr (2), Andreas Wahner (2), Yuanhang Zhang (1,3)

(1) College of Environmental Sciences and Engineering, Peking University, Beijing, China (z.tan@pku.edu.cn), (2) Institute of Energy and Climate Research, IEK-8: Troposphere, Forschungszentrum Juelich GmbH, Juelich, Germany, (3) CAS Center for Excellence in Regional Atmospheric Environment, Chinese Academy of Science, Xiamen, China

A comprehensive field campaign was carried out in winter 2016 in Huairou, a small town located 60 km northeast of Beijing downtown. Concentrations of OH, HO₂ and RO₂ radicals were measured by a laser induced fluorescence instrument. Radical concentrations were smaller than during summer because of reduced solar radiation. Maximum hourly averaged OH, HO₂ and RO₂ radical concentrations were $(3\pm2)\times10^6\text{cm}^{-3}$, $(8\pm6)\times10^7\text{cm}^{-3}$ and $(7\pm5)\times10^7\text{cm}^{-3}$, respectively. Chemical modulation measurements were applied on a few days showing no significant OH interference for different chemical conditions. HONO and HCHO photolysis were found to be the most important primary source of RO_x radicals. OH reactivity, the inverse of the OH radical lifetime, was also measured by a laser-photolysis and laser induced fluorescence instrument. In general, CO and NO_x were the dominated OH reactants which contributed more than half of the total OH reactivity. The relative high OH concentrations in polluted episode enabled a fast oxidation of fresh emitted pollutants and the formation of secondary products. The observed radical concentrations were compared with the results from a chemical box model. The model is capable of reproducing radical concentrations in the moderate NO_x conditions but has difficulty in both the low and high NO_x regimes. The underestimation of RO₂ radical concentrations in the high NO_x conditions indicate a missing RO₂ source.