Observation and modelling of the OH, HO_2 and RO_2 radicals at a rural site (Wangdu) in the North China Plain in summer 2014

Zhaofeng Tan (1), Hendrik Fuchs (2), Keding Lu (1), Birger Bohn (2), Sebastian Broch (2), Rolf Haeseler (2), Andrease Hofzumahaus (2), Frank Holland (2), Xin Li (2), Ying Liu (1), Franz Rohrer (2), Min Shao (1), Baolin Wang (1), Ming Wang (3), Yusheng Wu (1), Limin Zeng (1), Andrease Wahner (2), and Yuanhang Zhang (1)

(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) Nanjing University of Information Science and Technology, School of Environmental Sciences and Engineering

A comprehensive field campaign was carried out in summer 2014 in Wangdu located in the North China Plain. A month of continuous OH, HO_2 and RO_2 measurements were obtained by a laser induced fluorescence system. High daytime OH, HO_2 and RO_2 radical concentrations were observed of which their daily maximum concentrations were $(5 - 15) \times 10^6 cm^{-3}$, $(3 - 14) \times 10^8 cm^{-3}$ and $(3 - 15) \times 10^8 cm^{-3}$, respectively. A chemical box model constrained by observed trace gas compounds with state of art chemical mechanism is used to interpret the observed radical concentrations. The model underestimated the observed OH concentrations by a factor of 2 when NO is less than 100ppt in the afternoon hours. Like PRIDE-PRD2006 and CAREBEIJING2006, an additional OH recycling is required to reproduce the observed OH concentrations for the high VOC and low NO_x conditions. Based on a few chemical modulation experiments we performed at the site, the determined OH interference signal were very small for the afternoon conditions. In addition, we found that observed RO_2 concentrations were underestimated in the morning hours which indicated the existence of additional chemical sources of RO_2 and an underestimation of the local ozone production rates in current model.