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Observation and modelling of the OH, HO_2 and RO_2 radicals at a regional site of Beijing in winter 2016

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A comprehensive field campaign was carried out in winter 2016 in the campus of UCAS (University of Chinese Academy of Science), located in a small town 60 km northeast of urban Beijing. Concentrations of OH, HO_2 and RO_2 radicals as well as the total OH reactivity were measured by a laser induced fluorescence instrument. Maximum hourly averaged OH, HO_2 and RO_2 radical concentrations were (3±2)×106cm-3, (8±6)×107 cm-3 and (7±5)×107 cm-3, respectively. These radical concentrations were smaller than those observed during summer as the reduced solar radiation. Chemical modulation devices were applied on a few days for the ambient OH measurement which showed negligible OH interference from clean to polluted air masses.
HONO and HCHO photolysis were found to be the most important primary sources of ROx radicals. CO and NO_x were the important OH reactants which contributed more than half of the total OH reactivity and the leftovers are mainly fulfilled by VOCs. The relative high OH concentrations in polluted episode enabled a fast oxidation of fresh emitted pollutants and the formation of secondary air 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 for the peroxy radical concentrations. The underestimation of RO_2 radical concentrations in the high NO_x conditions is discussed in the context of recent campaigns.