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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Nighttime measurements of HO_x during the RONOCO project and analysis of the sources of HO_2" *by* H. M. Walker et al.

Anonymous Referee #1

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This paper presents nighttime measurements of OH and HO_2 (really HO_2*) during the RONOCO campaign during summer (July 2010) and winter (January 2011) as well as daytime measurements of OH and HO_2 during the SeptEx campaign in September 2010. Measured OH concentrations during the nighttime flights were below the detection limit of the instrument, while measurements of OH during the daytime flights were above the detection limit. They find that their nighttime HO_2* measurements were higher during the summer compared to the winter, with the highest nighttime measurements during one flight correlating well with the measured NO_3 concentrations but not with ozone, suggesting that NO_3 chemistry rather than ozone was an important source of HO_x radicals during the night.

The authors then present an analysis of the nighttime rates of alkene oxidation and

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find that the overall nighttime oxidation rates vary with the season, with the higher rates during the summer due to the increased rate of alkene oxidation by NO_3 radicals. The authors also calculate rates of alkene oxidation by O_3 and OH during the daytime SeptEx flights, illustrating that daytime alkene oxidation is dominated by reactions of O_3 and OH as NO_3 was not detected during the daytime flights. However, during the winter daytime flights NO_3 was detected above the LOD while OH was not. The authors find that oxidation of alkenes during the summer at night can be as fast as daytime oxidation in the winter. An analysis of HO_2 production from alkene oxidation indicated that reactions of NO_3 with alkenes dominated nighttime HO_2 production during the summer, and ozonolysis of alkenes dominated HO_2 production during winter. These results are in contrast to model predictions, where NO_3 chemistry was predicted to dominate HO_2 production during both the summer and winter at night, with the discrepancy likely due to the model overestimation of the measured NO_3 concentrations.

The paper is generally well written and presents some interesting results and is suitable for publication in ACP after the authors have addressed the following:

The authors should clarify throughout the manuscript that their measurements of HO_2 include a small interference from RO_2 radicals and should be labeled as HO_2* rather than HO_2 to avoid confusion, including Figures 4, 7, 8, and 15. This would also be consistent with the presentation of their data (as HO_2*) in Stone et al. (2014b).

Pages 3008-3009: Although the RO_2 interference with HO_2 measurements has been quantified in the ground based instruments as described in Whalley et al. (2013), it appears that this has yet to be done for the aircraft instrument with only the interference due to ethene quantified and the rest calculated using the MCM. What was the distribution and calculated detection efficiencies of the different peroxy radicals calculated for the campaign conditions that led to the conclusion that only 15% of RO_2 radicals were detected by their instrument?

Page 3011: The authors state that the LOD reported in Table 4 are for an averaging

ACPD
15, C1170–C1172, 2015

time of 1 min, while on pages 3007-3008 a 5 min time average is state for these LOD. Stone et al. (2014b) lists these LODs for 4-5 min averages.

Page 3014: The authors present the OH and HO_2 measurements as a function of altitude, but calculate what appear to be average rates in Figures 11-14. This should be clarified in the text. Did the authors observed an altitude dependence of these rates? A figure that illustrates the measured concentrations of ozone, NO_3 and alkenes as a function of altitude would be useful.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 2997, 2015.