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Atmospheric Measurement Techniques Discussions

Interactive comment on "Airborne intercomparison of HO_x measurements using laser-induced fluorescence and chemical ionization mass spectrometry during ARCTAS" *by* X. Ren et al.

Anonymous Referee #2

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This paper presents results of an airbourne intercomparison of several HOx instruments using both laser-induced fluorescence and chemical ionization mass spectrometry. This is an important area of research, as measurements of HOx radicals are often significantly greater than expected, suggesting either that there are significant gaps in our understanding of HOx radical chemistry, or that there are unknown interferences with the measurements. Intercomparions of different measurement techniques can help to identify errors in the measurement techniques and provide confidence in the

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measurements.

The study described in this paper is the first airborne intercomparison of HOx instruments on the same platform, and involved OH measurements using the Penn State LIF-FAGE instrument and the NCAR SI-SIMS instrument and HO2 measurements by the Penn State LIF-FAGE instrument and the NCAR PerCIMS instrument. In general, measurements of OH and HO2 by these different instruments agreed to within their combined experimental uncertainties, giving confidence in the accuracy of the HOx measurements by these techniques. The measurements were also compared to the results of a box model, and similar trends were observed with the measurements from both sets of instruments, with the observed to modeled HO2 ratio increasing with increasing NO concentrations, and the observed to modeled OH increasing with increasing isoprene concentrations. These results suggest that either there are measurement interferences with both instrumental techniques, or a problem with the model.

The paper is well written and suitable for publication in AMT after the authors have addressed the following:

1) Most of the paper focuses on a presentation of the results of the intercomparison, with little discussion. For example, the OH CIMS/LIF ratio decreases significantly below one above 5 km (page 2543-2544) but there is no discussion regarding potential reasons for the discrepancy. Similarly, there is little discussion regarding the significant difference between the CIMS and LIF HO2 measurements (page 2544). The paper would benefit from an expanded discussion of these results.

2) Similar to the LIF HO2 instrument, the PerCIMS HO2 instrument is also sensitive to the detection of RO2 radicals, with higher conversion efficiencies for the detection of alkene-based peroxy radicals (Hornbrook et al., 2011). Were the PerCIMS HO2 measurements corrected for this interference in the same way as the LIF HO2 measurements?

3) Although the OH and HO2 measurements between the CIMS and LIF instruments

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appear to agree to within the combined uncertainty of the measurements for all flights, there is little discussion whether the agreement is independent of NO and isoprene concentration.

4) Similar to previous measurements, the authors find that the OH measurements from both the LIF and CIMS instruments are significantly greater than the modeled OH concentration at high isoprene concentrations, although there does not appear to be many measurements above 1 ppb of isoprene. The authors suggest that the high OH measurement from the LIF instrument may be due to an unknown interference based on their recent measurements using an ambient OH scrubbing technique (Mao et al., 2012). However, there is no discussion of the CIMS measurements, as it also appears to be significantly greater than the model at high isoprene concentrations. Could a similar interference affect the CIMS measurements? This should be clarified in an expanded discussion.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2529, 2012.