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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement of atmospheric nitrous acid at Blodgett Forest during BEARPEX2007" *by* X. Ren et al.

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Reply to the Review by Referee #2

We thank Referee #2 providing us valuable review comments that have improved the manuscript. We have included the review comments followed by our responses. In the revision of this manuscript, we will highlight these changes accordingly.

Comment (1): In section 2.1, the descriptions of the HONO inlets for both instruments are not detailed enough. Sampling inlet is a critical part of the HONO measurement. On the inlet surface, HONO can be either lost or produced through heterogeneous reaction involving NOx and solar radiation. What is the length of the inlet? Is the inlet shielded from sunlight? Is the background check at night different from daytime? An

inlet test will be very helpful to validate the HONO observation.

Response: We have provided the description of the inlet for the wet chemistry HONO instrument in Section 2.2.1 as: "Ambient air was pulled through a light-shielded Teflon tubing (OD = 0.375", and ID = 0.25", length = 18 m) at flow rate of 12 L min-1, of which 2 L min-1 was fed the HONO instrument housed in a trailer laboratory. The total residence time in the sample line was about 2.8 seconds." We have done extensive interference tests as described in 2.3.3, including the background check with a dry denuder coated with Na2CO3, in which the signals obtained from the ambient air through the denuder were essentially the same as the signals from zero air. The possible HONO loss through the sampling line was examined using the gas phase HONO source and HONO and we found that the wall loss was little and (99.2$\pm$1.3)% of HONO went through the tubing. These tests indicate that there is no significant loss or production of HONO in the sampling line.

For CIMS, the sampling inlet has been described in Crounse, et al. (2006). We have added the description of the CIMS inlet in Section 2.2.2 as: "Ambient air was sampled through the same glass inlet described in Crounse, et al. (2006) with the exception that parts A, B, D, and E (Figure 1, Crounse et al 2006) were not part of the BEARPEX CIMS instrument configuration. Air was drawn through the large inlet tube (C) at a linear flow rate of $\sim$10 m/s using a wet/dry vacuum. Air was sub-sampled for analysis from the center of the large flow as described in Crounse et al (2006) with the difference that ambient air was diluted with UHP N2 in a 1:3.5 ratio to reduce the water vapor mixing ratio in the flow tube (J). Also the glass inlet tube was encased in a stainless steel tube and shielded from light."

Comment (2): Fig. 7 can serve the purpose of data validation but the CIMS signal shows significant variation. Although CIMS follows the same trend as the LOPAP, CIMS detection limit (two sigma) is barely below ambient HONO concentration. The reagent ion, CF3O-, can react with water to form water clusters (CF3O-(H2O)n) or fluoride anion water clusters (F-(H2O)n). Thus, CIMS is expected to be very sensitive to changes

in ambient humidity. Has the CIMS data set been corrected for the humidity effect?

Response: We agree with the reviewer that the CIMS signal shows large variations. As we have stated in the manuscript, this is mainly because of the relatively poor precision ($\pm$25%, 1σ) of the CIMS instrument and a small fraction (0.5 second every 18 seconds) of the CIMS measurement time dedicated to HONO measurement for the need of measuring other 25 species. We believe that the noise can be decreased by increasing the time fraction of CIMS measurements dedicated to HONO measurement.

Water vapor dependent HONO calibrations have been conducted in the laboratory with the CIMS instrument and have been applied to the BEARPEX 2007 data using ion (H2O)2.CF3O- (m/z 121) as a proxy for water mixing ratio. This ion was periodically calibrated to absolute water mixing ratio using standard RH data. The CIMS HONO sensitivity factor varied by less than $\pm$15% over the range of water mixing ratios encountered in BEARPEX 2007.

Comment (3): I also suggest the author move section 3.3 (inter-comparison) before section 3.2 (diurnal HONO trend). It seems more logical to validate the data first by inter-comparison before further discussions.

Response: We have made this change as suggested. Because of this change, we also change the order of Figure 5-7 (Figure 7 is now Figure 5, Figure 5 is now Figure 6, and Figure 6 is now Figure 7).

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/10/C4497/2010/acpd-10-C4497-2010-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7383, 2010.