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Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of an online ion chromatography-based instrument for gradient flux measurements of speciated nitrogen and sulfur" *by* Ian C. Rumsey and John T. Walker

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We wish to thank the reviewer for their careful and thoughtful review and acceptance of our manuscript. Our response to the reviewer's questions and recommendations is as follows:

Comment 1: This manuscript presents a very detailed analysis of the application of an online wet chemical system to the measurement of surface-atmosphere exchange by gradient measurements. The manuscript is generally well-written and suitable for publication in AMT.

Response: Thank you.

Comment 2: In the analysis, the authors use the co-location tests to correct for offsets between different samplers. While the authors state in the conclusions that colocation tests are valuable, it would be useful to know how the results would have been impacted if this correction had not been carried out. This insight could help other researchers to evaluate whether they need to carry out a co-location test before attempting similar measurements.

Response: We appreciate the reviewer's comment and agree that more detail on the importance of the co-location tests is warranted. As an illustration, we performed a sensitivity analysis in which we applied hypothetical co-location corrections to the three weeks of data presented in the manuscript. For the sensitivity analysis, a reasonable range of slope and intercept values were determined based on co-location slope and intercept values from this manuscript (see table 1 (table S6 from supporting information)). To illustrate the influence of co-location slope and intercept values on overall average fluxes, we quantify the percent change in average flux, with test values for slope and offset applied, relative to the average flux assuming a slope and offset of 1 and 0, respectively.

Results, shown in figure 2 (figure S7 in the supporting information), indicate that correction for a co-location slope of 1.1, and assuming an offset of 0.0, can change the average flux by 30% for HNO3 and approximately a factor of 4.5 for NH4+. Correcting for an offset of 0.1, assuming a slope of 1.0, can change the average flux by 70% for SO2 and approximately a factor of 7 for NH4+. Because concentration gradients are small relative to the air concentration, the co-location correction can be large, particularly for aerosols, which deposit more slowly than gases thereby resulting in smaller concentration gradients. It should be noted that, because concentrations and fluxes (i.e., concentration gradients) vary by site, the importance of the co-location test will also vary by site. However, the sensitivity analysis presented here demonstrates that co-location tests are needed to help control the accuracy of the concentration gradient measurement. The above information has been added to the supporting information. A

short paragraph indicating that an analysis of the influence of the co-location concentration adjustment on calculated fluxes is provided in the supporting information has also been added to the manuscript.

Comment 3: I would have found the supplementary information much easier to follow if the figures appeared in the relevant sections throughout the document rather than all at the end.

Response: Thank you for your suggestion. We have now grouped the supporting tables and figures into sections.

Comment 4: Table S4 – intercept should have units.

Response: Thank you for your comment. We have now added units to the intercept columns of table S4 (now table S6 in the manuscript).

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Table 1. Orthogonal least squares regression coefficients comparing SB1 (x) to SB2 (y). Results are reported for individual colocation experiments during June-July (Period 1), August (Period 2), and October, 2012 (Period 3). Number of hourly observations for each period are approximately 87, 138, and 73, respectively.

Period	1	2	3	1	2	3
	--------	Slope	-------	-------	Intercept ($\mu g\ m^{-3}$)	-------
NH_3	0.94	1.03	0.95	-0.10	-0.01	-0.08
NH_4^+	1.06	1.01	1.02	-0.03	-0.01	-0.01
HNO_3	0.86	1.02	1.00	0.05	-0.02	-0.01
NO_3^-	0.87	1.06	1.03	0.02	-0.02	0.01
SO_2	0.97	1.04	1.03	-0.02	-0.01	-0.05
SO_4^{2-}	1.02	0.99	1.01	0.09	0.05	0.01

Fig. 1.

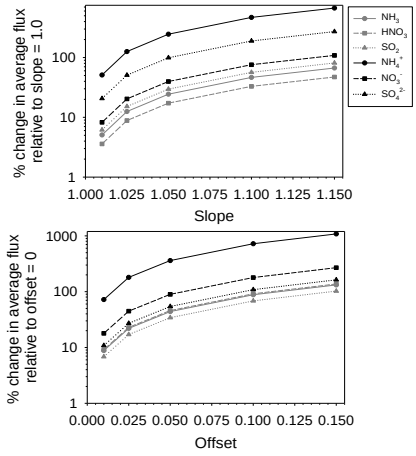

Figure 2: Results of co-location sensitivity analysis in which hypothetical values of slope and offset (intercept) were applied to the observed fluxes.

Fig. 2.