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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "The use of disjunct eddy sampling methods for the determination of ecosystem level fluxes of trace gases." *by* A. A. Turnipseed et al.

A. A. Turnipseed et al.

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We would like to thank Referee #2 for his/her insightful and helpful comments. Our responses to the specific and technical comments are listed below.

Specific comments

Experimental

Reviewer Comment: Page 15: Description of the DES sampler: Sample air is fed through a pump before analysis (or storage in case of DEA); this can be critical for measurements of some compounds and a sentence should be added explaining why the authors are convinced it will not affect the measurements presented here.

Author Response: We agree with Referee #2 that passage of the sample through the pump can be a substantial problem for many compounds. We used a pump with Teflon diaphragm and observed no measurable losses for either of our target species (CO2 or isoprene) in lab tests prior to field deployment. We have added the sentence: "Laboratory tests showed no losses of our target species (isoprene or CO2) upon passage through the sampling pump."

Reviewer Comment: The flushing via V2 (and through the vent between VA and VC?) during step(1) and step (3) minimise carry-over effects. In case of DES (configuration 3a) carry-over seems to be completely avoided, but from the given information it is not possible to assess potential carry-over for the DEA configuration. More detailed information about the remaining "dead volumes" (vol. between the cross and VA/VC and between VA/VC and bags) should be given to exclude significant carry-over effects.

Author Response: The referee is correct in pointing out that carry-over between samples is a significant concern in the DEA mode. The dead volume between the cross and valves VA/VC was only 0.06 cm3 (a 2.5 cm piece of 1/8" Teflon tubing). For a typical dispense time of 5 seconds at a flow rate of 250 sccm, this is $<$ 0.5% of the added volume per sample. The referee was also concerned about the dead volume between Valves VA/VC and the actual bag reservoir. This volume was $<$ 2 cm3 and was insignificant relative to the total reservoir volume (˜ 1 Liter). We have added the sentence: "The dead volume between the cross and valves VA-VC was kept as small as possible ($<$ 1% of a typical dispense volume) as well as the volume in the connecting tubing from VA-VC to the bags ($<$ 2 cm3) to minimize carry over effects."

Reviewer Comment: Page 16: Selection of w for determining dispense time in DEA mode: It seems that the best w reading would be the data point just before stopping the ISR flow, i.e. 0.1s before stopping the flow or an averaging of the two w measurements during the filling of the ISR. Have the authors explored the influence of such a w-averageing/selection?

Author Response: We used a lag time of 0.2 s (or two data points before stopping the ISR flow) based on flow rate measurements. The suggestion that the "best" w reading for basing the DEA decisions would be the data point just prior to stopping the ISR flow or by averaging the prior two data points has significant merit when taking into consideration the temporal concentration profile along the inlet/ISR. However, a DEA simulation using the sensible heat flux data from Figure 5 and offsetting the w and temperature time series by up to 0.3 s (or 3 data points) resulted in only a 6% flux loss. This suggests that, at least over the tall canopy here, the autocorrelation of w is broad enough that errors in the lag time selection (by 1 or 2 samples) will be small relative to the overall uncertainty in the measurement (described in the text). However, this may be more of an issue for DEA measurements over short canopies. On page 21 (in Results section), we have added: "We used a 0.2 s delay time to account for transit time in the ISR/inlet of the DEA as suggested by flow rate measurements and our previous DEC cross correlation measurements. DEA simulations using sensible heat flux data and varying the lag between the w and Tv time series indicated only small losses in flux (˜6 %) for errors in lag time of up to 3 samples (0.3 s). Any small error caused by improper lag selection is likely overwhelmed by the overall uncertainty in the flux measurement (discussed below)."

Results and discussion

Reviewer Comment: 4.1. DEC/EC intercomparison: The tendency of DEC to be higher than EC fluxes is surprising, but as stated, within the uncertainty. How close were the EC and DEC inlets to each other, could differences in sensor separation be an issue?

Author Response: The tendency for higher fluxes from the DEC system relative to EC was also surprising to us as well. The two systems were displaced 0.5 m vertically and 2 m horizontally on the tower. We cannot rule out sensor separation as part of the reason for the discrepancy; however recent intercomparisons at Niwot Ridge suggest that much of this discrepancy may be explained by an underestimate of the EC fluxes from the closed-path CO2 flux system. This is thought to be due to loss of high fre-

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quency fluctuations in the long inlet line of the EC system and appears to result in flux underestimates of up to10%. This flux bias is likely less significant in the DEC due to the short inlet line and very high flow rate.

Technical corrections

Reviewer: Page 15, lines 11 and 14: Wrong figure numbers

Author: Corrected.

Reviewer: Page 15, line 18: remove "the".

Author: Corrected.

Reviewer: Page 15, line 19: ... and obviously also V1 needs to switch

Author: Corrected.

Reviewer: Page 15, line 20: sccm/min

Author: Corrected.

Reviewer: Page 24, line 3: Figure 8b. Switching the order of figure 8a and b would be more intuitive and logical.

Author: We have taken the reviewers suggestion and switched Figures 8a and b. We have changed the first sentence of the paragraph in question to introduce the figure.

Reviewer: Table 1: The websites mentioned here cannot be accessed, please verify.

Author: Corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13413, 2008.

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