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Atmospheric Measurement Techniques Discussions

Interactive comment on "Lag time determination in DEC measurements with PTR-MS" *by* R. Taipale et al.

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We thank the referee for the review and the helpful comments.

The referee had two main issues. First, the referee suggested pointing out clearly that the averaging approach can be useful also in conventional EC measurements with a low signal-to-noise ratio. We added this note to the abstract and conclusions.

Second, the referee was doubtful about the visual assessment method (VIS) as it does not appear to be scientifically sound. Right, VIS is not a formal and objective method. It is an ill-defined but extremely practical procedure. Many groups have applied it to DEC measurements affected by noisy covariance functions. We certainly hope that our averaging approach and its possible future upgrades will become one objective

alternative to visual judgement. However, subjective assessment still has a central yet rarely advertised role in lag time determination. The presence of VIS in the method comparison seems therefore justifiable, even though we fully understand referee's concern about the lack of objectivity. We amended the method description to make it more informative (please see the details below).

We noticed a small mistake in the calculated lag times for the IRGA and PTR-MS measurements in Sect. 2.4. They were revised from 2.7 and 7.0 s to 2.9 and 7.1 s to take account of the tubing inside the instruments. We also revised the error definition in Sect. 3.2 to clarify the error analysis. The effects of these corrections were fairly marginal but enhanced the consistency of the paper. We modified the text and figures accordingly.

Response to the specific comments

P408, L15: We changed "the only viable method" for "the only viable option" to slightly tone down the sentence and improved the method description in Sect. 2.4.

P409, L3–7: We inserted a reference to Müller et al. (2010) in the end of the paragraph. We also added a remark on the applicability of AVG to conventional EC measurements to the abstract and conclusions.

P411, L8–10: The idea was to study whether some of the lag time methods yield better agreement with the reference H_2O fluxes in terms of the linear correlation coefficient. It was adequate to express M37 in ncps for this purpose. To clarify our aim, we changed "agreement" for "correlation" in the text.

P412, L13–15: True, the example in Fig. 2 implies that the lag time ranges -180 to -160 s and 160 to 180 s were not wide enough. These 20-s windows were adopted from Spirig et al. (2005). We tested the sensitivity of the flux uncertainty estimation by increasing the windows from 20 to 60 s at intervals of 10 s. Although individual values varied, the changes in the median uncertainties were not statistically significant. This held true for H_2O_{noise}, M33, M37, and M137. We decided to use ranges −180 to −140 s and 140 to 180 s in the revised manuscript. They captured the true variability in the covariance function slightly more often than the original ranges. In addition, these 40-s windows were deemed narrow enough to avoid contribution from the covariance function maximum.

P413, L6–7: To clarify the rationale behind TYP, we interpolated this note in the text: "The objective of this method was to illustrate consequences of considering a limited number of measurements representative of the whole period." The number of acceptable measurements was limited to five due to the methanol data. However, somewhat less distinct covariance function maxima were identified in VIS.

P413, L20–24: As explained above, we would like to include VIS in the method comparison. Hence we improved the description in Sect. 2.4: "The VIS method was based on manual assessment using the following guidelines. The lag time was determined visually from a figure showing a covariance function for the lag time range −180 to 180 s. This first view gave a general idea of the function patterns and noise. It was zoomed in on the lag time window used in MAX to look for a positive or negative peak with a minimum height of about two times the noise and a minimum base width of about 2–3 s. The lag time was determined from around the middle of the peak, i.e., not necessarily from the maximum. If an unambiguous resolution was impossible, only the flux uncertainty was calculated."

Conclusions: We added a note on the importance of determining the optimum averaging window for each application to the conclusions. The basis for our five-second averaging window was included in Sect. 2.4: "The width of the averaging window was estimated visually using the EC measurements of H_2O and the simulated DEC data of H_2O_{noise}. The chosen window was deemed wide enough to allow a sufficient noise reduction but also narrow enough to prevent a considerable shift in the covariance function maximum." We tested the effect of the averaging window on the H_2O_{noise}, M33, M37, and M137 fluxes by changing the window from 3 to 7 s at intervals of 1 s.

The median fluxes were not affected, and more importantly, the error in H_2O_{noise} was never statistically significant.

Response to the language corrections

P406, L15: Replaced with "based on".

P407, L23: Replaced with "Slower instruments".

P408, L14: Replaced with "dependent".

P408, L18: Replaced with "difficulties".

P409, L4: Replaced with "affected".

P409, L8: Replaced with "look at".

P410, L28: Replaced with "procedure".

P411, L12–13: Replaced with: "The correlation between the M37 signal and the H_2O concentration varied substantially. When calculated for the 45-min flux averaging time, typical daytime correlation coefficients were 0.65–0.90, but nocturnal values were below 0.30."

P413, L5: Replaced with "the lag time was kept constant".

P413, L20: Replaced with "was based".

P418, L1: Replaced with "It would be wrong".

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 405, 2010.