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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparative measurements of water vapor fluxes over a tall forest using open- and closed-path eddy covariance system" *by* J. B. Wu et al.

Anonymous Referee #1

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This could potentially be an interesting paper comparing long-term water vapor flux measurements using open-path (OP) and closed-path (CP) systems above a temperate forest in China. The novelty of the study could be better emphasized but it is true that there are much fewer long-term studies comparing OP and CP water vapor fluxes than it is the case for CO2 fluxes. The vegetative region in China is underrepresented in these measurements (e.g. evapotranspiration). Long-term measurements using OP and CP systems can be helpful to characterize and reduce the uncertainties in each season in which changes in relative humidity and other environmental parameters can impact the accuracy of fluxes measured by OP and CP systems.

General
Although the paper makes a promising first impression, after reading it more thoroughly it becomes apparent that significant work is needed to meet the AMT standards. The story is unfocused and generally unclear which often misleads the reader. It promised long-term measurements but the actual comparative fluxes are demonstrated only for five days (Figure 3 and 4). The annual data in Fig 5 therefore does not seem to be justified. A more extensive period of calculated fluxes including gapfilling (e.g. highlighted with different color) would be more convincing.
It is paramount to observe quality control protocols and account for all the major factors behind the accurate measurements. The authors point to the importance of accurate lag-time determinations but it is unclear which dataset was processed with which lag time approach. This is unfortunate because demonstrating the importance of lag time could have convinced those from the community who regard the lag-time component as trivial. Figure 3 shows counter-intuitively that the datasets are not much different regardless of which lag-time approach is used. This is very surprising because the authors discuss that the lag time was not constant and therefore inaccurate lag-time would be expected to cause significant underestimation (e.g. Taipale et al., 2010).
It is suggested that the authors make a deeper insight into the interpretation of the results, clarify in the methods how exactly (step by step) each flux dataset was treated and work on the overall coherence of the story. In addition the comments below should be addressed before the publication in AMT.

Major
1) The authors made a good effort to describe corrections applied to the fluxes. While they describe the corrections it is not clear how and to which datasets they have been applied. It could be useful for a reader to have this information summarized in a table (e.g. expanded Table 1 or as a new table) so that it is clear which corrections were included to the CP and OP systems and if there were any differences in how the OP

and CP datasets were treated.

2) It is mentioned that 15.7 % of data were rejected due to nonstationarity. Were the fluxes from the second class (i.e. low quality) permitted? It would be useful to know how much data were in each quality category for each correction. It is also unclear if the authors detrended the datasets before the flux calculation and if the night time data below the u* threshold were rejected.

3) Water vapor fluxes can be underestimated for a number of reasons, including mismatched fetch, inhomogeneous surface characteristics, lack of coincidence of source areas (e.g. leaves, soil) (e.g. Mahrt, 1998). The authors do not discuss here moisture advection or flux divergence. The question is if the impressive agreement between the LE fluxes measured by CP and OP can be for the right or wrong reason? The discussion should be expanded to include all important factors.

4) The major problem with the data is clearly seen in Figure 1 which I have pointed to during access review to give authors a chance to clarify these discrepancies. P4718 L11 "As shown in Fig. 1, the fluctuations in water vapor density recorded from the OP analyser are similar to those from the CP analyser, and both follow the same fluctuation trends." It is extremely surprising how these two traces can look similar to the authors. Further the authors write: "Overall, the magnitude of fluctuations in water vapor densities measured from OP system is approximately 1.2 times higher than that from the CP system." –The amplitudes seem to me at least a factor of two different. I am therefore concerned about the quality of the presented data. I had thought that the authors showed different periods by mistake, but looks like there must be a problem with the data if these are the same periods (after lag-time correction). Do the authors suggest that the tube attenuation could completely change the signal? This reviewer is not convinced.

Specific

5) P4715 L14 Data processes or data processing?

6) P4718 L7 Why is there a correspondingly larger fraction (15.7

7) P4718 L11 "The time series from the CP analyser was set back 9.1 s to account for the tube delay." This is confusing. Earlier the authors wrote they used accurate lag-times from crosscorelation which were meant to be compared with median lag-times. It should be made very clear how the lag time was accounted for in each analysis.

8) P4717 L15 "Comparison of data coverage" seems to be misleading. The authors are describing here differences in data availability, but this section could fit better the methods section. A section "Flux validation and quality control" with individual CP and OP subsections could make it much clearer to a reader how the data were treated.

9) Table 2 "For sound statistical analysis, the minimum available data for time lag analysis was 30 in each class. If the filtered data number is less than 30, its time lags are set equal to that of adjacent class.". I am not comfortable with this statement. I think it would make sense to show the median lag time values also for the dry conditions.

10) P.4719 The discussion about the lag times is generally interesting but unfortunately is very unclear. It is expected that lag-times from the covariance function would not work at night due to low turbulence. Also condensation in the tube should be prevented in particular when the temperature goes down in the morning. Was the tube insulated/heated to prevent condensation? If not, the data which clearly indicate water condensation should be rejected.

11) P.4720 L.1 “This increases the possibility that unrealistic time lags are detected and hence results in flux overestimations”. This does not make sense. If the lag time is inaccurate the flux should be underestimated not overestimated because the value would be away from the maximum peak (e.g. Taipale et al., 2010).

12) P4722 L11 “But currently, there are no generally accepted standard procedures to handle the flux data.” This is very surprising to hear from the authors (see, for example, Foken et al., 2005; Mauder et al., 2008).

13) Conclusions are not sufficiently strong and lack clear take-home messages. In particular the last sentence is not impressive. The authors should try to summarize the novel elements of their study and highlight the key findings in response to what has been promised in the abstract.

14) Table 1: What do you exactly mean by "total datasets", "Technique issues", "other hard flags without no clear reason"?

15) Table 2: if there was no data in class 1 it can be deleted. The median flux value should be used in class 2 as in other classes even though less data points is present in class 2.

16) Figure 1:It is unclear why the datasets are not similar. It does not seem to be because of dampening in the tube. Perhaps the data may have been taken from completely different periods.

17) Figure 3: It is recommended to replace DOY with actual date including the year.

18) Figure 4: as above

Technical

There are numerous places with spelling, typographical and language issues. The language and clarity should be significantly improved throughout. In particular some sentences can be difficult to understand for readers. Here are just a few examples: P.4712 L19-22, P. 4714 L20-21, P4718 L6-8, P4714 L15.

References

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