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Atmospheric Measurement Techniques
Discussions
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Interactive comment on "An innovative eddy-covariance system with vortex intake for measuring carbon dioxide and water fluxes of ecosystems" *by* Jingyong Ma et al.

Anonymous Referee #2

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Summary: ——

This paper describes a new intake (called the "vortex" intake) that is part of the Campbell Scientific EC155 eddy-covariance system. The subject matter is appropriate for the AMT journal and the topic is innovative and interesting. While I am completely convinced by the authors that the vortex inlet requires less maintenence than a standard in-line filter type system, which is especially important in "dirty" environments; I am less impressed with the instrument-comparison-setup and presentation of the limited results that are shown. Though the authors want the readers to believe the vortex inlet has similar or better frequency response, a more focussed field comparison should be presented to convince readers (or at least this reader).

General Comments: ————

1. In the conclusions the authors state, "There was no signficant attenuation of high frequencies, compared to the in-line filter-based system." I have the following comments related to this statement:

- a much more robust field comparison would be to have both a vortex and standard inlet systems setup side-by-side and operated over a long time period. In that way, a true comparison between instrument can be performed and the relative frequency respone between sensors can be presented.

- This statment in the conclusions apparently comes from Fig. 4...there are several questions about this figure (listed below), but from what I understand these normalized cospectra are from mid-day...if you want to convince me that the two different inlet types agree, you need to show that they agree during more than just mid-day conditions—-some comparison over a range of stability conditions should be shown.

2. It is stated that the freq response of sonic temperature produces an "ideal" response (p. 11). The results in Fig. 4 appear to suggest that the CO2 and H2O response are both exactly the same as that of temperature. One needs to keep in mind that this result is only for mid-day conditions and does not necessarily extend to other conditions (the discussion on p. 11-12 does not mention this important fact at all). I also don't see a "sharp attenuation when the frequencies > 0.1 Hz" for WC and WH...it looks to me that the WC, WH, and WT cospectra all follow each other very closely? Finally, why does the vortex inlet "warrant automating high-frequency spectral corrections"? Because of the comparison with WTs?

3. The vortex inlet appears to have a sharply angled side walls...was this element to the design given much consideration? There has been much research in the particle sampling community that might be relevant here..I give one example reference, but I'm sure there are many...

Hermann, M., Stratmann, F., Wilck, M., & Wiedensohler, A. (2001). Sampling characteristics of an aircraft-borne aerosol inlet system. Journal of Atmospheric and Oceanic Technology, 18(1), 7-19.

4. The fluid mechanics in the inlet look like they might be quite complicated.. Has any wind tunnel or CFD modeling of the inlet been made? How does it perform in high winds?

5. The english language usage could be improved in places (a few examples are below).

Specific Comments: ——————

* p.3, l.47, "extent" should be "extend"...

* p.4, l.85, isn't the system not working properly in the examples already given? (ie, what do you mean by extreme cases?)

* p.5, l.108, how often is "frequently"? every week? every month?

* p.6, l.113, "The vortex intake..."

* p.8, l.157, "vortex inlet", not "vortex design"

* p.8, l170-172 and Fig. 2..it would be nice to add arrows and label some of the components shown in Fig. 2 that are discussed within the text.

* p.9, l.180, details about the "large filter"?

* p.9, l.190, mounted on the tower at a height of 11.7 m. (similar fix to wording for the Badaling site).

* p.9, l.192, this statement is rather vaugue (or, is there a better reference with more specific details about these EC data?).

* p.10. l.207, what do you mean by "very well"? Can this result be quantified?

* p.17, "Mchale" should be "McHale" (similar for McPherson).

* p.25, Fig.4, these are normalized cospectra so please state that in the legend.

* p.26, Fig. 5, what happened to the vortex inlet that is shown in Fig 5b. It is clearly much better than the inline filter, but it also appears to have some problem. Was a specific component of the vortex system getting plugged up?

* p.27, Fig. 6, any idea about the cause of the small "wiggles" in the differential pressure time series for the vortex inlet (I don't see any such wiggles with the inline filter)?

* in both Figs 5 and 6 the filters are clearly getting quite dirty–but the optical signal strength (red line) for the inline filters is practically unchanged (even in the very dirty environments)...is there any explanation for this seemingly surprising result? Also, is there any reason why the optical signal strength for the inline filters shown all start so low (near 80%) while those for the vortex intakes are all close to 100%?

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