Review
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Title: Mean vertical velocities and flow tilt angles at a fetch-limited forest site in the context of carbon dioxide vertical advection

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General evaluation

This manuscript is an important contribution to an unsolved problem in micrometeorology, namely the measurement and the assessment of the true meteorological vertical wind component. In this context the crucial topic of vertical advection is also shortly addressed. In general, the paper is well written and provides new insights in sonic anemometry and some of its applications.
My main criticism is that the text is rather long. Though being aware that the use of LIDAR data for the assessment of the vertical mean velocity may provide helpful information, I have the impression that this part of the analysis is somewhat superficial and preliminary, as mentioned by the authors themselves. I therefore suggest deleting the LIDAR parts from the text and publishing in a separate paper after a detailed revision. In my opinion the analysis about sonic anemometry (tilt corrections, angle of attack, accuracy, vertical advection) provides enough material for a very interesting paper.
Since the proposed changes require substantial modifications and rearrangements of the text and some of the figures, my recommendation is accepting the paper only after “major revision”.

Detailed remarks:

I could not find a comment in the text referring to fig. 2!

y-axis of fig. 4 is confusing. Why using a log-scale? The log-scale gives the impression that there is a lot of data with absolute flow angles greater than 30 degrees and absolute vertical velocities greater than 2 m/s though there frequency of occurrence is less than one ppt!

P8169L7: please, cite correctly “Paw U et al., 2000”, also the following citations of this author and in the reference section P8199L8. His first name is “Kyaw Tha”, his last name “Paw U”
P8172L11: In the Vickers and Mahrt (2006) study, horizontal advection was not explicitly measured (or “investigated”), but taken as the residual of the carbon balance equation (their eq. (7)). I therefore suggest to delete “horizontal”.
P8172L19: suggestion to replace “used” by “tested”
P8172L21: “horizontal”
P8173L19-P8175L5: additional literature: Dupont & Brunet (BLM 2007): Edge flow and canopy structure: A LES study.
P8180L21ff: suggestion to move the description 1.-8. to the figure caption
P8181L24: please, place brackets correctly “Pilegaard et al. (2003)”
P8182L10ff: I am not surprised that “these effect have otherwise been ignored” (L24). In my opinion, the van der Molen correction has some important deficits: it is only derived from a 60° sector (ignoring the struts), which is then extrapolated to 360°. And it is supposed to be generally applicable to every Gill sonic with the

relevant geometry. However, Gill provides individual instrument specific calibration files, probably with good cause.

P8184L3-9: suggestion to delete this paragraph because it is not relevant

P8185L19ff and fig. 5: Obviously, corrections for the R2 are largest during the day. Is this related to the prevailing wind direction or mainly to the angle of attack? Further on, the METEK correction seems to be a simple offset correction. Please comment!

P8187L7: P8186L24: “The good agreement….” With a correlation coefficient of 0.25?

P8187L9ff: This section is confusing, please consider rewriting. What does “the 50 samples running mean curve” mean? The curves in fig. 7 rather seem to represent bin-averaged points (of 50 samples for each point? Placed in the middle of the respective wind direction interval?) In this case, additional symbols could make the plot better readable and provide information about the frequency distribution of wind direction.

P8188L4ff: Does this mean that the corrections have a huge impact on w (as fig. 5 suggests) but not on the flow tilt angle? Later in the text (P8189L4ff) it is written that “the correction … led to a large negative shift of vertical velocities **and** flow angles”

P8190L1: “or” instead of “of”

P8191L23: “flexed”! This is a rather adventurous speculation!

P8192L7ff: This section is nearly unreadable! The reader is forced to switch back and forth between figures 1 to 10. At the end (L21ff) he learns that “this detailed interpretation … is uncertain”! Please consider rewriting.

P8193L10ff: This section could be extended. I do not understand why using “a hypothetical case” (L25) if there is real data available?