

Interactive comment on “Identification of Tower Wake Distortions Using Sonic Anemometer and Lidar Measurements” by Katherine McCaffrey et al.

Anonymous Referee #4

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This paper presents a nice study of flow distortion characterization around a super-structure, in this case the tall-tower of the Boulder Atmospheric Observatory (BAO) tower near Boulder, CO. The results show the importance of assessing these effects when doing observations with sonic anemometers. By combining both sonic anemometer and lidar technology, the methods used in this study give a clear picture of the distortion impacts and provide suggestions on how to best quality control such data set. Overall the paper and results are interesting but I suggest some modifications for consistency and clarifications.

Specific comments:

- * In section 2.1 you refer to a “four-step, six-sigma outlier-rejection scheme” being

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applied to the data. Can you elaborate a bit on this? Do you mean you plot the distribution, use a six-sigma limit to reject outliers and repeat 4 times? Is that the reason why on Figure 4b, some data are missing for the northwest sonic (blue line) around hour 11?

- * In section 2.2, what is the width of the WCv2 range gates? You mention a 50m pulse with for the 200S lidars but we don't know for the WCv2. Also there is something confusing on the 200S scanning strategy. In this section, you mention that from 21-24 March the stares were performed at 50, 100 and 150m. But then in Figure 13 you mention it went from 50 to 300m. Might want to verify for consistency.

- * In section 3.2. Line208-209. When the sonic anemometer is in the wake, its TKE should increase and this is what Figure 8 is about. The red dots are depicting the case where the NW sonic is in the wake of the tower, i.e winds are from the SE, so that NW TKE>SW TKE. And vice-versa. Therefore, one should read “... , either above (northwest sonic anemometer is in the wake) or below (southeast sonic anemometer is in the wake).”

Technical corrections:

- * line 32: “solidity of the tower” are you insinuating that a less solid tower would not disrupt the free-stream flow? Perhaps use shape, structure, frame ...
- * line 49: Replace “5.7 x” by “5.7 times”
- * line 207: “The biases in observed TKE are displayed in the scatterplot in Fig. 8”
- * lines 259-261. Numbers not consistent with figure and table 1. Also part of the sentence is redundant with lines 257-258. I suggest “The northwesterly winds see wake effects 54 degrees clockwise from the northwest boom, and 46 degrees counter-clockwise from the northwest boom.
- * Table 1. Add a line describing the columns. For instance “ columns indicate swath counterclockwise (CCW) and clockwise (CW) from boom of interest”

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- * Line 332: Northwest and southeast are flipped. One should read “the northwest (top panel) and southeast (bottom panel) booms of the BAO tower.”
- * Line 344. “This effect is not, however, seen in the WCv2, and is not visible in the comparisons. . .”. This is not consistent with what is said in section 4.1 and figure 13b where we see that the ratio from the WCv2 dips below 1 in the 90-210 range. . .please correct. Perhaps: “This effect is not visible in the comparisons. . .”
- * Line 352: “The WCv2 does not see this dip in wind speed. . .” I thought we were talking here about the situation where the ratio is above 1. Perhaps replace dip by increase or move this phrase where it belongs.
- * Line 416-418: “the question arises as to what fraction of data points are in a wake in a temporal averaging interval and how it will substantially alter the mean observation away from the free-stream value. “
- * Line 433. “(123–179 and 310–10 degrees)” – numbers not consistent with table. Perhaps you mean 100-175 and 300-25?
- * Line 474. Numbers not consistent with figures and table. One should read “between 115 and 17, and 315 and 10 degrees “
- * Line 480. Again number not consistent with figures and table. One should read “from 100–175 and 300–25 degrees from north “
- * Figure 3 bottom needs more legend and clarification to be consistent with the discussion in the text. Mention that the crosses are the center or the measurement volume (cyan square) and VTS footprint (black circle) or get rid of them. Also describe the line by saying here they represent the extent of the range gates from the 200S lidars and that the circles are the centers. Similarly add a note on the fact that we see the WCv2 lidar on the top picture.
- * Figure 12b. Shall we assume that N=2188 as in 12a?

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- * Figure 15: Are we looking at 2-min data? Perhaps add it in the caption. Also correct your x-axis label to show that it is “theta lidar” or “theta WCv2” to be consistent with labeling of figure 13.

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