

Interactive comment on “Improved Observations of Turbulence Dissipation Rates from Wind Profiling Radars” by Katherine McCaffrey et al.

Anonymous Referee #1

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1 General comments

In this article, the authors attempt to measure the dissipation rate of turbulence in the atmospheric boundary layer using vertically oriented, high spectral resolution, wind-profiling radars (WPRs). They compare their measurements with a collocated array of sonic anemometers, and they find a degree of comparison. For the most part, I found this paper clear, easy to read, and interesting. While I don't share the enthusiasm of the authors in their conclusion, I do think that the techniques and the results presented contribute to scientific progress. I recommend this article for publication, with the condition that the authors address the scientific and technical questions I've listed below.

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2 Specific comments

In the first paragraph of Section 3.1, an important point is made on how dissipation rate can be measured by a WPR. However, the reference is to another article, under review, by the lead author of this article. Is there not a more authoritative reference, perhaps Hocking (1985) or Cohn (1995)? Further, this sentence would be a better fit in Section 3.2. References to McCaffrey *et al.* (2016a) are again used in Section 4.2, in Section 5, and in the Conclusions. Might a more canonical reference be appropriate in these locations, as well?

In the third panel of Figs 3 and 6, the lower bound of the y -axis should be zero, since the fractional bias values are never less than zero. In the current Figures, this causes the bias values to appear closer to unity than they actually are. Further (and we can argue about this, because perhaps I'm being too picky), in Figs 3, 6, and 8-11, the fractional biases should be plotted as a ratio, not as a percent. Plotting as a ratio would decrease chartjunk. Moreover, plotting as a ratio would make it clearer just how different the ϵ values calculated from the different sources can be. For example, in Fig 11, the 449-MHz WPR measures bias-corrected ϵ values that are remarkably close to those captured by the sonics, but only over a range of $[3 \times 10^{-4}, 6 \times 10^{-2}] \text{ m}^2\text{s}^{-3}$. Outside of this range, the values differ by a factor of two to a factor of 100. (An aside: an explanation is offered for why the WPRs don't match the sonics for these large and small values of ϵ at the end of Section 5. Perhaps this could be expanded and included in the Conclusions?)

Figs 12 and 14 would also benefit from additional detail. I'd like to see R^2 values for the plots in Fig 12. They look like blobs. In Fig 14, a subplot of residuals would give a more accurate view of the differences between the dissipation rates measured by the sonics versus those measured by the WPRs. By eye, the plots look close, but the residuals might show otherwise.

I also have a short list of secondary scientific comments. Line numbers are given

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where appropriate.

- 71: It would be helpful to move the description of ΔR to Eqn 11 (I had to flip back to find it)
- In Eqn 8, $\phi_E(k)$ isn't defined; is this the 3D spectrum?
- In Figure 1, it's difficult to distinguish the pale and bright colors
- 135: I suggest "interval" instead of "inertial range", since you can't be sure that this is the inertial range
- 136: I would prefer a more authoritative reference than the one given
- In Figs 9 and 10, the purple is really close to the red; could a different color be used?
- 392: Strike "very"

3 Technical corrections

There are several run-on and clumsily structured sentences. One more read-through by the authors, which will likely come about through the review process, will undoubtedly help.

- 21 "Wind profiling radars...": Run-on sentence, with "introduced" used twice
- 41 "A 300-meter...": Run-on sentence
- 44: "6" should be "six"

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- 45: "wind profiling radars" should be "WPRs"
- 46: Strike "the" after "BAO"
- 76 "If desired...": Run-on sentence
- In Eqn 3, the subscript i is used to represent velocity components, while on line 121, xx is used
- In Eqns 4, 6, and 11, three different symbols are used for mean wind speed
- 114: The end of the sentence might read better as "which operate at sufficiently high frequencies to resolve the inertial range"
- 120: Strike "used to move from frequency to wavenumber space"
- 133: Strike "It is seen that"
- 151: Run-on sentence
- 164, 255: Use "percent" instead of symbol
- 175: Sentence might read better as "The integral in Equation 12 can be solved by converting to spherical coordinates"

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