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Atmospheric Measurement Techniques Discussions

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Interactive comment

Interactive comment on "Recovery of the 3-dimensional wind and sonic temperature data from a sonic anemometer physically deformed away from manufacture geometrical settings" *by* Xinhua Zhou et al.

T. Foken (Referee)

thomas.foken@uni-bayreuth.de

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The paper describes a useful tool for recovering data from sonic anemometers when the mechanical construction of the anemometer has been slightly deformed. This may be of interest for remote stations without permanent control or following deformation during transport to remote areas, as was the case in the paper.

The basic equations of wind vector and of temperature measurements for sonic anemometers are given in the literature, e.g. for wind by Hanafusa et al. (1982) and

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for temperature by Kaimal and Gaynor (1991). Furthermore, overview papers and textbooks are available (Kaimal and Finnigan, 1994; Aubinet et al., 1999; Aubinet et al., 2012; Foken, 2017). It is unusual to use sensor documentation as a reference (p.2, line 2, p.4, line 32, p. 6 line 19). It is acceptable to use the symbols of these documentations. Furthermore you should highlight (e.g. p. 2, line 12, p. 6 line 23) that the firmware must be known in order to apply your method. This is true for the Campbell instruments but not for all available sensors on the market (or is p. 14 line 37-39 the relevant statement?). For specific firmware problems of Campbell instruments you should check the relevance of the paper by Burns et al. (2012) for your method.

The UW-sonic anemometer (University of Washington, Wyngaard and Zhang, 1985; Zhang et al., 1986) looks like the IRGASON, but is not identical. For the transducer shadow effect, first published by Kaimal (1978), you should use the data from the more recent reference (Horst et al., 2015), p. 5 line 29ff.

You used the calculated sonic temperature rather than the wind measurements as a reference for the accuracy of your corrections, because sensors were missing. Besides the difficulty of making a comparison with the 3D wind vector, there is another reason that the temperature is a more sensitive parameter. This can be shown if you add a small error epsilon to all measured traveling times in Eqs. 3 and 17. You can therefore assume that if the sonic temperature for corrected path lengths is within the accuracy limits of the sensors then this should be realized for the wind components as well.

The separation of the results (Section 4 – 7) and the discussion (Section 8) section is always difficult because of the repetitions. On the other hand, information from Section 8 is necessary for a better understanding of the applied methods (perhaps you can make some modifications), e. g. p. 13 line 18ff: different response times of measured and calculated sonic temperature. This is not a simple lag time. A correction of the dynamical error may be necessary.

Please discuss with the editor whether the software (Appendix C) should be published

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in the supplement (not as an Appendix) or in a separate software publication, e.g. on the Zenodo server (https://zenodo.org/).

Minor remarks:

Perhaps you could reduce the number of equations by writing the basic equations in a more general form like Eqs. 3, 4, 12, 13 etc.

p. 3, line 33: information about the used radiation shield of the HMP-sensor is necessary (ventilated?) for Section 8.

p. 11, line 10ff: Could you please give temperature differences in the SI-dimension K. In the present form misunderstanding is possible.

p. 12, line 1: The symbol cT2 could be misunderstood because CT2 is the standard symbol for the temperature structure parameter; perhaps you can find a better symbol.

p.14, line 2-3: I do not understand the sentence "sonic path becomes shorter by some degree". If the geometry of the sonic anemometer changes below – 20°C, why can you not correct this effect with your software.

p. 16, line 4-5: Energy balance closure is not a good indicator for data quality (Foken et al., 2012). However your result is in the typical range reported in the literature.

p. 22, line 12: Buck (1981) is not an acceptable reference, because the temperature scale has been changed (ITS-90). A relevant reference is WMO (2014 (update 2017)) or the original reference (Sonntag, 1990).

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