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Atmospheric Measurement Techniques Discussions

Interactive comment on "Fiber optic distributed temperature sensing for the determination of air temperature" *by* S. A. P. de Jong et al.

Anonymous Referee #3

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Short summary

The manuscript aims at showing how fiber optics distributed temperature sensing can provide accurate air temperature measurements, if the correction proposed by the authors for the heating of the optical cable due to incident solar radiation is applied. After a concise introduction on the fiber optics distributed temperature sensing principles and main applications, the authors present the correction and the experiment they performed to proof its effectiveness.

General Comments:

I personally appreciate the manuscript. It is well written, edited, and I think it deserves publication, although some minor revisions are necessary. In particular I like that the

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Interactive Discussion
Discussion Paper

authors tackle the problem of the presence of a multi-layer protection cable surrounding fiber optics. The effects of its presence on the measured temperatures are often either neglected or considered one of the most limiting factors to the use of fiber optics distributed temperature sensing systems, especially for active heating applications (i.e. when a heat pulse is sent along the fiber optics cable and temperature change rapidly, see e.g. Sayde et al. 2010). In this particular context of a cable stretched in the air and exposed to solar radiation, the authors clearly show how the uncorrected temperature data can differ from the real air temperature (black cable), but also show how a simple correction allow for significant improvements in the accuracy of the measured temperature. I find that the manuscript has a high scientific significance, not only for the Atmospheric Measurement Techniques but also for the community of fiber optics distributed temperature sensing users. Somehow, it represents an invitation to don't stop at the raw temperature data and instead to try to account for the factors potentially affecting the measurements, and correct for them, even in a very simple fashion as in this case.

Specific comments:

That said, I go more in detail into the scientific quality of the contents. I premise that I read both the interactive comment of the first referee and the reply of the last author, Prof. van de Giesen, and I refer to them in the next lines.

I agree with the fact that each experiment can be improved a posteriori, and that new measurements in improved conditions would always represent the best solution. But since in this case new measurements are impossible it is worth focusing on how these results can be presented in the best possible way. I agree with the points a), b) and c) raised by the first reviewer and I am fine with the way the authors replied in the interactive discussion and intend to update the manuscript accordingly.

Now I also have one main comment:

d) You stretched 750m of (different) cable with 3 splices and several spools for the

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calibration baths. Moreover, the Halo is not the non-plus-ultra of the instruments. You said that you measured in single-ended mode. I expect a quite high loss due to splices and distance, in particular for the thin white cable, the last segment. Did you check that? Did you also measure in single-ended but from “end to start” (from thin white to thick black) to compare and, in case, correct the temperatures? Or was the particular calibration that you applied able to compensate for the losses along the way? I think this is a crucial point that must be better explained. This also links to the reference temperature in the water baths. Please add more information (how did you monitor it? Fluctuations? Did you calibrate once or every measurements?) since the measured fiber temperature heavily depend on that.

Technical comments:

I agree with the technical comments posted by the first reviewer, therefore I will not repeat them. The authors will fix them properly. In particular, since the journal mainly focuses on the Measurements Techniques, more technical details, accuracies, comparisons with references, statistical indexes (rather than “good”, “close”, etc.) are preferable and they would strengthen the message.

In the abstract, you should give more emphasis to the significant decrease of RMSE due to the correction applied rather than the r2. I think that is the most impressive result.

Beside that, please cut the vertical axis in Figure 2 to 30 C for the 4 panels. This would increase a bit the temperature traces and would be consistent with Figure 3.

In the conclusions: what do you finally think is the best solution for atmospheric air temperature measurements? White thin cable plus the correction? Or at the end the correction acts so well that it does not matter the color and the thickness?

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 6287, 2014.