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Review of “Effect of snow-covered ground albedo on the accuracy of air temperature measurements” by Musacchio et al.

Craig Smith (Referee)

Referee comment on "Effect of snow-covered ground albedo on the accuracy of air temperature measurements" by Chiara Musacchio et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-63-RC1>, 2021

The paper entitled “Effect of snow-covered ground albedo on the accuracy of air temperature measurements” by Musacchio et al. describes a combined laboratory and field experiment to establish the impact of reflected radiation due to the presence of snow cover on the apparent temperature observation. Although temperature sensors employ radiation shields to prevent radiative errors to the measurement, most designs considered only minimizing errors from incoming radiation and not the errors associated with reflected radiation from snow cover (especially during conditions where the snow cover is fresh during low wind and high solar radiation conditions). The authors, after examining instrument uncertainty in a controlled laboratory, set up a field experiment using pairs of sensors located over a snow-covered area and over an area where the snow in the area of influence has been cleared. The results showed that the temperature error due to reflected radiative heating varied by configuration, but could be as large as 3° C.

I thought that the experiment plan was well thought out and appeared to be quite robust. The analysis and reported results were interesting and useful. I felt that the leading sections were generally well written with some wording and grammar issues that need to be cleaned up. The methodology was largely easy to follow and the figures, with some minor suggested edits, are appropriate. However, I felt that the Discussion (Section 5) and Recommendations (Section 6) are quite disorganized, poorly worded, and require a substantial amount of work before this can be published. My major concerns are as follows:

- 1) Generally, Sections 5 and 6 need to be re-written so that they convey the main points more succinctly. These require a thorough proof-read for English wording and grammar. I tried to make some recommendations, but since this needs to be re-worked anyways, I'm not sure they are that helpful.

2) In Section 5, many of the main considerations (lines 345-358) were confusing. The bulleted list is a good idea but this needs to be more clear. See the annotated file for more specific issues.

3) The discussion of the night time intercomparison in Section 5 (lines 359-361) doesn't really add much to the discussion and should probably be removed. You mention this also in the Section 4.4, stating twice (I think) in the paper that it is out of scope.

4) I thought that your discussion of your study limitations in Section 5 (lines 362-385) were too negative, somewhat detracting from the valid results. I think that you can point out your limitations and compromises with more brevity with a short discussion about how these may or may not have impacted your results, and thus improve the flow and readability of the section.

5) In Section 5, on line 388, you state "A complete correction curve in function of reflected radiation, wind speed for a specific instrument can be generated by users" but earlier you note that the relationship between temperature differences and reflected radiation are not always clear: line 329 "...the spread in values does not allow for a definition of a relation by fitting, nor it was possible to calculate a function between ΔT_{ref} and ΔT_{ref} ." Maybe I misunderstood the messages, but it appears contradictory.

6) In Section 5, line 390, you compare your methods to Huwald et al., (2009), referencing the use of a sonic anemometer on several occasions. Unless I missed something, you don't really talk much about the Huwald et al. methods so the reference to the anemometer use is confusing.

7) In Section 6 (Recommendations), it is good that you point out that recommendations have been submitted to WMO committees, but I would recommend that you summarize the recommendations based on what is found in this paper, perhaps in bullet form. If the purpose of the study is to make these recommendations, then they should be clear and concise, and not just quoted from another report. Also, pay particular attention to the redundancies in this section.

8) I would like to see some discussion in Section 6 as to why you think the different configurations are being impacted differently by reflected radiation, wind speed, etc. Can you make some general recommendations on shield/instrument design given your results, and if so, include these in the recommendations section? Further related to this, it would have been interesting to see a non-shielded pair of sensors in the experiment. Why was this not considered as a control?

9) Section 7 (Conclusions) can be written more concisely, quickly summarizing the

experiment, major findings, and main recommendations. The content is generally ok but it is too wordy with some confusing statements that muddle the message.

More specific comments and suggested revisions are embedded in the attached annotated document.

Please also note the supplement to this comment:

<https://amt.copernicus.org/preprints/amt-2021-63/amt-2021-63-RC1-supplement.pdf>