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Discussions

Interactive comment on "Hotplate Precipitation Gauge Calibrations and Field Measurements" *by* Nicholas Zelasko et al.

R. Rasmussen

rasmus@ucar.edu

1. Area incorrect: I agree that the area in my original paper is incorrect. We had a number of prior designs of the hotplate and this is probably left over from one of those sensor heads. Boudala et al. (2014) also found this. Not sure how I missed it in proof reading. However, I never expected the factor to be perfect, so I fully expected it to need calibration, so at the time I was mainly worried about the hotplate working and not the exact value of the theoretical factor. I think the algorithm worked well for the data we collected, I never thought that the Yankee algorithm would have the same factor (in fact, I don't think it does). The reasoning used on page 12 is correct, however, I expected the calibration factor not to be exactly equal to the terms which is why I called it a "calibration" factor and not a constant. 2. The snow particle collection efficiency is

the most uncertain part of the original hotplate algorithm. It worked well for the data I had a Marshall, but I was not sure it would work as well elsewhere. The recent WMO solid precipitation experiment evaluated three hotplates, and they performed well, in fact, they had the lowest RMSE of all the snow gauges tested. I attribute this to the aerodynamic profile, making the dependence of snow particle type less than weighing gauges. This report will be coming out before January 1, 2018. We did spend a lot of time worrying about the level that the wind speed was taken from, so your discussion on this is useful. However, the Yankee algorithm uses the wind from the hotplate itself, so the raw data is from 2 meters. 3. Do you have photos of the sites? Are they flat? The hotplate will be biased if the wind is not horizontal or there is upstream blocking. What I would also like to see is an uncertainty analysis of the truth gauge (ETI) as compared to the hotplate data. 4. The paper is quite detailed. If possible, I would try to focus on less of the details of the testing and more on the results. How well is the hotplate performing given the current algorithm? How much accuracy is gained by including radiation (%)? 5. I also tried to calculate the Nusselt number but never got a satisfactory comparison to a flat plat. I assumed this was due to the addition of the ridges. As a result I left this out of the original paper. 6. One of the major findings in running a hotplate that I found is that its performance depends on whether it is outdoors or indoors. Thus, the outdoor turbulence, in my experience, makes the hotplate perform a lot different than in a wind tunnel. In the wind tunnel, the data are very clean and everything works as you would expect. Outdoors, the turbulence on the bottom plate and upper plates impact the cooling differently, causing me to take a 5 minute average before initiating accumulation. 7. The final comparison to outdoor data (pages21-23) is confusing to me (and I expect an independent reader). The SPICE evaluation of the YES hotplate suggests that it is 10% high, yet you find it 10% or more low. I am not sure if this is due to using the wrong level for the wind or a different wind correction algorithm. If YES has a different catch efficiency algorithm than I do I don't know where they got it from as they did not do any outdoor testing in comparison to a truth gauge. I think it might be useful to have a discussion on these data next time

you are in Boulder or I am in Laramie. We could also do a conference call, but it might take some time to figure this out. 8. Conclusions: I think you can state that the area is incorrect, but, again, the factor was not stated as a constant but a calibration factor. I think this point is over-stated and was already made by Boudala et al. (2014). 9. I would state the main conclusions in the final section. What I want to hear about is: 1. Is a radiation correction important to the hotplate?, 2. How well does the Yankee hotplate do compared to field observations? The wind speed in the Yankee hotplate is from the hotplate itself, so it self consistent. The fact that the unit has performed well for me and SPICE over the past 5 years suggests that the algorithm if fundamentally sound. 3. Any suggestions on how to improve the catch efficiency? How variable is it from storm to storm? I think a histogram plot of the delta precipitation as compared to a truth gauge as I did in my 2011 paper would be very useful. Are the differences biased one direction or another? Do we need to take into account snow type, for instance. Are there are observations of snow type? The largest discrepancy I saw was for graupel. Was there graupel particles observed during OWLS?

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