

Interactive comment on “Arctic Snow Microstructure Experiment for the development of snow emission modelling” by W. Maslanka et al.

Anonymous Referee #1

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General Comments

This manuscript describes a unique experimental setup that revisits some classic snow slab measurements made by Wiesmann et al approximately 20 years ago with the added benefit of recent state of the art techniques for quantitative snow microstructure characterization. The paper is well written and clearly organized. While there are no fundamental weaknesses in the analysis, the scope of the study is quite limited and the discussion/interpretation of the results is thin. The paper would be strengthened considerably if:

-all of the quantitative microstructure measurements that were described in Section 2.1.3 were included in the analysis, such as the micro CT and snow micropen measurements

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-the revised extinction model for HUT was explored as noted as a future goal at the end of the paper (which depends, I suppose, on use of the micro-CT and SMP measurements)

-a more detailed and physically based discussion was provided for the difference in model performance for the ABS and REF measurement setups. For the REF measurements, why the difference in bias direction between models? Why are the RMSE values for the REF measurements so much higher at 37 GHz?

In my opinion, adding at least 1 of these components is necessary to give the paper sufficient scope and depth. Other comments:

1. Page 5 line 3: “The preparation and extraction of the snow slabs was a delicate process.” I have no doubt! If the authors of have any recommendations, suggestions, advice, for other groups who may try to replicate this sampling approach, some additional details here would be helpful.

2. It's not easy to distill the information contained in Tables 1 and 2. Can this measurement be converted to graphical form, perhaps also incorporating the snow information summarized in Table 3. This may take some creativity, but with only 14 slabs it shouldn't be too onerous.

3. Page 6 line 31: Traditional grain size was determined from the macro photos? Some additional explanation of this process is needed, especially since the micro-CT and SMP measurements were not utilized.

4. Section 2: Details are needed on how the traditional grain size and SSA measurements in Table 3 were converted to effective grain size inputs for HUT and correlation length for MEMLS.

5. Page 8 line 18 and Table 3: Does slab depth refer to the thickness of the slab or the depth in the snowpack from which the slab was taken?

6. Page 9 line 21: The suggestion in this paragraph is that within slab variability ac-

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counts for the larger bias and RMSE at H-pol. If the micro-CT and SMP measurements could be added to the study it would reduce this sort of speculation.

7. Overall, the RMSE values in this study are slightly better, but comparable to those found for undisturbed snowpacks at the plot scale with ground based radiometers. I was a little surprised by this result. Is there an explanation for why model performance wasn't substantially better given the controlled experimental setup? Does this speak to fundamental flaws in the models or the difficulty in conducting measurements of this nature?

Editorial Comments

Abstract line 11: provide the names of the two snow emission models

Page 3 line 7: no capitals for snow water equivalent, snow depth, and snow extent

Page 4 lines 1-4: an additional citation for the comparison of HUT and MEMLS is: Pan, J., M. Durand, M. Sandells, J. Lemmetyinen, E. Kim, J. Pulliainen, A. Kontu, and C. Derksen. 2015. Theoretical differences and their effects on the comparison between two snow microwave emission models. *IEEE Transactions on Geoscience and Remote Sensing*. 89: 1-19. 10.1109/TGRS.2015.2493505.

Page 5 line 11: remove '(transparent to microwaves)'

Page 8 line 21: change 'ranges' to 'ranged'

Page 10 line 8: change 'produced' to 'influenced'

Interactive comment on *Geosci. Instrum. Method. Data Syst. Discuss.*, 5, 495, 2015.