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Geoscientific Instrumentation Methods and Data Systems Discussions

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

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Thank you for the thorough and complete review of the paper. We will now answer your comments and suggestions in the presented order. The original comment will be displayed, followed by the response. A modified version of the paper will be submitted after the review period. As suggested, more quantitative microstructure measurements (SMP and micro CT measurements) will be included, to keep a complete record of the data collected. A more detailed analysis and discussion will be given; going into the reasons behind the errors associated with the model simulations.

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.

This sentence was moved to form a new paragraph, and much more detail into how the slab was physically extracted was given, in order to try to make the process as clear as possible.

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.

We agree, the information within Tables 1 and 2 was not clear. However, when trying to convert the measurement into graphical form, trying to retain the brightness temperature values proved to be too difficult. While not in graphical form, the tables were redesigned to improve the clarity of the information.

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.

More details into the macro-photography process is given, to show the way in which these measurements were taken.

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.

Equations for the conversion of traditional grain size and SSA measurements into effective grain size and correlation length for HUT and MEMLS respectively are added.

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?

“Slab depth” referred to the thickness of the slab, and has been changed to “slab thickness” for clarity.

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

The bulk average and standard deviations of micro-CT derived SSA and density is given in Table 4, and the bulk average and standard deviations of SMP derived SSA and density is given in Table 5, to show the internal variability of the slab, as measured by these two techniques.

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?

The discussion section has been elaborated on, discussing the potential reasons for the bias, especially on thes subject of the HUT reflective plate simulations. The discussion includes details about flaws in modelling the reflective plate within the single layer HUT model, which ultimately produces the RMSE and bias in the single layer HUT REF simulations.

Editorial Comments

All editorial comments have been made, to improve the structure and layout of the paper.

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