Dear Christian,

thank you for your careful reading of the manuscript and your positive feedback. Your comments are pasted below, followed by our replies in blue.

Best regards,
Henning Löwe, Ghislain Picard

***Interactive comment on* "Microwave scattering coefficient of snow in MEMLS and DMRT-ML revisited: the relevance of sticky hard spheres and tomography-based estimates of stickiness" *by* H. Löwe and G. Picard General comments**

The manuscript is a valuable contribution to an improved and unified understanding of two different models for microwave scattering by snowpacks. The theoretical part is contained in Sections 1 to 3. The results of this analysis are described in these sections, and a summary is given in the Discussion Section 5. Real data of snow were applied in Section 4 to derive the optimal parameters for one of the models (SHS). There, the symmetric treatment breaks down to a certain degree. Only the associated optical diameter (d_0 values), related to the correlation length, is shown in a scatterplot versus one (d) of the fit parameters (Figure 6). The conclusions from the presented material with respect to needs in future work should be improved.

The evaluation of real data focuses on SHS only because both scattering models can be evaluated only for this particular microstructure model.

We agree that it would be helpful to elaborate more about the needs in future work which will be added in the discussion.

Special comments, questions and requests for corrections

1) Introduction, p. 2497, l. 27 -- p. 2498, l. 3: Although I agree that the exponential shape of the correlation function is an oversimplification, I would still state that observed correlation functions for snow approach the exponential one often surprisingly well.

We partially agree and will state here that "the exponential correlation function is a reasonable first guess for some examples" which will be added. But we prefer to avoid words like "good" here, because this would require a more elaborate definition of "goodness", which is not so relevant for the paragraph.

2) p. 2504, l. 19 -- p. 2505, l. 2: Comment on directional averaging in IBA. It seems to me that the authors refer to Eqs. (15) -- (18) of Mätzler (1998). Please note that this transition correctly results for isotropic correlation functions because, in this case, the directional averaging in (15) is independent of A(x).

We agree that this statement is not very clear and will be reformulated. We also agree that the isotropic case considered here is not affected by that, which we will stated explicitly.

3) p. 2509, l. 25 and p. 2513, l. 13: To avoid confusion change expression for v(d) to v(d) = $\pi d^3/6$.

Will be changed.

4) p. 2510, l. 13: Change '(Eq. 24)' to '(Eq. 23)'

Will be changed.

5) p. 2511, l. 19--20: Change 'sticky hard spheres (SHS) model to represented the position …' to 'sticky hard sphere (SHS) model to represent the position …'

Will be changed.

6) p. 2512, l. 6: Change 'the inverse the stickiness …' to 'the inverse of the stickiness …'

Will be changed.

7) p. 2518, l. 8: add unit (mm) to a_0. Same for a_0 and b_0 in Tables 1 and 2. Can you add uncertainties of the parameters ?

Units and uncertainties will be given.

8) p. 2522, l. 19: Please refer to Eq. (41) when discussing b_1. Or clarify.

Reference to (41) will be added.

9) p. 2525, l. 4: Change 're--interpretating' to 're--interpreting'.

Will be changed.

10) Figure 5: The different grey shades are hardly visible. In the captions refer to (and explain) the solid and the dashed lines.

The figure has only one gray-scale for the percolating phase and white for the non-percolating phase. We will enhance the contrast. We also agree that the meaning of the lines are missing, which will be given.

11) Figures 4 -- 7: The different datasets of the snow samples show quite different behaviour. Especially the DIV dataset is very inhomogeneous. Please specify this one more clearly to make the information more useful.

The DIV data set contains all kind of different snow types, which are not related to each other, in contrast to the other data sets which are all time series. So larger fluctuations in the DIV values are natural. We will add the information of snow type in the figures by using different symbols for different types.

12) Figure 7 showing RMSE data (of numerical fit -- model): Since the numerical values of model and fit are unknown to the reader, it is unclear what the actual RMSE values mean, i.e. it is unclear how well the fits approach the snow data. Please mention at least the order of magnitude of the model/fit values or else show relative RMSE data (RMSE/model).

This comment is interfering with a comment from the other reviewer and his request for R^2. We will thus replace the comparison of the RMSE with a comparison of the coefficient of determination R^2, as a differently normalized variant of RMSE, which can likewise serve as a “goodness of fit” measure for comparison.

13) Plots showing all observed and fitted correlation functions (and pair--correlation functions) might help to elucidate the relations established in this work.

Our approach was to show one correlation function to illustrate the process of fitting the SHS correlation function and to show all the fitted parameters (d, tau) along with an

information of goodness (RMSE, which will be changed to R^2). We acknowledge that this information is limited, but showing all the 167 correlation functions is not possible in a paper and would be difficult to analyze. Exploring the specifics of the correlation function is a logical next step after this paper which is, in fact, work in progress. It requires significant additional analysis that cannot be added in this paper. To meet the request half way, we will include a plot of the correlation functions for *all* examples shown in Fig. 8, to illustrate some differences depending on snow type.

14) Language: Especially in Section 4, 'perfect times' were used instead of 'past' for completed actions. Example: 'For the following analysis we have used …' , instead of: 'For the following analysis we used …'. Please correct where applicable.

We agree, there are some tense inconsistencies. Will be corrected.