Response to Alain Royer

I suggest to modify the Table 1, because, as said in the text (see p.11), all choices of microstructure parameters are not compatible with all choices of electromagnetic models! I also suggest to add in this Table 1 the input parameters needed for running SMRT corresponding to each of the microstructure parametrization. The Fig.1 only gives the fundamental parameters used by the model.

We have added the information about the compatibility of each microstructure representation with the electromagnetic models.

The input parameters of each microstructure with their definition is given in the equations in Section 2.3. This section is concise and clearly ordered. Adding the parameters in Table 1 would duplicate the information and would require to overload the table legend with the parameter definition which is non-trivial for many of them (all except radius and correlation length). We prefer to keep Table 1 self-consistent and concise.

For Table 1, we have added ellipses to the list of fundamental parameters to make clearer that the list of parameters is insufficient. It is impossible to show explicitly all the possible parametrisations offered by SMRT in this figure.

For the IBA_exp mode, the definition of lex is not clear (Eq. 17). In prac
tice, as said in the text, in the field, the correlation length can only be estimated from easy measurable parameters, e.g. SSA and density!
The commonly used relationship is the Deby equation :
lex= 4 A
where A = (1 –f) / (rho_ice SSA)
In practice, previous studies and this SMRT paper show that, in general, a factor phi must be used, such as: lex= 4 phi A (Eq.1)
Matzler et al used phi = 0.75, given : lex = 4 3/4 A = 3 A
or in general: lex= 3 phi A (Eq.2)
I think that there could be a confusion here depending of the definition of the Autocorrelation function used (Eq.17). Is it the same definition in MEMLS?

We have added a statement regarding the equivalence of Cex as employed here to MEMLSto comprehend the definition of lex. The same is used in MEMLS (in Matzler and Wiesman 1999, p 318 column a, in the text before equation 4).

Montpetit et al. (2013) used Eq.1 for running MEMLS. The factor considered by Montpetit as input of MEMLS is not for Eq. 2 but for Eq. 1 (Line 32, p16). When applied to Eq2, this gives phi_ex =1.3 x 4/3 = 1.73 instead of 0.975 as stated in the paper. I suspect a mistake here?

We indeed have mis-interpreted Montpetit et al. 2013. We have corrected the text.

Why Fig. 8 uses Eq.2 , instead of the original formula Eq. 1 ? For clarity and to ovoid ambiguity, I suggest to plot the Fig. 8 using Eq.1 and not Eq.2. Text p17 should then be modified. (there is presently a typo error: 0.13 at 300 kg/m3, line 6)

Fig 8 uses Debye formula scaled by phi which is your Eq.1 lex= 4 (1 –f) / (rho_ice SSA) but

expressed with the radius a=3/(rho_ice SSA), so that lex = 4/3 (1 –f)a.

The typo error is corrected.

I also suggest to better discuss or explain how to include an ice lens in the snowpack.
This is a major issue because of the observed significant increase of winter heat wave events and of rain-on-snow events. Both events generate ice crust in the snowpack that have a strong impact on microwave emission.

We have added a sentence referring to ice lenses in the IBA section: “ This allows in particular the representation of pure ice lenses and ice crusts in the snowpack using IBA.”. This is added in this section because MEMLS absorption coefficient is not compatible with high density. For this reason, we propose a different absorption formulation as a default (while still providing the original formulation for users interested by inter-comparison).

Other comments:
- Defined the nu parameter (frequency) p5, line 31

added

- P9 Line 4 should need parenthesis? : ka = ko f2F(↙↗2Y2)

The formula is correct with or without parenthesis as Y2 is a real number.

- P10 Eq. 17, 18, 19, 20 and 24 should be aligned?

The equations has been aligned.

- P27, Eq 65 : e1

Corrected.