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Interactive comment on "Influence of meter-scale wind-formed features on the variability of the microwave brightness temperature around Dome C in Antarctica" *by* G. Picard et al.

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nly account for the "effective microwave radius". It also compensates for errors in measurements or calibration. Despite this unwanted effect, we believe that the scattering model with 'phi' is still useful to understand the underlying physics of the interaction, which is the main purpose of the present paper. The reason is that we only consider 1 optimized parameters for several frequencies, polarizations, incidence angles and two snowpits and we got similar agreement in all these configurations. It means that the predictability of the scattering model is quite good albeit not perfect. We are confident that the difference between SP1 and SP2 can only be explain by the density, whatever

the chosen value of 'phi', which is the main goal of using the model in this paper.

We have changed the text to specify more clearly the link between snow representation and phi, but proper discussion is found in Roy et al. 2012 and more work are still needed:

"The model was evaluated at Dome$\sim$C \citep[][B11 hereafter]{brucker_2011_domec} using similar inputs as used here considering monodisperse nonsticky ice spheres to represent snow"

"The need to introduce ϕ is probably due to the representation of snow microstructure by monodisperse nonsticky spheres as discussed in \citet{roy_2013}."

CM: b) The expected error of the density measurement (10 to 20 %) was possibly too large for the important role firn density plays in this experiment.

Aut: These errors are rough estimates of the maximal error. They are not systematic errors that would affect all the samples in the way. Given the large number of samples used for each simulation (>170 samples), the effect of these errors should averaged out. To confirm this, we performed simulations by perturbing the density profiles with a gaussian noise with a standart deviation of 15 kg m-3 (the errors are unbiased and independent between the samples). With densities around 300 kg m-3, it means that 68% of the values fall within the $\pm$10% range and 95% fall in the $\pm$20% range from the 'true' value. The results of the simulations are shown in the figure below. The noise in brightness temperature is not large and the difference between SP1 and SP2 at 37 GHz is significantly larger than the noise due to the error in density.

CM: 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes 8. Does the title clearly reflect the contents of the paper? Yes 9. Does the abstract provide a concise and complete summary? Yes 10. Is the overall presentation well structured and clear? Yes 11. Is the language fluent and precise? Some improvements needed 12. Are mathematical formulae, symbols,

abbreviations, and units correctly defined and used? Yes 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Figure 11 is not well described. I think it should be eliminated, including the associated text in the mansucript ("whale back").

Aut: The part on “whale back” is important for a few other applications than microwave modeling. As written by Ted Scambos “Dome C is thought to be an extremely uniform snow and firn region, and the identification of wind-driven (?) variations in the snow could be important. ”. We only have limited details on these “whale backs” but we prefer to keep this part because it links these features of glaciological interest to microwave observations.

Figure 11 has been improved: - added a red line to make the contour more visible. - changed the paragraph to better link the figure to the text.

CM: 14. Are the number and quality of references appropriate? Yes, one exception, see below. 15. Is the amount and quality of supplementary material appropriate? Not applicable.

Further comments On p. 3681, the observation angle is called ’zenith angle’. The correct name here would be ’nadir angle’.

Aut: Browsing the literature (inc. several from the reviewer), it appears that "incidence angle" is often used. Even though "nadir angle" is arguably more correct, we have changed the paper accordingly.

CM: Same page: I do not understand the following text: "the surface moved between 0.4m to 2.5m – with respect to the radiometer vertical"

Aut: The sentence is changed to: “Since the radiometer position was fixed, the footprint center at the surface was located at 0.4\,\unit{m} from the radiometer vertical for zenith angle of 20° and 2.5\,\unit{m} for zenith angle of 65°.”

CM: On p. 3683, reference is given to the HUT snow emission model to refer to an

atmospheric emission model. This is not convincing. Please give a more proper reference to an atmospheric model.

Aut: The atmospheric model used is: Liebe, H. (1989) MPM - an atmospheric millimeter-wave propagation model, International Journal or Infrared and Millimeter Waves, vol. 10, p. 631-650. The reference is changed in the paper.

CM: On p. 3690: Correct ’mean square root’ to ’root mean square’.

Aut: Done

Interactive comment on The Cryosphere Discuss., 7, 3675, 2013.

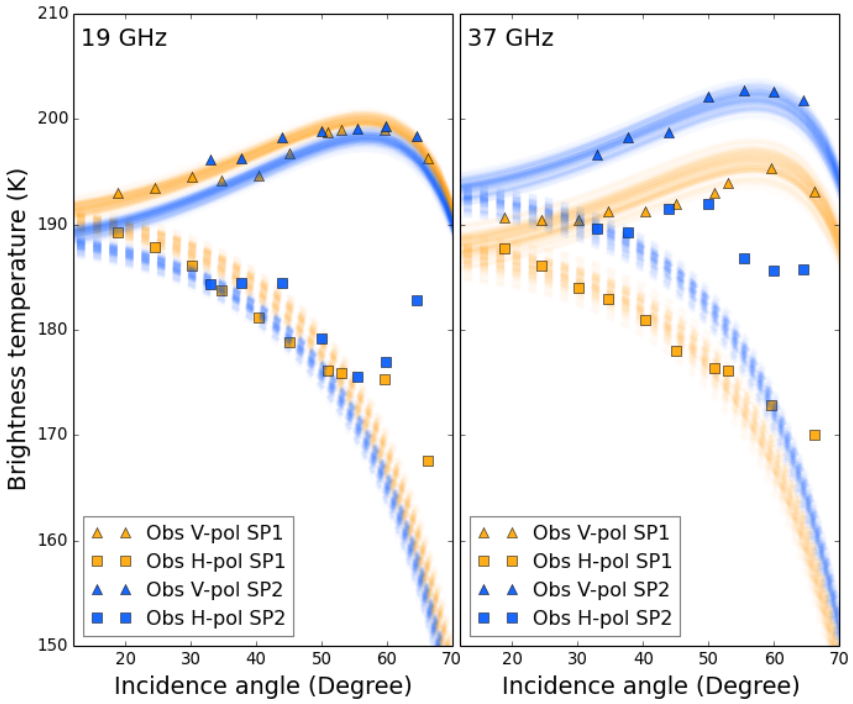
19 GHz
37 GHz
Brightness temperature (K)
Incidence angle (Degree)
Incidence angle (Degree)
Obs V-pol SP1
Obs H-pol SP1
Obs V-pol SP2
Obs H-pol SP2
210
200
190
180
170
160
150
20
30
40
50
60
70

Fig. 1.