

Comment to manuscript AMT-2018-152: Assessing the impact of different liquid water permittivity models on the fit between model and observations by K. Loniz and A. J. Geer.

General comments: The paper summarizes results of testing six water dielectric models in NWP models especially evaluating the performance in the regions where supercooled water ( $< 0^{\circ}\text{C}$ ) occurs frequently. Different experiments and metrics are developed and tested to find which dielectric model yields a better fit with satellite measurements assimilated in NWP models. The results seem to point to the latest Rosenkranz, TKC, and perhaps Stogryn (for some frequencies) as the models that may agree better with observations of supercooled clouds. These type of testing is necessary as it is useful to know which model to use especially in view of the large radiative impact of supercooled clouds at high latitudes, therefore I recommend publication. The paper is generally well written and organized. I have minor comments and few questions for the authors.

- 1) The conclusions in the abstract not entirely consistent with conclusions in the discussion section.
- 2) Page 4 line 15: *“For SSMIS-F17 an observation error of 1.8 K is used in clear-sky conditions ( $C37 < 0.02$ ), which increases linear up to 18 K for very cloudy situations with  $C37 > 0.42$ . The higher the observation error the less impact the observation has on the analysis. More details can be found in Geer and Bauer (2011).”*  
Are these observation errors theoretical or are they based on actual observations?
- 3) Fig.2 is interesting as it shows discrepancies between models at higher frequencies even in non-supercooled liquid. In view of the new ICI satellite that will use frequencies  $> 200$  GHz this will require some additional validation. Perhaps in Table 3 it may be worth adding a few frequencies in the sub-mm range, perhaps 325, 448, and 664 GHz?
- 4) In Fig. 7 is the cloud liquid water path estimated from microwave observations using the L89 model?
- 5) I am not really sure how to interpret fig 9 since the bin size (5 K) is much bigger than the differences in brightness temperatures between the models. Not sure this figure adds much to the discussion. Fig. 10 seems to provide more information.
- 6) Page 19 line 23 *“Rosenkranz15 and TKC16 show a larger value in skewness in FG departure (see Fig. 11) than Liebe89 at 37 v.”*  
Stogryn95 model seems very similar.
- 7) Page 23 lines 16-25. This sentence appears confused at least isn't clear to me what the

authors are trying to say. First they say there is a neutral impact in the rms error in humidity, but then they say that there is an improvement in ATMS data, but then they say ATMS data are not affected by permittivity models.