Review comments on TC paper 2024-3972 Active-passive microwave scattering in the Antarctica wind-glazed region: an analog for icy moons of Saturn

This work provides an active and passive simulation study for the East Antarctica using SMRT model. Simulations are done for a wide range of frequency channels from 5.2 to 89GHz. The authors wants to draw an analogy between the ice moons and this particular region of Antarctica and looks like the authors want to claim that this region would be a good example for the study of icy moons.

From my personal perspective, some major points need to added to the paper and some concerns need to be resolved before the paper can be published.

Here are some general comments for the paper:

1. In the abstract, the authors need to provide some conclusions that they obtained from this study and also need to provide the "up-shot"(how would this study contribute to a "larger picture" and would help answer a problem).
2. If the goal of the paper is to show that the Region of Interest (ROI) in the East Antarctica is a good analogy for icy moons, the active and passive data signature, and the measurement set-up for the icy moons needs to be presented and the features of the icy moons and ROI needs to be discussed. In such a way, the analogy could be drawn. Currently, the discussions are not sufficient.
3. Since the paper is majorly doing simulation to match up the observations, if parameters from icy moons can reproduce the measurements over ROI, this can also imply an analogy.

Detail comments are the following:

1. Resolution. As indicated by the sensor parameters, the scatterometers and radiometers are having different resolutions(ASCAT, Qscat 25km, AMSR2 based on frequency). In this work, the authors project the different data sets into uniform 12.5km grids. In such a way, the near by data pixels would be highly correlated and would not provide extra information for pixels within the resolution of a given data set. Such a interpolation would ignore the heterogeneity within a large resolution and may mistakenly use the coarse, larger area averaged measurement to represent the measurement for a smaller area. I believe a better way is to aggregate the high resolution data into low resolution such that different data sets can have the same averaging effect over the measured area. Can the authors provide some discussion on this?
2. If my memory serves me correctly, L3 data from AMSR is already grided. That data set might be better? Only a suggestion.

3. The way of data averaging is not clear to me. How is the measured data averaged to a data point in each frequency?
4. In matching the data, active part looks fine to me, but the passive part doesn't look satisfactory. The observables from radiometers are brightness temperatures, emissivity values are derived values. Radiometers are very accurate, usually the errors are within 3K, assuming a physical temperature of 270K, this corresponds to an error in emissivity around 0.011. I would suggest the authors show the comparison in terms of brightness temperature. In such a way, the forward simulation would show a difference of 10K or more. Match up can be improved.