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Ocean Science Discussions

Interactive comment on "Technical note: A sensitivity analysis from 1 to 40 GHz for observing the Arctic Ocean with the Copernicus Imaging Microwave Radiometer" *by* Lise Kilic et al.

Anonymous Referee #2

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This technical note deals with the sensitivity of the future CIMR microwave mission to various ocean and ice parameters. It is an update of the Wilheit figure that has been widely used with a focus on the incidence angle of CIMR (55°) and using a more recent modelling. I have no doubt that this information will be useful to the CIMR community, but I find the novelty of the paper quite modest with respect to other studies. I think with some changes (see below) the paper could represent a more important contribution to the community. It is nicely written and easy to read.

A first concern is about the atmospheric contribution : to which extent is the Rosenkranz (2017) model valid at L-Band ? The Rosenkranz citation corresponds to

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Discussion paper

a code and I did not find easily the corresponding references in the litterature but I am not sure at all it considers the contribution of the molecular Oxygen which is the dominant contribution at low frequency. Even though this contribution is much less than at higher frequency, given the low sensitivity of the brightness temperature to the salinity at L-Band, it cannot be ignored. This model is not used in salinity retrieval processors today.

Another concern is with Figure 2 : the title of the paper makes a focus on the Arctic Ocean but this figure is for the middle latitudes, I suggest you change the title of the paper or do this Figure for Arctic conditions. The conditions described in Table 2 are very restrictive and do not represent the true variation of the parameters. I suggest you consider more representative variations and report the corresponding sensitivity as a shadowing around median conditions on Figure 2. The normalisation of Figure 2 does not allow to get quantitative estimates. I suggest you add several Y axis with scales corresponding to the non normalized sensitivity for each parameter.

Detailed remarks :

Abstract Line 7-8 'state of the art': Levine and Dinnat (2020) recently published a similar study with a discussion of the sensitivity given by various state of the art ocean RTMs. The originality here is not to reproduce the figure of Wilheit with a recent model, but to update it at 55° which was not specifically studied by Levine and Dinnat. In addition, to my knowledge, the Rosenkranz atmospheric model is not considered as a state of the art model at L-Band.

Le Vine, D.M.; Dinnat, E.P. The Multifrequency Future for Remote Sensing of Sea Surface Salinity from Space. Remote Sens. 2020, 12, 1381.

Line 29-30 : what are the main parameters of interest on METOP-SG for CIMR ? Maybe add a reference for METOP-SG. What do the acronyms MWI/ICI and SCA mean ?

Line 40 : I guess it is meant : state of the art of the various components of Radiative

Transfer Model. In fact only one model is considered for each contribution whereas several are in use in the community and none of them have been absolutely ruled out given present uncertainties. I suggest to refer to the recent study of Levine and Dinnat who showed the sensitivities obtained with various widely used components of radiative transfer models.

Table 2 : how do realistic variations in the surface and atmospheric conditions modify the results ? I would suggest putting a shadow around the curves on Figure 2 to reflect the variations due to surface and atmospheric conditions as well as uncertainties coming from uncertainties on RTM.

Lines 68-75 : Molecular Oxygen is the main contributor at L-Band and is a significant contributor at low frequency (see Levine and Dinnat, appendix C), it should be considered. How does the Rosenkranz model compare with the MPM92 model more widely used at L-Band ?

Strictly speaking, equation 1 should be vertically integrated ; I guess neglecting the vertical integration might have some impact on the result, especially at high frequency, this should be discussed.

Line 91 and Figure 2: I guess you mean : maximum value of the sensitivity. I don't like much this normalisation because it does not allow a quantitative reading (I also have this problem when reading the Wilheit figure). You might envisage to add several Y axis with scales corresponding to the non normalized sensitivity for each parameter.

Line 111 : Partly redundant with the introduction

Legend of Figure 4 : unclear what does 'units' mean

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