

Thirteen Winters (2012 – 2025) of penetration – Aware Arctic Sea-Ice Emissivity and Emission Temperature from AMSR2

The study presents a study of penetration aware emissivity and emission temperature from AMSR2

The study aim to eliminate the assumption that emissivity and emission temperatures originate from the surface. This is done by training a neural network based on training data from a forward model that is physical consistent. The neural network inverses this. A dataset for 13 winters has been produced based on this.

The manuscript is in general nicely written and I only have a few comments

My main issue is that the ANN model is very limited described as oppose to the physics of the retrievals and the forwards models. The forward models seems to be background data for this work. Therefore I would have like to have the weight changed a bit towards the neural network.

ERA 5 profiles are used for training (line 117)? How trustworthy is it to use an assimilated reanalysis to create data for retrieval of remotely sensed data that is then used for assimilation. It is well known that ERA 5 suffers due to its bad sea ice boundary.

It is not only this manuscript but I think that it deserves to be noted/discussed when assimilation is part of the motivation.

OSISAF use among other satellites AMSR2. Sea ice concentrations and brightness temperatures. A bit the same issue as before if these are also based on AMSR2 then the method and the training data depend on what one want to predict. It seems circular.

AMSR2 is at the end of its lifespan. Is it necessary to retrain for AMSR3 or how smooth will the transition be?

It has been chosen to train two ANNs for the two parameters. Has it been attempted to only have 1 ANN and include both parameters in order to get cross correlations?

The two parameters are found at the location in the ice/snow column but is that what is needed for assimilation or is at the surface for NWP modelling. This is also where the comparisons are made (observation space)?

Line 87: It is stated that winter is the season where the microwave surface boundary is particular challenging. I assume that is due to the variations of where the emissivity and emission temperature and where it is measured. Correct? It should probably be mentioned here

171: How large a time window for assimilation and how is this done?

176: How well do the snow climatologies represent the truth? Which ones are they?

Line 360: How are the results impacted by the clear sky assumption?

Table 3: The correlation is very impressive (maybe too impressive). Is it independent of input parameters?