The Cryosphere
Discussions

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Interactive comment on "Estimating Snow Depth on Arctic Sea Ice using Satellite Microwave Radiometry and a Neural Network" *by* Anne Braakmann-Folgmann and Craig Donlon

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This paper presents and compares some very interesting and promising methods to retrieve the Snow Depth (SD) with AMSR-2. Such studies are very important because the Snow Depth over sea ice remains largely unknown whereas it plays an important role in the climate (albedo), the sea ice dynamics (thermal insulation, melt pounds), the biochemical (UV insulation), etc. But the validation of the emerging solutions is a very difficult task du to the snow diversity and the lack of in-situ data. Also we must be very careful in our conclusions and clearly stated the uncertainties and the conditions of applicability.

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My remarks and questions are the following :

1/ Could you indicate if the presented SD-AMSR-2 products are available and where we could get them in order to make alternative tests ?

2/ Did you evaluate the product that is freely distributed by NSIDC (https://nsidc.org/data/AU_SI12/versions/1) ?

3/ How do you manage the impacts of the fog and clouds ? For instance within the NSIDC product some large parts are missing because of the presence of clouds, which is not the case for the 5 solutions you present. More generally, do they work all along the year over the full Arctic basin ?

4/ For the sea ice thickness comparisons, it seems that you are using the CryoSat-2 Baseline-C freeboard (FB), which is known to over estimate the sea ice freeboard by more than 10cm (ie, 1m on the thickness). This biais will be corrected in the next baseline-D. In the meantime, you should use other FB products (AWI, LEGOS, CPOM, NASA, JPL, ...).

5/ Due to the dramatic lack of SD data over the polar regions, all study tracks have to be investigated and the solution will most probably come from the synergy between several solutions to cover the different needs. Nevertheless, in order to improve the Sea Ice Thickness (SIT) retrieval from altimetry, it is really important to measure the SD synchronously and coherently with the FB, ie, from the same platform and the same instruments, as proposed by CRISTAL Copernicus candidate mission.

On the other hand the synergy between CRISTAL and CIMR could aim to daily pan-Arctic SD observations, which would be a major step forward to better model the dynamics of the ice pack and its snow cover, and their impact on the climate.

This kind of study could definitively participate to reach such an achievement.