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The Cryosphere Discussions

Interactive comment on "Thin sea ice in the Arctic: comparing L-band radiometry retrievals with an ocean reanalysis" *by* Steffen Tietsche et al.

Anonymous Referee #1

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The paper provides a useful story on the potential and the pitfalls of using SMOS derived sea ice thickness for the validation and assimilation with an ocean reanalysis. The paper compares SMOS sea ice thickness with ORAS5 reanalysis sea ice thickness. It finds strong correlations, considerable biases and also areas where there is little agreement between SMOS and ORAS5. Some ideas are presented why this disagreement maybe both due to retrieval and modeling errors. While those results are not conclusive, they provide some guidance on how to proceed further and how to potentially incorporate SMOS sea ice information into an ocean reanalysis. I find the paper to be well written and claims sufficiently supported by the evidence. While one may have hoped for some stronger conclusions, I think it is useful as is and provides an incremental contribution.

Specific Comments: Page 3, Line 12. . . JRA-55. . .. Later JRA-25 is indicated, please clarify Page 4, Line 33„ Thus the OSTIA ice concentration product can not. . . I don't understand what is stated here, I must be missing something. Page 5, Line 16, most of this is likely due to the model being unable to simulate the coastal polynya in the Laptev Sea Why is this? I think that could be probed a little more? Is the ice too thick to be advected away from the coast and create the polynya or does it regrow too quickly? Is this a resolution effect? If ice concentrations are assimilated and they show open water there (L-Band does so I assume the higher frequency ice concentration does too?), then why doesn't the model. I understand that this is not necessarily a model validation paper but given the uncertainty in both model and observations it would be good to tie this down a bit more, particularly since later the model seems to be favored over the observations in the case of the Laptev sea. Page 6, Line 18, polynya. . . as mentioned above, why does the model not show open water areas that SMOS shows and presumably should be visible in the ice concentration data that are assimilated Page 6, Line 28, under the ice This could use a reference Page 7, SST information cannot be used. Again, how come the model doesn't show the open water if it is there in the OSTIA ice concentrations. If there is open water, why can't you assimilate the SST (if they are available). I can't quite follow this argument. I have a sense that this may be an issue with the model which is biased thick and has excessive internal ice strength which keeps the ice from moving off shore. Though this doesn't explain why the assimilation doesn't create the opening. Another plausible explanation might be that excessive ice production due to excessive advection creates too much ice in this area. A look at advection and growth rates in the model might be helpful. This is particularly important since the authors seem to give the Model and Cryosat measurements the upper hand while discounting EM and SMOS measurements. EM measurements aren't really discussed. Page 8, Line 8, Surface Temperature Clarify if ice or air temperatures, I think you mean ice Page 8, Line 10 two reanalysis Correct JRA-25/55 issue see above and remind readers how the JRA reanalysis is used in the SMOS retrievals.

Page 8, Line 26, various thickness classes ORAS5 has thickness classes? I though it was a single category model? Page 10, Line 3, lack of thickness categories in combination with an artificial thickness Please clarify, I can't follow this Page 10, Line 5, incapable of simulating the polynyas Is this because of the lack of thickness categories or a general bias in ice thickness and associated ice strength? How does the model do in general with respect to ice thickness in the interior pack? That information would be useful. Page 10,Line 3 structural limitations Note them please Figure 1. Please explain saturation ratio and where the 90% threshold comes from. Figure 2: Scatter density... what's the unit of density in this context. All scatter plots could use some statistics (e.g. correlation, bias, RMS error in either the figure or caption Fig 4: with added and subtracted.... Add uncertainty Not much discussion is given to the EM data point and why this seems to be rather supporting SMOS than both CryoSat and the Model.

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