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Interactive
comment

Interactive comment on "A Weekly Arctic Sea-Ice Thickness Data Record from merged CryoSat-2 and SMOS Satellite Data" *by* Robert Ricker et al.

Anonymous Referee #2

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This is an interesting study which merges two sea ice thickness data sets from CryoSat-2 and SMOS since both provide distinct information on sea ice of different thickness ranges. The study is well organized and described. Some of the main points I suggest to address are listed below.

- A detailed description of uncertainties needs to be included since it is a key component to the weighting of the different data sets. In particular the CryoSat-2 uncertainty is not discussed in the manuscript but should be.

- The abstract and conclusion both state that a 0.7 m reduction in RMS deviation in the Barents Sea was observed though it is unclear where this number came from. The data from the Beaufort Sea should be mentioned as well in the abstract if that from the Barents Sea is provided.

- I'm not sure if data exists, but a comparison between the CS2SMOS data and the AEM data would be interesting towards the outer edge of the ice pack where one might expect a different weighting between CS2 and SMOS than in the comparisons done in the central Arctic.

- Some minor grammar mistakes need to be fixed throughout the text.

P2L3-4: CS-2 has been used to retrieve thickness over first year ice as well, the Wingham reference doesn't necessarily support the exclusion of this as well.

Figure 1: How are the uncertainties derived? This needs to be explained in the text.

P6 eqn 3: Is a freeboard correction due to the lower speed of light in snow applied?

P8L2-3: Given the need for cold temperatures, was a mask applied for this or were certain time periods with the data excluded? P10L15: It is stated that the CS-2 data are used from October/November, but what is the starting date used or does it vary? It is not clear in the text.

Eqn. 5: If your observation, analysis, and background fields are all ice thickness you shouldn't need the H operator.

Section 2.3.1: It's not clear to me why you need to construct a spatially continuous background field. If your uncertainties are dependent on distance then you can produce an analysis from the CS-2 and SMOS data at any given point considering the distance between the observations. Presumably this must have been done to fill in the pole hole.

P11L8: It was stated previously that the SMOS algorithm assumes a 100% ice concentration otherwise the measurements are expected to be biased, yet you are using a 15% ice mask in your data. What is the uncertainty introduced by this assumption and how does it impact your retrieval?

Eqns 8-9: I don't understand these equations. What is H in this equation? Equation

9 is defined using matrices on the left-hand side but as a single number on the right hand side, it should be re-written to be mathematically correct.

P14L18: What is the iterative procedure? Optimal interpolation shouldn't involve an iterative method since the solutions are defined equations.

P15L31-32: How is the background field constructed over the pole hole since no data is present there?

Section 3.1: The mean ice thickness values presented, particularly those in Table 2, are for the entire Arctic domain? It would be interesting to see the numbers presented for just the central Arctic Ocean as well since this would give a basis of comparison for other ice thickness data which are typically done for that region.

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