

## ***Interactive comment on “Evaluation of Sea-Ice Thickness from four reanalyses in the Antarctic Weddell Sea” by Qian Shi et al.***

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I would like to start by pointing out that I was asked to serve as a reviewer in June.

This manuscript evaluates the Southern Ocean sea ice thickness produced by four reanalyses against observations from AUVs, ships and satellites. The manuscript is quite good honestly. Sure it is not how I would have written it, so that I regularly took note of "[whatever] is missing" that I erased after reading the information a few lines later, but nothing that really impairs understanding. There's a lot of figures, but they all have a reason to be here.

I have two somewhat methodological points that I would like to see addressed, and a series of comments to improve the readability, but I consider that it should not require

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a lot of work. Hence my evaluation "minor revisions".

1) The regions On Fig 1, you present the four regions into which you split the Weddell Sea, and that you analyse in Fig 3. You base that split on data from ULS, but you present only their mean, not the uncertainty attached to it. I am particularly surprised that 210 and 212 would be in different regions. So at least on Fig 1b, add the errors bars. Then modify the region split if needed.

2) The more recent time period and long term perspective Most of the analysis is performed on the time period common to all four reanalyses (late 2000s), which I understand. Unfortunately, it is a bit old and short. Southern Ocean sea ice has behaved very differently since. So please, include a short extra subsection dedicated to comparing GIOMAS and GECCO to SICCI (CryoSat2 at least) and APP. Ideally, also add something about trends in these reanalyses.

Now for the more minor comments, in order of appearance:

Line 109: say that all the information to come is summarised in Table 1. Try to write this entire section in a more structured manner, giving the same information about all four products (at least time period and resolution).

Line 140: you mention ASPeCT now, but only introduce the product line 170.

Fig 1a: add the lines separating the four regions plotted there too Fig 1b: see comment above, add the error bars, and potentially modify your region division accordingly.

Fig 3d: why is the correlation negative for Envisat? What happens? Is the bias mostly in summer or winter?

Fig 4b-d: why are you showing different thickness bands for different products? They are not even the thicknesses you comment on in the text. Please show only one range, so that the reader can compare the reanalyses.

Table 3: have you checked whether the reanalyses are correlated with each other? It

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is suspicious that they all seem to have similar biases when compared against ICESat.

Fig 7: present it like Fig 6, as difference against reference rather than actual values. This way, we can compare with Fig 6 (alternatively, present Fig 6 like Fig 7).

Fig 8 (and text corresponding): since the sea ice concentration is about right, and that all reanalyses present similar biases in thickness when compared to satellite retrievals, can it be that the thickness retrievals are the ones that are not perfect yet? Sea ice concentration retrieval is after all more mature.

Line 331: you meant to refer to Fig 8 here.

Line 345/Fig 9: I know you write that you will not investigate the reasons for biases in the reanalyses, but I find the north sea ice of GIOMAS in winter/spring surprising. Is the reanalysis known for having too fast an Antarctic Circumpolar Current? Or is the ice too thin/mobile?

Line 342-346: you forgot to refer to Fig 9 here. The caption of Fig 9 refers to itself instead of Fig 8 by the way.

Table 5: the units need to be fixed. Indicate the net flux in the reference product as well (at least in the caption).

Line 373: not "sea ice ocean models", reanalyses. Sea ice ocean models have their own series of problems, but that's beyond the scope of this review.

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