

Interactive comment on “On the time and length scales of the Arctic sea ice thickness anomalies: a study based on fourteen reanalyses” by Leandro Ponsoni et al.

Anonymous Referee #2

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The paper provides a summary of the sea ice thickness anomalies found in the most recent ocean-ice analyses. It considers the impact of the assimilation of sea ice observations within some of these systems to spatial and temporal scales of the anomalies.

In my opinion the paper has lots of potential and is almost there, but at the moment it is missing some extra synthesis/analysis which would make it a really useful reference for the observation and modelling community. The impact of sea ice assimilation was considered (but did not state if any of the models assimilate anything other the concentration, one may nudge the thickness too?); it would be helpful to understand how the impact of other choices in the system may also influence the sea ice thickness anomaly.

C1

lies. The sea ice models may have very different methods for modelling thickness. Do they have ice thickness distributions or a single category, does this have an impact? Different atmospheric forcing sets (with different imposed sea ice cover) may influence the local energy balance and in turn affect the ice thickness. I think considering a few other key elements of these systems would make this paper very helpful in guiding the use of reanalyses and their future development (both in terms of the type of data that is used but also the set up of the assimilation systems)

Specific comments:

The paper provides some details of the reanalyses you have studied but I think it is missing a table summarising the reanalyses - some form of synthesis would be beneficial to the reader, the papers that do tabulate some of this (e.g. Chevallier et al) are not complete for this reanalysis set. A table with clear information about the forcing data set and types of data that are assimilated and what methods are used to do this. Given that we also know that the strength parameter impacts the thickness it would be good to tabulate P^* or equivalent as well. As the paper addresses the timescales of anomalies it would also help to determine the assimilation window length and see if this has an impact.

One reason for requesting the table is when looking at your first figure. You present results but there is not much discussion about the differences that are present in the time series. Are you able to stratify the impact of certain assimilation choices other than whether sea ice data is assimilated.

I would suggest that you may see an impact of the different forcing sets that are used, many are forced with ERA-Interim but MOVE(CORE and G2), GECCO, EDCA, MERRA are not. The ice fields that the atmospheric forcing fields have "seen" will have an impact on the forcing they provide. Differences due to SST relaxation or model parameter choices may also play a role - it would be good to at least see if there are other reasons for the differences other than they include sea ice assimilation or not.

C2

Section 2.3:

It was not entirely clear to me how you were treating draft and SIT differently from the reanalyses when comparing to observations. Did you use the snow cover from reanalyses to compute this when comparing to observations or just disregard for both reanalyses and observations?

Section 3:

Figure 4: some of the scatter diagrams look like the model thickness stops at a particular value e.g. ECDA are you missing some data from thickness categories? Where the draft data do not show a similar relationship to the SIT is there something different about the way snow on ice is treated in the systems? Is this dependent on the assumptions you made about how you compare draft and SIT?

Do you have an understanding of why the largest differences are near the Greenland coast and Canadian Archipelago? is this down to model physics differences?

Section 3.3:

You note that the GloSea systems have shorter timescales than others - is this persistence also linked to mean state? If you have thinner ice on average you may lose it over the summer and it will reduce your persistence.

pg 12, lines 5-6: these sentences were not entirely clear - would suggest you consider rephrasing to make sure the meaning is clear. do you mean that G2V3, ORAP5, PIOMAS, TP4 and UR025-4 are just similar and if so why highlight this group - is it for a particular region of the Arctic. It wasn't totally clear what you wanted to point out here.

pg 12, lines 17-18: do you mean years or months?

Does your wavelet analysis give an indication how robust your findings might be based on the limited time series? If so I think this would be worth commenting on in the text.

Section 4:

C3

pg 17, lines 3-6: You are comparing c_GLORS05-G2V3 - do both of these systems assimilate sea ice data in the same way? You also note that G2V3 and ORAP5 could be considered similar - they may be similar in some respects but potentially have different forcing G2V3 its not clear to me if G2V3 uses operational analysis from ECMWF rather than ERA-Interim - which may lead to some differences. ORAP5 uses a non-standard value of P* compared to standard LIM2 setup.

Figure 11 shows the reduction in time scale in one system with the application of sea ice assimilation but the change seems somewhat smaller than the differences with the no ice assimilation across the ensemble - would you expect this given your results? where would G2V1 be in your fig 13?

Figure 13 and discussion pg19, lines15-17. I was not convinced that the ice volume anomaly correlated well with the time and length scales - without the GloSea systems it seems less clear.

Technical comments:

Abstract: line 4: intend rather than intent

section 2.2:

pg4, line3: not sure what you mean by ponctual - is this "point" measurements?

pg4, line 14: run by Environment....

section 3.1: pg8, line 2: Don't you mean MERRA rather than MOVE?

section 3.2: pg8, line 22 and pg11, line8: do you mean "error" or "difference" ?

Section 3.4:

the last sentence of the section ".for what a quantification is presented in the conclusions of this study" - the phrasing is somewhat awkward and hard to understand exactly what you mean

C4

