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Geoscientific Model Development Discussions

Interactive comment on "The Arctic Predictability and Prediction on Seasonal-to-Interannual TimEscales (APPOSITE) data set" *by* J. J. Day et al.

Anonymous Referee #2

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The manuscript presents an updated version of the APPOSITE dataset that is originally presented and discussed in Tietsche et al 2014 and Day et al 2014. In its current version, the manuscript adds unfortunately little new information or insights into sea ice predictability to these two papers, and I feel it is, as it stands, a missed chance to use the dataset to explore issues that are at present topical in the field. I would encourage the authors to extend their analysis. I suggest below a few ideas to explore.

How does predictability depend on mean state? The APPOSITE dataset, with its start dates split between high,medium, and low initial conditions (p8815 L18), is currently the best opportunity to explore this question. If you find that the number of ensembles/runs

is still not large enough to yield statistically robust results, this finding would still be useful for the community - I suspect the answer will depend on whether in fact there are (meaningful) inherent differences in predictability with mean state. Given current trends in sea ice in observations, exploring this issue is key.

How can we understand the inter-model differences in predictability? While the patterns in change of predictability with time are similar across models (e.g., predictability barrier in SIV in early summer, winter>summer SIE predictability in years 2,3), there is a considerable spread in predictability across models as you point out in the conclusions (as an aside, I would guess given your ensemble size that the inter-model differences are significant, but it would be good to calculate and show this). This is a significant result. I note that in Day et al 2014 (Jclim), you explore links between predictability and persistence, and persistence and mean state. It would be good to do this with the current larger dataset. Are models with higher predictability more 'persistent' (Figure 1 shows models have varying degrees of persistence in their control runs)? It has been shown (B-W and Bitz, 2014) that models with thicker sea ice tend to have longer thickness persistence timescales - does this help explain inter-model differences? By looking at Figure 4 and 5, it's hard to figure out if there's a link between total volume and predictability. Perhaps a scatter plot of e.g., mean NRMSE over year 1 against mean SIV would help. (You could even split each model into its 3 high/medium/low ICs and obtain 6*3 datapoints).

Can you extend the dynamic v thermodynamic analysis of Tietsche et al 2014 (see their section 3.3, Fig3) to more models? Discerning which physical process leads to loss of predictability, particularly at seasonal timescales, would be an important result. Additionally, considering if the relative importance of different processes varies between different initialization seasons (January vs July) would be equally insightful.

Minor:

There are several spelling mistakes - please proof read cautiously

p8818 L1 How is EC-Earth different to the other models? In Fig 5 it doesn't look different.

In Figure 1, it would help in comparing models if all y-axis have the same resolution

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Interactive comment on Geosci. Model Dev. Discuss., 8, 8809, 2015.