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Interactive comment on "Seasonal sea ice predictions for the Arctic based on assimilation of remotely sensed observations" *by* F. Kauker et al.

Anonymous Referee #3

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General Comments

The assimilation of ice thickness data and its potential impact on the predictability of seasonal sea ice is an interesting topic and one that deserves publication in The Cryosphere.

I was excited to read about this work when first I saw this study but sadly after finishing the paper I was left feeling disappointed.

Unfortunately, in its current guise, this article does not advance the scientific understanding of this topic because the paper is not easy to follow and not well motivated. In particular I find that the article has nowhere near enough detail to allow the reader to understand what was done and why but at the same time feels a bit dry and technical to

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read! This article will therefore require considerable revision before it can be accepted for publication.

One of the reasons I find this difficult to read is that this work appears to be documenting two different pieces of work: a) an Arctic model tuning exercise and b) implementation of ice thickness data assimilation. The result is that neither of these pieces of work are described in adequate detail.

There is also not very much discussion of the results and the Conclusions section is more a summary of the tasks performed rather than anything else. Therefore it is not obvious what this study is trying to tell the scientific community about such an interesting and high profile issue.

I also find that the figure captions are not descriptive enough. They should include more details about the plot (i.e. what the individual coloured lines etc. mean).

Specific Comments

There is little or no mention about the underlying sea ice model being used in these studies. I would like to know what processes are included (or not) and what the performance of the model is. In particular there is no discussion of model biases which really need to be understood before assimilating data.

The data assimilation system used is simply referred to as multi-variate or variational but there is little discussion of the mechanics involved. Questions that are left unanswered include (but are certainly not limited to):

1. is 3D-Var or 4D-Var being used?

2. how are the ice concentration, ice thickness and snow thickness contributions balanced?

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3. what length-scales are used?

4. what ice/snow thickness is used when ice is added?

5. is the sea ice model single or multi-category (and if the latter then how does the DA deal with this)?

I am confused as to what the motivation is behind the PIOMAS Topaz comparisons. This section should be better explained or removed.

I find it odd that there is a lot of motivation for near-real-time, "operational" observations when there is no mention anywhere that this system is used for operational forecasting or that it produces any products. Perhaps more information could be included about this?

The "reconstruction" and "bias correction" techniques need to be better motivated and described. I find myself wondering what their purpose is here – save for to account for biases in the underlying model (which are not discussed). The fact that the reconstruction shows that unrealistically high March ice thickness is required to get a good September forecasts suggests to me that the model is melting too much ice.

Furthermore it seems to me that the "bias correction" is derived using information about the future ice concentration. How would this work in a real forecasting situation?

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Interactive comment on The Cryosphere Discuss., 9, 5521, 2015.