

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

Anonymous Referee #1

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Review of “Seasonal sea ice predictions for the Arctic based on assimilation of remotely sensed observations”, by Kauker et al.

This paper describes a tuning exercise and a set of sea ice data assimilation experiments using the NAOSIM model, designed to improve the performance of this system in producing seasonal sea ice forecasts for the Arctic.

General comments: This study's merit lies in the fact that it has performed a multivariate sea ice assimilation (concentration, snow and thickness), which is a new area. However, the authors should make more effort to describe the papers unique contribution and importance in the preamble. The study is quite technical and the authors make little effort to make the material accessible to a wide audience and it is not clear to me what the studies key findings/recommendations to other forecasting centres are. For

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example, lots of DA jargon is used, which is not explained. I found that the Conclusions section was more a summary of what has been done than a digested message to take away from the paper. Due to the technical nature of the study, I think it is particularly important that the conclusions are clear, since many readers will be interested in the papers message, but not full details. I suggest that in the authors add a paragraph to the conclusions section discuss recommendations about the usefulness of this method for other forecasting centres.

My understanding is that this is more a model development paper, rather than a scientific one. I therefore suggest the authors change the title to: "Developments to a seasonal sea ice prediction system using remotely sensed observations", or similar and frame the rest of the paper like this. Then it is clearer that it is mainly a development paper.

A lot of information is presented in the paper, but it is not always clear why certain aspects of the analysis are important, or why certain graphs have been included. It is therefore quite impenetrable. I suggest the authors carefully edit the paper to stitch the different parts of the analysis together as part of a coherent story.

Specific suggestions: The paper uses a lot of technical jargon, such as "Data stream" and "Operational Products". I suggest these are changed, or at least defined, to make the paper more accessible to a wider audience.

P5523:L21-22: See also Day et al. (2014)

I think the introduction would benefit from some discussion of why we think sea ice should be predictable on seasonal and longer timescales. I suggest at least mentioning predictability studies such as Koenigk and Mikolajewicz (2009) or Holland et al. (2010), which provide this justification. A review of the state of the art in sea ice prediction is also presented by Guemas et al. (2014).

P5531: It is not clear what the purpose of the comparison with PIOMAS and TOPAZ is.

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I don't really think it adds too much to the paper. I suggest this is deleted. P5532:L1-5: Why is NCEP reanalysis chosen as the driving data? There is evidence that ERA-Interim performs much better in the Arctic (Lindsay et al., 2014).

P5532:L6-11: I suggest the authors reiterate what they expect to learn from the different experiments here.

P5533:L20-30: It is really not very clear to me how the lines in figure 7 were calculated, or how to interpret them. Was the DA scheme used to update the state vector all through the simulations, or was a control simulation run without data assimilation? This needs to be much more explicit. It is very important that this explanation is improved as it is impossible to assess the validity of the paper, when the method is not clear.

Figs 6, 8 and 10. Suggest adding dates to the plots to make it easier for the reader.

Fig 11: I suggest the more information is included in the caption of this figure

Day, J. J., Hawkins, E. and Tietsche, S.: Will Arctic sea ice thickness initialization improve seasonal forecast skill?, *Geophys. Res. Lett.*, 41(21), 7566–7575, doi:10.1002/2014GL061694, 2014.

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Holland, M. M., Bailey, D. A. and Vavrus, S.: Inherent sea ice predictability in the rapidly changing Arctic environment of the Community Climate System Model, version 3, *Clim. Dyn.*, 36(7), 1239–1253, 2010.

Koenigk, T. and Mikolajewicz, U.: Seasonal to interannual climate predictability in mid and high northern latitudes in a global coupled model, *Clim. Dyn.*, 32(6), 783–798, doi:10.1007/s00382-008-0419-1, 2009.

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