**Minor comments:**

(1) Page 5, Line 14-17: Regarding the assigned value of sea ice concentration data. I don't really understand the argument used to justify your 50% sea ice concentration data error when you say that you 'verified the sensitivity' of your results by comparing the 'results of the sea ice assimilation' between constant 50% errors and spatially and temporally-varying errors (from OSI-SAF?). If sea ice concentration misfits were the dominant (or only) term in the cost function then you could probably even use much higher concentration errors and end up with similar reductions of the cost function. So that exercise wouldn't verify the correctness of the SIC prior error. *A key aspect of the sea ice concentration prior error that seems to be missing in this paper is that the prior errors assigned to the data are central for determining whether your final state estimate is consistent with the data*. The statistics of the distribution of the model-data misfits of the state estimate should be consistent with the prior data error statistics, if they aren't then one needs to offer explanations.

When you use a 50% SIC error you are essentially saying that you would accept a distribution of SIC model-data misfits with a standard deviation of 0.5. Now, you might have a good argument for why you think your particular model would not be able to do better than that, but I don't see any such argument. I think a 0.5 error is very large if you consider all nonzero SIC points because so much of the Arctic has SIC near 1 for so much of the year. In winter in the central Arctic, both model and data are going to be so close that the RMSE errors are going to be very low, probably much lower than 0.5. Also, as far as I can tell there is no comparison of the SIC prior errors and the model-data residual statistics before and after the optimization.

You should probably show a distribution of the SIC residuals before and after the optimization and compare the standard deviations of those residuals against each other and against the prior error. With the 0.5 value that you assumed, you may find that you have formally achieved consistency with the data at iteration 0, or you may find that you achieve it after your iterations, or you may find that you have not achieved it. The RMSE tables offered are not sufficient because according to the text they include 'every grid location', which would include points where SIC in both the model and the data are always both 0.

I suggest that for each day separately you include only those points where the model OR the data have nonzero sea ice. If, before the assimilation, the model-data residuals RMSE each day are < 0.5 then you are already formally within your data prior errors and there is no apparent need to do data assimilation. If SIC model-data residual RMSEs are higher than 0.5 at iteration 0 then you have to determine how close to 0.5 they get after the assimilation. That's the point of the SIC prior error that is missing here. The SIC prior error defines a *target* for the model-data residuals that the state estimate is trying to achieve.

(2) Page 5 line 22: The 1% criteria that you used to stop iterating is not indicative of model-data consistency, it's indicative of a slowdown of the cost function reduction. Since only a

few years were considered, please mention then number of iterations required for each year to get to the 1% threshold as that information might be useful for future researchers.

You should also probably show the goodness of fit of your estimated state before and after the data assimilation compare with the prior error, especially with respect to sea ice concentration since that is the focus of the paper. See comment above.

**Technical Corrections**

1. Page 4, line 9: should be 'ice-tethered profiler' data. Also include a reference to ITP data here.
2. Page 5, line 10: write out standard deviation instead of STD. Also, the standard deviation of the NCEP fields over which time period?
3. Page 7, line 12. You probably mean 'since a perfect total SIA or SIE' instead of 'SIC or SIE'.
4. Your doi for Detlef's 2016 paper is still incorrect. It should be DOI: 10.1146/annurev-marine-122414-034113 Remove the ncbi.nlm.nih.gov/pubmed link.