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# *Interactive comment on* "The benefit of using sea ice concentration satellite data products with uncertainty estimates in summer sea ice data assimilation" *by* Q. Yang et al.

**Anonymous Referee #1**

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Authors perform sea ice concentration assimilation for 3-month period (June-August) in 2010 (April). They use two observational datasets, and different uncertainties associated with this data. The paper explores performance of the model in terms of sea ice concentration and thickness after data assimilation with different uncertainties.

##General comments

The topic of the paper is very interesting. It is one of the first studies that explores effects of spatially and temporarily variable uncertainties of sea ice concentrations on its assimilation in to the model. However the paper leaves an impression of being written in hurry, with a lot room for improvement. It is certainly have to be expanded to

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make results more conclusive, especially in terms of sea ice thickness analysis.

I do not recommend publishing the paper in the present form in "The Cryosphere".

## Specific comments

Description of the data, that is used for assimilation have to be very clear. Now it is hard to understand where exactly the data came from.

Use of the selected time period (summer 2010) have to be also justified, especially considering attempts to perform sea ice thickness analysis. There are some satellite data on sea ice thickness in recent years, which can serve for comparison. Not including September in the analysis, the month with maximum melting, also have to be justified.

Evaluation of the sea ice concentration simulated by the model is based on comparison with NSIDC dataset that can hardly serve as an independent data source. Moreover it is not shown how NSIDC data compares with OSISAF and SICCI and if being closer to NSIDC data is actually mean being closer to reality.

I find discussion on the sea ice thickness comparison very weak. It is based only on two point stations, and can't serve as a basis for very broad conclusions presented by the authors. All discussions about thickness should be ether excluded, or better expanded to compare with more representative data.

## Detailed comments

### Abstract

Abstract reads rather strange – you begin with description of the results, skipping the setup of the experiments (data assimilation with constant and varying uncertainties). So the "how" section of your abstract is incomplete.

P2544

7-9: I don't think this information belongs to the abstract.

### Introduction

21-22: Using IPCC report as a reference for such a statement is a bad practice. You should at least point the reader to the chapter in the report, or even better just cite individual researches that support your statement.

P2545

13-29: Here you discuss OSISAF and SICCI datasets that have temporal coverage of 1978-2009 and 1992-2008. On the next page you state, that you are going to use this datasets to study summer 2010 sea ice concentration. This sounds a bit strange. In the next section, you mention that it is actually OSI-401-a and SICCI AMSR-E. Please make it very clear what you use exactly. If you still want to discuss sea ice re-analysis products in the introduction, then you have to connect them to the data you are actually using.

### Forecasting experiment design

P 2546

22: Define SEIK. Before you define LSEIK with the same references. Is it the same thing?

P2547

5: Why this time period is chosen?

7-9: You use EOF information, but how exactly initial conditions for your ensembles were generated? Please clarify.

23: Here you use LSEIK again. Is there a difference between SEIK and LSEIK, and if there is, please explain it.

P2548

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4-9: I strongly doubt that this product can be considered to be independent. The SSM/I and SSMIS are deliberately made quite comparable, so that the satellite measurements record started in 1978 can be continued. So SSMIS is improved version of SSM/I but it is in no way it can be considered as producing results "independent" of SSM/I.

### Results

P2549

18: You don't mention how you handle missing data around the North Pole in NSIDC during the comparison. Was this region excluded, or you assume some constant concentration?

18: Your model and NSIDC data have different resolutions and different grids, so I assume for comparison you have to interpolate sea ice concentrations at some common grid. Details of this interpolation should be provided. Such interpolation can lead to quite significant local changes in sea ice concentration, so these effects must be considered in your comparison.

P2550

2-5: The sentence is hard to follow, consider rephrasing.

10-12: I don't think that you can make such a statement. What you show is that LSEIK-3 is close to NSIDC data, but you did not show, that being close to NSIDC data mean being more realistic. It might be quite opposite. NSIDC data have a number of problems, especially in summer. What you doing here are comparing model after assimilation of more advanced sea ice products against presumably less accurate product. You at least have to show how NSIDC sea ice concentration compares with OSISAF and SICCI in terms of RMSE.

13-29: It is hard to estimate performance of the model using only two observational points. This analysis can't serve as a ground for your statement in the abstract that " SICCI concentrations outperforms the assimilation of OSISAF data in both concentra-

tion and thickness forecasts", it is just simply too local. In my opinion this comparison should be excluded from the study, or considerably expanded by adding analysis of spatial thickness distribution

21: You use abbreviation DA here for the first time. Define it.

### Discussion

P2552

16: You use abbreviation SD here for the first time. Define it.

### Conclusions

P2553

14-15: This is just contradicts your statement at P2551 L13:14.

### Figures

When plotting maps of the Arctic Ocean most of the time the 0th meridian is used as a central longitude. What is the advantage to use 45th meridian in this case?

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Interactive comment on The Cryosphere Discuss., 9, 2543, 2015.