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Interactive comment on "Assimilating high horizontal resolution sea ice concentration data into the US Navy's ice forecast systems: Arctic Cap Nowcast/Forecast System (ACNFS) and the Global Ocean Forecast System (GOFS 3.1)" *by* P. G. Posey et al.

Anonymous Referee #1

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GENERAL COMMENTS The authors present a method to create a blended high resolution sea ice concentration product from AMSR2 and MASIE/IMS and model results from US Navy's sea ice forecasting system (in hindcast mode) that assimilates this newly developed blending concentration data. This newly blended data includes information of human analysis, and has a very high horizontal resolution of 4km, and hence are well suitable for using in the forecasting model of the Arctic Ocean with the high horizontal resolution. Comparing with the independent NIC data, the new assimilation

decreases the predicted sea ice edge error significantly.

In recent years, US Navy updated its operational system from PIPS to ACNFS. This paper describes their latest advances over an earlier sea ice concentration data assimilation used in their operational system. This manuscript is well written, and the results are clearly presented. Although the paper is quite technical, I think the focus on improving high resolution sea ice edge forecast using this innovatively high resolution sea ice concentration data justifies publication in TC.

However, some points should be addressed before publication: 1) In the Introduction, the US Navy's forecasting system is described in too many details. But for a scientific publication, it would be also helpful to add some overview of the advances of the sea ice data assimilation in the current scientific community. At present, there are already a lot of sea ice data assimilation method and related research, e.g., nudging, OI, 3D-Var and EnKF, why you still use this simple approach of weighting technique? Is this method particularly suitable for your operational use? Further, I would suggest the authors to re-organize the structure of the paper, e.g., to move the description of the forecasting system from the "introduction" to the "data and methods". 2) In Part 2 and Figure 5, you show that the blended concentration varies from 70% to 100%, and there are no concentration values below 70%. Is this a reasonable approach? Could this method introduce additional errors to the model? E.g., it seems not realistic that the concentration data within the sea ice edge are as high as 70% in the blended data, but you fuse this information into your model. 3) In Part 3, more details of assimilation method is strongly required in the MS. Do you update the ice thickness and water temperature during the initialization? Is this initialization introduces inconsistency to your model physics? 4) In Part 3, you show the substantial improvements in the sea ice edge area, but besides this, sea ice concentration and ice thickness are also very important information for the forecasting use. So how about the sea ice concentration change in the sea ice edge area? Can you also compare your results with some other sea ice concentration data set, for example, NSIDC, OSISAF, ESA CCI or ice analyzed

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charts from Canada. It would be also interesting to investigate the effect on the sea ice thickness. Can the new assimilation further improve the ice thickness forecast over the earlier approach? I notice that you had done such comparison in Posey et al. (2010), so in this MS, I would suggest you also do such comparison with in-situ observations, especially in the sea ice edge area. If you cannot show the improvements in the sea ice concentration and thickness, I would suggest you change the title of the MS to show the limit of this data assimilation study, e.g., Improving the Arctic sea ice edge forecasts by assimilating high resolution sea ice concentration data into the US NAVY's ice forecast systems.

SPECIFIC COMMENTS 1) Page 2349, line 4, "difference" should be "different". 2) Page 2350, line 12, (29 vs. 45 km, a ")" is missed. 3) Page 2362, the color bar in Figure 5 is not clear. Please redraw this figure.

Interactive comment on The Cryosphere Discuss., 9, 2339, 2015.