

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 #2

This paper introduces an interesting approach to blending observations from different sources and resolutions to initialize coupled sea ice-ocean forecast models. The improvements made to ice edge forecasts is impressive and it would be good to see ongoing improvements of this magnitude.

The paper could be improved/made more useful by providing additional information about the observation data handling, the assimilation methodology and the ice edge verification. A clear understanding of these would allow the reader to better understand the results presented. In addition, the term resolution is used rather loosely to describe the various observations and greater rigour is advised. Lastly, the results are presented without significant discussion about the sources of error or how these might be overcome in future.

Specific comments: (S=Section, P=Paragraph, L=Line)

S1-P1-L6: numbers or references should be provided to clarify 'high year-to-year 'variability' and 'rapidly changing Arctic environment'

S1-P2-L5: the term 'determined' is vague and should be replaced by observed or analyzed as appropriate

S1-P3-L4: the resolution of SSMIS is frequency dependent so it would be helpful to indicate which channel has a resolution of 25 km and this should be relevant to the sensor's use for this application

S1-P3-L13: the IMS acronym and reference should be indicated here and not repeated at S2.2-P2-L1

S1-P3-L17: 'into the both' should be 'into both'

S2.1-P2-L5-7: higher gridding resolution is not equivalent to higher resolution observations. The ice concentration retrieval algorithm that is being used should be identified and the resolution of the channels used should be provided

S2.1-P5-L4: it would be helpful to identify the 'human-analysis-based product' here

S2.2-P1-L1: insert 'using' before the Interactive...

S2.2-P1-L2: should indicate the valid time of the IMS product or indicate if it is a daily average product. This has significance to the later results

S2.2-P1-L5: insert satellite before imagery

S2.2-P1-L7: suggest removing the remainder of the sentence beginning with 'with a 40% ...'

S2.3-P1-L5: should indicate the source of the AMSR2 ice product

S2.3-P1-L7: the term 'modeled forecast' seems redundant

S2.3-P2: the choices about only using AMSR2 derived concentrations above 70% and assuming a value of IMS concentration of 70% seem arbitrary and certainly introduce bias. The impact of these choices should be better justified as AMSR2 derived concentrations span the full range from 0 to 100% while IMS only tells you whether the concentration is above or below 40%. Indeed, the 40% threshold probably isn't precise

S3.1-P1: further details on the assimilation methodology would be helpful such as whether the ocean is adjusted according to the initial ice concentration, how the ice thickness is specified and how the weighting works

S3.1-P1-L5: 'near the ice edge' refers to the model ice edge?

S3.1-P1-L11: what is the NCODA ice analysis and is there a reference?

S3.2-P2-L4: why is such a short forecast period used? It would be more instructive to see how the forecast error changes with forecast duration

S3.1-P2-L6: is there a reference for the NIC ice edge product? How is the ice edge defined? What is its valid time and is it an analyzed edge or a nowcast edge?

S3.1-P2-L9: what is meant by 'conservative edge location'?

S3.1-P2-L11: what is meant by 'buffer'?

S3.1-P2-L14: it seems odd that the NIC ice edge product and NIC IMS product use different data sources and that they are independent. Presumably the same data comes to NIC even though the analysis systems may be different. One would expect coordination for preparation of similar products

S3.1-P3-L1: 'observed' should be replaced with analyzed or nowcast

S3.1-P3-L5: how sensitive is the choice of a 5% threshold and is this consistent with the verifying data? It has been indicated that the model is never initialized with ice concentrations between 0 and 70%

S3.1-P3-L6-8: more detail and a reference would be helpful here. For instance, how closely spaced are the 'NIC observed points' and is this consistent along the edge? How are potential problems related to shore leads and patchy ice dealt with? Are the results the same if you measure the distance from the model edge to the NIC ice edge?

S3.1-P3-L8: the results for the 6 regions are never discussed. Either some mention should be made of the regional results or the information removed

S3.1-P3-L13 and onward: while these improvements are impressive, the actual error seems incredibly large especially for a 6 hour forecast. To better understand this error, it would be helpful to quantify the error or difference in the IMS and the NIC ice edge. Presumably the difference between this and the reported errors are due to the model adjusting to the imposed ice field, i.e. melting ice or forming ice according to its internal SST/upper ocean heat content. Also, is it possible to quantify whether the model under or overestimates the ice extent?

S3.1-P4-L4-6: it would be helpful to include this information in a table

S3.2-P1-L4-8: it would be helpful to provide more and clearer detail here

S3.2-P3: it's not immediately clear why the results found by including SSMIS are identical to those without it. In fact it's not clear how the SSMIS and AMSR2 ice concentrations are used in combination. More elaboration is required