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Interactive comment on "Assessing the impact of multiple altimeter missions and Argo in a global eddy permitting data assimilation system" *by* Simon Verrier et al.

Anonymous Referee #1

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Review comments for "Assessing the impact of multiple altimeter missions and Argo in a global eddy permitting data assimilation system" by S. Verrier, P.-Y. Le Traon and E. Remy (os-2016-104).

General Comments

In the paper, Authors addressed how much multiple altimeter data and Argo data constraint a ocean data assimilation system from the simulated observed data of the higher resolution (1/12 degree) free simulation run, which are the observing system simulation experiments (OSSEs). Based on four OSSEs, Authors found that the altimetry data assimilation using simulated Jason 1, 2 and Envisat, increase the accuracy not only of sea surface elevation but also of surface currents, subsurface temperature and salinity

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fields. Simulated Argo data in the OSSE, not surprisingly, increase subsurface temperature and salinity fields. OSSE could be an effective tool to diagnosis responses of ocean data assimilation system for considering observations, and this research article would be helpful to understand for the responses. From this review, it seems that this paper would be publishable to Ocean Science after revision with following comments

Specific Comments

O In this paper, the analysis in horizontal distributions are estimated from the differences of each OSSE (Sat1,2,3 and Arg1) from FR (e.g. Fig. 2,4,5,6,7,8,11,15). In order to understand more clearly on the impact of single and multi altimeter date on the assimilation system, it would need the differences among Sat1, 2, 3 as well as the difference from FR.

O page 4, 2nd paragraph from the bottom. It is needed that more explanation on larger improvements of Sat2-Sta1 than one of Sat3-Sat2. This pattern occurs in all comparisons.

O Page 5, 3rd paragraph from top (line 10-11). In the OSSE, this statement is only relevant in the 7-day forecast of this OSSE, and results of the comparison must be changed by the periods of forecast. Is there any more generalized result on this impact?

O Page 5, line 14. “Model predictability” It is needed more detail discussion on “Model predictability”. What is the definition of the predictability in this analysis?

O Page 5, 4th paragraph from top (line 14). It is unclear why the MSE increase globally 28% for Sat1, 35% in Sat2, 37% for Sat3. The previous results show that MSE decrease by adding multiple altimeter data. It seems that more discussions on the error are needed.

O page 5, line 28. What is “model surface error fields”? It would be guessable, but in order to understand more clearly, it is needed to clarify what the error field is.

O page 6, 1st paragraph from top. The spectrum of variance preserving form seems to

show different results from the spectrums in Fig.10, especially on impacts in the length scales. The spectrum of variance preserving form would need to be shown, and it need to discuss on the differences of OSSEs in scale between the spectrums.

O Page 7, line 7-8. Model results show the assimilation of altimeter data improved MSEs of subsurface temperature and salinity, and Authors suggest two brief possible mechanisms. The mechanisms would be model and assimilation scheme dependent, so more detail discussion on this mechanism is needed.

O Fig. 4, 5, 6, 7, 8, 9 It seems that more organized figures would be needed rather than separated figures, which is associated with the results in Fig 10.

Technical comments

O Page 2, line 23-24. It seems that this statement is irrelevant.

O page 6, line 22, “MS” would be “MSE”

O Captions of Fig 12, 13, 14 “RF” would be free run or FR

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