

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 #3

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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).

Based on four OSSEs, Authors assessed the impacts of assimilating multiple altimeters and Argo observations on the global data assimilation system. The simulated observations (three altimeters and Argo) taken from a high resolution NEMO model were assimilated into low resolution NEMO model. It is not surprised that increasing the altimeter data improved the AR results. Assimilating the derived Argo observations further reduced the bias of the deeper temperature fields relative to the FR. Scientific and presentation qualities should be substantially improved by the major revision of the

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manuscript.

Here is some suggestions from me:

Description and explanation of Methods. The authors did not give a clear descriptions of the data assimilation system used in the study. For example, different assimilation window has large impact on the data assimilation results, which is directly related to the observation selections and the disturbed frequency of AR by data assimilation. In this study both observations and anomalies ensemble are different from the Lellouche et al., 2013, why you still used the 7-day time window? Further, Authors used the anomalies constructing method similar to the other studies with EnOI method like Oke et al. (2008). This kinds of method needs large member of samples. How it can save the computation cost compared to the 'EOF' methods in SAM2? How many members have been used? How to select these members? How about the localization? Observation erros covariance? What is the control variables? And so on . . .All these are related to your OSSE results, authors should give a clear descriptions.

Experiment design. The paper discuss both the impact of Sat 1.2.3 and Argo observation systems on data assimilation system. The derived Argo observation effect to the AR results is shown. The corresponding experiment is deigned by assimilating Argo alone or both Argo and satellites? Please clarify it and supply another corresponding experiment. Further, Authors show the three experiments with one (Jason-2), two (Envisat and Jason-2) and three (Jason-1, Envisat and Jason-2) assimilated satellite data sets. The other experiments and analysis with single or combined sat. dataset are also need to be addressed.

Salinity is not improved too much in AR experiments related to the temperature field. The improvements of salinity among three AR experiments (Fig .13) are very small. why? Is it caused by poor T-S background error covariances? The reasons need to be clearly discussed.

The study is mainly focus on the overall impact of assimilating Sat.123 and Argo. The

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evolution of impact is also interested for the T,S,U,V in time.

The impact of Argo on the SL also need to be addressed. Perhaps forecast errors in SL might reduce?

Fig3. The Global MSE of SL is fast reduced during the first or two month and then keep small variability. And you explain it “The system constrained by the 1/12° simulated SSH observations converges toward a stable state in 2 to 3 months” Why these happened? Because of the observations coverage or initial conditions or other reasons???

P2 As a following of Turpin et al. (2016), it seems to not true in the beginning of the manuscript : “Analysing the impact of altimetry and Argo in a global data assimilation system through OSSEs has, to our knowledge, not been carried out at least in recent years”

The OSSEs is from January 7, 2009 to end of 2009. So it is not the 1-year OSSEs. Please correct it.

P2 Line '7', “results for existing observing systems must be consistent with those derived from OSSEs.”, why must be consistent?

P3 “:::within the upper 100m and with 1m resolution at surface up to 450 m at the bottom:::”, make it clearly

P3 Line 20. “::: our best estimation . . .:::”, How about other setup of NEMO or other models, observation. Why you say it is the best one. . .

P5 Line 11 “The error level of the analysis with one altimeter is close to the forecast error level when two or three altimeter data sets are assimilated.”. why? One altimeter doesn't work in you AR experiment? Please explain it.

P5 Line 8-9, make it clearly. Why you compare the Sat2 to Sat1 and Sat3 to Sat2, not Sat3 to Sat1?

Please make the unit in Fig2 and other figures same.

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