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Ocean Science Discussions

Interactive comment on "Application of EnOI Assimilation in BCC_CSM1.1: Twin Experiments for Assimilating Sea Surface Data and T/S Profiles" *by* Wei Zhou et al.

Anonymous Referee #2

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The contribution of this paper is to describe the construction of the Beijing Climate Center Climate System Model BCC_CSM1.1 and to document some of its behavior in a set of idealized data withholding experiments. While the BCC_CSM1.1 is not unusual in that it follows along the lines of Bluelink and the NOAA GODAS, I think it is useful to have it documented in the literature. This part of the paper, up to about line 181 is fine.

The results section then presents seven withholding experiments (E1-E7) using some combination of the primary ocean data sets: SST, SSH, SSS, and the hydrological profile data. Previously experiments such as this have been carried out to test the impact of the TAO array, or the usefulness of satellite altimetry. This current study lacks

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that clear motivating problem. In addition the paper suffers from lack of clarity regarding the definition of RMSE and what is meant by a 'forecast'.

The authors do not define the mean used in calculating RMSE. It is an important omission. The short (one year long) length of the experiments means that they could not have removed a mean seasonal cycle so a assume the mean is a constant. But is it the true mean or the mean taken from the individual experiment?

The authors present forecasting experiments. Were the forecasts produced using a coupled model with a free atmosphere (in which case we should have multiple ensemble members)? If so their results are quite important. Or did the authors simply carry out an ocean simulation forced by NCEP reanalysis? Some explanation of how the forecasts were carried out is needed.

In lines 391-406 the authors draw five conclusions.

1) "Data assimilation generally improved all investigated quantities" OK.

2) 'E7 gave better forecasts'. What this means depends on how the forecasts were carried out.

3) 'initial conditions produced assimilating only SST produced as good a forecast as initial conditions produced using hydrography.' This would be surprising if true, suggesting that enso does not depend on thermocline variations! Again I suspect the reasons for this conclusion have more to do with how RMSE is defined and what is meant by a forecast.

4) 'Ocean currents are better predicted when hydrography is assimilated than when, e.g. SSH is assimilated' Hydrography has information about the vertical shear of the horizontal velocity, while SSH has information about the geostrophic component of surface currents. Without knowing more about the forecasting system it is hard to interpret this result.

5) 'The development of a CP El Nino was well predicted when all information was used'.

As above, I can't even react to this statement without knowing about the forecasting system.

Beginning on line 408 the authors have attached several seemingly unrelated paragraphs touching on an ensemble Kalman filter, additional experiments starting with different initial conditions, 'a comprehensive test in a realistic framework', and a few more variables the authors may want to assimilate. This is all very confusing and should either be expanded or eliminated.

More comments

Table 1 seems to have formatting issues.

Fig. 1 were the floats kept in the same location throughout the experiment? That's unrealistic.

Fig.2 Again, how was the mean defined?

Fig. 4 Need a better explanation of what is plotted. How can there be negative error?

Fig. 5 upper left: How can the assimilation of SSH warm the south atlantic mode water?

Fig. 6 In E2 when SSH is assimilated the SSH error is larger than in E1 when SSH is not assimilated. How can this be?

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