Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2020-32-RC1, 2020

Ocean Science
Discussions

Interactive comment on "Importance of El Niño reproducibility for reconstructing historical CO_2 flux variations in the equatorial Pacific" *by* Michio Watanabe et al.

Anonymous Referee #1

Received and published: 19 May 2020

The authors present an interesting work to compare the relationship of air-sea carbon fluxes to ENSO in the equatorial Pacific simulated by the two earth system models with assimilation and without assimilation, which are developed by the same institute. What's more interesting in this paper is that the old earth system model with assimilation generated an incorrect upwelling during the El Nino period, which led to a great problem in the simulation of carbon fluxes, but the new earth system model did not. Although this work has not made much contribution to the study of the response mechanism of carbon fluxes to ENSO in the equatorial Pacific, it will be very helpful to the people who are interested in assimilation or the model development, especially to those who are interested in the simulation of the carbon cycle process in the equatorial Pa-

cific, if we can find out why the old and new models have different performances after the same assimilation method is added. The content of the article fits within the scope of OS, but much work needs to be done before publication to refine the theme of the article, highlight key points, and give a more detailed discussion on the conclusions. Major points: 1 AbstractïijŽGreat changes are needed to reduce the description of the study significance and increase the discussion of the final result. 2 Some descriptions need to be supplemented, such as the vertical range of assimilation. Are the temperature and salinity at the bottom of the mixed layer assimilated? That another content needs to be added is to compare the differences in the simulation of ENSO between the two models with assimilation and without assimilation, such as the periodicity and amplitude of ENSO. 3 In the old model with and without assimilation, the response of 10-m wind speed over the sea surface to NINO3- SST does not change significantly, but the response of sea water vertical velocity to NINO3- SST changes greatly (Figure 4). Dose the meridional wind change significantly?

4 Line 196, "howerver, the strong heating causes upwelling of DIC rich waters in the subsurface layers (Figure 6b)." Why does this strong heating occur? Is the simulated value of sea water temperature in the old model during the El Nino period lower than the data used for the assimilation? Please discuss in detail the reasons for the abnormal upwelling during the El Nino period in the old model with assimilation.

5 After assimilation is added to the new earth system model, the response of upwelling anomalies to NINO3- SST is weakened (comparison of Fig. 6 with Fig. 8). This change in the response is actually similar to that in the old model. Does this mean that the current assimilation method is not suitable to the earth system model?

Minor points:

1 Line 119, "three ensemble members". How were the ensemble experiments conducted? Were the initial fields of these experiments different?

2 The statement of Line 149-151 is error. $(\partial pCO2/\partial T)\Delta T$ is not the term of changing

the solubility of CO2.

3 How was the “temperature increment” calculated?

4 Line 236-238, “The correlation between SST and CO2F in the equatorial Pacific is consistently represented only in the case where the ocean temperature and salinity observations are assimilated into NEW.” This statement is ambiguous, because both OLD and NEW experiments can produce the relationship between the SST and CO2F.

5 Overall, the manuscript needs to be improved, including some language errors.

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2020-32, 2020.