Ocean Science
Discussions

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Interactive comment on "On the deep convection events and Antarctic Bottom Water formation in ocean reanalysis products" *by* Wilton Aguiar et al.

Anonymous Referee #1

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This paper compares water mass formation processes occurring in the Southern Ocean in three different data assimilated ocean model results. This is a very important exercise assessing model performance.

The authors related sea ice to the Weddle Sea Polynya and then the Antarctic Bottom Water. They conducted nice analysis on conversion from a water mass to another due to convection using volume percentage of water masses. They reported that in two of the models (ECCO2 and SoSE) AABW is formed through open ocean convection in Weddell Sea, while in other model (My Ocean University of Reading, UR025.4) through dynamically accurate continental shelf convection and exporting of dense water. I found that these processes are well explained in the text, and relationship between sea ice, open ocean convection and the volumetric percentage is consistent.

The authors argued that the excessive open ocean convection in ECCO2 and SoSE is due to insufficient assimilation of sea ice. I do not agree with the author on this matter. There is no doubt that sea ice is closely related to the open ocean convection, but oceanic processes such as rising of WDW might have initiated open ocean convection and the reduction in sea ice. In addition, what the authors have observed could be initial adjustment. For example, in ECCO2 sudden change occurs in 2004 as explained in the text. How could you show that this is not an adjustment process?

What is causing the differences between the models? I suppose it may be hard to pinpoint the processes causing the differences, but I suggest the authors to compared circulation patterns and vertical profiles of temperature and salinity more carefully. Except for SoSE (Fig. 3), there is no figure showing temperature and salinity. A related question is why UR025.4 performs better. Is this resolve the coastal geometry better? Is it initialized differently?

It must be explained in the references, but I hope there would a description on the assimilated data over the Southern Ocean. Comprehensive explanation on the initialization is necessary. Difference in the initial states might be the cause of the difference in the convection and water mass formation.

In several places, ocean current are introduced while explaining water mass formation. There, however, are no figures and it is not easy to follow the explanation. Please added appropriate figures.

It was concluded that improvements necessary. What kinds of improvement are necessary?

Figures 1, 3 and 4 should be improved. The contours lines except for the black ones in Fig. 4 are hard to see. A scale bar is necessary for SIC.

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