Ocean Sci. Discuss.,
doi:10.5194/os-2016-57-RC1, 2016

Ocean Science Discussions

Interactive comment on "Changes in extreme regional sea level under global warming" *by* S.-E. Brunnabend et al.

Anonymous Referee #1

Received and published: 2 September 2016

The study focuses on projections of extreme dynamic sea levels associated with propagation of mesoscale eddies under future warming scenario. The model used here is an eddying ocean version forced with projected surface fluxes from another climate model. It is found that the change in dynamic sea level extremes is mainly caused by the change in ocean eddy pathway. In particular, both the mean and extremes of dynamic sea level in the North Atlantic show significant changes during the 21st century, with important implication of coastal impacts.

This is an interesting study, although the results are mainly based on ocean-only model simulations, in which the representation of air-sea feedback may not be complete. The mean and extremes of dynamic sea level anomalies are analyzed in combination, providing an overall picture about future sea level variability and change. I particularly like the comparison between the high and low resolution version of the model. It effectively

demonstrates the role of mesoscale eddies. The manuscript is written clearly.

So I recommend publication of the manuscript after a minor revision.

Line 17: global mean sea level "rise"

Line 76: Such "as"

Line 82: Does the model employ any salinity restoring at the ocean surface? It is known that the AMOC simulation is sensitive to different boundary conditions. The potential impact of the boundary condition on AMOC needs some discussion.

Line 111: Please provide reference for the altimetry data (1993-2012).

Line 159 and Figure 3: Figure caption should include model information. It would be better to add the AMOC time series from the low resolution model for comparison.

Line 164: Is it possible to show ocean bottom pressure changes?

Line 180: The paper by Saba et al. (JGR, 2016) should be cited for the northward shift of the Gulf Stream and the warming of the oceans near the US northeastern coast.

Line 181: This "warming hole" and dipole pattern of SST changes are robust fingerprints of AMOC weakening, consistent with most low-resolution coupled model projections.

Line 196 and Figure 5: Caption should indicate the direction of the heat and freshwater flux, that is, positive value means flux into the ocean.

Line 197: But cooling also increases density, which tends to strengthen the AMOC. Which process (more cooling vs less evaporation) is dominant?

Line 215 and Figure 7: The corresponding regions of the first three panels should be clarified further in the caption.

Figure 7: The shift of PDF is greater in the ocean interior but smaller along the coastal regions. I am curious about how often ocean eddies can actually approach coasts, or

they are mainly confined in the ocean interior. The potential impact of energetic eddies on coastal sea levels should be discussed further.

Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-57, 2016.