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Interactive comment on "Changes in extreme regional sea surface height due to an abrupt weakening of the Atlantic MOC" *by* S.-E. Brunnabend et al.

Anonymous Referee #2

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General Comments

This paper assesses the impact of an AMOC shutdown on sea-level. It uses a high and low resolution model and stimulates an AMOC collapse by hosing from high latitudes. The impact on circulation is discussed: AMOC weakens, the Gulf Stream separation moves north, freshwater and temperature anomalies circulate. The impact of this on sea-level is considered with particular emphasis on the impact of eddies on sea-level highlighted by the difference between high and low resolution runs.

The paper presents an interesting aspect of the impact on sea-level of an AMOC slow-down. I have a number of concerns about the calculation of sea-level anomalies at the

coast and would like to see more discussion on the impacts of the mean circulation change on sea-level but once these (and a few minor issues) are addressed, I would recommend this paper for publication.

Specific Comments

- how representative is the coastal sea-level in these simulations? Firing and Merrifield focus on a mid-ocean island. As we know the open ocean is eddy filled. However, eddies cannot be sustained near the boundary of the ocean e.g. Kanzow et al. J. Phys. Oc., 2009. Can you show that eddies have an impact on the real coastal sea-level i.e. are you sure that the eddy influence on the ssh doesn't diminish at the coast? Can the coastal sea-level derived from the model be validated against tide gauges (if not in absolute terms, then in terms of the timescales of variability seen)?

- In spite of this being a paper that studies the impact of an AMOC slowdown on sea-level, there is little mention of the impact of mean circulation on sea-level. There has been a lot of work recently on sea-level rise along the US east coast being linked with the strength of the AMOC (e.g. Ezer et al., J. Geophys. Res. 2013). Could the authors look at the meridional changes in sea-level along the US east coast to see if they see similar changes to Yin et al., Nat. Geoscience, 2009?

- F2(b&d): the coherence and strength of the GS as far south as the Florida Straits changes following the hosing experiment. I understand why the GS extension, north of Cape Hatteras, is affected by a hosing. But, when the GS is mainly wind driven in the Florida Straits, why would the circulation weaken there?

Fig. 1. Missing data in the 0.1 Sv hosing HR experiment. Why are these data missing? Why wasn't a 0.1 Sv run done in LR? I think the reader deserves an explanation about this in the paper.

l134-150. As the GS has a very stable separation latitude, I find this change very interesting. Could the authors comment more on why the hosing affects the latitude of separation? I think this warrants more discussion. I don't see why a simple weakening of the current would affect the latitude of separation.

Technical corrections

All figures should have the font size increased l56: Island -> Iceland l13: could you use a more updated reference than Bindoff et al., 2007? l32-27: need a reference here that focuses on linking AMOC and sea-level. Srokosz et al. only summarise. l146: lateral density gradient: is this simply that the freshening to the north reduces the dynamic height difference across the GS? Fig. 7: the sea level rise figures should have the same y-axis for comparison. The very strong sea-level rise on the North American coast is somewhat less obvious when the axes are as they are. l178: a -> an Fig. 2 should be combined onto a single page and the font size increased as it is difficult to read as it stands. l276: sensitivity to freshwater perturbations is not discussed by Smeed et al—they report a decline. Robson et al., 2014, Nat. Geoscience does link the current decline in the AMOC with high latitude density changes. Fig. 10. typo in titles: detredet -> detrended

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Interactive comment on Ocean Sci. Discuss., 11, 1213, 2014.