

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.

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We thank this Referee (B. Sinha) for the excellent suggestions on rewriting the manuscript. As indicated below, we have followed nearly all of these suggestions. The revised manuscript will focus much better on the topic of eddy-induced changes in sea level extremes. Only the section on how the different model resolutions influence sea level change through mean circulation changes is not deleted but rewritten to address the suggestions of Referee 2. Below we provide responses to specific comments of Referee 1 (original comments are in italic).

1. *My suggestion is to dispense with Figures 1-6 and lead with results on the sea level extremes – e.g. 10 year monthly extreme anomaly at each grid point with respect to the 10 year climatology for first and last 10 years for and their differences for LR and HR cases (control and perturbation runs). This gives the reader an intuitive and first order impression of the changes in sea level extremes due to resolution, and to changes in the AMOC. A second plot would be for return periods of a chosen representative extreme (e.g. average return period for a 10cm anomaly in the first 10 years). The three or more regions to focus on should then be selected on the basis of these figures rather than the mean sea level change – this is the right way round as you are interested in the regions where the extremes change, not the extremes where the mean sea level changes (although they might end up being the same).*

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This suggestion is followed. Fig. 1 now only includes the decline of the MOC for the different cases considered and the change in SSH. Fig. 2 and Fig. 3 now contain the first and second plot, respectively, as mentioned above by the referee. The anomaly for computation of the average return period is chosen to be $0.1m$ for the high-resolution case and $0.05m$ for the low-resolution case. Location of three areas and coastal positions of interest are now shown in Fig. 4.

2. *The next figures could be distributions (i.e. histograms) of the monthly maximum in the selected region along with the fitted distributions.*

A figure of the extreme value distribution with the fitted distribution is added to the manuscript as Fig. 5.

3. *On a procedural point, I am not sure why the authors subtract the area average mean and then detrend the values. It seems to make more sense to just take anomalies with respect to a 10 (or 20) year mean at each grid point and look at extremes in the average anomaly for the area, but I am willing to be persuaded on this point. Linear detrending looks problematic to me based on Fig 7b – OK for the $0.1Sv$ hosing, but maybe not ideal for the $0.5Sv$ hosing. Again, I am not sure why the analysis is done on anomalies from the control run. To me it makes more sense to do the extremes analysis on the*

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separate runs and then compare perturbed runs with the control.

We did the analysis on the anomalies from the control simulation to consider only the sea level changes that are caused by the reduced AMOC and leave out the variations in sea level that are occurring without the hosing included in the model simulation. The subtraction of the area average and detrending of the signal has been performed to focus the analysis on the change in short-term sea level extremes that are caused e.g. by changes in the eddy flow. However, we agree that linear detrending may not be ideal for the 0.5Sv hosing experiment. Therefore the long-term signal is filtered out using a high pass filter in the results of the revised paper.

4. Having hopefully drawn in and convinced the reader that the authors have some new and interesting results, versions of Figs 7, 8 and 9 could then be presented. Finally, for the explanation of the results, selected plots of e.g. eddy KE, Gulf Stream separation etc. can be shown to back up the hypotheses for the reasons behind the changes in extremes.

Suggestion followed.

5. Since I am suggesting a structural rewrite of the paper it seems unimportant to list minor comments at this stage, but I would like to draw to the authors' attention that although they place 95

We will add a statement about the significance of the changes in the return periods in the revised paper.

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