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Ocean Science Discussions

Interactive comment on "Frequency-dependent effects of the Atlantic meridional overturning on the tropical Pacific Ocean" *by* L. A. te Raa et al.

Anonymous Referee #2

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Review of the manuscript "Frequency-dependent effects of the Atlantic meridional overturning on the tropical Pacific Ocean", by Lianke te Raa, Geert Jan van Oldenborgh, Henk Dijkstra, and Sjoukje Philip.

This manuscript presents very interesting and important modeling results about the effect of AMOC changes on the tropical Pacific SST and ENSO amplitude. The tropical Pacific response is significant in the water hosing ensemble with a forced collapse of the AMOC, but very weak and not significant in the ensemble of with natural variability of the AMOC associated with the AMO. The results suggest that the connection between AMOC and ENSO depends very strongly on the frequency and the amplitude of the AMOC variations. The manuscript also pointed out the crucial role of the Caribbean SST anomaly for the linkage between the Atlantic and the Pacific. The manuscript will

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enhance our understanding of the impact of the AMOC on the tropical Pacific mean state and variability. I recommend the paper to be accepted for publications with minor revisions outlined below.

(1) The title of the manuscript is focused on the frequency-dependent effects of the AMOC on the tropical Pacific SST and ENSO amplitude. However, the different responses in the two sets of ensemble are strongly affected by the very different amplitudes of AMOC changes. The AMOC change is about 20 Sv in the water hosing ensemble, and only a maximum of 1Sv in the ensemble with natural decadal variability. The title of the manuscript might be modified to include the amplitude-dependent effect.

(2) The Caribbean cooling and thus the tropical Pacific response are strongly model dependent. Early coarse resolution models are not able to obtain similar magnitude of Caribbean cooling and the tropical Pacific response even with similar amplitude of AMOC changes. The manuscript should discuss the dependence of the response to the model employed.

(3) On Page 481, Line 19-21, the manuscript stated that "Note that by using only SSTs north of 25N in the AMO index, the inclusion of tropical Atlantic ENSO teleconnections (that could cloud the AMOC-related variability the AMO index is thought to express) is avoided".

At the multidecadal time scale, the observed tropical North Atlantic SST anomalies are highly correlated with the AMO index and higher latitudes North Atlantic SST anomalies, i.e. it reflects AMO signal not ENSO signal. The observed tropical North Atlantic SST anomalies reflect the AMO signal but models can not simulate this feature. The above statement should be modified and the difference between observed and modeled tropical North Atlantic SST multidecadal variability should be discussed. In particular, the model underestimates the AMO-connection to the Caribbean Sea compared to observations and this should be discussed.

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