

Interactive comment on “Chaotic variability of the meridional overturning circulation on subannual to interannual timescales” by J. J.-M. Hirschi et al.

Anonymous Referee #2

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The authors compare different eddy permitting model experiments to study the forced and chaotic MOC variability on sub- to interannual timescales. They found that to a large extent the MOC directly reflects the atmospheric forcing. Nevertheless, the chaotic MOC variability shows maximum values of up to 30% of the total MOC variability in the Atlantic. In similar non-eddying experiments the chaotic MOC variability accounts for less than 10%.

My main concern is about the experimental setup of the twin experiments. The initial conditions of the second pass (B025, B100) should only differ from the first pass (A025, A100) in the "chaotic" presence of the eddies and in the phases of the involved waves. A time lag of ~ 1 year between the initial conditions of both passes seems adequate. Why do the authors use the end of pass A as initial conditions for B? My concern is

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that some results are highly influenced by the drift in water mass properties between both passes. For example, the low correlation of the deep water masses in Fig 8 & 9 which also reflects on the ratio of the chaotic/total MOC in Fig 11, 12 & 13. Does figure 8 & 9 look similar in the low resolution runs? Especially changes within the Deacon Cell should be interpreted carefully if not shown in density space.

Ideally the twin experiments should have exactly the same atmospheric forcing, i.e. all sea surface temperature and salinity values used for the bulk formula / restoring should be the same in both passes (for example using mixed boundary conditions). Additionally the sea surface velocity dependence of the wind stress should be switched off.

A more careful experimental setup would strengthen some of the results which are not understood yet, e.g. the high chaotic MOC variability at the equator or the still surprisingly high values in the non-eddyding experiments in some areas.

Minor comments:

- p. 3195, only gravity waves are usually considered as internal waves
- p. 3213, a discussion to which latitude A/B025 could be regarded as "eddy-permitting" should be included

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