Earth System
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Discussions

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comment

Interactive comment on "Collapse of the Atlantic Meridional Overturning described by Langevin dynamics" *by* Jelle van den Berk et al.

Anonymous Referee #1

The paper by van den Berk et al "Collapse of the Atlantic Meridional Overturning described by Langevin dynamics" is an interesting application of the classic analytical approach of Poston and Stewart with introduced stochasticity for modelling AMOC trajectories of the EMICs published in [Rahmstorf et al 2005]. I think the paper should be published after a minor revision.

The title should be corrected: "Modelling collapse of the Atlantic Meridional Overturning using the Langevin dynamics". As the authors admit themselves, EMICs are not sufficiently,representative of the real climate. Also, given the number of parameters the authors use to fit their model (six) and their geometrical origin (see description of ν and λ), I understand why the authors claim that only the freshwater forcing is the variable that determines the dynamical behav

It would be interesting to see how the model can be used for forecast of bifurcations.

C1

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Discussion paper

The authors perform derivation of the model parameters using Bayesian framework, but once the model has been fully formed and the parameters are obtained for several EMICs, can the authors attempt forecast or hindcast of the bifurcating time series?

[Rahmstorf et al 2005] paper used 11 models and only hysteresis loops were presented (not actual AMOC trajectories)

https://agupubs.onlinelibrary.wiley.com/doi/pdfdirect/10.1029/2005GL023655?download=true

Can a figure be added with plotted time series that could be derived from the obtained model? For example, for the set of parameters averaged over a set of the selected EMICs? I wonder how realistic could be the time series and at what time scale it could forecast an AMOC bifurcation?

I understand that the framework is quite heavy computationally. Can the authors add discussion on how applicable can be this approach in other areas of geosciences where similar potential models may be used?

The authors derived datasets from the published figures - is it allowed practice? Shouldn't they be obtained from the authors as datasets? Can the authors add information about the derived datasets in the table (number of points, etc)? Also, can more recent EMICs be used?

Further comments

The abstract should be modified to say that model is fitted to the trajectories.

In the first paragraph, AMOC acronym is introduced twice.

Instead of "invigoration" it is better to say "re-activation".

Line 90 - "diagrams"

Figure 2 - labels in all panels should be of the same font size

Line 124 - "the simplest"

Line 152 - grey lines are mentioned in Figure 4, not clear which, maybe make them dashed? Similarly, dashed lines in Figs. 6,7 are impossible to see - enlarge these figures and all labels.

Table 1 should be expanded to include more information on the selected models - countries, resolution, etc.

Interactive comment on Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2020-43, 2020.