Dear Michel Crucifix, Dear Reviewer,

We are grateful for the appreciation of our revision by the reviewer and are thankful for the additional comments. We have reworked our manuscript according to the suggestions of the reviewer and have addressed all remaining comments.

Please find below a detailed point-by-point response. The changes in the manuscript are marked in blue. We are grateful for the opportunity to further improve our manuscript and are looking forward to further feedback.

Sincerely yours,
Nico Wunderling, Jonathan F. Donges, Jürgen Kurths, Ricarda Winkelmann

It is a pleasure to see that the authors have taken the time to produce a much better paper than the previous versions. Section 2 now contains a much better justification of the methodology and the coupling between the tipping elements. Also the section 3.4 on including ENSO is now much better positioned. I still have some relatively minor comments, and I hope the authors will consider these to improve the manuscript.

We appreciate the positive evaluation of our substantially revised manuscript. We have also considered all minor points, please see below.

1. l28: It is better to use Global Mean Surface Temperature than Global Mean Temperature, because otherwise this can be confused with a volume average, and this is what the authors use.

Yes, that should be clarified, see ll 27 and ll 272-273 of the manuscript.

2. l39: Specify better where 'this' refers to.

We meant that it is unclear how the interactions between the tipping elements would affect the stability of the overall climate system. We have rewritten the according sentence, see ll 38.

3. l73: the Marine Ice Sheet Instability -> local Marine Ice Sheet instabilities (these are local instabilities related to the topographic bottom slope)

Thanks for pointing us here. We agree and have rewritten this passage, see ll 69-70.

4. l77: the influence of Greenland melt water on the AMOC is relatively small; the weakening is mainly due to a changing surface buoyancy forcing. Many CMIP5/6 models show this decline even when there is no melt water input.

Thanks, this is a good point. We have cited a recent paper, which researches the impact of surface buoyancy on the overturning strength of the AMOC in CMIP5 models (Levang and Schmitt, 2020, J. Climate). We also quoted recent evidence that the AMOC is currently at its weakest state since centuries (Caesar et al., 2021, Nature Geoscience). The changes can be found in ll 75-78.

5. l93: Following the introduction, in -> In
6. caption Figure 1, l6: initiates -> initiates cascades
7. l120: c_{i 1,2} -> c_{i}^{1,2} or c_{i}^{\pm}

We thank the reviewer for these corrections and have changed the respective sentences in the manuscript (see ll 92, ll 119 and caption of Fig. 1).

8. l145: In the Mecking et al. 2016 paper a weak AMOC state is found over a few hundred years. However, the pattern of the AMOC does not correspond to a collapsed state, so this is not really evidence of a multiple equilibrium regime.
9. l140-l151: It is much more convincing to cite papers where explicit bifurcation diagrams have been computed for global ocean models, e.g. Huisman et al., JPO, 40, 551, (2010).

The reviewer is right and we are thankful for this additional reference. We have checked whether all cited model studies explicitly show a hysteresis in their computations (and removed the Mecking et al. (2016) reference). See manuscript ll 142-144.

10. l150: AMOC -> AMOC is

Thanks for catching this typo.

11. l201-212: The effect of Greenland melt water on the AMOC in the present-day climate is considered to be weak, so I would recommend to restrict to the paleoclimate `evidence' here. If one forces a climate model with realistic melt water fluxes, the response of the AMOC cannot be distinguished from the intrinsic variability of the AMOC.

We agree and have shortened the respective lines and restricted the evidence of multiple AMOC states to paleoclimatic evidence and modelling studies, see ll 200-205.

12. l233: conducted hosing experiment -> the release of freshwater in the Southern Ocean.

We have rephrased the sentence, see ll 226-227.

13. l244: `stabilization' is confusing here. Probably it is meant that the AMOC amplitude increases.

It is meant that the AMOC overturning strength would remain at a certain level (or even slightly increase). We have clarified this in the manuscript, see ll 237.

14. l278, l280, equation (3): it is \Delta T_{limit,i} instead of T_{limit,i}, in correspondence with Table 1.

It should indeed read T_{limit, i} since a specific value of the critical temperature T_{limit, i} is drawn in each member of our Monte Carlo simulation. And the limits between which the critical temperature is uniformly drawn is \Delta T_{limit, i}. Those limits are given in Table 1. To avoid confusion, we have explicitly mentioned that in ll 274-275 of the manuscript.

15. l321-322: model years -> time (`model years' always have units)

We agree and have replaced model years by time, see ll 316-317.

16. l355: `randomly' is not specific enough. What distribution is used?

We agree that this should be noted in the manuscript (see ll 351). We base the Monte Carlo ensemble on a continuous uniform distribution between the respective limits of the drawn parameter values.

17. l381: 'likely due to' is too vague. For such a simple model, this can be precisely determined so please do so.

This is correct and we checked this: we can omit the word 'likely' from this sentence.

18. l431: the multiple equilibria view on ENSO has long been abandoned (it is also not in the Dekker et al. (2018) paper), so please omit it here.

Indeed, it is better to say that a Hopf bifurcation in ENSO has been observed in modelling studies from the literature (e.g. Dekker et al. (2018), ESD) in case the ENSO-component is forced by a tipping AMOC-component. We rephrased the according sentence (see ll 428).

19. l499: start a new paragraph

We have started a new paragraph at this line (see ll 498).

List of additional references in the manuscript:

1. **Caesar, L., McCarthy, G.D., Thornalley, D.J.R., Cahill, N. and Rahmstorf, S.: Current Atlantic Meridional Overturning Circulation weakest in the last millennium. Nat. Geosci., 1-3, 2021.**
2. **Huisman, S.E., Den Toom, M., Dijkstra, H.A. and Drijfhout, S.: An indicator of the multiple equilibria regime of the Atlantic Meridional Overturning Circulation, J. Phys. Oceanogr., 40, 551-567, 2010.**
3. **Levang, S.J. and Schmitt, R.W.: What Causes the AMOC to Weaken in CMIP5?. J. Climate, 33, 1535-1545, 2020.**