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Climate of the Past Discussions

Interactive comment on "Glacial fluctuations of the Indian monsoon and their relationship with North Atlantic abrupt climate change: new data and climate experiments" *by* C. Marzin et al.

Anonymous Referee #4

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The paper "Glacial fluctuations of the Indian monsoon and their relationship with North Atlantic abrupt climate change: new data and climate experiments" presents interesting results based on a marine sediment core from the Bay of Bengal and based on climate model experiments in coupled and uncoupled mode using the IPSL_CM4 model. A focus of the paper is to interprete oxygen isotope variations in the sediment data in terms of glacial fluctuations of the Indian monsoon and to link these fluctuations to abrupt climate change in the North Atlantic realm. The model experiments are set up to achieve a better understanding of the atmospheric teleconnections contributing to the signal found in the marine sediment and to identify key ocean regions involved. The numerical experiment design is reasonable and provides insight into glacial at-

mospheric anomalies associated with North Atlantic Heinrich events. In general, the paper is written in a very clear way and should be published in CP. But I have a few (mostly minor) comments to be addressed before publication.

- Section 2: From the literature, it seems that data from core MD77-176 have already been published quite some years ago. Therefore, the authors should provide some historical perspective on their sediment core analysis by stating in which respect their proxy analysis is new or builds on formerly published records which are now interpreted differently. The authors might want to check whether the symbols of d18O, d_w and GISP2 d18O (not explained on p. 6275) are used consistently in the paper.

- Section 3.1: Is the hosing simulation (p. 6279 l. 13) branched off the LGMc? I would add this for clarity. What do you actually mean by "integrated climatologies" (p. 6279 l. 18)? Also, it is not fully clear how the three initial states of the AMOC-off simulation have been chosen (p. 6280 l. 19).

- Section 3.3: The names of the regions (North Atlantic, tropical Atlantic, Indian/Pacific Ocean) could already be given near l. 8 (p. 6283).

- The approach of prescribing SST in a certain region to force an AGCM has already quite a history. It is reasonable to use this approach to address the questions of this paper. But since the AGCM sensitivity experiments are a central point, it would be good to mention this approach already in the introduction and to refer to this kind of modelling approach in the literature (e.g. Lau and Nath 1994 J. Climate Vol. 7; Kharin 1995 Clim. Dyn. 11 and References therin).

- Section 3.3 near p. 6285 ll. 25-29: I am not fully convinced by this. From Figs. 5 and 6, it looks as if the Pacific SST produces anomalies of opposite sign than in Figs. 5a and 6a. I would rather stress the importance of the tropical Atlantic SST which really seems to contribute most.

- Section 3.4 and Fig. 8: You should specify more clearly how you define the ocean

transport.

- Conclusions: Given the papers by Kucharski et al. and others who discuss the tele-connection between tropical Atlantic and Indian monsoon, I would be careful with the expression "new teleconnection pathway" (p. 6289 l. 5). You should state more clearly that you applied the hypothesis (importance of tropical Atlantic SST) to glacial climate / abrupt climate change.

- p. 6270 l. 10: I suggest to include an expression like "complex", "Earth System", "general circulation" to indicate the type of model.

- p. 6270 l. 26: from... Something is missing here.

- p. 6271 l. 2: A reference for these modelling studies showing the reduced moisture transport would be helpful.

- p. 6271 l. 20: "as shown in speleothem"

- p. 6271 around line 27 and Fig. 1: I think a surface salinity map would be helpful to illustrate these structures

- p. 6272 l. 8: missing: "by"

- p. 6273 l. 7, 11: Since the authors list of this article is different from Kageyama et al. (2009), I would try to present it more neutrally (also p. 6282 l. 21).

- p. 6273 last paragraph of Introduction: The outline should be done at the Section level only and not for subsections.

- p. 6274 l. 16 and Fig. 2: Including a reference for this coefficient is suggested.

- p. 6277 l. 17: summer/winter precipitation ratio - This needs a reference.

- p. 6277 l. 24: missing "of"

- p. 6278 l. 11: I would write "model analysis".

- p. 6278 l. 21: with a resolution of 96 x 71 x 19 gridpoints

- Sometimes you write Last Glacial Maximum, sometimes last glacial maximum (same for Indian Monsoon / Indian monsoon)

- p. 6280 l. 28: confidence intervals - better write "the significance is not shown"

- p. 6281 l. 9 and Fig. 4: This Figure does not really show the Southern Ocean.

- p. 6281 l. 13: delete "experiment"

- p. 6281 l. 15: Please also mention the even stronger increase of precip. further to the south seen in Fig. 4b.

- p. 6282 l. 6: Are you sure about the units? Giving some absolute numbers would be interesting for comparison with modern observations.

- p. 6282 l. 20: This structure seems much more large-scale and not only confined to the Himalaya.

- p. 6283 l. 14: rephrase: "of the coupled simulations presented in the previous subsection"

- p. 6283 l. 23: "north of 30 N" instead of "above 30N"

- p. 6284 l. 13: rephrase "reciprocate the precipitation results" to "reproduce the results" (also l. 23)

- p. 6285 l. 20-21: I have difficulties seeing this. This rather seems to be true for the open Indian Ocean than for the Bay of Bengal.

- p. 6286 l. 22: "contribution to" instead of "component of"

- p. 6288 l. 22: rephrase this sentence, it is a bit hard to read

- p. 6289 l. 4: I would write "regional" or "regionally confined" instead of "local" here.

- Figures: Using a),b)... for the Figs. 3 and 8 would help for the captions. The long part

in brackets in the caption of Fig. 3 is not directly obvious. Please rephrase.

- Fig. 4: I would place JJAS (June to September mean) in front of (a) as it refers to all subfigures.

Interactive comment on Clim. Past Discuss., 8, 6269, 2012.