**Climate
of the Past
Discussions**

Interactive comment on "Internal and external variability in regional simulations of the Iberian Peninsula climate over the last millennium" *by* J. J. Gómez-Navarro et al.

Anonymous Referee #3

This paper attempts to separate forced and unforced responses of the climate change over the last millennium using two global GCM simulations with embedded nested regional climate models (RCM). Despite the author's claim, the use of RCM in paleo-climate study is not new for both temperature and precipitation changes (see the first specific comment below). Nevertheless, since this study is an application of RCM to the climate of the last millennium, which has a weaker estimated forcing than LGM, simple description of the outcome is useful. However, because major findings of the temperature analysis are already published, the precipitation analyses is the novel part. My worry is that more careful analyses are required to support the conclusions. A "good" agreement of two noisy time-serieses can also occur partly due to pure coincidence,

and the temporal smoothing with running mean would introduce an artificial autocorrelation, which makes the matters worse. The discussion of statistical procedure needs more clarification. The equations and technical terms such as "chaotic", "fingerprint" and "detection" should be carefuly used to avoid confusion. Also, the use of correlation removes the importance of the absolute magnitude of precipitation. Do authors believe the magnitude of the forced response is insignificant? Above all, the performance of the new RCM has not been tested with any observational data, simply saying instru-mental data is too short for multi-decadal changes (P2580), but the precipitation data was non-dimensionalized with observational data in later analysis. Therefore, I cannot recommend the publication in the current form, and would recommend to write a more-focused article for new submission rather than a revision.

More specific comments:

P2581, L24, RCM in paleoclaimate studies predates the references listed. eg. Diffen-baugh and Sloan (2004), J. Clim. 17, 2927-2937. Jost et al (2005), Clim. Dyn. 24, 577–590.

Model descriptions: Is there a more technical description of how MM5 and Echo-G models are coupled in terms of RCM initialisation and boundary forcing? If so, please add a reference. For example, I would imagine the coupling is one way (P2583, L11) between Echo-g and MM5.

In Eqn. 1, the term "W" is not clearly defined. The term alpha*W is probably be the unforced response, but how does it separate into alpha and W? Do authors assume a standard normal distribution noise for the precipitation?

In equation 2, is the term noted as "COR" the squared correlation rather than the correlation?

P2585, L14. Does "detected" mean statistically significant, a high correlation, or both?

P2587, L27 - P2588, L7: Although I may agree that the small-scale hydrological bal-

ance is not trivial to discuss, but the discussion here sounds overly naive. For example, in order to claim the higher temperature promotes evaporation, aren't the authors make some implicit assumptions about the humidity? Could authors also show the global results, which appear to conflict with eg. Allen and Ingram (2022), Nature 419, 224-233?

P2588, L24. What does the similarity between MM5-ERIK1 and MM5-ERIK2 imply for precipitation? Does this mean these runs show similar changes for the large scale pattern despite the large discrepancy in the smaller scale?

The EOF-based analyses of the larger scale pattern and its link to NAO-like pattern is interesting and has a good potential to warrant a publication after refinements of the issues due to smoothing. However, the value of the use of RCM is not clear for this part.

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