**Climate
of the Past
Discussions**

Interactive
Comment

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.
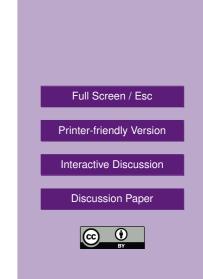
Anonymous Referee #2

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Review of "Internal and external variability in regional simulations of the Iberian Peninsula climate over the last millennium" by J. J. Gomez-Navarro et al.

Summary

The study investigates the role of internal variability versus external forcing in regional simulations which were nested in coarsely resolved global coupled climate model simulations for the past millennium. The authors show that the temperature is sensitive to the external forcing (which is expected and was already shown in other publications). More important they could show that precipitation behaves differently. Only if the model is sufficiently resolved it is able to find on a local scale that precipitation is to

some extent linked to the external forcing.

Overall, the study is well structured and nicely written. I think it is a very interesting and important study in particular the precipitation part, so I recommend publication after the following comments are dealt with.

Major comments

1. One major concern with the study is that it is not explicitly clear, that it builds on a former study (Gomez-Navarro et al. 2011). So I suggest that the authors write what was already found in the former study in the introduction and maybe the discussion part. Also the findings of the temperature are not new (at least they are obtained with global models) so a better discussion on this is needed.

2. The other major comment concerns the methodology. The authors use a running mean prior to estimate the correlation between the simulations. This could induce an artificial autocorrelation of the time series and certainly could affect the results. To test whether this has an impact I suggest to use different filtering techniques, e.g., a Gaussian filter, fourier filter, and/or digital filter and redo the analysis (of Fig. 2-4). One point which I found puzzling is the significance level shown in these figures, in particular for the 90-yr filtered data. It is hard to see for Fig 2 and 3 which level the correlation is, but for fig. 4 I would expect a much higher level, given the fact that a 90 yr filter for a 1000yr time series leads to roughly only 10 independent points, or degrees of freedom.

Minor comments

1. P2580,l12: Maybe the following reads better: "...respond to the external forcings. In this respect we explore the underlying physical mechanisms responsible.

2. The last two sentences of the abstract express more or less the same and could be merged.

3. P2581,l1: What could be affected? This needs clarifications.

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4. P281,l3: I think the authors mean observations in general and not a specific observational record, so I suggest to start with: "Observations are too short . . ."

5. Introduction: There are also other studies which show that internal variability is important, in particular the ocean circulation could have an impact on Scandinavia temperature but also the IP precipitation, so it would be nice to include also the paper Hofer et al. (2011, Climate of the Past).

6. P2583,l1: Please change 'constant' to 'irradiance'.

7. P2583,l4: 'and only differing in their initial conditions (ERIK2 starts from a colder climate state).' reads better.

8. P2583 and elsewhere: I suggest avoiding the acronym 'PRE' to increase the readability.

9. P2583,l26: ' long cold period until 1850, and a strong trend towards a warmer climate afterwards.' Reads maybe better.

10. P2584, l2: Please change 'Medieval Optimum' to 'Medieval Climate Anomaly', which is more commonly used. I also think that it is 'Industrial Era'.

11. P2584,l5: Why are the authors vague about this? The Maunder Minimum and the Dalton Minimum are defined via the solar forcing.

12. P2584,l9-10: This is unclear and needs revisions. What is in good agreement? What is compared?

13. P2584,l13: '. . .is is not easy to identify an impact of the external forcing on precipitation.' Is probably what the authors would like to say.

14. P2584,l17: please change to '. . . as it corresponds to wetter conditions in this season – a feature correctly . . .'

15. P2584,l20: please change to '. . . variability by quantifying the signal-to-noise ratio.'

16. P2584,l21: It is unclear what is correlated.

17. P2584,last line: 'initial conditions.'

18. P2586, l16-17: The sentence starting with 'As before . . .' is unclear.

19. P2587, l6-7: Please explain what is correlated.

20. P2587,l26: I suggest including a line break after IP.

21. P2588,l12: Please be more specific about the 'simple low-pass filter'

22. P2588,l13-16: I was a bit puzzled when reading this part the first time. I guess the authors use the EOF analysis for each variable separately nad not a combined EOF analysis on both variables (as, e.g., Casty et al. 2007, Clim Dyn has used), correct? Maybe the authors could clarify this a bit.

23. P2591, line 23: Please change to '. . . it is due to interactions between . . .'

24. P2592,l1: Please remove 'would'.

25. P2592,l2-4: Maybe the following reads better: 'To check this, the condensation level is estimated using the approximation of the difference between temperature T and dew point temperature

T_d: $CL \sim (T\text{-}T\_d)$.

Both variables are measured. . .'

26. P2593,l15: please change to 'few areas'.

27. P2594-2595,L25-L3: I think the discussion on this is not very useful for the following reason: To decide which reconstruction of the solar forcing is more realistic using a model, one has to know the value of the climate sensitivity, which is unknown. So unfortunately we have two unknowns but only one constraint. So I think the paragraph need to be substantially revised.

28. Fig.2,3 Please do not use a continuous color scale, just define for certain levels of correlation a color. I also suggest using the scale from blue to red as this is the normal way. It would be also helpful to reduce the scale from -.3 to .9 in order to see more details

29. Fig. 4: Please use a different color instead of the dashed bars, as this is hardy visible.

30. Fig.5, top, Fig. 6, 7, 8 please avoid continuous color scales. Please include information about the significance for the panels representing correlation.

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