

## ***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 #1**

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The authors present an analysis of the role of internal variability compared to the response of the forcing in regional climate simulations over the Iberian Peninsula. As the subject has already been investigated previously for temperature (but not using a regional model), the main originality is the analysis of precipitation changes. It is particularly interesting to see that while precipitation may appear mainly governed by the internal dynamics at the scale of the Iberian Peninsula, a response to the forcing emerge at smaller scale in some regions. This illustrates the complex spatial structure of precipitation changes and the need for high resolution studies such as the one proposed here when focusing on this variable. The paper is clear and well written. I thus recommend its publication after the authors have addressed the specific comments

below.

Specific comments.

My main comment is related to the discussion page 2589-2591. The authors analyze the causes of the regional changes in precipitation. In summer, the mechanism proposed appears to explain reasonably well the behavior of the model but there is no discussion about the realism of this mechanism. Is the pattern in Fig. 6 with a SLP increase over the Azores and a decrease over Morocco linked with a dominant mode of variability of the model and/or of the observations in summer? Are similar changes in circulation observed during some periods of the 20th century? What are the processes responsible for the response of the circulation to the external forcing in the model? In winter, the central role of the NAO is standard in many experiments as well as in the observations. The proposed modulation of the condensation level is also well described page 2591-2592. However, a longer discussion is needed for summer.

Page 2581, line 2. A longer discussion and some specific references are needed at the end of this paragraph.

Page 2582, line 3-5. I consider that the discussion of the potential role of internal variability in the introduction is much too short. Earlier studies such as Goose et al. (2005), Hegerl et al. (2011), Servonnat et al. (2010) have analyzed the role of internal variability compared to the one of the external forcing on temperature changes at different spatial and/or temporal scales. The authors should at least briefly discuss their results.

Goosse H., H. Renssen, A. Timmermann and R.S. Bradley, 2005. Internal and forced climate variability during the last millennium: a model-data comparison using ensemble simulations. *Quaternary Science Reviews* 24, 1345-1360.

Hegerl, G., Luterbacher, J., González-Rouco, F., Tett, S. F. B., Crowley, T., Xoplaki E., 2011. Influence of human and natural forcing on European seasonal temperatures. *Nature Geoscience* 4, 99,103.

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Servonnat J., P. Yiou, M. Khodri, D. Swingedouw and S. Denvil, 2010. Influence of solar variability CO<sub>2</sub> and orbital forcing between 1000 and 1850 AD in the IPSLCM4 model. *Clim. Past.* 6, 445-460.

Page 2588, line 13. "timescales shorter than 50 yr" rather than " shorter timescales than 50 yr".

Page 2589, line 22. "not negligible". Do the authors mean "significant" ? Was this tested using a standard statistical test?

Page 2592, line 7. By "measured on the surface", it is meant at sea level? Is it similar to a potential temperature?

Page 2593. The last sentence of the first paragraph is too long and hard to understand.

Page 2593-2594. The two sentences related to the link between precipitation and forcing in summer mainly repeat the same information.

Page 2594. It would be interesting to have some discussion of the robustness of the findings. The mechanisms proposed play a role in the simulations investigated but do the authors expect similar results if other models are used, for instance displaying different circulation changes during the last millennium?

Page 2596., line 21. Instead of IPCC 2007, please cite the relevant chapter.

Fig. 2. The different between the various colors is hard to see, in particular between 0.5 and 0.9.

Fig. 7. The caption of the figure mentions that the first EOF of the winter residual once NAO signal has been removed is shown while the title of the panel mentions EOF2. This is also stated in the text page 2591, line 10-11.

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Interactive comment on *Clim. Past Discuss.*, 7, 2579, 2011.

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