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Interactive comment on "Simulation of the Indian monsoon and its variability during the last millennium" *by* S. Polanski et al.

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This manuscript examines simulation model results using ECHAM5 for various epochs of the last millennium. It makes some limited comparisons to certain paleoclimate proxy data. Higher resolution but atmosphere-only simulations are then performed for selected time slices.

This is a potentially useful analysis, but the implementation and description in their current form are unwieldy. I think there are also some substantial questions about the uncertainties in model, proxy, and instrumental data that need to be discussed and resolved before there can be confidence in the results presented here.

1. As the previous reviewer observed, the amount of variability in the AIMR calculated for the different ensemble members is quite large. For instance, mil0012 would be interpreted as a wet MCA and a dry LIA, but mil0014 would be interpreted as a dry

MCA and modern period with a wet LIA, and mil0010 would depend on how MCA and LIA were defined in time. This is a remarkable amount of variability for models that I assume have the same forcing (the forcing series used here need to be described and cited, in any case). One would draw completely difference conclusions about forcing of the South Asian Monsoon if one were to examine only a single member. What explains this large amount of within-ensemble variability? And, given the observed variability, how could it be possible to justify selecting a single ensemble member (mil0014) to continue with the analysis? Why not use the ensemble mean for the high resolution runs?

2. There is some limited comparison to proxy records. Section 4.1 accomplishes this mostly qualitatively, and the sign of the difference between MCA and LIA indicated in Figure 6 in some cases doesn't track from the proxy records themselves or depend strongly on how LIA and MCA are defined in time. It isn't clear how these were chosen, and I'm skeptical of the ability of some of them to resolve climate variability on the timescale considered here. Dandak, for instance, only comes up to 1550, and doesn't fit any simple MCA/LIA dichotomy. The Lonar is mentioned several times, but never described, nor plotted, and the reference for it indicates the record is still not published (nor is it clear what 'geochemistry' means as a proxy type). Several of the records are from pollen, which can have lags, human influence, and multiple climate interpretations at these time scales. The Godavari core (again, it isn't clear what 'bioisotopes' means), has only a handful of measurements in the last millennium. The Pokhara Valley cave record places the Little Ice Age in the late 1500s, but one could easily place the end of MCA in the 12th century or the 1300 to 1400s (how then was the choice to assign the LIA to 1515 to 1715 in the present analysis made?). Overall, the selection of the proxies used here doesn't seem to follow any particular justification, and their interpretation is severely hampered by time uncertainty, sampling resolution, and multiple possible interpretations.

3. A lingering question regards uncertainties both in the model representation of major

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teleconnection modes and the observation data used. Regarding observational data, large parts of the study domain are poorly observed and have very limited instrumental records. Where do we actually have confidence (or no confidence) in the APHRODITE and GPCC rainfall products? What are their uncertainties? I'm also concerned about how realistically the models represent teleconnections between the monsoon and remote modes of variability. How well does the ECHAM model reproduce teleconnections between ENSO and the monsoon? How realistic is the coupled model's ENSO and IOD and PDO, for instance? One thing that appears worrying in this regard is the lack of a meaningful tropical Pacific correlation with the leading EOF of the modeled drought index (Figure 9). Additionally, what are the consequences for using an atmosphere only model to simulate the monsoon? Here I'm thinking of Kumar et al. 2005, who found that coupling between ocean and atmosphere was necessary for accurately simulating teleconnections between the tropical Pacific and the monsoon. What are the consequences within this study of specifying the SSTs in atmosphere-only ECHAM5 simulations?

Interactive comment on Clim. Past Discuss., 9, 703, 2013.

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