

Interactive comment on “Obliquity forcing of low-latitude climate” by J. H. C. Bosmans et al.

Anonymous Referee #2

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The authors performed two model experiments of obliquity extremes with the climate model EC-Earth. The results show a statistically significant climate response in the tropics. From analyzing the climate response and tropical circulation changes, they argue that the changes are caused by the changes in the cross-equatorial insolation gradient and propose that this gradient may be used to explain obliquity signals in tropical paleoclimate records.

The manuscript shows that even without considering ice-sheets, changing the obliquity results in changes in low-latitude climate. However, the mechanisms of these changes and the relevance of the simulated changes remain unclear. Thus I find the scientific value of the manuscript in its present version somehow limited and recommend major revisions.

My major concerns are the following”

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Do the model experiments really prove that the orbital influence is via a low-latitude mechanism?

From the presented results, the mechanism of the climate changes is unclear. The response could be locally caused or via teleconnections from the high latitudes etc. In principle a climate model could be used to determine this by e.g. running an experiment with changing only insolation in the tropics or in certain latitude bands but with the two simulations performed in this study, this is hard to tell. The conclusion that the simulations “suggest that these patterns arise from a direct response to changes in the cross-equatorial insolation gradient” is thus not well supported by the presented evidence.

Is the amplitude of the simulated changes relevant?

The relevance of the amplitude of the changes is unclear as no reference is given. Maybe changing the precession parameters would give an even stronger change (thus the problem of a stronger obliquity than precession signal would still be unsolved), or including an ice-sheet would lead to an obliquity caused climate change which is much stronger than the response found in this experiment?

Is the amplitude of the change found in the experiments relevant for proxy records? Maybe showing relative changes would help (e.g. relative precip and wind changes relative to the absolute precip amount / windspeed).

Detailed comments:

Introduction, page 222:

In the introduction about insolation is missing a discussion about the seasonality of the insolation: Precession results in strong changes when looking at single seasons (or single days) but has no effect on annual mean insolation. Obliquity in contrast is the only parameter having a significant influence on the annual mean. Therefore, it is well possible that a 100W/m² insolation anomaly only acting seasonally (and thus resetting

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every year) has a smaller influence than a $2\text{W}/\text{m}^2$ annual mean change, which persists over thousands of years. Thus I'm not very surprised that some records, even in the tropics, only show obliquity.

Figures:

Figure quality is relatively poor and at least in my printouts it is hard to identify the axes labels. Please adapt the line thickness and size of axis annotations.

In Figure 6, it has to be clearly stated that these are all summer insolation values (June 21?). Maybe it would be useful to also show the spectra of annual mean insolation, which would give a completely different result.

Interactive comment on *Clim. Past Discuss.*, 11, 221, 2015.