

# ***Interactive comment on “The transient impact of the African monsoon on Plio-Pleistocene Mediterranean sediments” by Bas de Boer et al.***

## **Anonymous Referee #2**

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### General Comments

The paper by de Boer and coauthors compares transient records of runoff from the Sahara and the Sahel that is produced by an intermediate complexity model with the dust record from 659 and the Ti/Al XRF record from 967 across the intensification of Northern Hemisphere glaciation. They find there these is strong precession-scale variability in all of the records, and that obliquity, thought to be driven by the high latitude ice sheets, has more of an impact on the Sahara following the intensification of NH glaciation. Authors also use a clever technique of correlating the empirical records with a range of combinations of grid cells to find the most likely combination of regional impact on the sediment and look at how this combination changes through time. The methodological steps are laid out in a fairly clear way with useful figures, but often

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the details of the model and time series bog down the interpretation. There is little conclusion on what the lags, relationship between runoff and dust, and the change in regional input to the Mediterranean really means in terms of climate dynamics, and also what it means for humans evolving in East Africa. Please find my specific comments with more detail, as well as some technical comments on the text and figures, below.

### Specific Comments

- There needs to be more background in the first paragraph of the introduction. There are newer studies that have good enough age constraints to examine the phase relationships between orbital properties and the MPT and other transitions. I think authors also need to make it clear that the 100 kyr cycle after the MPT is likely an average of 120 and 80, as many have recently shown. Further, the MPT is not studied in this research, so perhaps removing that from the introduction would leave more room to provide better detail on other arguments.

- There also need to be far more citations for a sentence like line 39-41, where the authors link orbitally induced variability in the tropics. This has been seen in Africa in many different records by Tierney, Lupien (both Pliocene and Pleistocene), Rose, etc. In the conclusions (line 239-241) there is a vague sentence on this as well – orbital induced variations of what? If authors are talking about precession in climate records from Africa, there need to be many more citations.

- Similarly, the third paragraph of the intro on hominin evolution is very light in citations and seems to pick specific details from Joordens 2019 rather than focusing on the evidence and mechanisms for hominin transitions at the onset of NH glaciation or the variability selection hypothesis (Potts).

- ‘Continental runoff (i.e. p-e)’ is a bit misleading. This p-e balance is not equivalent to runoff as water can be stored in soil, lakes, and groundwater, which is fully stated in the description of the model. This is brought up again in line 129 and onward and needs to be explained more clearly and thoroughly before the interpretations are stated.

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- Figure 1 has the model grid cells, but they are not plotted over a map based on the 6 potential surfaces. This would be helpful.
- Why not use the principal component analysis, based on Ti/Al, from Grant 2017 for the 967 comparison? This is brought up later, and perhaps is a better estimate of climate than the raw Ti/Al record.
- Line 131: the location of the Sahel today is shown in Figure 1, but the location, spread, vegetation may well have been very different in the past, particularly in the Pliocene. How does this affect the grid cell coverage?
- The discussion surrounding the lags seems a bit tangential and perhaps unnecessary. If the lag is due to a choice in the LR04 tuning, then does this analysis tell us anything new?
- Line 207: the power spectra should not be influenced by lack of data. Either resample the data appropriately, or put the constraints up front in the methods section. Can authors resolve precession throughout the records? If not, then conclusions based on evolutive spectra shouldn't be made, or should be modified.
- What are the conclusions of the mechanisms linking the ice sheet inception to the change in runoff region source? The conclusions section appears to be more of a summary. Try to utilize this space for connections back to the topics brought up in the introduction – what about human evolution? Would this shift, and other aspects of the findings, impact humans, and how?

#### Technical Corrections

- “Myr age” can be replaced by “Ma” in every circumstance
- Line 42: replace ‘deterioration’
- Line 42: ‘central’ Africa? Do authors mean East Africa?
- Figure 3: the colors need to match better for clarity. Perhaps in b, use orange with

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different line types for the different frequencies, and in c, use blue.

- If table 1 could be shown in a figure, I think the point of lags would be much easier to comprehend by the reader. Perhaps use phase wheels.
- Figure 6: the legend should be changed to either show the location or the proxy, not the proxy for one site, and the site number for the other.
- Try not to conflate the Plio-Pleistocene transition with the onset of NH glaciation – authors have cited these at two distinct times (2.6 vs 2.8 Ma), so try to keep the wording consistent.
- There are multiple instances of awkward phrasing, run-on sentences, and misused gerunds, so further editing for grammar could benefit the clarity of the manuscript.

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