

## ***Interactive comment on “Three main stages in the uplift of the Tibetan Plateau during the Cenozoic period and its possible effects on Asian aridification: A review” by Zhixiang Wang et al.***

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Review of “Three main stages in the uplift of the Tibetan Plateau during the Cenozoic period and its possible effects on Asian aridification: A review” by Wang et al.

Overview Based on the scores I have given to the “principal criteria” of Climate of the Past (below), I do not present a comprehensive review of this work. I present rationale for the scores I have given, major comments and suggestions for improvement, and address the review questions provided by CP, as well as a few additional comments.

Journal-specific criteria: Scientific significance: 3 Overall, while this manuscript con-

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solidates a great deal of results and findings from the past decade or so on the topic of Tibetan uplift as related to global and local climate change, I do not think a considerable amount of new information or thought is presented in this work. Scientific quality: 3 There was little critical analysis of the data from other studies, so I do not have much to say about scientific quality. Presentation quality: 2 The acknowledgments suggest this manuscript has been edited for English language, but it needs more work before it is ready for publication. The overall structure of the manuscript is fine.

Major comments Insufficient background on the analytical techniques used in the cited works: Line 428 is an example of a common theme in this work in which the authors relay data from a previous study and state what the data imply, but lack additional background necessary for the reader to understand. In this specific example, the authors cite a “positive shift” in oxygen isotopic values and say that these shifts “imply an increased regional aridification and related to enhanced East Asian winter monsoon.” However, no where in the work do they explain how oxygen isotopes are related to aridity or how they can be used to make inferences about atmospheric circulation and weather patterns.

Incorrect use of jargon with respect to stable isotopes: I cannot speak to the discussion of paleomagnetism and radiogenic isotope techniques in this work, but I would caution some of the language used with respect to stable isotopes. The authors say “more positive/negative” or “positive/negative shifts” multiple times. A value is positive or negative and cannot be more or less positive or negative. A molecule can have a lighter/heavier isotopic composition w.r.t. a specific isotope/element, or have a lower or higher value. This may seem like a small thing, but will unnecessarily irk some readers.

Synthesis: The discussion section mostly summarized everything outlined in Section 2 without much additional discussion of the data or contradicting studies. I think for this work to be useful for the community, it should include a more substantive addition to the discourse rather than just a fairly comprehensive laundry list of recent results. Further, the last paragraph of the Discussion calls into question what has come in light

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of the authors' study of the recent literature. Lines 594-596 state that the authors could not draw linkages between the uplift of the TP and evolution of Asia's climate, which seems to be the motivation of the entire study. If this is true, what has been learned? In the same paragraph, the authors say that climate models do not take into account "detailed topography", but in addition to other such climate modeling work, the authors cite multiple studies that use topographic boundary conditions to constrain the effect of TP uplift on global and regional climate (as recent as the previous paragraph even). I think the Discussion section would be much improved if this paragraph was removed and replaced with a synthesis of the use of different types of proxies in each of the three tectonic intervals: which proxies seem to agree between the intervals? Which work best and which have greater uncertainty? If the authors believe more studies are needed on topographic boundary conditions, during which intervals and in which sedimentary basins and/or orogenies? These types of questions and answers can help guide the community, which is the ultimate goal of a review paper.

Figures 1, 2, and 4: It is useful to see geographically and from what tectonic domains the data used in your interpretations of "rejuvenation or initiation of tectonic activities" comes from, but because different proxies were used in each of the studies marked on the maps, and each proxy records a different thermal regime/extension/rotation/magnetism/etc., it's unclear to me how the different points on the map can be related by the viewer. This ties back into my overall comment that the reader needs more background on the commonly used techniques in many of your cited studies to assess what each proxy actually records under the umbrella of "rejuvenation of tectonic activities".

Figure 8: It would be interesting to see some of the additional proxies plotted in Figures 3, 5, and 6 throughout the span of the Cenozoic along with the benthic foraminifera oxygen isotopic composition. The oxygen curve in Figure 8 has been replicated and discussed in numerous studies since its original publication by Zachos, so it would be more intriguing to see how the other proxies change or do not change during the three

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pulses you attribute climate change and aridification to. Do pedogenic carbonate  $\delta^{18}O$  and wt. %  $CaCO_3$  also follow the benthic foraminifera  $\delta^{18}O$  curve?

CP Reviewer Questions 1. Does the paper address relevant scientific questions within the scope of CP? Yes. 2. Does the paper present novel concepts, ideas, tools, or data? No. 3. Are substantial conclusions reached? No. 4. Are the scientific methods and assumptions valid and clearly outlined? The hypothesis is that aridity is caused by three tectonic "pulses" of uplift and activation on the TP. The authors use data and data interpretation from previous studies to support this hypothesis. However, I do not think enough background on the reviewed works and analytical tools therein is presented for a reader to critically review the summation of data and interpretation the authors of this work come to. 5. Are the results sufficient to support the interpretations and conclusions? See previous comment. 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? N/A 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? The authors provide the appropriate citations for the data and data interpretations they summarize. The authors' scientific contribution is the synthesis of this 8. Does the title clearly reflect the contents of the paper? Yes. 9. Does the abstract provide a concise and complete summary? Yes. 10. Is the overall presentation well structured and clear? Yes. 11. Is the language fluent and precise? This paper needs further editing for English usage. 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? N/A 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? This is not a critical comment, but I think the map figures could be made into one figure with the three age ranges denoted by colored labels. 14. Are the number and quality of references appropriate? There are several instances where the authors choose to cite one paper when there are numerous papers that have contributed to the finding that they are referencing. In some cases it may be that the author is unaware of current and recent work, as it is hard to keep up with everything going on in the TP community, but other instances seem to be

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preferential choosing to make a point but may be unfounded. For example, in line 598, the authors cite Deng and Ding (2015) to say that the past elevations of the TP are still debated, which is true, but this paper is not the most recent work to be done and many advances have been made in the past 3 years. It comes off as either an arbitrary or an overly selective choice of citation. 15. Is the amount and quality of supplementary material appropriate? There is no supplement as far as I am aware.

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