

Interactive comment on “Stepwise drying of Lake Turkana at the end of the African Humid Period: an example of forced regression modulated by solar activity?” by Alexis Nutz and Mathieu Schuster

Anonymous Referee #2

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Review of Nutz and Schuster: Stepwise drying of Lake Tana at the end of the African Humid Period

General Comments This is an interesting paper which provides new geomorphic evidence from Lake Turkana, northern Kenya on the termination of the African Humid Period c. 5 ka BP. The analysis of shoreline data presented here is worthy of publication, adding new insights into the nature of shoreline regression and progressive drying during the termination of the AHP. I do however have concerns about the lack of chronological control of these features in relation to the claims which are made regarding solar forcing. The manuscript is generally well presented, although there are typographical and grammatical errors. Substantive comments and suggested editorial

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corrections which require attention are outlined below.

Specific Comments Section 3, Chronological framework: I appreciate that the authors give references to the original studies which provide the chronological framework but the techniques which generated these ages should at least be referred to in this section (e.g. line 84 specify this is a radiocarbon date). The authors have not taken into account that the errors quoted for the Forman et al date of 4.6 +/- 0.3 ka BP are 1 sigma (see their Table 7, note e). So, the minimum age of the end of the lake level decline could be 4.0 ka BP, extending the maximum possible duration of the phase of lake level decline. If 2 sigma ages for the radiocarbon dates are applied in the analysis here, the same should be applied to OSL ages. Trajectory analysis: Could the authors please explain why ‘fall 2’ identified by trajectory analysis is only present in 2 of the 3 transects (not clear from lines 103-105)? Furthermore, in one of these, P2, the gradient of the slope is not very distinct (only 0.3°) compared with other falls which are identified by this method.

Solar forcing of stepwise regression: The case for the link between stepwise regression and solar minima is overstated given the lack of age control for these features. I appreciate that it is not possible for the authors to resolve given the lack of material available in such settings and errors associated with chronological methods which could be applied. However, it is stretching the evidence to far to correlate five stepwise regressions with five periods of solar minima coinciding with the calculated mean of the duration of lake level decline (and these figures need to be revised to account for 2 sigma errors on OSL ages). There is no justification for the statement made in lines 176-178. It is fine to pursue this as a possible line of investigation, but there are other factors to considered such as multidecadal climate variability (e.g. AMO?). Feedbacks such as the impact of changing vegetation cover and evapotranspiration on water balance may also contribute. The final paragraph of the discussion needs more supporting references for the mechanistic link that is postulated between solar minima / maxima and shifts in the shifts in the Congo Air Boundary, at present this is not convincing. Section

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5.2 overall needs a much clearer statement that the chronological uncertainties mean that the link to solar forcing must be considered as tentative.

Minor / Editorial Comments There are a number of typographical errors and some phrases which could be constructed more clearly: 1. Suggest altering the 'running head' to 'Drying of Lake Turkana at the end of the AHP' 2. Line 17: should read 'rather stepwise, consisting of' 3. Rephrase sentence beginning on Line 18 of the abstract, 'Even the overall regressive trend...' – the first part does not make sense and two separate sentences would be better. 4. Line 28: should read 'impacted on the' 5. Line 35: I wouldn't use the word 'recent' in this context. 6. Line 40: should read 'drying trends remain' 7. Line 43: I don't think others have suggested that lake level fall was constant / continuous but have provided chronological constraints on beginning and end of the regression. Several authors explicitly state that the end of the African Humid Period was marked by fluctuating conditions. It would be useful to add in brackets the approximate age of the final regression that you are referring to for clarity. 8. Line 44: replace 'appears as' with 'is' 9. Line 46: should read 'terms of' 10. Line 52: it would be appropriate here to acknowledge some of the earlier studies on lake levels / shorelines at Lake Tana (e.g. Owen et al, 1982; Butzer 1971/1980). 11. Line 54: replace 'already' with something like 'clearly' 12. Lines 57: sentence starting 'Finally' should not come before sentence starting 'subsequently' 13. Line 78: 'archaeological' (depending on journal house style) 14. Line 145: replace 'volcanism event' with 'although volcanic activity' and replace 'even' on the following line with a comma. 15. Line 160: reference needed at end of sentence. Also rephrase to make clear that the AHP began before the early Holocene. 16. Line 162: should read 'reduction in' 17. Line 169: should read 'periods of higher insolation' – could specify summer here. 18. Line 193: remove 'the' from before Lake Tana 19. Line 211: should read 'stepwise' 20. Line 218: should read 'plateau' and start sentence with 'The'

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