

# ***Interactive comment on “Three distinct Holocene intervals revealed in NW Madagascar: evidence from two stalagmites from two caves, and implications for ITCZ dynamics” by Ny Riavo G. Voarintsoa et al.***

## **Anonymous Referee #1**

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This study focuses on speleothems from two caves in Madagascar. Several types of analysis are performed including stable isotopes, laminae, and mineralogy, each of which is anchored using U-Th dates. The age models appear robust (although an adequate discussion of age determinations and age model calculations is lacking) but there are several problems. First, the time slices spanned by these stalagmites are quite short, being punctuated by long hiatuses. As a result, the larger context of this record is difficult to identify. Second, I am not convinced of the corrections for differential fractionation between calcite and aragonite  $\delta^{13}\text{C}$  values. And associated with this is my concern that there may be microscopically intermingled aragonite and

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calcite that can only be corrected for isotopically using quantitative XRD, something that was not done here. Third, replication among samples of the same age is not particularly convincing, raising questions about the controls on isotopic values. Fourth, several claims are poorly substantiated, incompletely referenced, or (to some degree or another) unsupported by the data. Fifth, the writing is at times hard to follow.

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? No 5. Are the results sufficient to support the interpretations and conclusions? No 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Not always 8. Does the title clearly reflect the contents of the paper? No 9. Does the abstract provide a concise and complete summary? 10. Is the overall presentation well structured and clear? No 11. Is the language fluent and precise? No 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? 14. Are the number and quality of references appropriate? 15. Is the amount and quality of supplementary material appropriate?

Specific comments follow: 18 – is this one cave or two? 23 – why no dates associated with the middle Holocene? 27 – when? 27 - “globally colder” is a little confusing; the interhemispheric temperature gradient is responsible for determining mean global ITCZ position. 30 – when? 33 – is “exemplified” the correct word here? 37 – here is the missing mention of hemispheric temp gradient. I suggest making this explicit earlier in the abstract. 39-40 – delete this sentence 43 – delete “the” 49 – delete “the” 51 – reword as “a particularly” 52 – ITCZ was previously defined 61 – reword “variability of growth-specific width” as “growth laminae” 61 - do not capitalize “cave” 90 – wasn’t

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replication already discussed on line 42 100 – “long-term” is vague; records of what? 101 – “longer” vague (see previous comment) 112 – “chronologies were” 133 – I am not sure that the correction for carbon isotopic fractionation between calcite and aragonite in speleothems has been adequately explored. As a result, I am uncertain if this part of the results will hold up. 142 – looking at the data table in Supp Materials, it appears that ANJB-2 (sometimes labeled as ANJ-B-2) has a wide range in U abundance. So why the s.d. of 0? 144 – Providing this level of U and Th abundance data is not particularly useful. I would simply refer the reader to the relevant data table. What is missing that should be included here is a discussion of 238/232 ratios in each sample, what 232/232 value was used to correct for inherited 230 (and how this value was derived), and how well the ages fall in correct stratigraphic order. Most ages look quite good but some late Holocene dates have larger errors. These deserve some discussion. 148 – The wording here is confusing. Why argue for some continuous growth intervals but define others as separated by hiatuses? 154 – these are enormous ranges in d18O and d13C. 161 – drop the hundredths place in the stable isotope values (where they are included). It complicates the paper but doesn't have any relevance for interpretation. 205 – this basic introduction should be presented much earlier in the paper if readers who require it are going to glean any meaningful information from the stable isotope results. 272 – relative to what time interval? 276 – I guess, but the record spans so little time that it's hard to get a clear sense of how anomalous this 8.2 isotopic excursion actually is. 278 – “suggest”? The mineralogical composition should be defined precisely (even down to percent calcite or aragonite). Or do you mean to suggest that it may have originally been aragonite but was altered to calcite? 291 – missing a chance to fit this finding into a large context. What other regional records (African, south Asian) record the 8.2 event and what is the nature of these records? 295-297 – I don't understand this sentence. Is this saying what you mean it to say? 373 – there are a lot studies to cite here. I am not sure self-citing is most appropriate in this context. 377 – my reading of much of the SH paleoclimate literature suggests a dominance of NH insolation. 408 – is “he” appropriate useage for Climates of the Past? 416 – similar findings were made

based on lakes and speleothems in South America, and thus it may be worth citing some of this work here. 475 – does the Gulf Stream actually shut down when AMOC slows? Need to cite a modeling stud to support this claim. 729 – is the name for this reference correct? It is a hyphenated name in the text. Fig 5 and Fig 6 – It would be helpful to have the isotopes presented on the same scales oriented along the same horizontal lines so that the reader can assess how each stalagmite's isotopic trends and values compare with the other. Fig 6 – I don't see the connection between solar and stalagmite isotopes here.

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