Climate
of the Past
Discussions

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Interactive
comment

Interactive comment on "Climate impact on the development of Pre-Classic Maya civilization" *by* Kees Nooren et al.

Anonymous Referee #1

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Overall summary of comments: I found this paper to offer a new valuable source of paleodata for Mesoamerica, and believe that with some moderate revisions it will be an excellent paper for Climate of the Past. The paper is written well and clear, and it does an excellent job at investigating the wide range of existing paleorecords for the region. The beginning of the paper is particularly strong, but the structure and quality flags toward the end. Generally, more emphasis is needed on interpreting the data in light of the observations the authors point out.

The structure of the paper after the methods is quite muddled and difficult to determine a consistent focus. Reorganization of this section with clearly defined results separated from discussion of those results may help. For example, the portion from 232-281 feel very different than the earlier parts of section 3. The earliest parts read very much as

straight results, whereas the later parts attempt to discuss the drivers of these results. I feel these should be in different sections.

In the end, I believe that the paper brings some interesting ideas up backed by an excellent study and report of new paleodata. However, while the data itself and first half of the paper are excellent, the discussion of the results leads much to be desired. I believe many of main points of your discussion are already present in this manuscript, but the structure at present does not bring these points to the forefront. Many of these discussion points also need more development to describe how they relate to the existing body of knowledge, and how to interpret your new data with existing data in mind. Again, I think that the big conclusions exist in this paper, but they need to be written in a way that highlights them and supports them better.

Finally, the abrupt ending of the paper left me feeling like this was an incomplete draft. I actually thought that there would be at least another page of material based on the flow of the paper up to that point. Make sure the ideas you highlight at the beginning of the paper (e.g., role of floods in Maya myth, the benefit of having the paired but different size watersheds of the beach ridges and lakes, etc.) are brought up again or emphasized throughout the paper.

Line by line commentary 71-72: The use of 'likely' twice here reads a little awkward 106-111: Can you rephrase this sentence? It is very long and full of multiple clauses. I had to read it multiple times to make sense of it. I think splitting it up and simply restating it in another way would get your point across much better 131: In the methods section, you talk about elemental analysis through X-ray fluorescence and how you use that to identify floods, but in the background on Lake Tuspan, you only discuss diatoms. I was left trying to figure out why you brought up the elemental analysis and whether it was just supporting diatom conclusions or if you were using it as an independent proxy. Perhaps a few sentences in the background clarifying all the techniques you use to make a paleo precip lake signal would help. 152: Missing an extra line spacing here (not a big deal, just bringing it up for when you are doing final format

check) 167: In the background, you discuss the beach ridges before the lake study, but it's flipped in the methods. There's also some inconsistency in this order in the results/discussion. Again, this is not a critical problem, but readability can be enhanced if you keep the order of information similar between sections. 167: It would be nice to have a brief restatement (maybe in the background) on how these ridges were dated rather than having the reader look up cited literature. 186 (and prior): Your abstract makes it clear that this paper is reporting a paleorecord based on the combined record of the lake and the ridges. However, much of the background (e.g., line 92) emphasizes the beach ridge record and treats the lake as secondary/supplemental data. In section 3, the balance between the two records is much clearer, but later discussion again seems to emphasize the beach ridges. My takeaway impression at the end was that the lake data sometimes seemed haphazardly integrated into a study largely based on the beach ridge data. To help this, I don't think you really need more analysis or data from the lake; you just need to make sure that you are equally discussing the contributions of both in all sections and making it clear why you are favoring the lake or the ridges in some parts of the discussion. 223: There is decent evidence of regional drying at the close of the late Preclassic. Does your record support this? Or does it not extend far enough to be confident? 233: Long term drying trend in what? Your data? Perhaps describe what you think is the long-term trend of your data, because up to this point it is not clear based on your previous discussion (185-230) that there is a drying trend (it seems quite variable). 233-239: This whole sections reads more like background information to set up your study rather than discussing your findings. It also feels a bit out of place to discuss broad long term variability AFTER you've covered the short term, period by period results. 246: The Macal Chasm record shows broad similarities in the timing of long-period dry events with many of the other paleorecords in the region, although this is based on visual matching and not statistical work like wavelet analysis. Why do you think that the Macal Chasm record is the only one to show a match? Some discussion of whether you feel this is due to actual environmental differences or if it is data quality/characteristic driven would be nice here. Perhaps

the records that match well in the Classic and Postclassic show more divergence in the Preclassic? 251: The Macal Chasm chronology is not particularly precise, especially compared to other stalagmite records in the region like from Yok Balum. The uncertainties in the chronology run 200-400 years in many cases. Even if this doesn't adversely affect your conclusions, you may wish to address this and at the very least qualify how you decided that Macal Chasm is considered 'well-dated'. 269: Why would this period be different? If you are going to tell us that it isn't an analogue, you need to explain why this period is such an aberration. 241-281: I feel that this section is one of your weaker parts of the paper. I do not see a convincing argument laid out that the North Atlantic is driving your variations, although I catch a glimpse of it. I would start this section laying out how your record relates with the North Atlantic and atmospheric data and build the argument of what is driving the changes you observe in your data. I think that is the best and clearest argument you have in your whole paper, and you should highlight this. Then as a follow up, you can examine how your data relates to other regional records. This would be a nice set up for you to go into more discussion on why you think this North Atlantic signal expressed in your data isn't showing up in other data beside Macal Chasm. Your final paragraph on Cariaco is more what I am looking for in terms of discussing how/why your data has coherence/lack of coherence with other records. 284-305: I also feel that this section is underdeveloped. You are arguing that overly wet conditions may have delayed maize agriculture development, and I think this can be a valid hypothesis. However, you earlier pointed out that climate instability may be to blame for delayed maize (line 76). You also do not supply evidence for your 'overly wet' hypothesis in the form of maize physiology or ethnographic studies. If the region became wetter overall, some low lying areas would be too wet for agriculture, but wouldn't other regions that are presently too dry become potentially productive? Could it simply be a coincidence that local maize varieties hadn't been selected enough for local adaptation until the boom in agricultural clearance you note? Or that populations grew enough in the 'wet' years to support the increased social structures required for large scale agriculture and societal development, rather than

maize being actively suppressed by the climate? These alternatives may not be valid, but I don't feel that your argument for wet = bad for maize = suppression of societal development makes enough of a causative case to defend itself against alternative theories. In particular, many have argued that the Classic Period was relatively wetter (e.g., YOK-1, Chicancanab) and this drove societal development and population growth. Others (e.g., Macal Chasm) argued that their data doesn't support a wetter Classic and that other factors, such as climate stability, are more important than wetter vs drier. Where does your research land on this issue? Overall, I think you need to discuss the Maya-environment interactions in much more depth if you wish to make arguments of a somewhat environmentally-deterministic nature. 306: A very abrupt end without any concluding statements. I was left with, "Wait, what was the point or points they really wanted me to focus on?"

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