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Climate of the Past Discussions

Interactive comment on "Spatial and temporal variability of Terminal Classic Period droughts from multiple proxy records on the Yucatan Peninsula, Mexico" *by* Stephanie C. Hunter et al.

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We would like to add an additional response to one of the comments suggested by N. Evans, which has come to our attention after our initial response.

1. Comments: The use of published age models and the assumption they are accurate (which is highly unlikely) is critical to the subsequent comparison of the data to changepoint analysis conducted on PDO, ENSO and AMO signals. As a bare minimum, Bayesian age analysis should be used to quantify the errors in the age models. Sites with <5 radiocarbon (or other) dates in the last 2000-year interval should not be used (see Bhattacharya et al., 2017).

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Initial Response: Upon revising this paper, we could expand on our assessment of the age models by employing Bayesian age analysis to quantify age uncertainty. We agree that sites with fewer than five age dates have much more uncertainty than those with more age dates. We attempted to account for this by ranking each proxy record in terms of confidence in that record. We don't believe it is necessary to completely exclude them from the analysis, as the point of this paper was to look at the available proxy records for the Yucatán Peninsula as a whole. We could, however, make it more clear in our conclusions that these records should not be considered to have definitive evidence of drought.

Additional Response: While we agree that it is possible the published age models for the proxy records used in this study are not completely accurate (and that this will be further expanded on in our discussion of uncertainty and identifying droughts), we are not convinced that Bayesian age analysis of the uncertainties would add much to this analysis. In Blaauw (2010), it is noted that for low-resolution dated age models, using Bayesian modeling techniques for the age-depth model may not provide much value compared to classical age-depth modeling. An increase in uncertainty with Bayesian methods (Bacon) using fewer radiocarbon dates is also noted in Trachsel and Telford (2016). As many of the proxy records used in this analysis have low resolution (see Supplementary Info, Table S1), and in particular a low number of radiocarbon dates (see Figure 1 of our manuscript), we believe that our qualitative assessment of uncertainty in the proxy records, which assigns more uncertainty to records with lower sample resolution and fewer radiocarbon dates, is still valuable for the assessment of uncertainty in these proxy records.

References:

Blaauw, M. 2010. Methods and code for 'classical' age-modelling of radiocarbon sequences. Quaternary Geochronology, 5: 512-518.

Trachsel, M. & Telford, R.J. 2016. All age-depth models are wrong, but are getting

better. The Holocene, 27(6): 860-869.

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