

# ***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.***

## **Anonymous Referee #2**

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The problem that this paper tackles is an interesting one: there has been much debate about whether the so-called ‘Terminal Classic’ drought represents a coherent interval of climate change across the Yucatan Peninsula, and what dynamics may be responsible for the drought. This paper definitely has potential, but the authors should review additional relevant literature and reframe or expand some of their analyses.

First, why does the study only focus on the Yucatan Peninsula? If the authors are interested in looking for evidence of ITCZ changes, we would expect to see changes in the Caribbean, Gulf of Mexico, Central America, and northern South America. We may also expect to see antiphased changes in records from places farther south in

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the Amazon. We also have records of tropical storms from the wider circum-Caribbean region (see the work of Jeff Donnelly's group at WHOI). Can we more rigorously test the idea that the ITCZ may have shifted in this interval by using additional proxy records? The claim of using of '23' proxy records is a little bit misleading because many of the proxy records are from the same sites, and therefore are not really independent datapoints.

Line 121: Given that pollen is not necessarily a linear indicator of forest cover, it is possible that there could have been intensified deforestation at the Terminal Classic – I recommend checking the land use reconstructions of Kaplan et al. 2011 “Anthropogenic Land Cover Change scenario for the preindustrial Holocene” to see what the reconstruction looks like in this particular region.

One factor that isn't really considered in this study is the timing of social change or site abandonment in the archaeological record – we know for a fact that this was not uniform across the Maya region - see for instance Aimers et al., 2007 – this could be discussed more in the paper.

The citations in this paper are not really up to date - A few other papers that already address some of the themes in this paper, in some cases with more detailed analyses of the climate dynamics and age models for each site, should be discussed and cited.

-Bhattacharya et al., 2017 in Quaternary Science Reviews includes a detailed analysis of the timing of drought in multiple records accounting for age uncertainty, and analyzes the drivers of drought in comprehensive climate models.

-Evans et al 2018 in Science used new measurements of gypsum hydration waters and lake level modeling to estimate large changes in precipitation at the Terminal Classic. The estimates stand in contrast to Medina-Elizalde and Rohling, 2012, which estimated a modest change in rainfall.

-There is also an interesting discussion in Metcalfe and Barron, 2015, which reviews

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an extensive dataset of proxy records from across Mexico and parts of the Caribbean and Gulf of Mexico. These should be incorporated into the discussion, and can provide pointers on additional proxy records to incorporate into the text.

Line 430: El Nino events do increase winter rainfall in this region, but they actually decrease summer rainfall. This is because warm ENSO events generate an atmospheric Kelvin wave that dampens surface precipitation in much of the tropics – see Lintner et al., 2005, *Journal of Climate*. There is a delayed response in the following spring that enhances rainfall as a delayed response to ENSO.

Line 442: I am skeptical of the inferences of Knudsen et al about the inverse relationship of AMO precipitation and Yucatan rainfall – it runs counter to much of what we know about the dynamics of the region. See the work on the Atlantic Warm Pool by Wang et al., 2005 in *Journal of Climate*, as well as the work by Giannini et al. that is cited in this paper.

Overall, the paper addresses a topic worthy of study – it just needs revisions to the text and the inclusion of a greater number of proxy records to fully test the hypotheses it sets forth.

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