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Interactive comment on "Extreme warming, photic zone euxinia and sea level rise during the Paleocene/Eocene Thermal Maximum on the Gulf of Mexico Coastal Plain; connecting marginal marine biotic signals, nutrient cycling and ocean deoxygenation" *by* A. Sluijs et al.

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Thanks, appy et al. for writing an excellent paper on an interesting and important topic. Most of it I'm not qualified to comment on, but I do have a couple of specific and general questions and comments.

I'll start simple and factual and work my way to more philosophical issues.

Where actually is/was the Harrell Core located? Seems like a simple question, but the literature is vague on this. How about an actually latitude and longitude? Meridian MS and the associated Red Hot Truck Stop (after extensive research a physical location for the famous defunct landmark can be inferred from information here http://redhottruckstop.tripod.com/index.htm) are at 32 deg 22 min latitude -88 deg 40 min longitude. When I plug that information into Gplates (probably better to use the Boyden ref below than the Muller 2009 ref) I get a paleolatitude of 32.9 at 55 Ma (or 33.5 at 56 Ma) as opposed to ∼28 deg N cited in the text. What's the reason for the discrepancy? This makes a difference for model-data comparison and interpretation of the data since we might expect meridional temperature gradients on the order of at least 0.5 degrees C per degree latitude (maybe more on the subtropical margins. In what follows, I'll assume that the actual location is closer to 32N than 28N (although the max and min I cite, pretty much accounts for that ambiguity).

As I showed previously (Huber, 2009, Figure 1; Huber and Caballero, 2011, Figure 3a middle) , for typical Paleocene conditions, models predict temperatures between 25-30 in this region (allow me to quote a range here, since there seems to be ambiguity about the paleolatitude of the core, and of course there is always error introduced by the different plate rotations in boundary conditions employed in the model as opposed to more recent ones). For a warmer simulation that can be thought of as being characteristic of just pre-PETM or 'background' EECO conditions (i.e the temperatures at the cusp of hyperthermals) conditions are 2 degrees warmer in the ocean and 2-4 degrees warmer on land then those 'typical Paleocene' simulations (Huber and Caballero, 2011, Figure 3 top, bottom). Absolute values in the Harrell Core region produced by the model for these warmer simulations in that region are 33.4 (mean) 32.6 (min) 34.2 (max) as described in Huber and Caballero, 2011. And as mentioned previously the SSTs in the cooler, more typical Paleocene-like conditions are 2C cooler than that.

The TEXH SSTs in this study are 29 (pre-PETM) and 35 (peak PETM). These values are well within the range (even slightly below) that are simulated for typical Pa-

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leocene and latest Paleocene/EECO intervals. If I chose the hotter values from the MAAT records it is also possible to get a reasonable match between the models and data. (There's no question that one might alternatively pose a very unflattering picture for models and theory by using TEXL or the Peterse calibration, but my interpretation of the spread of the various calibrations is that those are giving us some information about how little we really understand about these proxies still). So, on the basis of the simulations and proxy data we have I do not see a compelling reason to say, "Although more estimates from tropical regions are required, our data might be inconsistent with the recently proposed hypothesis (Huber and Caballero, 2011) put forth to 5 explain extreme warmth at high latitudes, that low latitude regions were much warmer than previously anticipated. In their scenario, SSTs outside the PETM along the GCP should have been > 35 C (Huber and Caballero, 2011) while all available data suggest temperatures well below 30 C."

On the contrary, the model predicts values between 25-30 for the cooler parts of the Paleocene and ~33 for the conditions that should correspond to just pre-PETM values. I have not published results on simulations that correspond to peak PETM conditions (i.e. that match existing mid-to-high latitude temperature reconstructions).

I think that this is an overstatement, "Therefore, although uncertainties remain regarding the accuracy of the TEX86 and MBC/CBT proxies, our data may reinforce the notion that current climate theory (Huber and Caballero, 2011; Lunt et al., 2012) cannot yet fully explain the low meridional temperature gradients during the early Eocene and the PETM."

Actually, I'm surprised by how well the model is performing 55 million years before it's calibration/tuning interval. A couple of degrees of error is well below either the error bars in the proxy data and the ability of modern models to achieve a match in a given region to modern observations. On the other hand, if the TEXL or Peterse interpretations were right, that would be quite a fundamental problem.

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It seems to be an odd scientific proposition to pick and chose which data interpretations to believe based on how well they agree with the same theories that your are saying do not work. There seems to be a lot of intuition at work here. Which I can understand, I agree with that intuition. This kind of paleoclimate inference using new proxies is more of an art than a science at this point. But, I think that should make us less willing to throw stones at theories and models that are reasonably successful rather than encouraging that. So, it's a bit of a conundrum, chose interpretations of the data (which frankly most of don't believe) that enhanced the model-data mismatch so that it appears to be a fundamental challenge to theory, or chose interpretations that bring data and expectation closer together (which appears to lesson the impact of the paper).

I think there's a good case for the latter approach in this paper, which is pretty close to what has already been done. But, I would carry it slightly further andâĂŢif the authors agree (the model output are in the supplemental material of my paper)âĂŢthey might entertain the possibility that their preferred proxy interpretation does not disagree much with models/theory.

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