

## ***Interactive comment on “Alluvial record of an early Eocene hyperthermal, Castissent Formation, Pyrenees, Spain” by Louis Honegger et al.***

**Anonymous Referee #3**

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This paper presents a detailed carbon/oxygen isotopic and geochemical dataset from the Castissent Formation to investigate the terrestrial record of early Eocene hyperthermal events. Based carbon isotope stratigraphy, the authors identify 6 hyperthermal events in the Castissent Formation. Using orbitally tuned stratigraphic data tied to mammal biostratigraphic ages, the authors correlate the most prominent of these to Hyperthermal U, previously identified by benthic oxygen isotope stratigraphy from ODP 1263. The authors also use major and trace elements to suggest that hyperthermal events are recorded in terrestrial deposits as horizons with dramatically increased mean annual precipitation proxies. Perhaps the most important conclusion of this paper is that such events can be recognized in the terrestrial record and may improve our understanding of the terrestrial effects of these climate fluctuations.

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Overall, this paper presents a large dataset and strong conclusions, and it will be of interest to a broad audience. A few minor questions/recommendations that might improve the paper are presented below:

1) I think this paper would benefit from a more detailed description of the model used to constrain the age of these deposits. Was the placement of the Castissent Formation within European Mammal Zone MP10 based on the same outcrops sampled here, and if not, what is the proximity of that site? Although the authors state that many of the well-dated sections within the Castissent Formation can be physically correlated to the current study area, how can the authors be confident that these are not time-transgressive deposits? Finally, I am skeptical that the age designation bracket of  $50.534 \pm 0.025$  and  $49.695 \pm 0.043$  Ma can be realistically applied to this unit. That extremely precise age range is based on orbital tuning of a marine record, correlated to a continental record, correlated to the current study area. I am not disputing the correlation, just that the precision of the marine record might not be retained through two iterations of lithostratigraphic correlation.

2) The authors note that unlike most marine hyperthermal records, the oxygen and carbon isotopic records are not coupled in the Castissent Formation (the oxygen does not reflect hyperthermal events, whereas the carbon does). Why might this be? Is there evidence of isotopic resetting of the O system (petrographic or other)? How deeply have these rocks been buried? This seems to suggest that even in well-preserved systems, oxygen isotopic records should be used and viewed with caution.

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