

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

**Thomas Westerhold (Referee)**

twesterhold@marum.de

Received and published: 18 September 2019

The authors present new stable carbon isotope data measured on pedogenic carbonate nodules from a terrestrial fluvial sedimentary succession from the early Eocene Castissent Formation in the South-Central Pyrenees. Their endeavor is the important task to correlate marine and terrestrial realm during the Early Eocene Climate Optimum, the warmest time on the planet in the Cenozoic characterized by frequent transient global warming events. This study is highly relevant because regional terrestrial archives are needed to understand regional responses to global warming events, in particular monitoring changes in the hydrological cycle. In essence the new record provides evidence that hyperthermal events in magnetochron C22r are associated with regional increase in precipitation intensity. It is well suited to be published in CoP after

[Printer-friendly version](#)

[Discussion paper](#)



minor revisions.

The manuscript is well written, clearly structured, has superb figures and informing supplementary section. Here I particularly comment the age model, the soil nodule carbon dynamics and their implications has to be judged by someone else. Correlation between marine (lower sedimentation rates) and terrestrial (high sedimentation rates) is notoriously difficult. The author present a robust and clear approach to get a decent age model comparable to the marine records. Uncertainties and different correlation options are discussed giving the opportunity to evaluate the effects of various age models. Supported by wider correlation to nearby outcrops and bio-magneto-stratigraphic data to me the preferred correlation makes perfect sense. Also because the sedimentation rates of this option is in line what has been observed in similar settings like the Bighorn Basin. The only concern is the scaling of the U labeled hyperthermal in the deep sea and the CIE D in the carbonate nodules of the Chiriveta record. How do the events labeled B and C plot in Figure S2? However, the overall pattern in the carbon isotope records of marine and the Chiriveta record match well reinforcing the age model preferred.

The manuscript hopefully will stimulate seeking for more continental records, although the age model construction will be difficult. Despite this, the section 5.4 Preservation potential of hyperthermals in continental sections is informing but a bit out of context. It is clear to the community that higher sedimentation rates allow a more detail insight. This section, if kept in the manuscript, also needs to discuss that sedimentation is not uniform (steady) in terrestrial records but highly dynamic (50m away from the section things will look very different, see Bighorn Basin Project results where outcrops studies and drill cores allow a 3D view).

Comments: Abstract Line 23 – Hyperthermal cannot be “potential analogues, in the geological record, to the ongoing anthropogenic modification of global climate”. Background conditions 50+ million years ago were much different. But the events can help to test the assumptions made by climate models and revise them for a better under-

[Printer-friendly version](#)

[Discussion paper](#)



standing of the climate system dynamics.

Line 44-45: remove “towards icehouse conditions eventually reached later in the Cenozoic”

Line 48: “Turner et al., 2014” change to Kirtland-Turner et al. 2014 in the entire text

Line 51: “e.g., Westerhold et al., 2018”; add Lourens et al. 2005, Sexton et al. 2011, Kirtland-Turner et al. 2014, Lauretano et al. 2015, 2016. They published the records used.

Line 52: “Early Thermal Maximum (ETM) 2, H2, I1, I2, and ETM3/X events”– correct to Eocene Thermal Maximum. Change the wording of the sentence to clarify the nomenclature (ETM is only for 1,2,3; H1 H2 etc. are from Cramer et al. 2003 revised by Lauretano. . ., Sexton et al. 2011 suggested the relative to magnetochron scheme, see Westerhold et al.). In Figure 1 the text refers to this, please streamline the manuscript text accordingly.

Line 54: “In the stratigraphic record, these events are primarily characterized by important negative carbon isotope excursions (NCIEs)” – rephrase!, they are characterized by a paired negative excursion in carbon and oxygen isotope data; do not use NCIE throughout as it confuses with the commonly used CIE (Carbon Isotope Excursion) abbreviation for the e.g. PETM.

Line 150: please specify the target material of the X-ray tubes (Mo, Rh?).

Line 180: provide tie-points to ODP 1263 as a table in the supplement and add the age to your data tables of isotope as well as XRF results.

One important thing would be to show images of the soil nodules from the Chiriveta record in the supplement.

---

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2019-88>, 2019.

Printer-friendly version

Discussion paper

