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Interactive comment on "A seasonality trigger for carbon injection at the Paleocene-Eocene thermal maximum" *by* J. S. Eldrett et al.

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Thank you for the review and helpful suggestions for improving the manuscript. As with the previous referee comments by Carlos Jamarillo, we believe we can incorporate many of the suggestions you make.

A response to specific points:

1) Biostratigraphic elements in the text detailed by authors in reply to C. Jamarillo: We can incorporate a brief biostratigraphic discussion and include distribution and abundance of A. augustum in Figure 2.

2) A pre-CIE seasonality trigger: The occurrence and abundance of A. augustum and the associated globally recorded Apectodinium acme in core 22/11-N1 constrains the

stratigraphic position to the PETM. As pointed out by the reviewer and as discussed in our supplementary information (lines 41-54), the occurrence of A. augustum constrains the PETM interval, but can occur below the isotope excursion (e.g. Sluijs et al. 2007). The magnitude of the CIE globally varies between -2‰ and -7‰ (see overview in McInerney and Wing 2011). At site 22/11-N1, this step occurs at 2264mbsf. The slight negative trend around 2273mbsf is not significant (t Stat < t Critical [t stat = 0.04; t critical = 1.85]; p value > α [p value = 0.48; α =0.05]; whilst the CIE as defined from 2264mbsf is significant (t Stat > t Critical [t stat = 9.81; t critical = 1.7]; p value < α [p value = 4.6E-10; α =0.05]. As suggested by both reviewers we shall expand the discussion in the text to substantiate the chemostratigraphy.

3) Organic matter composition and the C-isotope curve shape We agree with your review as per our response to C. Jamarillo, that we believe the source of organic matter does not affect the long term decrease in our 13C record. We do not have palynofacies data of the core, and in particular the interval above 2225mbsf to determine if there are significant changes in organic matter, but in general from other locations in the North Sea (King 2001; unpublished thesis on core 22/10a-4) the entire PETM/CIE interval (Biozones PT19.2 to PT19.4) is dominated by amorphous organic matter and our observations indicate this is also the case at the studied site. Whilst the reviewer points out the excellent paper by Garel et al. (2013), the Cap d'Ailly sections are lagoonal and completely different depositional environment from the "deeper" marine turbidite fans of the North Sea.

4) MAT and MAP fluctuations We are glad to see the request for comment on the shifts in temperature and precipitation, especially as we agree with the reviewer that shifts in the seasonality of climate are detected in our analysis, matching shifts seen in other mid-latitude PETM records from France (Storme et al., 2012; Garel et al., 2013), England (Collinson et al., 2009), and North America (Kraus et al., 2013; Wing and Currano, 2013). Whereas our record shows short term warming and cooling and concomitant shifts in seasonal precipitation, owing to the large uncertainties in our es-

timates we don't feel these small temporal scale shifts are necessarily meaningful as they fall below the analytical precision of our method (the minimum and maximum estimate returned from the method as shown in Figures 3 and 4). We instead would argue that a focus on the larger scale patterns is best justified as these show a clear shift in CMMT, WMMT and WMMP during the CIE. As we noted in our response to Reviewer Jaramillo, we have re-run our palynological climatic analysis due to the availability of better modern climate range data for key spore and pollen fossils in our samples, as well as new recommendations on analysis. In our new analyses using both bioclimatic analysis and the Mutual Climate Range technique, the shifts in CMMT and WMMT, and WMMP and CMMP are comparable to those seen in some other records, i.e. a shift to warmer-wetter summers during the CIE as seen also in the Cogham lignite (Collinson et al., 2009) and Vasterival NW France (Storme et al., 2012; Garel et al., 2013), vs. warmer-drier in the North American interior (Kraus et al., 2013; Wing and Currano, 2013). Our new analysis now also shows a clear shift to higher MAT values during the CIE. The WMMT warming we detected pre-CIE may match with that seen in the Bighorn Basin (Secord et al., 2010; Kraus et al., 2013), and shows up in our revised MAT record from the MCR technique analysis.

5) Point by Point corrections: We shall make all the amendments as suggested by the reviewer.

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