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Interactive comment on "Plants in movement – Floristic and climatic characterization of the New Jersey hinterland during the Palaeogene–Neogene transition in relation to major glaciation events" *by* Sabine Prader et al.

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Answer to referee 1.

We can follow several comments made by Referee 1 and will change the manuscript accordingly. In some other case, the comments have a rather general character, e.g. relating to weaknesses of our record regarding the hiatuses between the different sequences. We are very much aware of the discontinuous nature of the presented record, which is typical of palynological records from shelf regions, such as the mentioned hia-

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tuses between sequences or concerning taphonomical aspects. This is offset by the importance of making direct (single core) land-sea correlation since the work is part of an IODP site with many parallel analyses, sampling a large integrated catchment area, and the absolute scarcity of well-dated palaeobotanical records for the eastern coast of North America so that our record, which comprises several relatively well-dated sequences, is in any case a very important addition which should be of interest for all studies dealing with the onset of the Miocene in the research area.

1. The sedimentary record is very discontinuous. There are big "jumps" in time – in some cases of many million years, for example with no sedimentation between 28.2-23.5 Ma or between 23-20.9 Ma - and this limits the pollen data and their interpretation in terms of vegetation/climate dynamics. The authors say at some point that the glacial (sea-level lowstand) part of the sequences are missing. However, the diagrams show a slice of the sequence that would cover one of the most important glaciations at that time - the Mi-1 glaciation at around 23 Ma - but there is barely any discussion about it. Are there any vegetation patterns that would show this significant environmental cooling? In this respect, the pollen diagrams are very difficult to understand because they are represented continuously even though there are significant hiatuses and graphically one tries to see cycles that are obviously not there.

To facilitate the understanding of the hiatuses in the analysed time interval, we plan to graphically indicate these hiatuses in the diagram. Compare also comments by referee 2. We can follow Referee 1's argument that the discussion about the Mi-1 event is relatively short. However, as mentioned in the discussion the placement of the Mi-1 event at the New Jersey margin is not clear and since today, no clear conclusions exist if the Mi-1 event is expressed at the New Jersey margin or not. We suggest that we discuss the temporal placement of the Mi-1 event at the New Jersey margin in more detail, also in relation to the increased input of bisaccates pollen grains during cold events. 2. The discussion is very short, shallow and naïve. The adjective "weak" is used twice in the abstract describing the vegetation and paleoclimatic estimations but

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no further information is given describing the patterns, which seem to be shown in Figs 2 or 3 (i.e., peaks in conifers). I feel the authors did not squeeze the data enough to obtain conclusion. Do you really believe climate was "a straight line" between 30 and 20 Ma??? For example, the authors first say that the hiatuses "inhibits the evaluation of vegetation responses to periodic orbital changes". However, some of the sections studied are about 500,000 years, long enough to at least record orbital eccentricity changes. At the beginning of section 4.3 the authors say that the terrestrial pollen signal could be hampered in the marine environment but they do not explain how.

We can only partly follow these comments. We assume that our record does not meet all expectations referee 1 has for a good climate record, and as discussed above, this is to some degree understandable, e.g. regarding the hiatuses. However, our study was in the first order designed to discuss vegetation movements during the time intervals reflected in our record and to contribute to palaeobiogeographical data. We do see a clear dynamic pattern in the New Jersey hinterland vegetation according to global climatic events where conventional palaeoclimatic reconstructions do not show similar fluctuations signals. This not only a problem in our record, but also in other publications using the nearest living relative approach or similar approaches to reconstruct climate variability. Thus, in our manuscript we want to point out that it is useful to think about new aspects within the development of approaches to quantify climatic dynamics in palaeorecords. We see our study as an example for such approaches. We did not intend to pretend that we have a continuing climate record without interruptions. The study was also not designed to detect orbitally-driven palaeovegetation changes. Indeed, some Sequences are about 500.000 years long and as well long enough to study orbital changes (actually we are preparing a manuscript in that direction focusing on another sequence from the same site), but such a study would have a different focus. What we wanted to state in section 4.3 is that the vicinity to the sea probably buffered the impact of different cooling events to some degree. We will rephrase the related sentences to make this clearer. 3. There are some pollen changes in some of the studied sections such as O3 or O6 with clear dynamics in the conifers that are

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barely discussed. However, some other events are discussed but are not very clear. For example, the authors in section 4.3 described a significant change, that they related with Oi2-a event at 28.3 Ma, characterized by an increase in Pinaceae. However, in Fig. 3 there seems to be a minimum in Pinaceae instead (sum-bissacates).

We are going to include the conifer peaks, which show a clear dynamic pattern into the discussion in the context that, for this peaks in the literature no cooling events are described and could be connected to regional changes in the hinterland. Taking the uncertainty of our age model into account the huge input of bisaccate pollen grains around the intrasequence o.5 could be related to the 28. 5 Ma cooling event described in Pekar et al. (2002). We agree with the Referee 1 that Oi2-a event at 28.3 Ma is not really expressed, this point we are going to discuss in detail.

4. The vegetation is mostly described as "units" and this is very confusing as one has to be going back to the figures or, even worse, the supplementary document, where the taxa are described. Why not calling these units by their names? For example, high-altitude conifer forest, instead of unit 1?

We aimed at keeping the manuscript shorter by using the abbreviations, but we agree that it would facilitate to understand the text when the specific names of the units were used. We will change the text accordingly.

5. The lithology plot shown in Fig. 3 is very confusing and very difficult to understand. Lithology of the studied core should be shown in standard lithological patterns so one can visualize if the pollen changes are at some point related with sedimentological, transport of taphonomical changes. We understand this that way that referee 1 would prefer the typical signatures for clay, silt etc. and will change the figures accordingly.

6. Eotrigonobalanus is described in the text as an extinct genus occurring in this sedimentary record. SEM seems to be necessary to classify this pollen taxon but no discussion is found in the manuscript concerning how abundant it was or if it occurred continuously throughout the record.

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We are going to show a diagram with the relative abundances of Eotrigonobalanus and other rare taxa, and the discussion about this genus will be a bit longer, including information on its abundancy in the pollen records. (Compare comments to T. Denk , referee 2.)

7. There are some plant taxa that show affinities with subtropical climates such as Engelhardia, Sapotaceae, Cupressaceae with papilla (probably Taxodioideae) that do not occur in the area at present probably due to climate cooling but one gets the impression that the climatic inferences made here are pretty much like at present.

The above mentioned genera are not distinguishable at lower systematic level. This topic has been discussed by several authors recently (e.g. Cupressaceae: Grimm et al. (2015) and Grimm and Potts (2016), compare also Prader et al. (2017)). We will discuss some aspects related to these taxa in more detail, for example the relative abundances of the Engelhardioideae of the late mid Miocene (Prader et al. 2017) compared to the Oligocene to early Miocene so that the reader could see that minor changes in the vegetation composition occurred in the New Jersey hinterland. It is however difficult to make comparisons with the present-day situation in case of Engelhardia. This aspect is also related to comments by referee 2 concerning the development of Fagus in the research area.

Literature cited: Grimm, G., Denk, T., Bouchal, J.M., Potts, A.J., 2015. Fables and foibles: a critical analysis of the Palaeoflora database and the Coexistence approach for palaeoclimate reconstruction. BioRxiv 016378; doi: http://dx.doi.org/10.1101/016378. Grimm, G.W., Potts, A.J., 2016. Fallacies and fantasies: the theoretical underpinnings of the Coexistence Approach for palaeoclimate reconstruction. Climate of the Past 12, 611-622. Pekar, S. F., Christie-Blick, N., Kominz, M. A. and Miller, K. G., 2002. Calibration 5 between eustatic estimates from backstrippingand oxygen isotopic records for the Oligocene. Geology 30, 903-906. Prader, S., Kotthoff, U., McCarthy, F.M.G., Schmiedl, G., Donders, T.H., Greenwood, D.R., 2017. Vegetation and climate development of the New Jersey hinterland during the late Mid-

dle Miocene (IODP Expedition 313 Site M0027). Palaeogeography, Palaeoclimatology, Palaeoecology 485, 854-868.

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