We thank Dr. Grimm for the critical comments on the Coexistence Approach to reconstruct paleoclimate variables. The following are our responses to his comments.

Issue 1: Problems with reliability and comparability of used mean annual temperature and coldest month mean temperature CA estimates.

It is known from Dr. Grimm's earlier paper that the he doubts the applicability of the Coexistence Approach (CA) in general (Grimm and Denk, 2012). One main reason he cites is the difficulty in identifying the "real" climate requirements of modern plant taxa (Grimm and Denk, 2012). At the same time, the reviewer suggests that these "real" climate tolerances of modern plant taxa can be identified in such high detail that we can exactly quantify the error of published climate data. We find this argumentation contradictory.

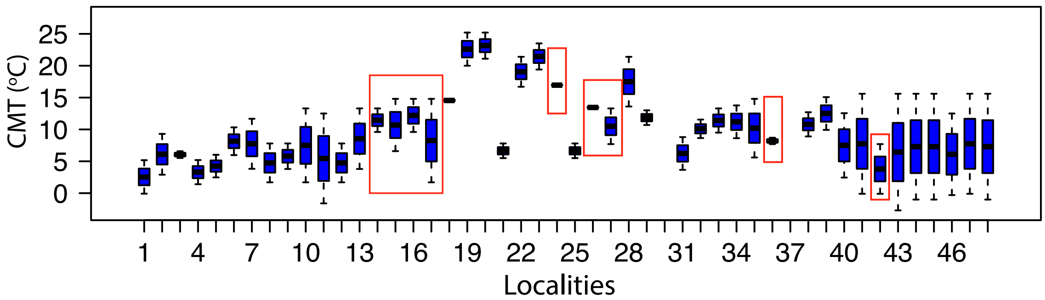
We do not claim to have real climatic tolerances of plants but we are convinced that they can be identified with **sufficient accuracy** to reflect regional climate in a palaeoclimate reconstruction (see Utescher et al. (2014) for a detailed discussion). Based on our experience we can say that differences between published CA-based palaeoclimate data and re-calculated results using e.g. an updated version of the Palaeoflora database (PFDB) usually are fairly minor. Of course, significant deviations or even typos (the reviewer cites tolerances differing by 19 °C) in published data have to be addressed. Therefore we would be grateful to Dr. Grimm if he could notify us in which site he detected such high discrepancy.

Issue 2: Method- and database-inherent bias towards certain subtropical climates when using CA in conjunction with PFDB tolerance data

Applying random sampling on a given set of Northern Hemisphere taxa and processing of their climate data using the CA will mirror basic biodiversity patterns of the Northern Hemisphere and will therefore "converge" in the warm temperate climate zone. This effect, however, does not affect the applicability of the CA. Plant fossils recovered at a given locality do not represent a random sample. The ability of the CA to resolve climatic conditions depends on the taxonomic resolution of the palaeobotanical record. Even in those cases where the fossil record only allows for identification at family level only, a meaningful climate reconstruction is possible with the CA method (at least on general level, such as: cold temperate, warm temperate or tropical climate).

We do not think the data used in our study exhibit inherent bias towards certain subtropical climates. The following figure shows the coldest month temperature (CMT) reconstructed from the plant fossil records in the Late Miocene (as listed in Table S1 in Supplement). The order of the localities follows the order in Table

S1. We denote the localities showing cooler-than-present winter temperature by red boxes. It is clear seen from the figure that the CMT estimates cover a wide rang from 0 to 25 ºC, and well resolve the large-scale pattern, i.e., lower (higher) CMT in high(low)-latitude/altitude region. In particular, the data show good resolution in the temperature range from 5-25 ºC. All the localities suggesting cooler-than-present winter temperature are likely to have CMT in this range. Therefore, we would actually have more confidence in the CMT reconstructions for these subtropical localities than the localities which CMT are likely to be out of the range. For example, in the very northern locality, its CMT is likely to be minus degree, but the CA method may not be able to capture the minus degree (as far as seen in the figure below).



In addition, we do NOT think it is fair to suggest systematic biases of the CA method by showing the Eocene temperature reconstructions in Dr. Grimm's Figure. Firstly, we do see large variations in the Eocence temperature reconstruction in Dr. Grimm's Figure. For instance, the ME data from southern China indicate CMT about 13ºC, while the ME data from central China indicate CMT less than 7 ºC. We do not know how large the temperature difference should be counted as different for Dr. Grimm. But for us, 5ºC temperature difference is large (For example the difference between mean annual temperature in Vienna, Austria (about 10 ºC) and Helsinki, Finland (about 5.5 ºC) is about 4-5 degrees). Secondly, even if all the data suggest uniform temperature over the whole China region in the Eocene, we could not say that the proxy data are wrong because we do not know how the Eocene climate really looks like. We are still lacking observations in the Eocene to validate these proxy data.

Issue 3: Discrepancies with recently formulated (Utescher et al., 2014) CA standards and recommendations for CA studies

According to Dr. Grimm's suggestion, we will add the list of fossil taxa, fossil-NLR associations, and the NLR tolerance range for our unpublished reconstructions for the Indian localities to the Supplement. For the published plant fossil data, we refer to the original publications.

Dr. Grimm notes that "only two of the yellow marked localities the reconstructed potential palaeo-climate values lie below the modern values" (according to Table

S1 in the supplement). He might misunderstand the meaning of "rang" for the modern climate (It is our mistake not explaining this clearly). The "rang" for the modern climate in Table S1 is defined by the difference between minimum and maximum yearly values (e.g., MAT, WMT, CMT) during 1901-2002 in the CRU dataset. It differs from the "range" for the proxy data.

For the proxy data, the real value might equally lie within its "rang", but for modern climate data, the real value should more likely lie on the mean value according to the normal distribution of the observation data. Therefore, to see whether the proxy data and the modern data are different, best is to compare the whole range of the proxy with the mean value of the modern observation only (or plus/minus one standard deviation). Note that the standard deviation should be much smaller than the "range" for modern climate data as shown in Table S1. As displayed in Fig. 6 in our manuscript, there are at least 5 localities with reconstructed coexistence intervals being completely below the present-day mean values, thus indicating cooler than present conditions.

Moreover, we want to stress that there are also temperature reconstructions using other methods indicating cooler-than-present winter temperature in the Late Miocene. For instance, using the Climate Leaf Analysis Multivariate Program (CLAMP), Xing et al. (2012) also found lower-than-present winter temperature in the Late Miocene. A very recent study using bioclimatic analysis also indicate cooler than present temperature in the Late Miocene in a locality from southwestern China (Li et al., 2015).

In summary, according to Dr. Grimm's comments, we will add more discussion on the uncertainties and potential biases of the plant fossil data, and explain in more detail the discrepancies shown in different localities in our revised manuscript. At the same time, we think that we can demonstrate by the facts outlined above that these uncertainties identified do not substantially impact our results and/or may led to other conclusion.

References:

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Utescher, T., Bruch, A. A., Erdei, B., François, L., Ivanov, D., Jacques, F. M. B., et al., 2014, The Coexistence Approach—Theoretical background and practical considerations of using plant fossils for climate quantification:

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