Reviewer comments

We deeply appreciate all time and effort spent by the reviewers during the revision of this manuscript. We thank all comments and suggestions provided by them that considerably improved the manuscript.

The following section includes a detail answer to all comments and suggestions made by the reviewers.

Reviewer 1

Reviewer comment 1: Line 52-53: Cite some broad references such as Yasuhara et al 2017 Biological reviews (https://doi.org/10.1111/brv.12223) and Yasuhara et al 2009 PNAS(https://doi.org/10.1073/pnas.0910935106).

Answer: We include some broad references for the initial paragraph and we include the references suggested by the reviewer.

Reviewer comment 2: Line 53-55: Late Quaternary climate change was important for extinction only in terrestrial (and freshwater?) system. There was no much extinction in marine systems (eg Yasuhara et al 2012 Ecology Letters:https://doi.org/10.1111/j.1461-0248.2012.01828.x;Yasuhara et al 2009 PNAS: https://doi.org/10.1073/pnas.0910935106).

Answer: Glacial/interglacial cycles had no much influence on biogeography of marine systems, we therefore, highlight in text that most changes described in the manuscript occurred in terrestrial environments.

Reviewer comment 3: Introduction can be improved by separating global and regional (Neotropics) things. It will be good to start from global and then go to regional (eg the 1st paragraph and also the 3rd paragraph on ostracods as a model system).For ostracods, it's good to cite these standard and updated refs:Mesquita-Joanes, F., Smith, A.J., and Viehberg, F.A., 2012, The ecology of Ostracoda across levels of biological organisation from individual to ecosystem: A review of recent developments and future potential, in Horne, D.J., Holmes, J.A., Rodriguez-Lazaro,J., and Viehberg, F.A., eds., Ostracoda as Proxies for Quaternary Climate Change:Amsterdam, Elsevier, p. 15–35.Rodriguez-Lazaro, J., and Ruiz-Muñoz, F., 2012, A general introduction to ostracods:Morphology, distribution, fossil record and applications, in Horne, D.J., Holmes, J.A.,Rodriguez-Lazaro, J., and Viehberg, F.A., eds., Ostracoda as Proxies for QuaternaryClimate Change: Amsterdam, Elsevier, p. 1–14.Horne, D.J., Cohen, A., and Martens, K., 2002, Taxonomy, morphology and biology ofQuaternary and living Ostracoda, in Holmes, J.A., and Chivas, A.R., eds., The Ostra-coda: Applications in Quaternary Research, Volume 131: Washington, DC, American Geophysical Union, p. 5–36.

Answer: The first paragraph is dedicated to briefly introduce global implication of climate change on biodiversity. Thereafter, we introduce regional topics and

information about climate reconstructions in the northern Neotropics. We follow the order suggested by the reviewer from global to regional.

For ostracodes, we include the references suggested by the reviewer.

Reviewer comment 4: Line 156-157: It's good that chronologies and sampling methods are explained here. Especially it's the key to know how the chronology is robust. Dating of out side of 14C dating is often not easy, and resolution/error of the chronology can affect the discussion seriously. Thus details on dating methods/chronology/age depth model are needed here.

Answer: Following reviewer recomendation, we include information about cores chronology, age model, core sampling methods and core to core correlation.

Reviewer comment 5: Lines 465-466: I don't understand. isotope stages are the same between marineand terrestrial, right??

Answer: We attempted to highlight that Marine Isotope Stages (MIS) are periods of climate changes detected primarily in marine environment, whereas Glacial/interglacial cycles are more evident in terrestrial records. As this information is not strictly necessary by discussion, we decided to delete it.

We modify the text as follow: "Marine Isotope Stages (MISs), which describe shorter periods of climate variability than Glacial/Interglacial cycles, were also used to evaluate the distribution dynamics of aquatic species

Reviewer comment 6: Line 553 etc, a space needed between number (155) and unit (ka).

Answer: Change done

Reviewer comment 7: Does these records have enough resolution to discuss abrupt climate change periods like Heinrich events? They are not shown on any figs.

Answer: We used our data published in Cohuo et al., (2018) to infer about species changes during HSs. We clarify that in text and include a figure modified from Cohuo et al. 2018 to show species composition during HSs.

Reviewer comment 8: Fig 5 says "Holocene" for the last 14 ka

Answer: figure corrected

Reviewer comment 9: Fig 3A, and other figs: too many numbers indicated (83, 85, 87...). "80, 90, 100", "80, 100, 120" etc will be enough.

Answer: figures corrected

Reviewer comment 10: The authors may like to mention ostracod response to abrupt climate changes are also known in deep sea (eg, Yasuhara et al 2008, 2014):Yasuhara, M., Okahashi, H., Cronin, T.M., Rasmussen, T.L. and Hunt, G., 2014. Response of deep-sea biodiversity to abrupt deglacial and Holocene climate changes in the North Atlantic Ocean. Global Ecology and Biogeography, 23 (9): 957–967.Yasuhara, M., Cronin, T. M., deMenocal, P., Okahashi, H.,

Linsley, B. K., 2008. Abrupt climate change and collapse of deep-sea ecosystems. Proceedings of the National Academy of Sciences of the United States of America 105, 1556–1560.

Answer: We mention the ostracode response to abrupt climate change in marine environments in the introductory section, we decided not to include it in discussion section as this is a topic not evaluated in our manuscript. We include the references suggested by the reviewer.

Reviewer 2

Comment 1: Line 180: There are two versions of WorldClim database available: 1.4 and 2.0.Please, refer here to 1.4 version, since it is the one including past and future models.

Answer: WorldClim database version 1.4 was included to the manuscript according reviewer suggestion.

Comment 2: Concerning the variables included: Are they correlated? Usually, it is reported the correlation among variables because it can lead to flawed SDM analyses.

Answer: a Pearson correlation analysis was conducted with 19 environmental variables from the northern Neotropical region related to precipitation and temperature prior running SDM analyses. Results of correlation analysis is presented in supplementary material, table S3.

Comment 3: Lines 347-391 Congruence between paleo-records and modeled paleo-distributions of freshwater ostracodes in the northern Neotropical region. Especially line 384-386:“In general, the comparison between species distribution models and paleorecords shows a quite high degree of similarity”. This question may be addressed more accurately by pre-modeling niche comparison – i.e. a comparison made without inferring a model that expresses a probability distribution. It would provide interesting statistics about how different are the niches of extant and paleo- distributions. Principal Components Analysis (PCA) calibrated on the environmental background (PCA-env) may be employed to measure and display graphically the niche overlap, and Schoener’s D metrics niche comparisons and Warren et al. (2008)’s niche equivalency tests may be run taking D metrics as reference. It takes the presence points of species under consideration and randomly reassigns them to each species, then it checks if the species niches are drawn from the same underlying environmental parameter distribution. If the observed value of D falls within the density of 95% of the simulated values, the null hypothesis of niche equivalency cannot be rejected. To perform all these tests, I recommend the R Package Ecospat (You can find details here: https://onlinelibrary.wiley.com/doi/full/10.1111/ecog.02671)

Answer: Evaluating niche equivalency between extant and paleo- distributions is a very good recommendation, especially because we are comparing composition and distribution of extant and paleodistributions. Such analysis is however, largely dependent on feeding data. In our study, models of paleodistributions remain with a degree of uncertainty due to climate model and modelling algorithm used. Constructing a PCA with past environmental background add another level of uncertainty as it can be speculative, especially by older periods such as last Interglacial, and Last Glacial maximum. Our validation method is the direct comparison between models and fossil evidence, both spatially and temporally. The presence of our fossil evidence in areas hindcated by models, allows us to fully compare both approaches. We decided to keep with the validation we are using and explain more in detail, why we are using this validation instead equivalency tests.

Comment 4: Lines 392-477 4.2 Endemic and non-endemic species responses during long-termclimatic fluctuations: Glacial/Interglacial cycles and Marine Isotope Stages Again, consider if your discussion may take some benefit from niche comparisons as suggested in the comment above. Indeed because one of the questions addressed in the study is related to how different are the responses of endemic and non-endemic species to climate change.

Answer: As commented above, the most important limitation we have is the uncertainty on climate model for past periods. Especially in the tropical areas, precipitation and temperature estimations can be uncertain due to orographic heterogeneity. For our species, another limitation is the abundance we have, which is needed to performing a niche comparison, especially PCA. Our data comes from a set of studies in which the presence of species is recorded but no in all the abundance per sample (stratigraphic section). Therefore, our comparison is based in presence-absence data, we only infer about the presence or absence of the species during climate periods. We consider that given our data base, we are limited to construct an equivalency test and PCA to compare endemic vs non endemic.

Comment 5: Table 1: Please, replace the codes for environmental variables (e.g.BIO 1) by their names (“mean annual temperature”), hence it will be much easier to the reader relate them to the discussion.

Answer: Given that names of environmental variables may be too large for the table, we include codes meaning at the base of the table.