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CPD

5, S309–S314, 2009

Interactive Comment

Interactive comment on "Pollen-based biome reconstructions for Latin America at 0, 6000 and 18 000 radiocarbon years" *by* R. Marchant et al.

R. Marchant et al.

Received and published: 6 August 2009

General revisions In addition to the specific revisions carried out to points identified by the three reviewers, captions have been placed on all the Tables and Figures rather than within a stand alone sheet. The manuscript, figures and tables have had several proof reads and grammatical / spelling errors picked up. In addition to dealing with the reviewer comments the manuscript has been circulated to all co-authors and final comments incorporated. Queries raised by the specific reviewers have been addressed as below.

Reviewer 1: Cristina Penalba • The approach taken when there are multiple samples from a site for a particular time period has been clarified within the text. This is important point about mapping the most dominant biome is one of the 'problems' with the biomisation technique, and how it (over) summarizes the exten-





sive information contained within a pollen spectra. This oversimplification of collapsing a diverse pollen signal to a single biome can be overcome at a single or few sites by mapping the affinity scores to the biomes rather than just the most dominant biome. Unfortunately, this approach is not possible at the broad geographical scale of Latin America where multiple sites are used. • The concentration of sites along the Andean spine did result in numerous assignments being mapped overlapping each other and hence the changes between the different time periods difficult to detect on a site-by-site basis. To rectify this problem, in addition to presenting the results on the traditional biome dot maps (Figures 7, 8 and 9) results are presented for all sites in a tabulated form (Table 6) so one can see which biome has been reconstructed for each site, how this compares to the potential vegetation and how it changes at each time period. The reviewer suggested an altitudinal figure could be of help - we have not added this in but this was indeed a concern of ours and we did in an earlier version explore producing 3-D maps. However, on reflection we wanted to be consistent in our approach to all the other regions to undergo the BIOME 6000 process. • The reviewer indicates the importance of site responsivity to register climate change and how the location of the site (ecotonal or being located within the middle of a biome) is crucial in driving the response under climates of the past. This area was already discussed within the original submission but has been elaborated on in the revised manuscript. Continued reconstruction of the same biome at a site at different periods demonstrates that certain locations are unlikely to register a change due to their position in bioclimatic space: those sites located far away from the boundaries of adjacent biomes would need a massive climatic change to result in an ecosystem shift. Such a situation has clearly been shown for the Holocene where the sites to undergo biomisation show little change relative to the modern – this is now placed in the context of the work in Mexico by Ortega-Rosas et al. (2008) – thanks for pointing out these nice new additions to the literature. • The numbering of the sections has been checked and where appropriate modified. • The reviewer questioned the ordering of the data in Table 3 (site details) and Table 6 (site specific results); the information

CPD

5, S309–S314, 2009

Interactive Comment

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Printer-friendly Version

Interactive Discussion



within these tables has been harmonized and ordered according to latitude (South to North). • Spelling of the Spanish and French references have been checked throughout. • Nomenclature of the PFTs, particularly in Table 1 and the text, have been checked and harmonised where needed. • The methods text has been re-organised to focus first on the PFTs and then the Biomes – the table for these have also been re-organised. • Presentation of the results has been looked at closely and modified slightly although the authors feel they are presented in a logical way. There have been some changes within the text to make this section more fluent but the reorganization suggested has not been adopted. • Figure 1 has been revised to correctly place the position of the July ITCZ. • Figure 2 has not been modified but there has been greater discussion of this in the text, particularly on the issue of separating out relatively small desert areas from tropical dry forest. This coarsening of the vegetation results in a significant smoothing of the ecosystem transitions, particularly when there are very sharp, or specific biomes are guite isolated. A good example is the relatively small desert areas of north-western Mexico that get mapped as tropical dry forest rather than desert. • Figure 3 has been updated and checked. • Figure 4 now includes an inset from Colombia and is presented as an altitudinal cross section. • Figure 5 has been updated and checked with locational information presented in Table 3. • Nomenclature on Figure 6 and Table 1 have been checked and where necessary harmonized. • The colours on Figures 2, 7, 8 and 9 are slightly different (as these have been produced in different drawing packages) but highly comparable. Colours have been checked and are consistent and match the keys associated with the figures. • It is suggested to plot the biome dots on the vegetation map – as these are the same colour these would be lost. Results are presented in Table 6 that provide, on a site-by-site basis, a comparison on modern vegetation and modern pollen-based reconstruction. •: All specific technical correction suggested have been addressed within the re-submission.

Reviewer 2: Anonymous reviewer • The reviewer suggests adding a table in

CPD

5, S309–S314, 2009

Interactive Comment

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Interactive Discussion



to compare the modern biome reconstruction – this information is already presented as table 6. • The process involved in the vegetation classification (Figure 2) has been discussed to a greater extent within the text, although I have not put in a table explaining how the 57 original vegetation type has been collapsed –information on the different vegetation types in included in Table 2. • It was suggested to move p 378, lines 10-18 to the methods, as this paragraph of the text is making the link between the Latin American vegetation, PFTs and Biomes we think it is justified being placed here. • Table reference has been switched from Table 6. • The modern samples are not stored within the LAPD. We did not investigate the sub-biome results to look at consistent differences between pollen traps, moss pollsters and surface samples although at the coarse scale of the Biome there does not see to be any biases. • Biome 3 has been changed to Biome 1. • More detail has been provided on what constitutes a Biome affinity score. • Reconstructions of the Steppe biome are discussed but not the deserts as there are no desert reconstructions. The reasons behind the lack of desert biome reconstructions (too dry for sediments to accumulate in lakes / bogs) are discussed in the context of the Biome schematic for Latin America (Figure 5). • The discussion about the mid Holocene vegetation shift and how this compares to the African situation has been adjusted. • Greater precision has been added by reference to the palaeoclimate reconstruction by Farrera et al. (1999). • Modern analogue driven transfer function has been replaced by modern analogue approach. • Wu et al references have been added – thanks for pointing out these nice new additions to the literature. • Table 1 figure caption and values of alpha have been adjusted. • Table 2 caption has been adjusted and definition of bioclimatic range explained within the manuscript. • Table 3: the meaning of RC has been specified. • Table 4 and 5 are kept in this order as the pollen is first assigned to PFTs and then PFTs combine to form biomes. • Figure 1: the biome codes are fully explained in Table 2. • Figure 3 has been checked and the ordering is correct • Figure 4 caption has been clarified. • As also requested by Reviewer 3, more

CPD

5, S309–S314, 2009

Interactive Comment

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Interactive Discussion



detail has been provided on the creation of Figure 5. • Reference to the correct tables has been checked throughout

Reviewer 3: Anonymous reviewer • Was confused about the number of sites and how 344 listed sites could result in 287 sites with 381 samples being used for the modern calibration. As specified in the text, all samples that fell within the time period were analyzed from each site so that a single site could have 3 or 4 samples analyzed within the specified time window. When a site has multiple samples the most common result was used – again this is clarified in the text. • Patterns of change…:.. Sentence re-written to give great clarity. •: Some sites….. sentence re-written to give great clarity. • We have included a sentence on Latin America being characterized by permanent contact between the tropical and temperate domains throughout geological time. • The paragraph on 'Complicating this potential vegetation distribution (Piperno 2000)' has been simplified, however, this has not been removed as we feel trying to get a true picture of the modern vegetation is difficult, particularly through modern pollen samples and must acknowledge human impacts here. • The paragraph on El Nino event has been simplified. • The confusing sentence on Latin American vegetation has been removed. • We have not found different reconstructions result from different types of modern sample (moss, soil, sediment). From tropical rainforest through to cool grasslands the nature of the vegetation surrounding the site where the modern pollen sample is from can be reconstructed. However, this is with the caveat of the biome reconstruction being a relatively course summary and we are sure at a more refined ecological level (PFT) the impact of sample type might be apparent. • All tables and figures have tittles attached to them. • The site table has been ordered according to latitude as suggested; this ordering has also been extended to the results table (Table 6) so there is clarity on seeing which site responds in which way. We have not split the table as suggested into modern and fossil sites as we think the paper is already long and heavy on large table and another 6 page table will only complicate it further. The suggestion of having the present day biome from the pollen

5, S309–S314, 2009

Interactive Comment

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Interactive Discussion



compared to that on the vegetation is presented in Table 6. • RC stands for radiocarbon and has been specified in the Table caption. • For figure 2, further information on the production of this has been provided in the text. The process of reclassifying the vegetation was carried out in consultation with a number of the coauthors, particularly those with good ecological knowledge and a range of geographical expertise. • Figures 3 has been added to with additional information given on the types of species present in some of the plates as space allows. We tried placing the suggested biome code on the plates and it made the plate a little messy – the information is placed within the figure caption. • Figure 4 has been modified with an insert added on where the cross section is from with a modified caption. • Figure 5 is indeed an important figure and how it produced has been elaborated within the text. The red triangles indeed indicate the location of the sites where there are modern and fossil data from. There is greater explanation of how the plot was produced and some of the interpretations from this. • Figure 6 has been updated with a more convincing example of a tropical rain green tree. An explanation of a forb (herbaceous flowering plants that are not graminoids) has been given within the text. I have not added names of the illustrate plants as many of these are not from Latin America but comparable to Biome and could just add confusion

I hope you can see that the reviewer comments have been addressed and have provided a tighter more focused manuscript. If you require any further information please do not hesitate to contact me.

Dr. Rob Marchant

Interactive comment on Clim. Past Discuss., 5, 369, 2009.

5, S309–S314, 2009

Interactive Comment

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