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Biogeosciences Discussions

Interactive comment on "Paleovegetation reconstruction using δ^{13}C of Soil Organic Matter" *by* G. Wang et al.

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Dear Editor,

With this letter we are submitting the revised manuscript, "Paleovegetation Reconstruction using d13C of Soil Organic Matter" We have considered the reviewers' comments carefully and have made necessary changes to address the criticisms.

The point of this paper is not to come up with the most precise vegetation reconstruction for the Loess Plateau of China, nor is it to criticize the previous reconstructions. We want to point out comprehensively types of corrections that should be considered and the implied uncertainties given the fact that some correction coefficients are not

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well known. It seems that both reviewers think that the paper is trying to put others down, which was not at all our intention. We apologize if it appeared that way and have put much effort in changing the tone of the paper by making it a more general discussion. With that spirit, we address the reviewers' comments below. One major change we made is to add an additional section in the Discussion (section 4.4) to address several sources of uncertainties, most of which were pointed out by the reviewers. In the following point-by-point response, we refer to this section in several places.

Referee 1.
Introduction
1) We apologize for overlooking the work by Hatté et al. (2001) and Hatté and Guiot (2005). We now cite both of these contributions in the Introduction.
2) We already do have one reference (Zhang et al., 2004) as an example of the compound-specific work. This paper is more relevant to our work than Xie et al.

4.2 Variations in d13C and carbon contents of soil organic matter
1) P1806. Top soil means the 0∼5 cm depth mineral soil and bottom soil means the soil layer at the bottom of each soil profile. These are defined in the text. We understand that in soil science, the word topsoil has a specific definition. We therefore reworded top soil to surface soil.

4.3 Reconstruction of paleovegegation
1) No, we do not consider that "there is no vegetation dynamics to replace a biome by another." The implied assumption here is that changing biome does not significantly change the sensitivity of the ecosystem d13C (all species at a give site weighted by their biomass) response to precipitation. Is that a 100% justified assumption? No, of course not. That's a part of the reason why precipitation only explains 37% of the site d13C variations. Can we do better than that without additional information? Not at this point. Most paleo work has the same type of limitations, including the work done by Hatté et al. However, we do consider it a valid criticism. We now added a sentence to specifically state, "Assuming that the temporal sensitivity of the ecosystem d13C in

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response to precipitation is the same as the spatial sensitivity we determined for the modern environment, ... “We also add more discussion of this point in the new section of 4.4.
2) Now in 4.4, we specifically address this point with some added data from literature.
3) We have added, “We assume that all effects are linearly additive and there are no cross effects from more than one variables."
4) Jiaodao is located in Fuxian County, Shanxi Province. The mean annual temperature today in Fuxian County is 8.9°C and precipitation is 577 mm. We now use this more precise information in the manuscript, and have removed the Yanan city as a reference location.
5) Note that Feng and Epstein, 1995 also worked on cellulose. The point here is that this correction is not well known. Either cellulose or whole wood would deliver the same point. This is one of the uncertainties to be resolved in the future studies.

Figures
1) Figure 2a Plant sampled sites in ALZ (MAP, 150mm), YC (202mm), ZN (223mm) and JT (184mm) are located on deserts, only one C3 species was found at these four sites (see enclosed table1), so d13C of C3 plants have no uncertainty in Figure 2a (see table 1). In FXN (613mm) and ZWL (600mm) many C3 species occur, but we did not collect plants by ourselves at the two sites, and the d13C data in Figure 2a were supplied by other people who collected only one C3 species at each site. We have also added this information in the figure caption
2) Figure 2b. At many sites only one C4 species occurs (see table 1), so many points have no uncertainties in Figure 2b.
3) Figure 3. The figure has been fixed.

Referee 2
1) The site-averaged d13C of C3, C4 plants has been added to new Table 1. We can also present a table of all soil profiles including d13C values, soil type, location, and climate data if the editor requests that we do so.

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2) Although the correlation explains only 36% variation, the p value is < 0.001, so the linear trend is strongly significant. The uncertainty of the slope is provided, and readers can get a sense for the error involved in using the coefficient.
3) The uncertainty of the d13C analysis was reported to be 0.15‰. This applies to samples of both high and low carbon concentrations, because the uncertainty is controlled by the total amount of CO2 analyzed rather than by the carbon concentration of the sample. Samples with low carbon concentrations were analyzed with a large quantity of soil.
4) We cannot find Ahrens et al., 2000. Please provide more information about this reference.
5) The observations in Wedin et al. (Ecology, 1995) that d13C values of C3 and C4 species shifted in opposite directions during decomposition is interesting. However, the reason for C4 plants to shift in the opposition direction from C3 plants is because, as discussed by the authors, the litterbags were placed on a soil with C3 organic matter. This is exactly why we chose to do the experiment in C3 only ecosystem to avoid complications such as this one. We now added a paragraph of discussion about Wedin et al.'s observation in the new section of 4.4.
6) As mentioned earlier, we have change the tone of the paper significantly and now focus on types of corrections and their uncertainties.

We thank the reviewers for their critical comments, which significantly improved our paper. We hope that we have addressed all the criticisms properly, and the revised manuscript is acceptable for publication.

Thank you for handling the manuscript and we look forward to hearing from you.

Interactive comment on Biogeosciences Discuss., 5, 1795, 2008.