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Climate of the Past Discussions

Interactive comment on "Climate and modulate the balance and signal in simulated vegetation" *by* O. Flores et al.

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General comments:

We believe that confusion in the expression can lead to misunderstanding the approach taken; and we want to thank the reviewer for his detailed remarks. However we disagree with some points in the general comments.

Regarding the first issue raised, in their 2005 paper, Hatté and Guiot used two datasets that included C3 as well as C4 plants (p. 319) to validate their revised version of BIOME4. They simulate dC13 at a community level and nowhere argued that they focused solely on C3 plants. Therefore we don't understand the statement that they were interested in C3 plants only. A validation of carbon fractionation in C3 plants only would

require to simulate C3 PFTs only and compare the results with empirical data for C3 species, which does not appear in their paper. Moreover, they used the model to reconstruct the paleoprecipitation based on biomes and bulk dC13, which mixes C3 and C4 plants signals. Regarding carbon fractionation, Lloyd and Farquahr (1994) model deals with both C3 (Eq. 1-4 in the 1994 paper) and C4 (Eq. 5 & 6) plants. The distinction is also clearly made in BIOME4. The statement that the model is only for C3 plants is thus incorrect. BIOME4 includes two routines to calculate isotopic fractionation, based on Lloyd and Farquahr's model, one for C3 plants which was improved by Hatté and Guiot in two aspects (threshold for the Ci/Ca ratio and temperature-dependence of isotopic fractionation on CO2), and one for C4 plants which involves a subroutine to calculate the degree of leakiness as a function of temperature (constant phi in Lloyd and Farquahr model), whereas it was kept constant and set to 0.2 in earlier version of BIOME according to the original Lloyd and Farquahr model (1994). Although we did not perform extensive validation of the carbon fractionation routine (but used, for instance in Hatté and Guiot (2005) and validated elsewhere), we checked that the BIOME4 actually simulated distinct dC13 values for C3 and C4 pfts which were in full agreement with well-known observed ranges for those PFTs.

Regarding the second issue, the mixture equation presented in the introduction is of illustrative purpose and one point of the article (this is where poor writing may be in cause) is to argue that scheme is too simple. We thus agree on this point with the comment made. The interest of using BIOME4 to simulate a bulk dC13 signal is precisely that it models processes that control the values of the two poles, as well the proportion of C4 plants (rC4).

Methods - Our reconstruction of vegetation parameters aimed at addressing the influence of CO2 and climate. Although using estimated soil properties for LGM would make the LGM simulations more rigorous, this would increase the number of additional parameters to discuss where we wanted to focus on CO2 and climate only. - The labels in figure 2 and 3 for the Chinese site were wrong, not the data. Originally, we conducted

simulations under four conditions of C02 (180, 270, 360 and 540). We finally retained the two most relevant, but there has been a bug in the labeling of the figure. We are sorry for the confusion that it has caused. The labels have been corrected. - p1193: the first sentence of the page reads ÂńÂăcurrent distributions of temperature and rainfall were modified to adjust the mean annual temperature and annual rainfall to chosen values, while keeping the overall shape of the distributionsÂăÂż, which is accurate with regards to what we've done. The following sentence points out that although the seasonality was conserved the amplitude could change, and consequently the number of dry months for instance, which is an important climatic parameters but not addressed here (see below). The rest of the paragraph details the simple maths that were used. We did not actually change the mean annual value of rainfall, which is the mean value of monthly rainfall amounts over twelve months. We rather considered the annual rainfall amount, which is the sum of monthly rainfall. - p1193: we fully agree that the seasonality of rainfall is of critical importance. In fact, we addressed this issue in another paper (in review, http://www.clim-past-discuss.net/5/853/2009/cpd-5-853-2009-discussion.html). Here, we kept the analyses simple having a parallel method of to change both temperature and rainfall.

Results: - CO2 atmospheric concentration is a global parameter and its effect on the dC13 of C3 plants is global as well. However, its influence on integrated vegetation characteristics such as rC4 and bulk dC13 depends on other factors, such as the temperature and rainfall distributions. In the results we decompose the variation of dC13 in two components, one variation observed when only CO2 varies, and one variation observed changing climate parameters only (p1196-1197). The variation due to the change in CO2 were similar at both sites ($\sim$-4 per mil) which reflects the effect of CO2 as a global parameter. However, the change of dC13 due to climate change differed between the two sites, although rC4 increased in both sites. This reflects the effect of local climate.

Discussion - We agree with the reviewer about how the dC13 signal in the different plant

components can change and affect the bulk dC13 and we want to thank him for making this point. Our point that was in living plants the bulk dC13 and dC13 of n-alkanes are correlated. As the bulk dC13 changes during soil and sediment development, whereas the dC13 of n-alkanes is relatively conserved, the variation in dC13 as simulated by the model are likely to match the variation observed in the dC13 of n-alkanes more than the variation observed in the bulk dC13. We agree that the same reasoning does not hold with absolute values and will change the argument in the revised version. - We believe the discussion on the dC13 signal is still of purpose as BIOME4 routines to calculate to isotopic discrimination as been validated and published elsewhere.

Other issues:

We are currently correcting other raised issues as problems in the legends and references.

Interactive comment on Clim. Past Discuss., 5, 1187, 2009.