Review of "Sensitivity of atmospheric CO_2 to regional variability in particulate organic matter remineralization depths" by Wilson et al.

Overall, the manuscript has become clearer and the authors have addressed most of my comments. However, some parts in Article and especially in Suppl. Material remain still unclear, as illustrated below. It is also confusing that the authors did not distinguish the figures in Suppl. Material (usually denoted as Figure S1, S2, etc.) from the figures in the main Article.

I appreciate the additional sensitivity experiments where atmospheric CO2 is explicitly simulated, instead of being inferred from preformed PO4 changes in the model. In the manuscript, the authors stated that atmospheric CO2 was explicitly simulated in the "global" sensitivity experiment (page 4, line 29-page 5, line 11) and that the relationship between preformed PO4 and atmospheric CO2 was derived from Figure A1. In Suppl. Material and the response letter, the authors also stated that atmospheric CO2 was also explicitly simulated in the regional sensitivity experiments and added Figure 1. From which figure do the authors derive the relationship between preformed PO4 and atmospheric CO2 when estimating the regional sensitivity of atmospheric CO2 to change in b from the Latin Hypercube ensemble?

Likewise, it is difficult to understand the newly added Figures 1 though 3 in Suppl. Material. For example, what is the difference between Figure 1a and 1b, and between Figure 1c and 1d? What do the authors mean by "region of interest expanded"? Why do the relationships between preformed PO4 and atmospheric CO2 differ between Figure 1a (linear) and 1b (non-linear)? Which relationship is Figure 3 based on? In Figure 2, the studentized residuals seem large, on the contrary to the residuals shown in Figure 1. Why? In Figure 3, the magnitudes of CO2 sensitivity look different between the black bars and the gray bars (not only for the absolute values but also for the relative values across the regions), although the authors claim that there is a good agreement. I feel that the authors need to discuss in what aspects the two (black vs. gray) do not agree and in what aspects the two agree in more details.

In Figure 3 and Table 1 of the main article, it would be useful if the authors can add the error bars for the regional CO2 sensitivity (e.g., the 95% confidence intervals for the regression coefficients). This can help to see how much the regional sensitivities discussed in this study are robust within the employed model framework.

The revised Figure 5 and the associated text are clearer than before. However, I am still having difficulty in understanding the method and result. So, what is exactly plotted in Figure 5? Is it β_k^{region} from Equation (3) (page 6, line 30)? Or is it β_k^{region} from another equation where the P_{pre}^{region} in Equation (3) is replaced with the normalized P_{pre}^{region}? If the latter is true, then the "^" sign is missing in P_{pre}^{region} in page 7, line 4.

Minor points

From the Article
Page 3, Line 33: what do the authors mean by "a previous run"?

From the Suppl. Material
Figure 2 y-axis labels: a typo in "Studenised"
Figure 3 caption: a typo in "hyperube"
Page2, line 1: a typo in "usedn"