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Interactive comment on "Disentangling residence time and temperature sensitivity of microbial decomposition in a global soil carbon model" *by* J.-F. Exbrayat et al.

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We would like to thank Dr. Xia for their interest and positive comments about our work. We provide a brief answer here and we will incorporate these aspects in a more detailed way in the revised manuscript.

First, we agree that differences in the absolute values of f_T are smaller when T_s is below 15°C as shown in the reviewer's own Figure 1. However, relative differences are comparable between f_T with different values of Q_{10} for T_s greater or lower than 15°C as shown in our Figure 5. This explains the approximately two-fold range in zonal SOC at equilibrium found in both the warmest and coldest regions (Figure 6a).

As SOC input and soil physical states are the same in all model versions, we can attribute it to the response of decomposition to the spin-up procedure: a low (high) value of Q_{10} involves a low (high) decay rate in warm regions, and the build-up of large (small) SOC stocks; and a low (high) value of Q_{10} involves a high (low) decay rate in cold regions, and the build-up of small (large) SOC stocks. Regions with temperatures closer to 15° C are less sensitive to the choice of Q_{10} during spin-up. Overall, there is a zonal compensation that explains the apparent lack of sensitivity of global SOC to Q_{10} in our Figure 1a notably. Of course, we could have increased the sensitivity of equilibrium SOC stocks to Q_{10} by choosing a reference temperature that would have not led different f_T to cross within the spectrum of prescribed T_s.

Second, we also agree that as long as temperatures remain similar to pre-industrial conditions, the sensitivity of the model to the choice of Q_{10} is low. Conversely, when a strong warming is imposed the highest Q_{10} leads to the strongest depletion (or smallest accumulation) of global and regional SOC, while k influences the magnitude of the changes. Still, the magnitude of the change is very dependent upon the value of k.

In summary, we agree with Dr. Xia and will implement the required revisions to clarify the main message in the revised manuscript.

Interactive comment on Biogeosciences Discuss., 11, 4995, 2014.