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Interactive comment on “Global soil organic carbon stock projection uncertainties relevant to sensitivity of global mean temperature and precipitation changes” by K. Nishina et al.

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Dear authors,

I was very interested by your work that aims to narrow down sources of uncertainty in soil organic carbon (SOC) projections by driving several biome models with a harmonised climate data set.

However, I must agree with Reviewer #2 that the spread in initial SOC stock is of concern. Basically, it accounts for about half of the range in CMIP5 models that was highlighted by Todd-Brown et al. (2013). I therefore think that it should be given more importance in the results or discussion.

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First, more explanations on why this range exists and the initialisation procedure are needed. In particular, quantifying the respective contribution of differences in NPP and differences in residence time (and/or decomposition) at equilibrium would highlight where models disagree the most.

Second, as substrate availability controls heterotrophic respiration (e.g. your equation 1), initial conditions must play a role in the response of SOC stocks and decomposition to climate change. In other words, is the steady-state of the pool driving its dynamics? This would provide insights on how important it is to initialise models to match existing SOC stocks. A more philosophical point is whether simulated SOC is comparable to actual SOC, or whether it should be considered a model-specific state variable (see work on soil moisture by Koster et al., 2009).

For your information, we have recently touched on these aspects in a sensitivity analysis targeting the formulation of the environmental scalar $f(T) \times f(M)$ in a model driven by similar NPP (Exbrayat et al., 2013).

References

Exbrayat, J.-F., Pitman, A. J., Zhang, Q., Abramowitz, G. and Wang, Y.-P.: Examining soil carbon uncertainty in a global model: response of microbial decomposition to temperature, moisture and nutrient limitation, *Biogeosciences Discuss.*, 10(6), 10229–10269, doi:10.5194/bgd-10-10229-2013, 2013, accepted in *Biogeosciences*.

Koster, R. D., Guo, Z., Yang, R., Dirmeyer, P. A., Mitchell, K. and Puma, M. J.: On the Nature of Soil Moisture in Land Surface Models, *J. Clim.*, 22, 4322–4335, doi:10.1175/2009JCLI2832.1, 2009.

Todd-Brown, K. E. O., Randerson, J. T., Post, W. M., Hoffman, F. M., Tarnocai, C., Schuur, E. A. G. and Allison, S. D.: Causes of variation in soil carbon simulations from CMIP5 Earth system models and comparison with observations, *Biogeosciences*, 10(3), 1717–1736, doi:10.5194/bg-10-1717-2013, 2013.

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