Biogeosciences Discuss., 11, C1032–C1034, 2014
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Biogeosciences
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# *Interactive comment on* "How well can we predict soil respiration with climate indicators, now and in the future?" *by* C. T. Berridge et al.

**V. Brovkin (Editor)**

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Received and published: 14 April 2014

Dear Mr. Berridge and co-authors,

The reviewers see a major conceptual problem with the analysis done in your manuscript because you neglect the amount of carbon stored in the soil. You show that the soil respiration flux does not depend on temperature while it is constrained by precipitation. This result might confuse the carbon modeling community, because the respiration rate in the ecosystem models is parameterized as a function of temperature (using either Q10 or more sophisticated approaches). One could misinterpret your results in a way that the models calculate the respiration flux wrongly, especially for the future, because you also show that CO2-enrichment increases the soil respiration independently of changes in temperature and moisture. This confusion is reflected in

your conclusion that ". . .there seems to be no sound basis to assume that models with the best fit to contemporary data will produce the best estimates of future fluxes, given the methods, future dynamics and the nature of the observational constraints."

However, one would get your results much more consistent with the models if you account for the soil carbon storages and discuss climate-dependence of the respiration rate (erroneously called the "rate constant"), not the respiration flux. In line with comments by Colin Prentice, your results for the climate dependence of the soil respiration are suspiciously similar to the results by Helmut Lieth (1975) who demonstrated that NPP is determined more by precipitation than by temperature. And, outside the high northern latitudes, GPP correlates much better with the precipitation rather than with the temperature (Beer et al., 2010).

In your response, you refer to the Figure 3 in supplementary as the analysis of the dependence of soil respiration on the amount of the soil carbon. Your argument that the soil carbon storage depends on the soil texture is correct, however it is also dependent on the litter influx, which, in turn, is a function of NPP. This figure, therefore, does not help to address the reviewer concerns.

If you decide to stand the criticism of reviewers and to make your results useful for the terrestrial modeling community (a target auditorium of the GREENCYCLESII special issue), I see two main approaches how you can proceed.

1. If you would like to stay with pure observational analysis, you would need to include into your analysis the soil carbon pools either reported for the respiration data sites or taken from global dataset such as Harmonized Soil Carbon Database. The most informative for the modelers would be then the analysis of the respiration rate dependence on temperature, even accounting for the difference between soil and heterotrophic respirations.

2. You can compare observed soil respiration fluxes with the fluxes simulated by the Earth System models, e.g. in the CMIP5 simulations, or with offline simulations of ter-



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restrial biosphere models such as the TRENDY simulations. From this analysis, modellers could conclude whether the soil/heterotrophic respiration fluxes they calculate in their models are comparable with the data. You can also analyze whether simulated respiration response to temperature and precipitation patterns are in line with observations.

Without following these lines of additional analysis, I am afraid, I cannot recommend you to submit the revised manuscript. Please also note that the revised manuscript will be seen again by the reviewers, who will check whether you appropriately responded to their critical comments.

Your sincerely,

Victor Brovkin

References

Beer, C., et al., 2010: Terrestrial gross carbon dioxide uptake: Global distribution and covariation with climate. Science, 329, 834-838.

Lieth, H., Modeling the primary productivity of the world, in: Primary Productivity of the Biosphere, edited by H. Lieth and R.H. Whittaker, pp. 237-263, Springer-Verlag, New York, 1975.

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Interactive comment on Biogeosciences Discuss., 11, 1977, 2014.