

Interactive comment on “Assessment of model estimates of land–atmosphere CO₂ exchange across Northern Eurasia” by M. A. Rawlins et al.

Anonymous Referee #1

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Authors present a multi-model assessment of the carbon fluxes across the North Eurasia in last 50 years. Models are driven by observation-based climate data. Authors conclude that the soil carbon storage increases in last decade as compared to first decade of the analysis period, which happens despite decline of the soil carbon residence time due to faster decomposition rates owing to higher temperatures and a longer warm season. The test of the models against the GPP and NEP observations are made too. The findings are interesting for climate impact assessments and recommendations are also made for future model improvements. Manuscript is well written and has sufficient scientific value to be accepted for publications.

However it is recommended to give authors a chance to make minor corrections, additions to the discussion part.

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There are several factors not covered by the model analysis that need to be reflected in the discussion, concluding remarks:

- Fire regime change. Carbon harvesting by fires left out of scope, for convenience and fairness of the model inter-comparison. On the other hand accounting for fire fluxes would greatly complement the assessment of the carbon sink made in this study.
- Mismatch between modeled and satellite driven (MOD17) GPP pattern was mentioned without a hint at underlying cause. It could be under-representation of the edaphic variability across the landscapes. Do soil and drainage efficiency maps used in modeling reflect it properly? It may also be a cause of the problems with matching the observed GPP and NEP at flux tower sites.

Role of the nitrogen cycle feedback in increasing net carbon uptake in warming climate has been discussed only briefly. While the role of nitrogen cycle is varying between participating models, all models predict similar sign of sensitivity to climate change, which show some improvement since discussion by Sokolov et al, (2008). Table 2 states the nitrogen limitation is not included. That gives impression that detailed nitrogen cycle is not that needed. There are many processes that do need more explicit treatment of nitrogen cycle in northern high latitudes, like increased soil nitrogen availability due to decomposition of the stored organic matter in the thawed permafrost.

Technical comment:

Fig 12 is not easy to read.

References:

A. P. Sokolov, D. W. Kicklighter, J. M. Melillo, B. S. Felzer, C. A. Schlosser, and T. W. Cronin, 2008: Consequences of Considering Carbon–Nitrogen Interactions on the Feedbacks between Climate and the Terrestrial Carbon Cycle. *J. Climate*, 21, 3776–3796. doi: <http://dx.doi.org/10.1175/2008JCLI2038.1>

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