

Interactive comment on “Global spatiotemporal distribution of soil respiration modeled using a global database” by S. Hashimoto et al.

S. Hashimoto et al.

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Dear Dr. Hararuk,

We greatly appreciate your constructive comments and suggestions. We revised the manuscript based on your comments, and the responses to the Major and Minor comments are found below. According to the editorial instructions, the response is structured as follows: (1) comments from Referees; (2) authors' response; and (3) authors' changes in manuscript. Thank you very much.

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General comments:

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Comment 1: Comparison with NPP trends

Response: Thank you very much for the new idea. Although some assumptions are necessary and the results must be carefully examined, we think that the suggested comparison is quite interesting.

Changes in manuscript: Please see Table S5 in the Supplement. In the manuscript, the following revisions have been made: “The mean terrestrial NPP reported in previous studies was 56.2 ± 14.3 Pg C yr⁻¹ based on a thorough literature survey (Ito, 2011) (most data included were published after 1990), and our estimated RH between 1990 and 2012 was 51.5 Pg C yr⁻¹. The residual, the so-called net ecosystem production, is then 4.7 Pg C yr⁻¹. The global terrestrial carbon sink for 1990–2009 was estimated to be 2.4 Pg C yr⁻¹ (Sitch et al., 2015); when global fire carbon emission (2.0 Pg C yr⁻¹; 1997–2009) (van der Werf et al., 2010) is taken into account, the figures show surprising consistency even though they are based on different approaches.

Although previously reported NPP trends vary and are still debated (Table S5 in the Supplement) (Ahlström et al., 2012), and care must be taken to ensure that different climate data were used among the studies, comparing the trends of RH with those of NPP may imply possible changes in net global ecosystem carbon uptake. Before 2000, both NPP and RH showed increasing trends (Table S5 in the Supplement); however, the reported NPP values were larger the RH values estimated in this study, suggesting a possible increase in global ecosystem carbon uptake. In the 2000s, the increasing trend of NPP is likely to continue; however, one study reported the possible decline of NPP, which may imply the possible diminishment of increasing global ecosystem carbon uptake (Table S5 in the Supplement). However, in this study, RH was estimated using a simple empirical relationship with RS, and the interannual changes in RS are mostly climate-driven and do not include process-based changes in the carbon cycle. Therefore, the trends in RH obtained in this study may be underestimated and must be

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carefully evaluated.”

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Comment 2: More details in methods

Response: As requested, we have added more details about the methods to the revised manuscript.

Changes in manuscript: “We further extracted the data with the location information (latitude and longitude) to support their combination with the monthly climate data from the global climate dataset. Annual RS in the SRDB was used for data-model synthesis. Some of the data points in the SRDB are based on multi-year observations; however, the data were not weighted in this study. Each data point has the information of the year in which the study was performed or the middle year if the observation was conducted in multiple years, and we assumed that the data were obtained in a year of observation (or in the middle year if multiple years) and linked to the climate data. For each data point, we ran the model using a monthly time step and calculated the annual RS. The air temperature and precipitation were derived from the CRU3.21 climate data (University of East Anglia Climatic Research Unit (CRU) [Jones Phil and Harris Ian], 2013). The spatial resolution of the climate data is 0.5°. Using the latitude and longitude information and the year of observation in the SRDB, we extracted the monthly climate data from the climate dataset. The number of data points used for model parameterization was 1638.”

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Minor comments

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Comment 1: P4336, L24: “of it is limited”

Response: This mistake has been corrected in the revised manuscript.

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Changes in manuscript: “availability is limited”

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Comment 2: P4340, L16-17: typo: years are squared in the superscript

Response: After reviewing many papers in the biogeoscience fields that report trends, we found there are two ways in which trends are typically expressed: 1) PgC for annual flux and PgC yr⁻¹ for trends; and 2) PgC yr⁻¹ for annual flux and PgCyr⁻² (= pgCyr⁻¹/yr⁻¹) for trends. For example, the latter units were used in Ciais et al., 2011 (Philosophical Transactions of the Royal Society A), Piao et al. 2009 (Global Biogeochemical Cycles), and Sitch et al., 2015 (Biogeosciences). In this paper, this latter style is adopted.

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Comment 3: P4341, L12-14: “The RH and RA were nearly equivalent to each other, but in the regions of high RS, RH was greater than RA; and in the regions with low RS, RA was greater than RH”. Figures 7 and 8 show the opposite, please correct.

Response: Thank you for pointing out this error. It has been corrected in the revised manuscript.

Changes in manuscript: “but in the regions of high RS, RA was greater than RH; and in the regions with low RS, RH was greater than RA”

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Comment 4: Figure 1: I suggest including uncertainties to the functions to give an idea about the sources of uncertainties in global soil respiration

Response: The uncertainties have been included in the revised manuscript.

Changes in manuscript: Please see Fig. 1.

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Comment 5: Figure 9: it is inconvenient for the reader to open a supplementary file to identify the model in this figure; I think the figure will be improved if you put the model names on the x-axis rotated by 90 degrees or include the key in a separate panel of the same figure

Response: As suggested, the model names are now included in Fig. 9 of the revised manuscript.

Changes in manuscript: Please see Fig. 9.

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Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/12/C2901/2015/bgd-12-C2901-2015-supplement.pdf>

Interactive comment on Biogeosciences Discuss., 12, 4331, 2015.

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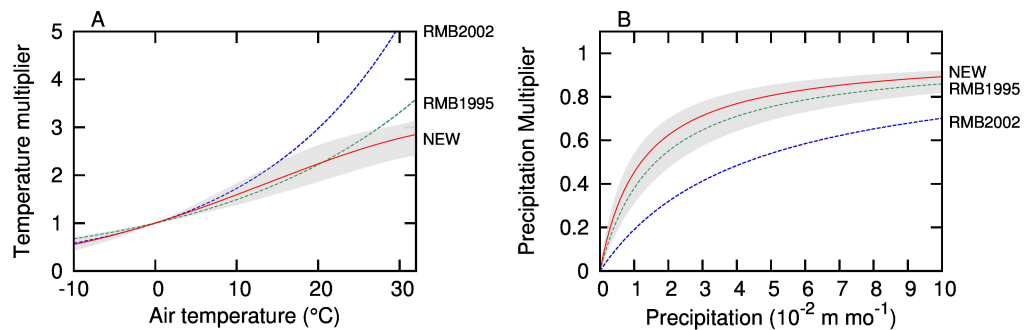


Fig. 1. new Fig. 1

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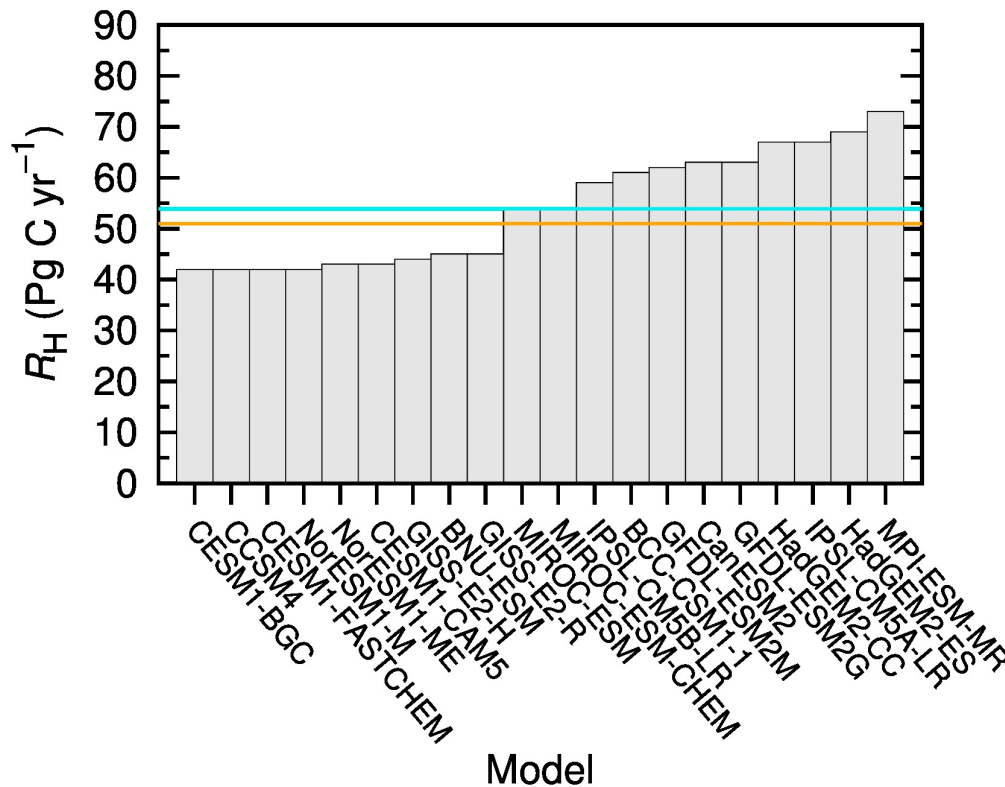


Fig. 2. new Fig. 9

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