

Dear Dr. Bowling,

We appreciated the constructive comments of the reviewers. We have addressed the comments below. Reviewer/editor comments are shown in bold with our responses in blue. Line numbers refer to the tracked changes manuscript, and changes to the text are underlined.

Anonymous referee #1

In general, I am satisfied with the author's thoughtful response to my comments (as well as author responses to reviewer #2 that expressed similar concerns) and I think that the paper is an important contribution to this issue of regional fluxes and their underlying processes. However, I am a bit confused about how the regional net fluxes are calculated in the revised figure 2. After all, the mismatch between the models and observationally constrained fluxes provides the rationale for the rest of the study. In the revised figure 2 there are apparent mismatches between OCO2 inversion estimates of NEE and the trendy model estimates of NEE, but not necessarily in the estimates of GPP. Therefore, I am surprised that these mismatches do not propagate to the inferred estimates of TER. For instance, over the cold region in July there is ~ 2 gC m⁻² day⁻¹ difference between IS NEE and TRENDY NEE and virtually no difference in GPP and yet the difference in TER seems to only be ~ 1 gC m⁻² day⁻¹. How is this possible? Were fire emissions included in the inversion estimates but probably not in the models, in which case we are not comparing the same fluxes? If we do not see big differences in TER, then the elegant thought experiment of Rh variability with soil depth seems less meaningful. I believe the authors that the DGVMs probably do a crummy job of simulating soil Rh, but if they are getting overall TER correct for the wrong reasons do we care that much.

This may be a bit of an optical illusion as the magnitude of data-model mismatches are very similar for NEE and TER plots. One could be misled due to the fact that the y-axis shows a much larger ranges for GPP and TER than for NEE. To mitigate this, we have revised the Fig. 2 and 3 so that the background grid has horizontal lines every 0.5 gC m⁻² day⁻¹ for each plot (see below).

Both the TRENDY and inversion NEE estimates are consistent in that they do not include fire emissions. We describe that we subtract fire emissions from the inversions in Sec. 2.2.

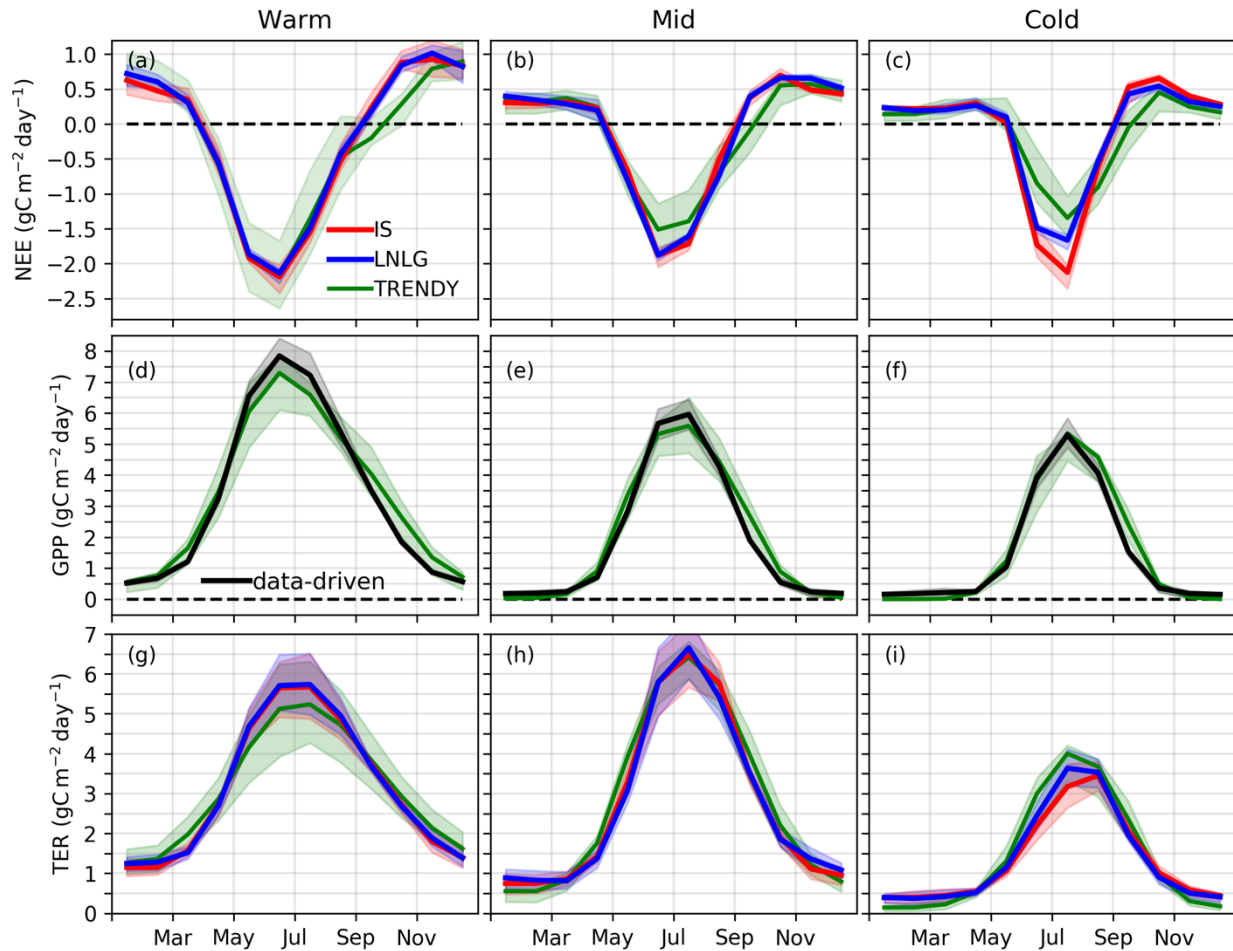


Figure 2. Monthly carbon cycle fluxes (average of 2015, 2016 and 2018; 2017 is excluded due to an OCO-2 data gap). (a-c) Mean (solid line) and interquartile range (shaded area) of NEE for the ensemble of IS (red) and LNLG (blue) v9 OCO-2 MIP and for the TRENDY ensemble (green). (d-f) GPP for the TRENDY ensemble (green) and data-driven datasets (black). (g-i) TER simulated by the TRENDY ensemble (green) and calculated from combining the data-driven GPP with the IS (red) and LNLG (blue) v9 OCO-2 MIP NEE constraints.

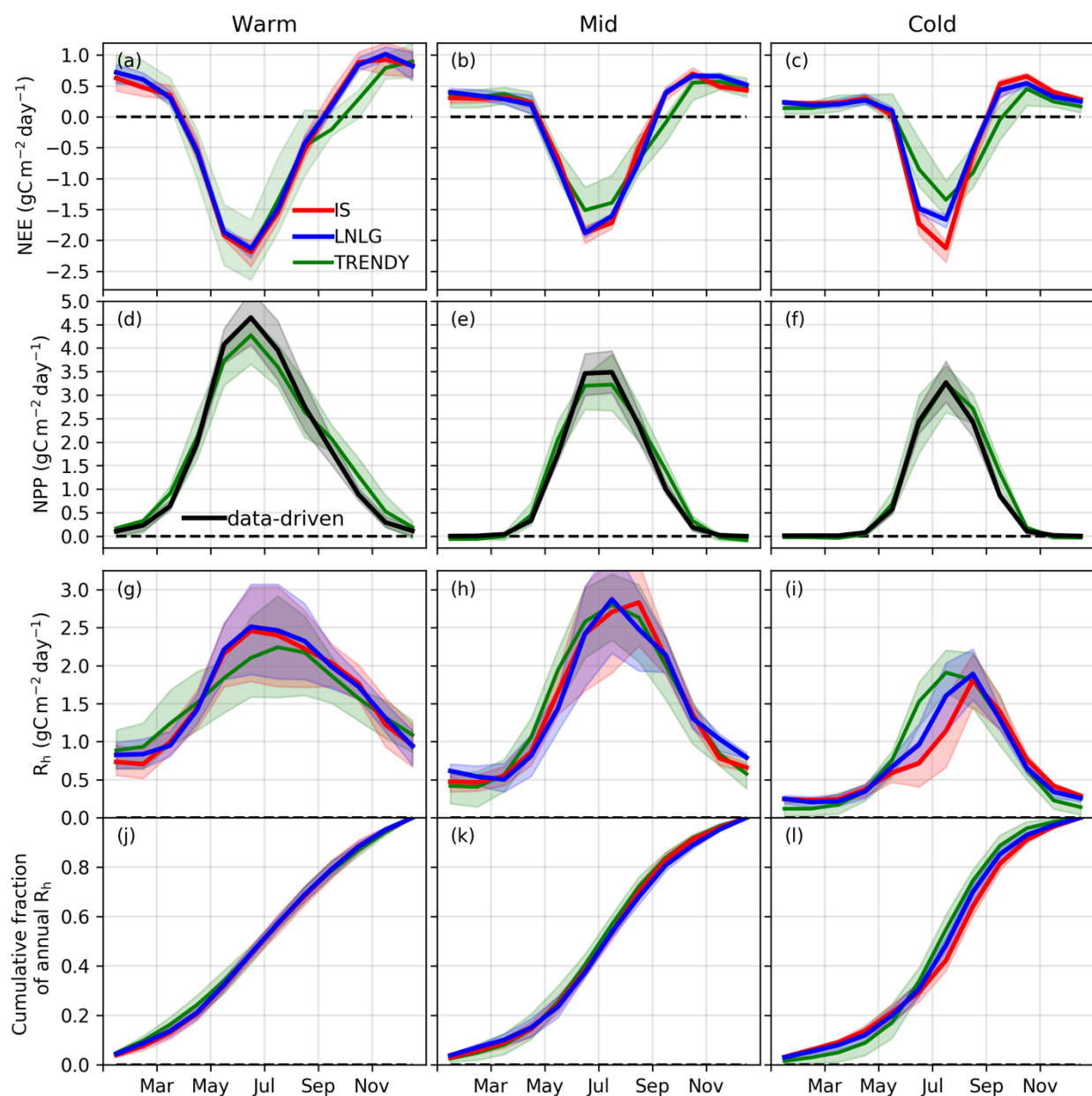


Figure 3. Monthly carbon cycle fluxes (average of 2015, 2016 and 2018; 2017 is excluded due to an OCO-2 data gap). (a-c) Mean (solid line) and interquartile range (shaded area) of NEE for the ensemble of IS (red) and LNLG (blue) v9 OCO-2 MIP and for the TRENDY ensemble (green). (d-f) NPP for the TRENDY ensemble (green) and estimated from data-driven GPP (black). (g-i) R_h simulated by the TRENDY ensemble (green) and calculated from combining the data-driven NPP with the IS (red) and LNLG (blue) v9 OCO-2 MIP NEE constraints. (j-l) Cumulative fraction of R_h over the growing season. Figure S7 shows these fluxes per unit area

Anonymous referee #2

The manuscript is improved and I thank the authors for their careful edits. I think the authors have responded to all points that I had made, except for one, and so the manuscript is acceptable beyond the one caveat.

The one exception is the data availability statement regarding the TRENDY model output. The revised text reads, "TRENDY v8 gridded data can be accessed through the website <https://sites.exeter.ac.uk/trendy>." I believe that this is not correct, I can't find on that website exactly how to access the DGVM data, all that I can find under the "data policy" tab is that the TRENDY PIs need to be contacted for data. So I believe that this does not qualify as publicly accessible data. Biogeoscience's data availability policy https://www.biogeosciences.net/policies/data_policy.html states, "If the data are not publicly accessible, a detailed explanation of why this is the case is required." So please either provide a description of where and how the DGVM output data can be publicly accessed, or a detailed explanation of why it is not publicly accessible.

Yes, that is correct, the instructions from the site indicate to contact TRENDY PIs. We did this and the data was provided by Stephen Sitch. This has been clarified in the data availability statement:

"TRENDY v8 gridded data were accessed by contacting Stephen Sitch following the TRENDY data policy described on their website: <https://sites.exeter.ac.uk/trendy>."

I am not a member of TRENDY and only a data user. I have no ability to influence their data policy.