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Biogeosciences Discussions
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Interactive comment on "Leveraging the signature of heterotrophic respiration on atmospheric CO_2 for model benchmarking" *by* Samantha J. Basile et al.

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This paper connected heterotrophic respiration and atmospheric CO2 concentrations, and examined impact of signals of heterotrophic respiration on atmospheric CO2 using model outputs. This study suggests that the atmospheric CO2 concentrations could be used to verify the global estimation of heterotrophic respiration, and furthermore verify models. The idea is interesting and the manuscript is basically clear. I have just a couple of comments.

We thank the reviewer for their time and comments.

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The diagram of your analysis (kind of flowchart) is necessary to understand this analysis.

We appreciate the need for clarification in this interdisciplinary work and have added a new Figure 1 flow chart to the figure list, along with an introductory description in section 2. Figure 1 shows a flow chart depiction of the analysis process from soil model fluxes to simulated CO2 concentration and comparison with NOAA observations.

Seasonal cycles of HR in Fig. 2: The peaks of HR in middle and high latitudes of northern hemisphere are in autumn (Sep to Oct). Is this widely accepted? For me, the peaks should be in July-Sep. Are the heterotrophic respiration and NPP you used well correlated with observation data oriented estimates in terms of amount, seasonality, and spatial pattern? This is important for this study.

The HR fluxes have been evaluated in Wieder et al., 2018. Figure 2 (now Figure 4) shows the seasonal cycle of atmospheric CO2 arising from HR fluxes, thus showing the cumulative imprint of HR fluxes. While the HR flux might peak in July-Sep, the CO2 concentration from HR continues to accumulate in the atmosphere leading to the peak in autumn.

There seems several jargons which the authors should explain more carefully or replace them with easier wordings.

We thank the reviewer for this note and have made a conscientious effort throughout the revisions to add additional explanation and remove jargon.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2019-256/bg-2019-256-AC2-supplement.pdf

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Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-256, 2019.

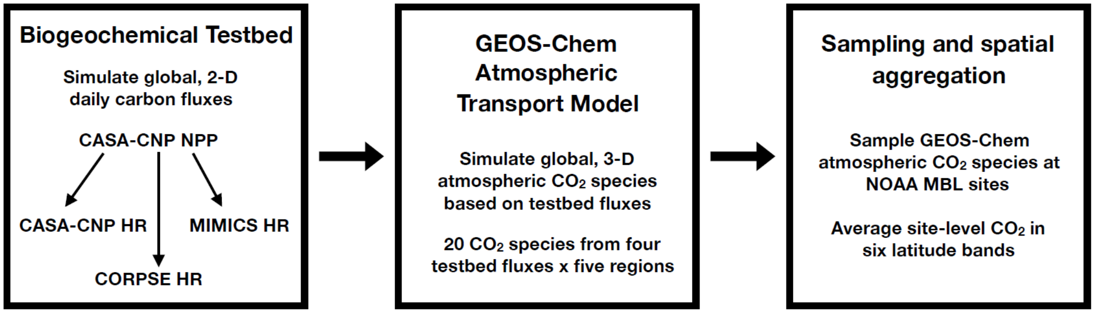

Fig. 1. Figure 1: Flow chart depiction of the analysis process from soil model fluxes to simulated CO2 concentration and comparison with NOAA observations.

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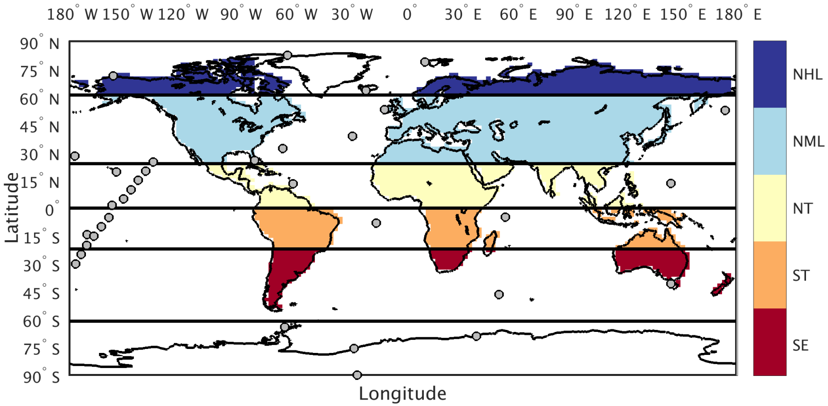

Fig. 2. Figure 2: Tagged flux regions and marine boundary layer CO2 observing sites used in our analysis. The 5 tagged flux regions are shown in color fill: Northern High Latitude (NHL), Northern Mid-Latitude

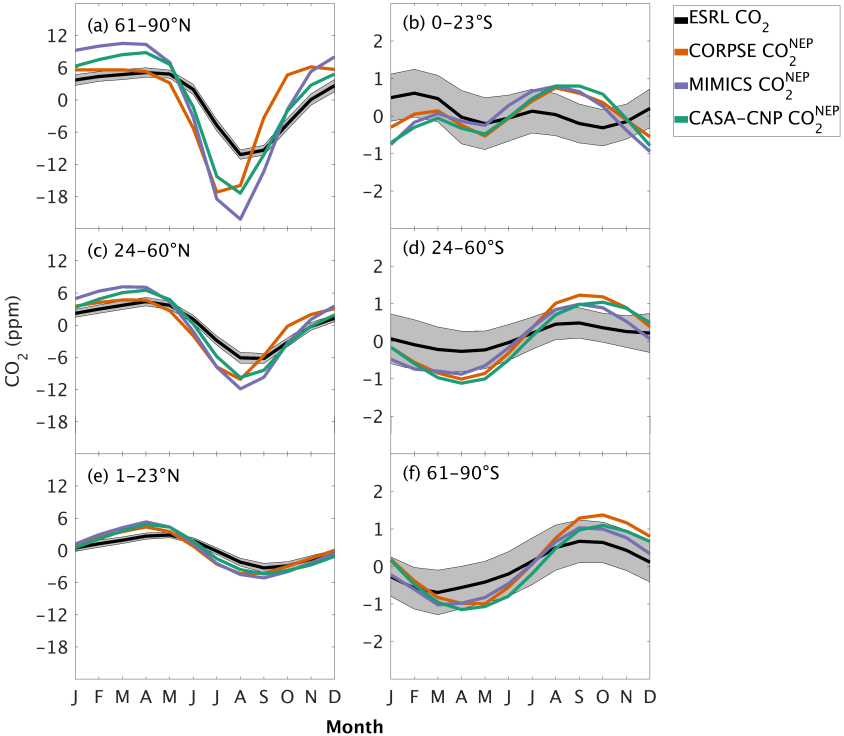

Fig. 3. Figure 3: Climatological annual cycle (median) of CO2 for observations (black) and global net ecosystem productivity flux (CO2NEP, colors) between 1982 and 2010. Monthly climatology values were create

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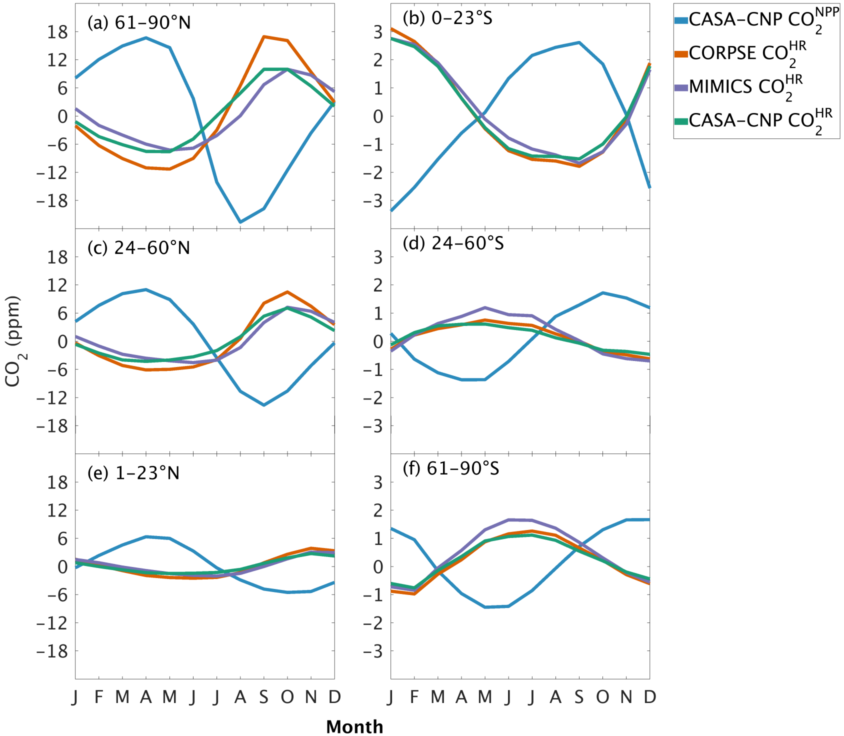

Fig. 4. Figure 4: Climatological annual cycle (median) of atmospheric CO2 simulated from land fluxes (CO2NPP, CO2HR) between 1982 and 2010. Monthly climatology values were created after detrending the CO2 tim

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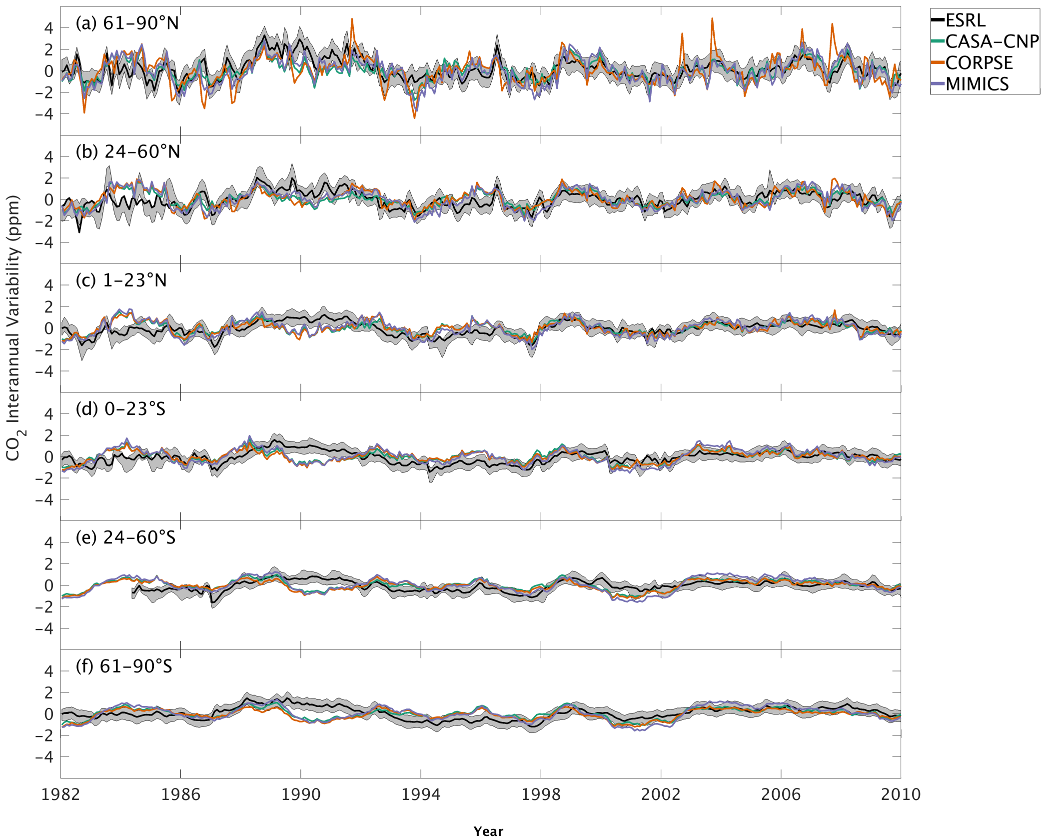

Fig. 5. Figure 5: Interannual variability of CO2 from global net ecosystem productivity (CO2NEP IAV) for testbed models (colors) and marine boundary layer observations from the NOAA ESRL network (black). Gra

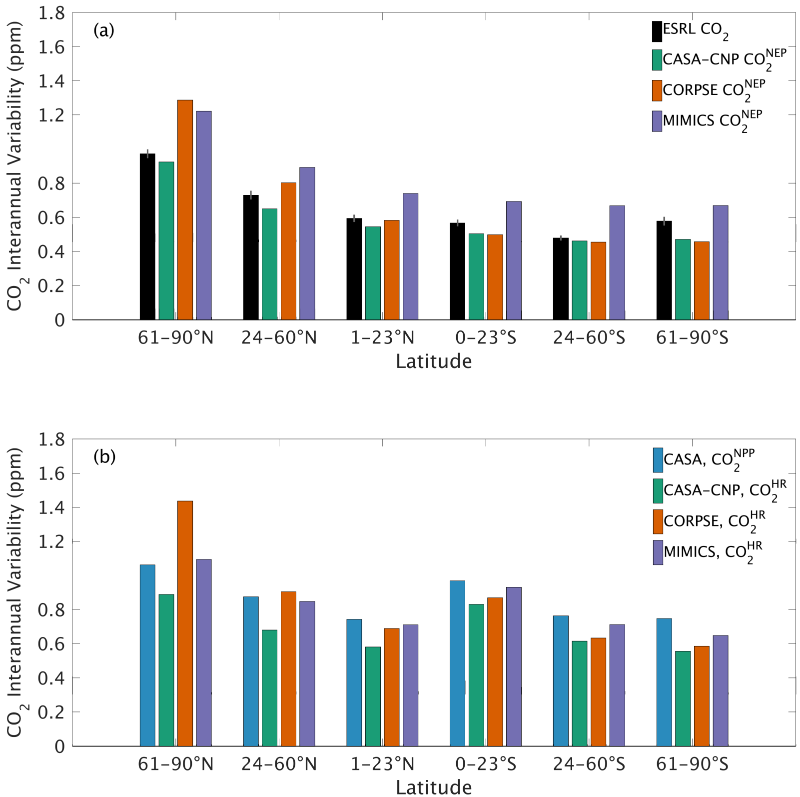

Fig. 6. Figure 6: Magnitude of CO2 interannual variability resulting from (a) individual flux components (CO2NPP IAV, CO2HR IAV) and (b) global net ecosystem productivity (CO2NEP IAV). Observed CO2 IAV from N

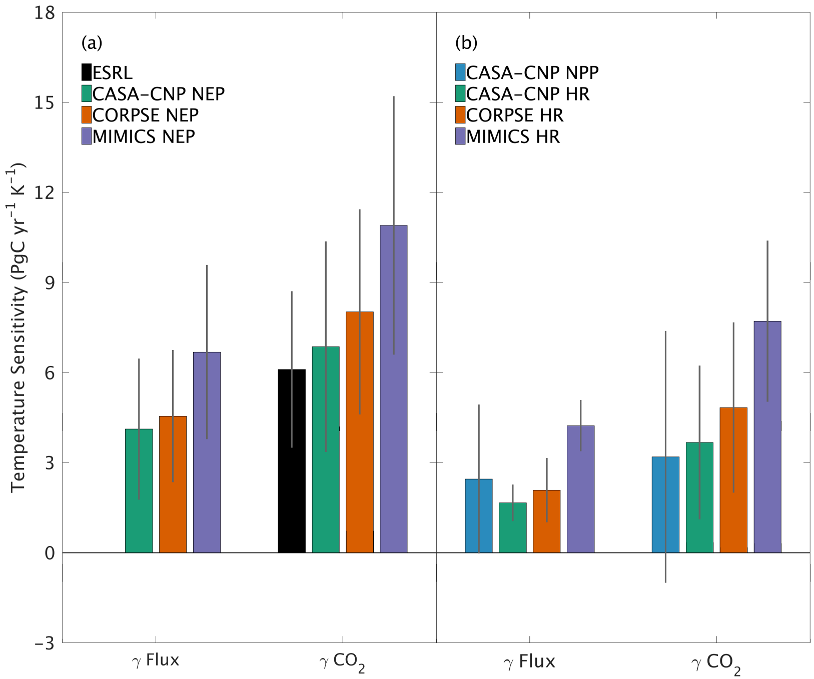

Fig. 7. Figure 7: Temperature sensitivity (γ) calculated for interannual variability (IAV) of CASA-CNP air temperature and (a) flux IAV and corresponding CO2 growth rate anomalies, (b) NEP IAV and CO2NEP grow

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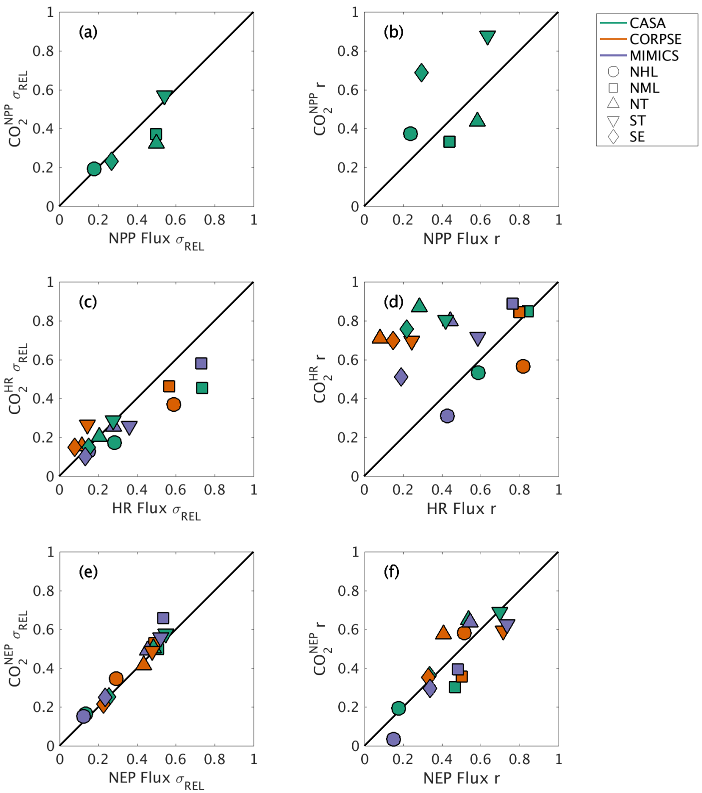

Fig. 8. Figure 8: Comparison of regional and global interannual variability (IAV) from land fluxes and resulting atmospheric CO2 between 1982 and 2010. (a, c, e) Normalized ratio taken between regional IAV an

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