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Supplement of

The impact of spatiotemporal variability in atmospheric CO_2 concentration on global terrestrial carbon fluxes

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Supplement

PFT number	Description
0	Bare soil
1	Needleleaf evergreen temperate tree
2	Needleleaf evergreen boreal tree
3	Needleleaf deciduous boreal tree
4	Broadleaf evergreen tropical tree
5	Broadleaf evergreen temperate tree
6	Broadleaf deciduous tropical tree
7	Broadleaf deciduous temperate tree
8	Broadleaf deciduous boreal tree
9	Broadleaf evergreen temperate shrub
10	Broadleaf deciduous temperate shrub [moisture + deciduous]
11	Broadleaf deciduous temperate shrub [moisture stress only]
12	Broadleaf deciduous boreal shrub
13	Arctic c3 grass
14	Cool c3 grass [moisture + deciduous]
15	Cool c3 grass [moisture stress only]
16	Warm c4 grass [moisture + deciduous]
17	Warm c4 grass [moisture stress only]
18	Crop [moisture + deciduous]
19	Crop [moisture stress only]

Table S1. The 19 PFTs used in Catchment-CN model. The split types are defined as in Koster et al. (2014).

Case	GPP	ΔGPP to 3hCO2 (PgC year^{-1})	NBP	ΔNBP to 3hCO2 (PgC year^{-1})
3hCO2	127.545	--	0.527	--
dCO2	128.038	0.492	0.626	0.099
mCO2	128.040	0.495	0.627	0.100
maCO2	128.059	0.513	0.632	0.105
magCO2	128.007	0.461	0.620	0.093
magtCO2	128.004	0.458	0.618	0.091
cCO2	128.082	0.536	0.616	0.089

Table S2: Differences in mean global GPP and NBP compared to the ctrl case (3hCO2). The values are global mean of 2001-2014.

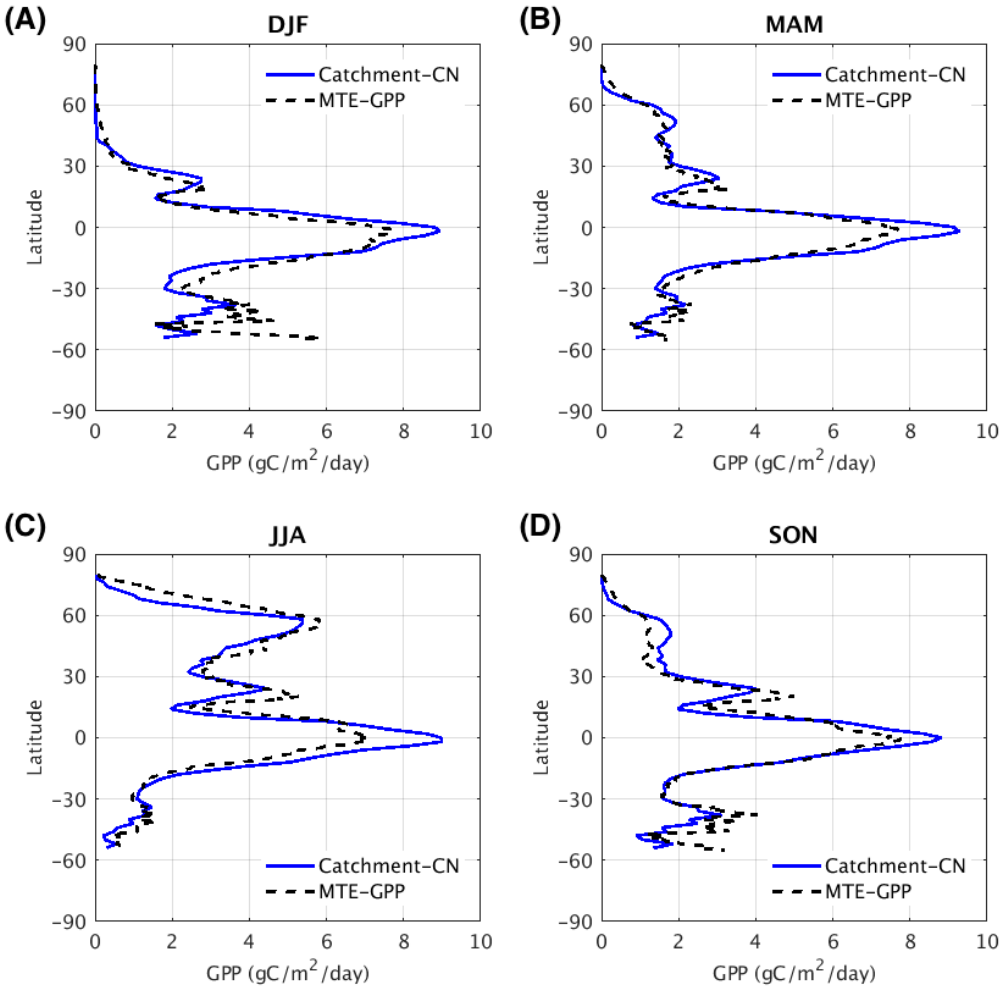

Fig. S1. Zonal mean GPP of 2002-2011 (solid blue: Catchment-CN model; dotted black: MTE-GPP) for each season (a) December-January-February, (b) March-April-May, (c) June-July-August, and (d) September-October-November.

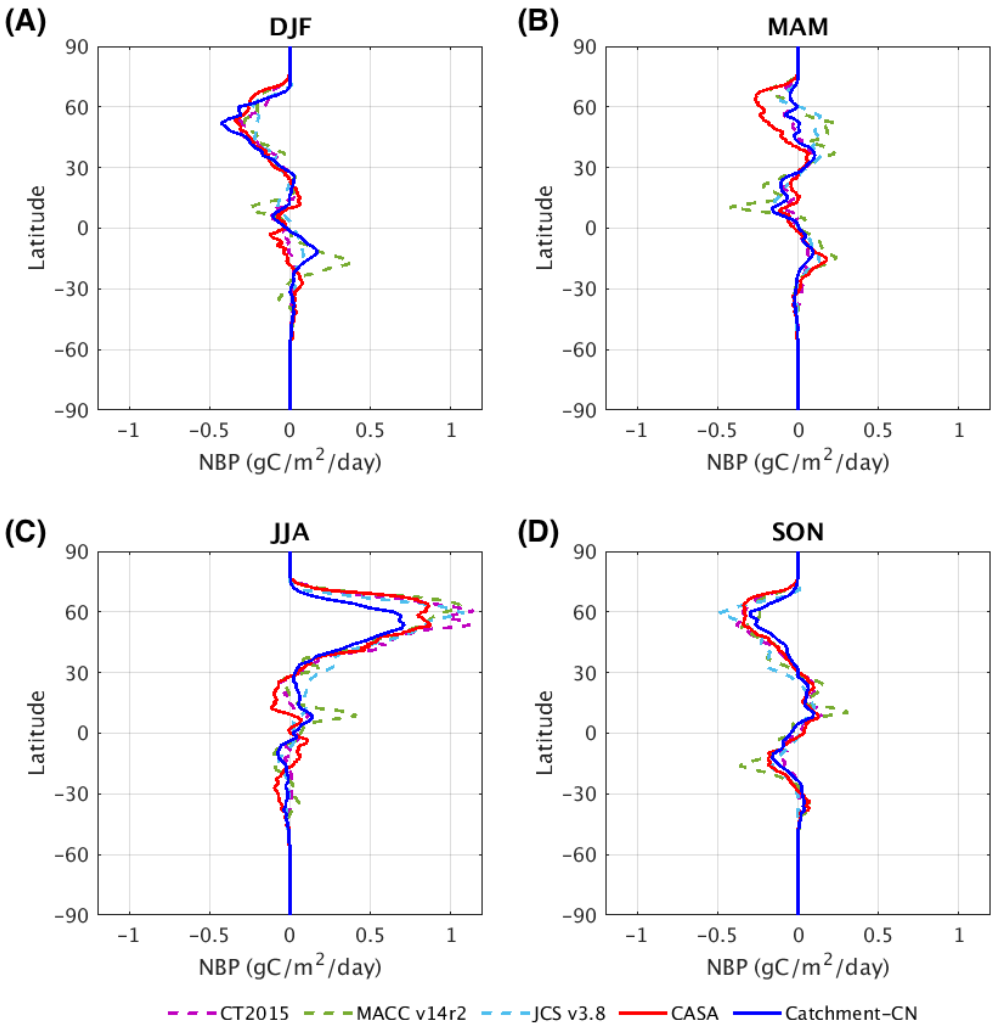

Fig. S2. Mean seasonal NBP of (a) DJF, (b) MAM, (c) JJA and (d) SON, of the Catchment-CN model (blue), the CASA-GFED3 model (red), and inversions (dotted lines) for the period of 2004-2014.

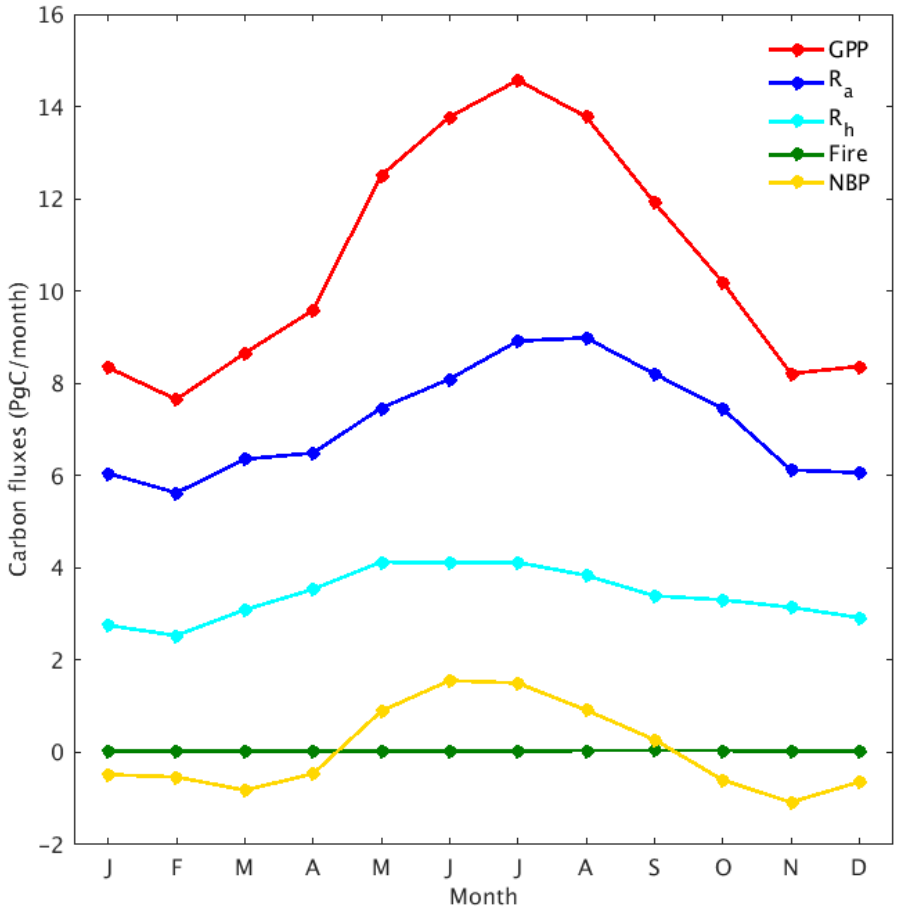

Fig. S3. Annual cycles of GPP (red), Ra (blue), Rh (cyan), fire (green), and NBP (yellow). The values are mean of 2001-2014.

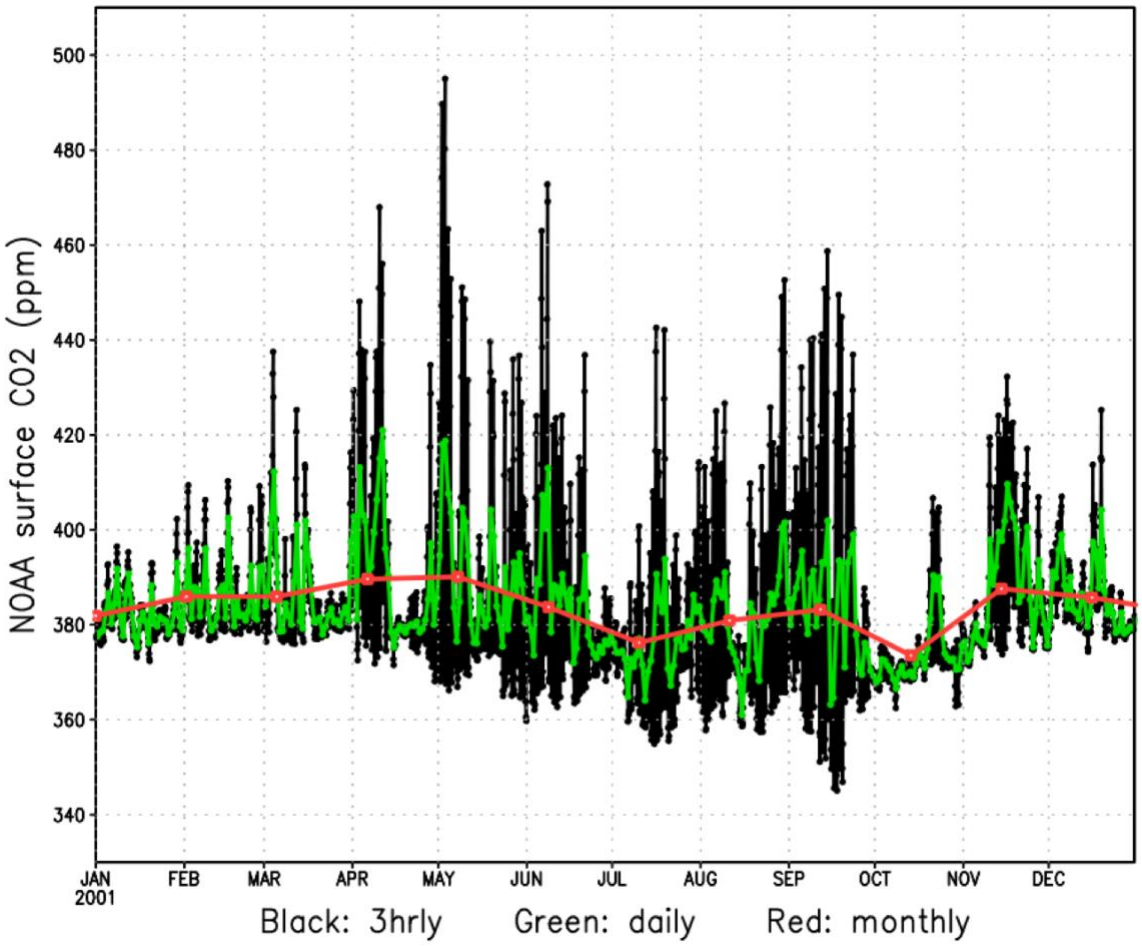

Fig. S4. An example of the surface-level atmospheric CO_2 from the CarbonTracker at 37N and 79W for year 2001. The amplitude of the diurnal cycle (black) varies as much as 120ppm in early growing season, while the seasonal change of CO_2 (red) varies only about 20ppm. Green indicates the mean daily CO_2 and red the mean monthly CO_2.

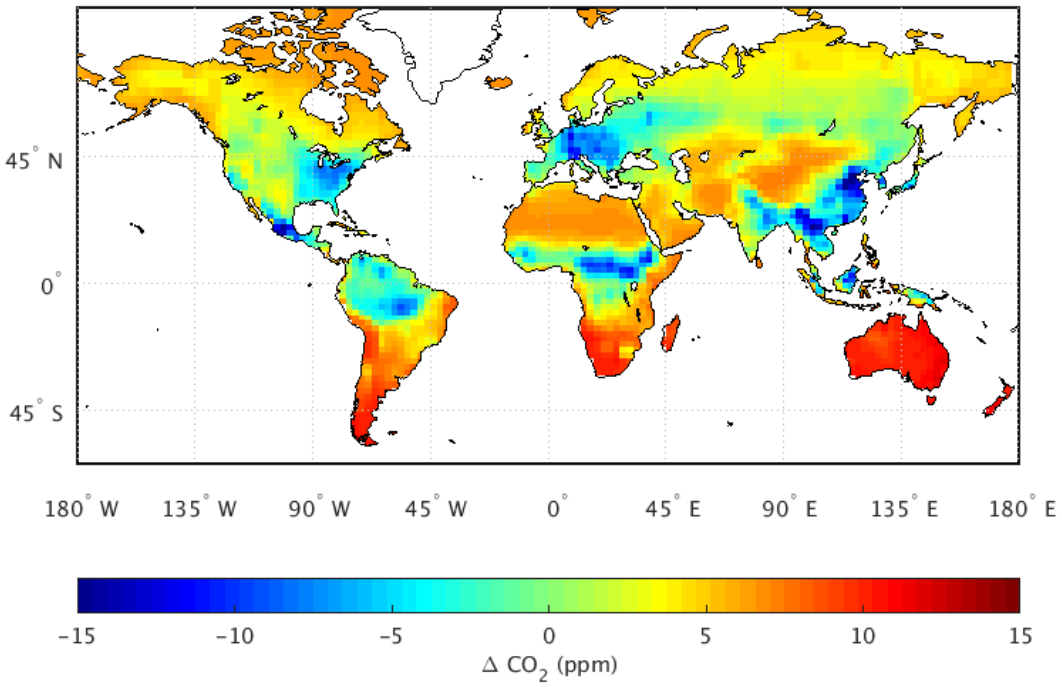

Fig. S5. Difference in the time mean of the CO_2 concentration (magCO2 minus maCO2).

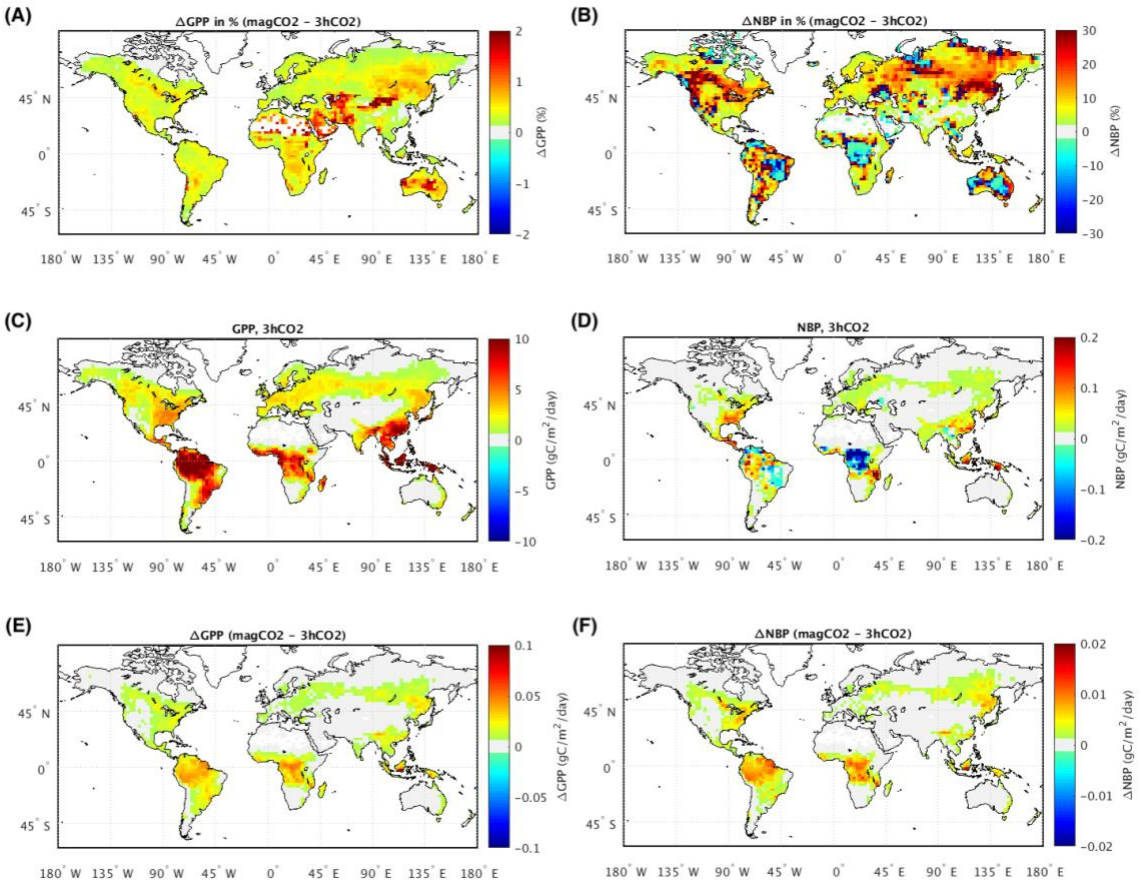

Fig. S6. Percentage differences in mean annual (a) GPP and (b) NBP between the commonly used CO2 forcing (magCO2) and the control (3hCO2). The mean values of the control case and the differences that are used to compute the percentage differences in (a) and (b) are presented in (c)-(f).

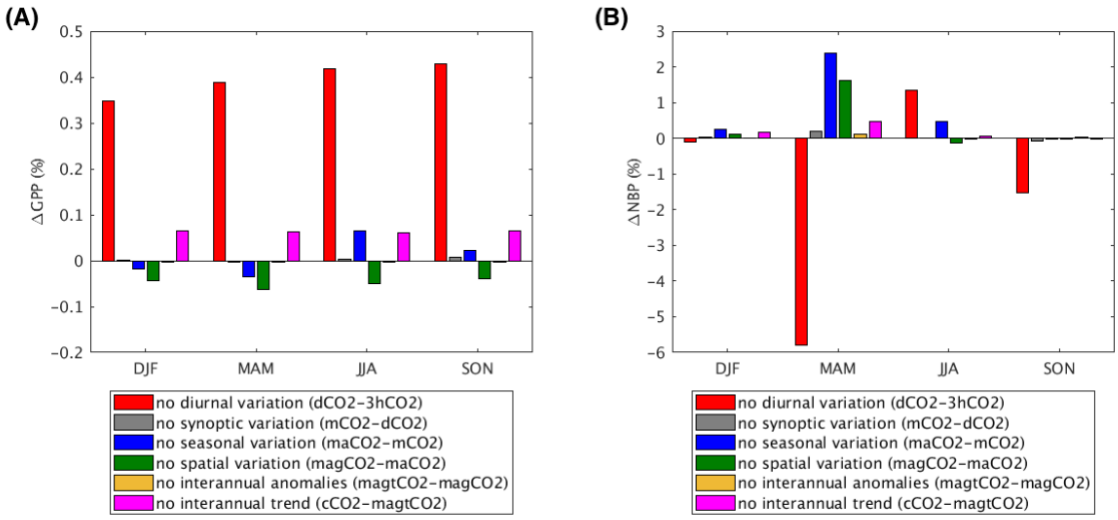

Fig. S7. Difference in mean global (a) GPP and (b) NBP for DJF, MAM, JJA, and SON, by removing each variability of the atmospheric CO_2 concentrations.