



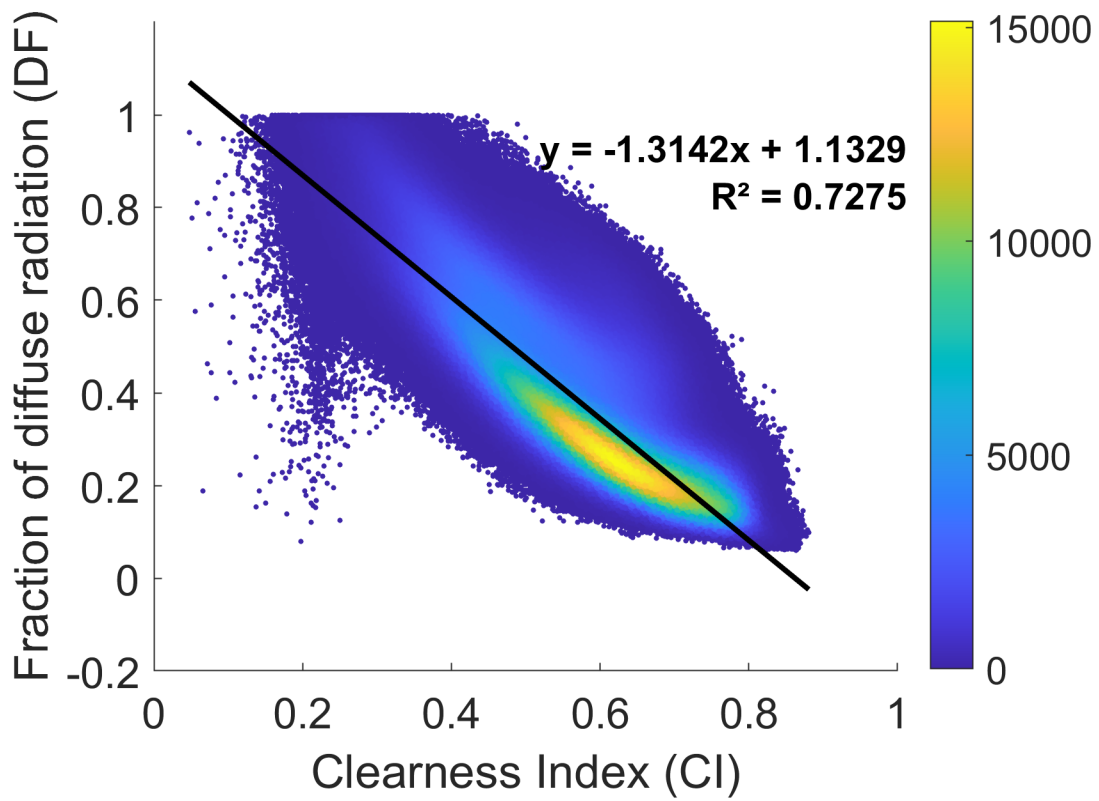
Supplement of

Ecosystem climate sensitivities drive the divergence in aerosol-induced carbon uptake across CMIP6 models

Zhaoyang Zhang et al.

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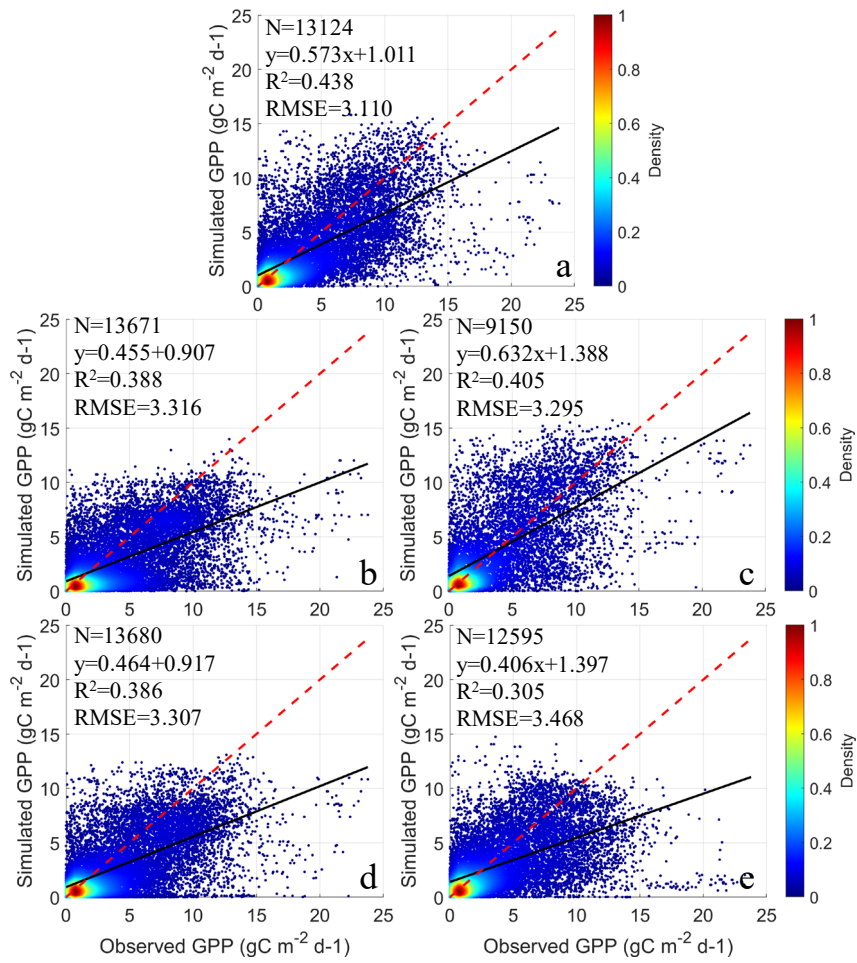
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15 Figure S1. The scatter plots of fraction of diffuse radiation (DF) against the clearness index (CI)

16 from NorESM2-LM and UKESM1-0-LL.

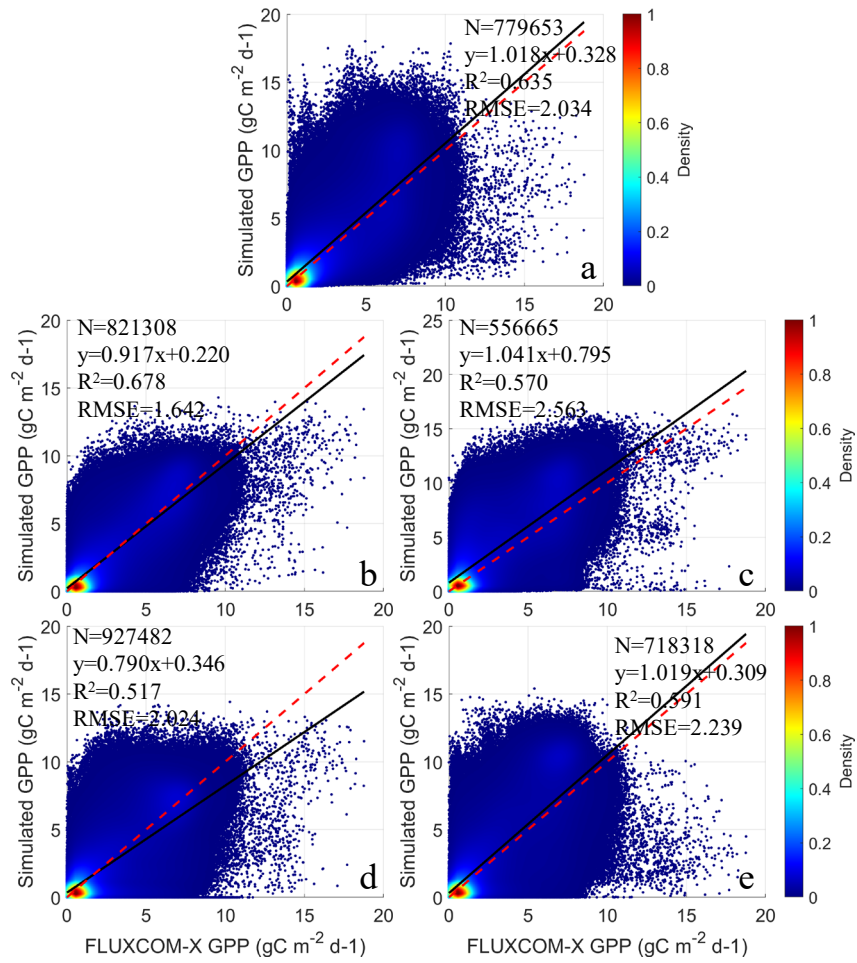


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18 Figure S2. The scatter plots of simulated monthly GPP from CMIP6 models (a. BCC-ESM1, b. IPSL-

19 CM6A-LR, c. MPI-ESM-1-2-HAM, d. NorESM2-LM, e. UKESM1-0-LL) against observed GPP from

20 FLUXNET sites.

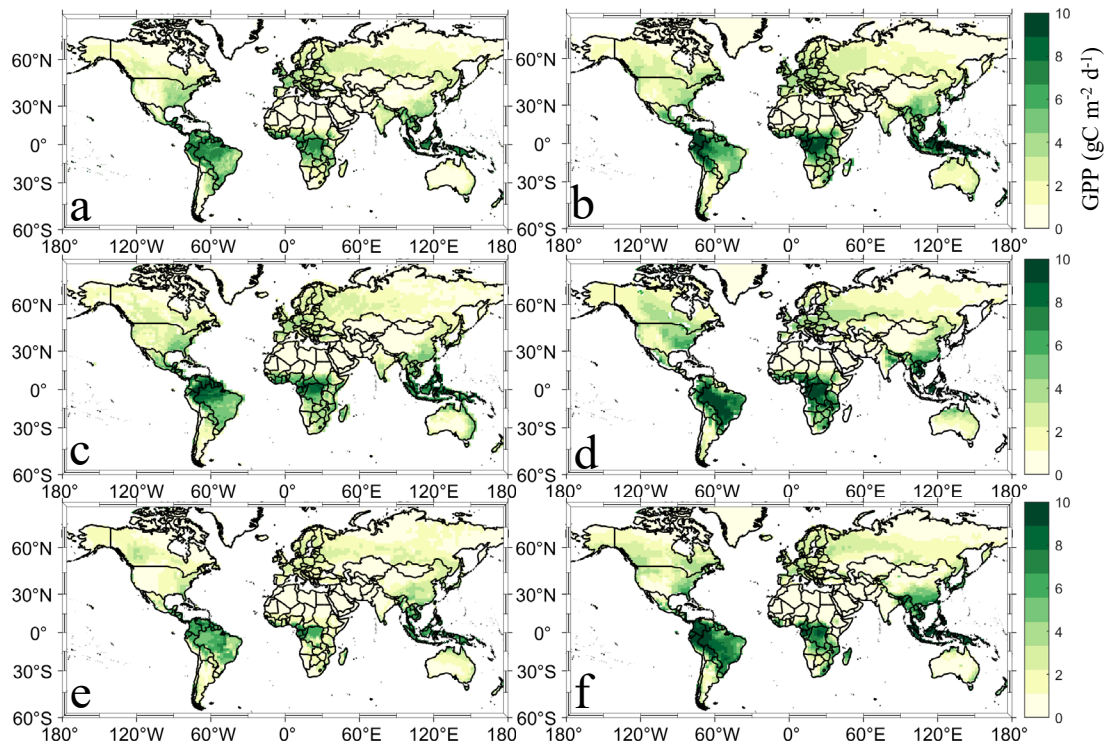


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22 Figure S3. The scatter plots of simulated monthly GPP from CMIP6 models (a. BCC-ESM1, b. IPSL-

23 CM6A-LR, c. MPI-ESM1-2-HAM, d. NorESM2-LM, e. UKESM1-0-LL) against GPP from

24 FLUXCOM-X.



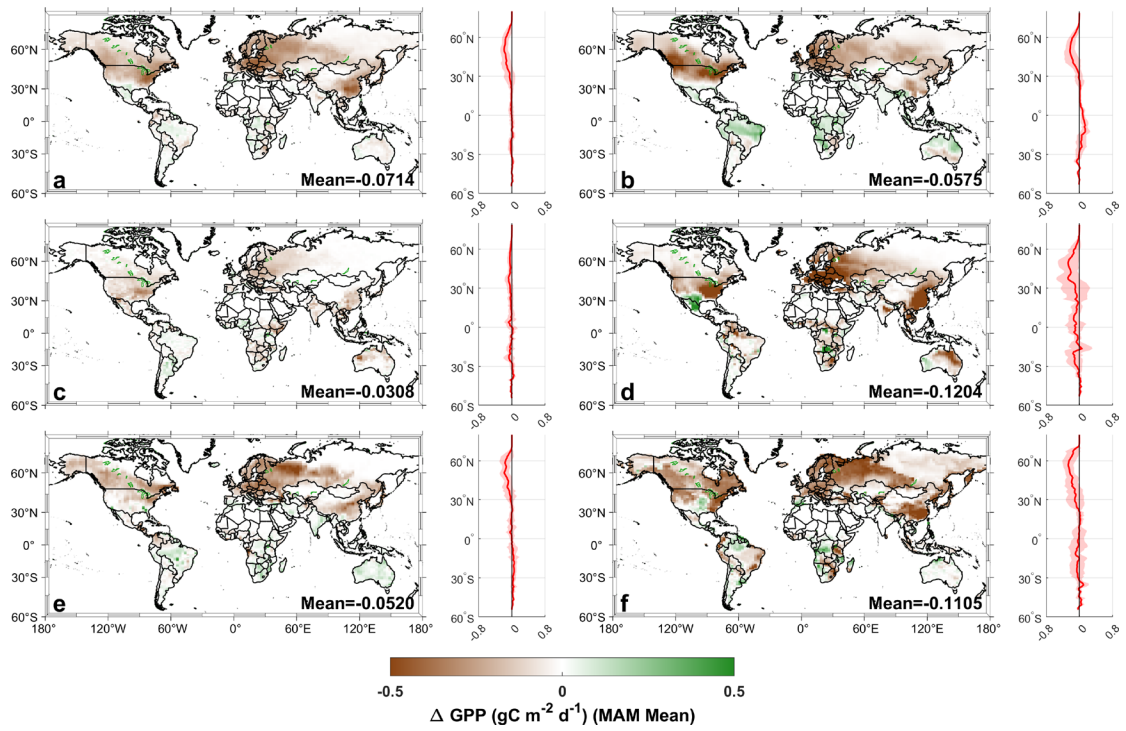
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26 Figure S4. The spatial distribution of observed and simulated GPP from 2001 to 2014 (a. FLUXCOM-

27 X, b. BCC-ESM1, c. IPSL-CM6A-LR, d. MPI-ESM-1-2-HAM, e. NorESM2-LM, f. UKESM1-0-LL).

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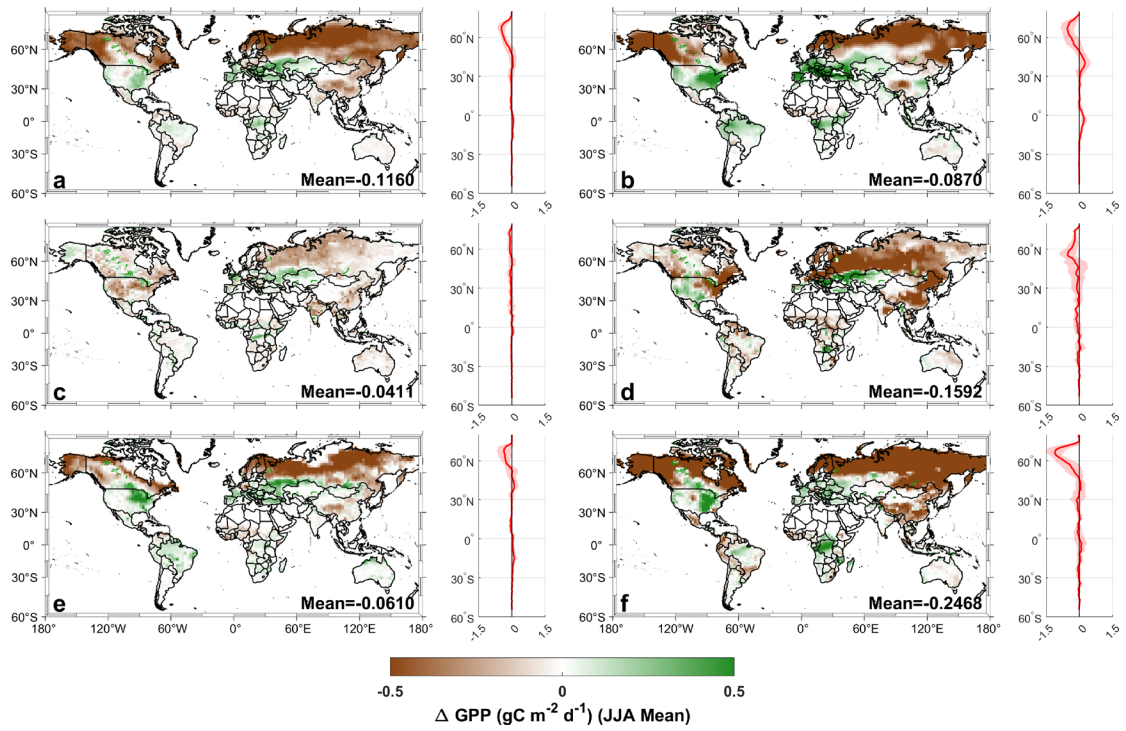
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31 Figure S5. The spatial pattern of changes in ecosystem GPP induced by aerosols from CMIP6 models (a.

32 multi-model mean, b. BCC-ESM1, c. IPSL-CM6A-LR, d. MPI-ESM-1-2-HAM, e. NorESM2-LM, f.

33 UKESM1-0-LL) from March to May.

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36 Figure S6. The spatial pattern of changes in ecosystem GPP induced by aerosols from CMIP6 models (a.

37 multi-model mean, b. BCC-ESM1, c. IPSL-CM6A-LR, d. MPI-ESM-1-2-HAM, e. NorESM2-LM, f.

38 UKESM1-0-LL) from June to August.

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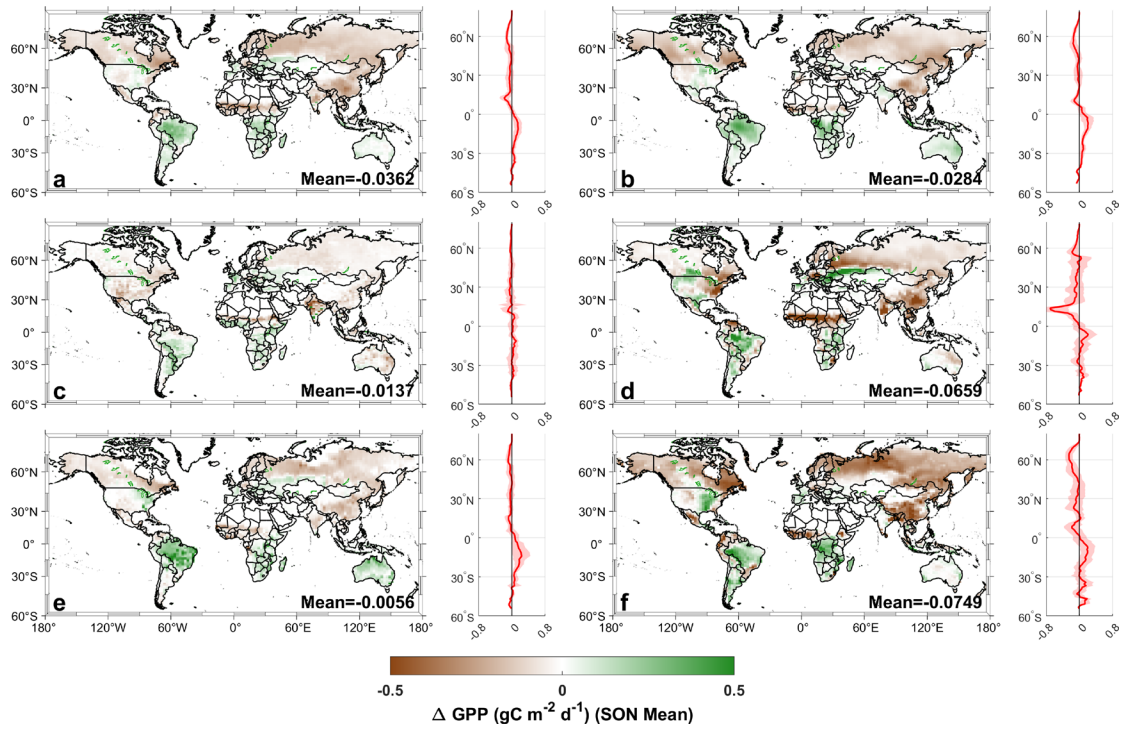


Figure S7. The spatial pattern of changes in ecosystem GPP induced by aerosols from CMIP6 models (a. multi-model mean, b. BCC-ESM1, c. IPSL-CM6A-LR, d. MPI-ESM-1-2-HAM, e. NorESM2-LM, f. UKESM1-0-LL) from September to November.

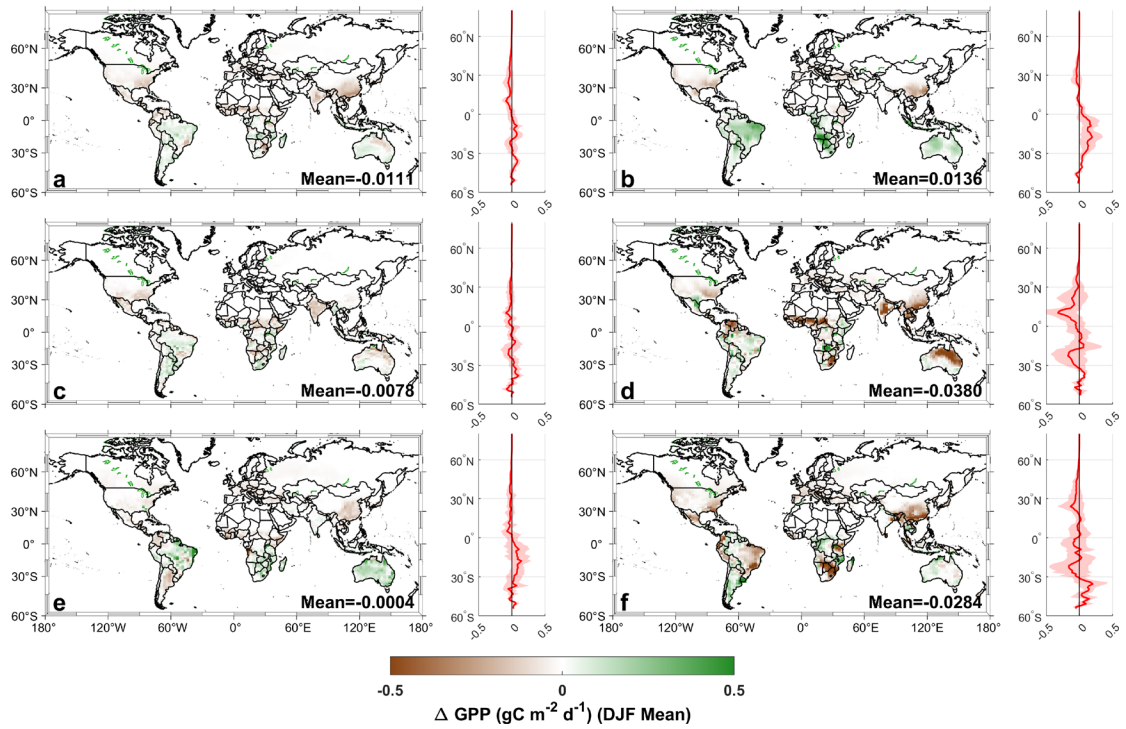
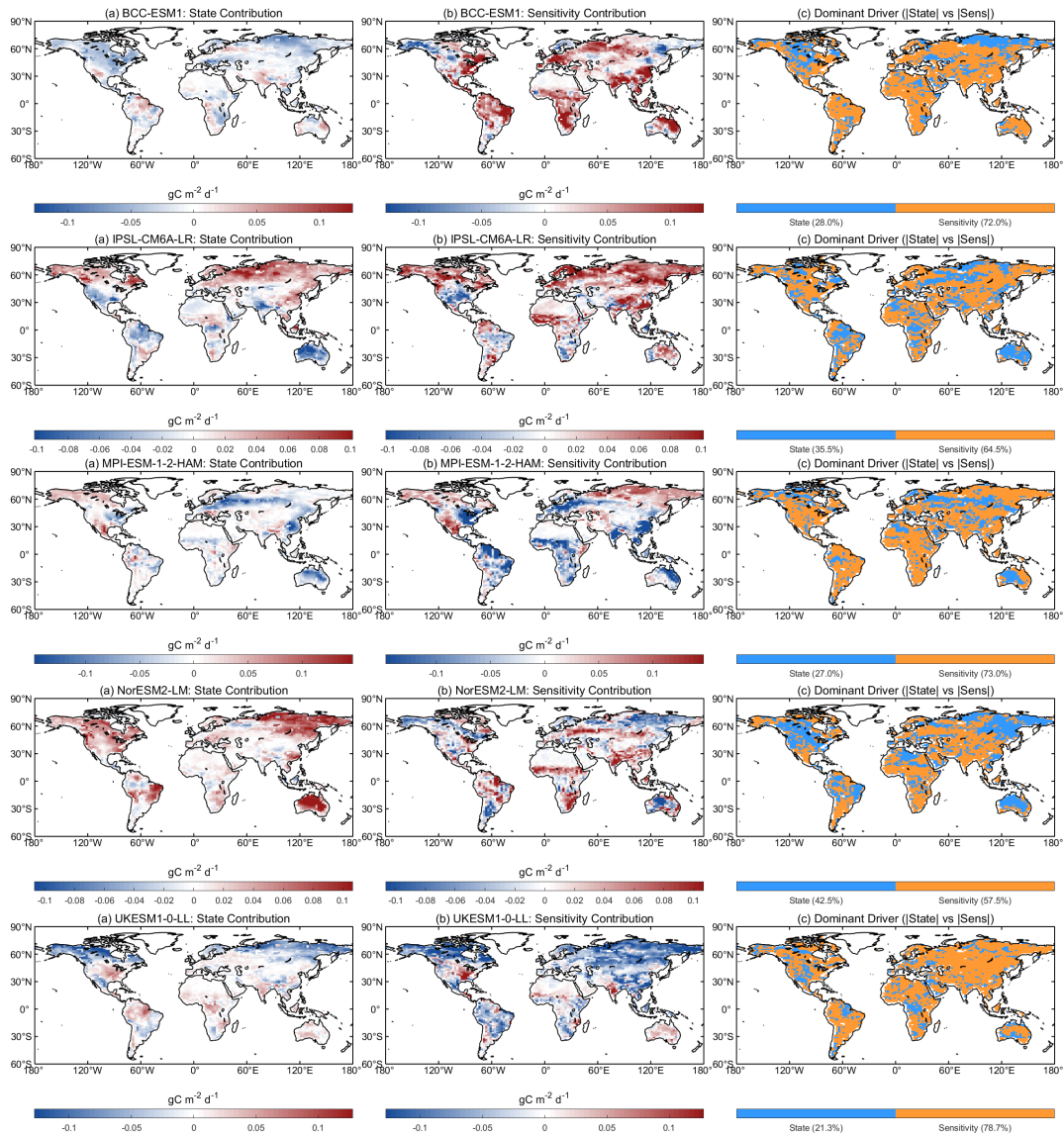


Figure S8. The spatial pattern of changes in ecosystem GPP induced by aerosols from CMIP6 models (a.

multi-model mean, b. BCC-ESM1, c. IPSL-CM6A-LR, d. MPI-ESM-1-2-HAM, e. NorESM2-LM, f.

UKESM1-0-LL) from December to February.



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53 Figure S9. The spatial pattern of sensitivity contribution and state contribution and dominant driver

54 across Earth System Models (ESMs).

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56 Table S1. Coefficient of determination (R^2) of the multivariate attribution framework in reproducing
 57 aerosol-induced GPP anomalies across Earth System Models per Plant Functional Type (PFT). ENF,
 58 Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf Forest;
 59 MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
 60 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	0.836	0.851	0.743	0.961	0.837
EBF	0.686	0.692	0.887	0.906	0.496
DBF	0.949	0.979	0.989	0.906	0.849
MF	0.660	0.729	0.867	0.901	0.433
OSH	0.880	0.811	0.859	0.764	0.751
WSA	0.779	0.830	0.792	0.870	0.521
SAV	0.807	0.786	0.757	0.787	0.651
GRA	0.682	0.804	0.645	0.814	0.420
WET	0.970	0.985	0.842	0.942	0.973
CRO	0.635	0.832	0.853	0.805	0.496
BAR	0.670	0.925	0.778	0.818	0.611

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66 Table S2: Sensitivity Coefficients for Total Radiation (β_{PAR}) per Plant Functional Type (PFT). ENF,
67 Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf Forest;
68 MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
69 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	0.060004	-0.009846	0.099274	0.070613	-0.000013
EBF	0.015620	0.041606	-0.087938	-0.037287	-0.112900
DBF	0.024524	0.016964	0.031943	0.043793	0.054809
MF	0.078144	0.017688	0.085544	0.042982	0.127988
OSH	0.029205	0.016505	0.032895	0.030918	0.067173
WSA	0.045420	0.002403	0.075611	0.032405	0.105841
SAV	0.043868	0.015162	0.080874	0.005151	0.114596
GRA	0.024818	0.001811	0.045616	0.010737	0.072748
WET	0.009624	0.013132	0.052078	0.021471	0.177116
CRO	0.017304	-0.008540	0.066934	0.020178	0.055000
BAR	-0.003314	0.000968	0.005285	0.007699	0.046106

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74 Table S3: Sensitivity Coefficients for Canopy Structure (β_{fPAR}) per Plant Functional Type (PFT).
 75 ENF, Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf
 76 Forest; MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
 77 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	0.114436	0.024338	0.006533	0.033213	0.061316
EBF	0.052473	0.075333	0.032322	0.057174	0.031813
DBF	0.078090	0.040978	0.079064	0.031206	-0.045522
MF	0.069046	0.031780	0.029651	0.035106	0.021965
OSH	0.038614	0.024632	0.007610	0.038204	0.012023
WSA	0.085676	0.026879	0.023365	0.029852	0.013253
SAV	0.051983	0.029588	0.023297	0.029316	0.026310
GRA	0.042318	0.025701	0.010717	0.023344	0.015249
WET	0.102288	0.031689	0.046637	0.031017	0.034506
CRO	0.030129	0.034112	0.029883	0.024567	0.007116
BAR	0.024839	0.021880	0.004078	0.010107	0.003583

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82 Table S4: Sensitivity Coefficients for Temperature (β_{Tas}) per Plant Functional Type (PFT). ENF,
83 Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf Forest;
84 MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
85 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	-0.002190	0.000240	-0.001651	0.000182	0.001585
EBF	0.001295	-0.000456	-0.003084	-0.000612	-0.003118
DBF	-0.000878	-0.000147	0.000666	-0.000001	0.001457
MF	-0.000185	-0.000032	-0.001440	-0.000465	-0.000310
OSH	0.000757	0.000585	0.000048	-0.000117	0.000593
WSA	-0.000888	0.000096	-0.000827	-0.000381	0.000434
SAV	0.000288	0.000038	-0.000311	-0.000540	0.001013
GRA	-0.000190	-0.000098	-0.000280	-0.000139	0.000120
WET	-0.000512	-0.000598	-0.000310	0.000095	0.000603
CRO	-0.000013	0.000312	-0.000921	-0.000161	0.000144
BAR	0.000048	-0.000008	0.000094	-0.000016	-0.000158

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90 Table S5: Sensitivity Coefficients for Precipitation (β_{pr}) per Plant Functional Type (PFT). ENF,
 91 Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf Forest;
 92 MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
 93 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	6.2364	-43.3238	225.1848	-201.5129	603.2267
EBF	165.3611	65.0377	109.1002	-6.1268	179.2539
DBF	235.2866	87.0353	235.4413	134.8818	554.0208
MF	78.9363	69.4605	178.7551	5.2673	439.8855
OSH	-136.0682	-21.2328	409.4631	70.6018	203.1865
WSA	-12.3793	68.3307	206.0095	-5.8931	444.5251
SAV	-16.7918	13.2379	260.7474	59.1503	293.8231
GRA	-61.7907	3.3118	357.4310	96.3369	264.5849
WET	-178.3743	-189.3849	-268.0948	-20.6870	169.6031
CRO	-23.3069	-19.1447	292.8703	36.4451	376.3037
BAR	-16.1049	-14.4027	257.5394	81.6666	473.4937

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98 Table S6: Sensitivity Coefficients for Clearness Index (β_{CI}) per Plant Functional Type (PFT). ENF,
 99 Evergreen Needleleaf Forest; EBF, Evergreen Broadleaf Forest; DBF, Deciduous Broadleaf Forest;
 100 MF, Mixed Forest; OSH, Open Shrublands; WSA, Woody Savannas; SAV, Savannas; GRA,
 101 Grasslands; WET, Wetlands; CRO, Croplands; BAR, Barren or Sparsely Vegetated.

PFT	BCC- ESM1	IPSL- CM6A-LR	MPI-ESM- 1-2-HAM	NorESM2- LM	UKESM1- 0-LL
ENF	-0.179400	-0.004691	-0.133819	-0.159882	-0.059526
EBF	-0.034866	-0.037444	0.212178	0.068153	0.255530
DBF	-0.065590	-0.000442	-0.043122	-0.085349	-0.088917
MF	-0.197453	-0.023796	-0.122750	-0.081399	-0.251073
OSH	-0.096439	-0.031949	-0.068272	-0.044959	-0.200439
WSA	-0.131831	0.015233	-0.108264	-0.061041	-0.223069
SAV	-0.128428	-0.013374	-0.133998	0.006582	-0.227113
GRA	-0.058220	0.003497	-0.069130	-0.008668	-0.106475
WET	-0.049906	-0.059406	-0.018018	-0.036812	-0.294887
CRO	-0.074630	0.012429	-0.095520	-0.043673	-0.093012
BAR	0.002708	-0.001309	-0.007610	-0.007820	-0.043406

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