1   Climate model response from the Geoengineering Model Intercomparison Project (GeoMIP)
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3   Supplemental Online Material
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Table S1. Variables used in the analysis contained in this paper. Not all models have all variables available as output.

Model	TOA Net Radiation	Surface Air Temperature	Precipitation	Evaporation	NPP	Moist Static Stability	Sea Ice Extent
BNU-ESM	X	X	X	X	X		
CanESM2	X	X	X	X	X	X	X
CESM-CAM5.1-FV	X	X	X	X	X	X	X
CCSM4	X	X	X	X		X	X
EC-Earth	X	X	X	X			
GISS-E2-R	X	X	X	X	X	X	X
HadCM3	X	X	X	X			
HadGEM2-ES	X	X	X	X	X	X	X
IPSL-CM5A-LR	X	X	X	X			
MIROC-ESM	X	X	X	X	X	X	X
MPI-ESM-LR	X	X	X	X	X	X	X
NorESM1-M	X	X	X	X	X	X	X

Table S2. Values for *abrupt4xCO2–piControl* averaged over regions. Ensemble mean is calculated as the mean of all ensemble members, while Minimum and Maximum correspond to single ensemble members featuring extreme values of the indicated variable. All values are averages over years 11-50 of the simulations.

Variable	Region	Ensemble Mean	Minimum	Maximum
Net TOA Radiation $(W\ m^{-2})$	Arctic	2.55	-2.48	6.71
	N. Midlatitudes	2.30	0.71	3.73
	Tropics	2.99	-0.25	5.43
	S. Midlatitudes	1.86	0.29	3.99
	Antarctic	2.51	0.73	4.35
	Polar regions	2.53	-0.87	4.97
	Global	2.49	0.84	3.62
Temperature (K)	Arctic	10.54	5.83	13.78
	N. Midlatitudes	5.43	3.43	6.69
	Tropics	3.86	2.62	5.13
	S. Midlatitudes	3.22	1.66	4.58
	Antarctic	4.95	1.76	7.16
	Polar Regions	7.75	3.80	9.96
	Global	4.33	2.79	5.19
Precipitation $(mm\ day^{-1})$	Arctic	0.42	0.22	0.62
	N. Midlatitudes	0.14	0.03	0.23
	Tropics	0.19	0.01	0.47
	S. Midlatitudes	0.10	0.01	0.17
	Antarctic	0.26	0.09	0.43
	Polar Regions	0.34	0.16	0.50
	Global	0.16	0.05	0.24
Evaporation $(mm\ day^{-1})$	Arctic	0.22	0.14	0.35
	N. Midlatitudes	0.13	0.00	0.26
	Tropics	0.21	0.05	0.42
	S. Midlatitudes	0.15	0.06	0.25
	Antarctic	0.06	0.00	0.12
	Polar Regions	0.14	0.07	0.24
	Global	0.16	0.05	0.25
Precipitation Minus Evaporation $(mm\ day^{-1})$ land only	Arctic	0.23	0.00	0.42
	N. Midlatitudes	0.07	-0.09	0.16
	Tropics	0.15	-0.05	0.42
	S. Midlatitudes	-0.03	-0.13	0.08
	Antarctic	0.16	0.00	0.42
	Polar Regions	0.19	0.00	0.38
	Global	0.13	-0.01	0.22
Net Primary Productivity $(kg\ C\ m^{-2}\ a^{-1})$ land only	Arctic	0.13	0.00	0.44
	N. Midlatitudes	0.31	0.04	0.80
	Tropics	0.58	0.07	1.54
	S. Midlatitudes	0.25	0.04	0.60
	Antarctic	0.00	0.00	0.00
	Polar Regions	0.07	0.00	0.22
	Global	0.37	0.05	0.96

Table S3. Values for *G1–piControl* averaged over regions. Ensemble mean is calculated as the mean of all ensemble members, while Minimum and Maximum correspond to single ensemble members featuring extreme values of the indicated variable. All values are averages over years 11-50 of the simulations.

Variable	Region	Ensemble Mean	Minimum	Maximum
Net TOA Radiation $(W\ m^{-2})$	Arctic	2.87	2.06	4.05
	N. Midlatitudes	1.11	0.16	2.19
	Tropics	-1.53	-2.32	-0.58
	S. Midlatitudes	0.70	0.03	1.25
	Antarctic	1.99	1.28	2.39
	Polar regions	2.43	1.91	3.11
	Global	0.05	-0.22	0.40
Temperature (K)	Arctic	1.01	-0.26	2.91
	N. Midlatitudes	0.22	-0.26	0.94
	Tropics	-0.31	-0.62	0.08
	S. Midlatitudes	-0.02	-0.27	0.70
	Antarctic	0.62	0.13	1.71
	Polar Regions	0.81	-0.03	2.31
	Global	0.00	-0.31	0.64
Precipitation $(mm\ day^{-1})$	Arctic	-0.03	-0.06	0.00
	N. Midlatitudes	-0.09	-0.16	-0.04
	Tropics	-0.22	-0.38	-0.08
	S. Midlatitudes	-0.07	-0.09	-0.06
	Antarctic	0.00	-0.03	0.07
	Polar Regions	-0.01	-0.04	0.04
	Global	-0.13	-0.21	-0.06
Evaporation $(mm\ day^{-1})$	Arctic	-0.01	-0.03	0.02
	N. Midlatitudes	-0.10	-0.16	-0.02
	Tropics	-0.21	-0.35	-0.08
	S. Midlatitudes	-0.07	-0.10	-0.02
	Antarctic	0.00	-0.01	0.01
	Polar Regions	0.00	-0.02	0.02
	Global	-0.13	-0.21	-0.04
Precipitation Minus Evaporation $(mm\ day^{-1})$ land only	Arctic	-0.01	-0.03	0.00
	N. Midlatitudes	0.02	-0.01	0.05
	Tropics	0.07	-0.16	0.32
	S. Midlatitudes	0.05	-0.02	0.11
	Antarctic	0.01	-0.02	0.07
	Polar Regions	0.00	-0.02	0.04
	Global	0.04	-0.06	0.13
Net Primary Productivity $(kg\ C\ m^{-2}\ a^{-1})$ land only	Arctic	0.04	0.00	0.09
	N. Midlatitudes	0.26	0.02	0.66
	Tropics	0.72	0.05	1.70
	S. Midlatitudes	0.25	0.02	0.64
	Antarctic	0.00	0.00	0.00
	Polar Regions	0.02	0.00	0.05
	Global	0.38	0.03	0.94

Table S4. Values for *G1–abrupt4xCO2* averaged over regions. Ensemble mean is calculated as the mean of all ensemble members, while Minimum and Maximum correspond to single ensemble members featuring extreme values of the indicated variable. All values are averages over years 11-50 of the simulations.

Variable	Region	Ensemble Mean	Minimum	Maximum
Net TOA Radiation ($W\ m^{-2}$)	Arctic	0.32	-3.90	5.10
	N. Midlatitudes	-1.19	-3.03	0.29
	Tropics	-4.52	-7.17	-0.33
	S. Midlatitudes	-1.16	-3.20	0.71
	Antarctic	-0.52	-2.13	1.28
	Polar regions	-0.10	-2.76	3.19
	Global	-2.43	-3.39	-0.44
Temperature (K)	Arctic	-9.54	-12.50	-6.09
	N. Midlatitudes	-5.21	-6.87	-3.56
	Tropics	-4.17	-5.24	-3.03
	S. Midlatitudes	-3.23	-3.88	-1.89
	Antarctic	-4.33	-6.03	-1.57
	Polar Regions	-6.93	-8.90	-3.83
	Global	-4.33	-5.43	-3.10
Precipitation ($mm\ day^{-1}$)	Arctic	-0.44	-0.65	-0.27
	N. Midlatitudes	-0.23	-0.31	-0.14
	Tropics	-0.41	-0.72	-0.25
	S. Midlatitudes	-0.16	-0.25	-0.08
	Antarctic	-0.26	-0.38	-0.12
	Polar Regions	-0.35	-0.51	-0.20
	Global	-0.29	-0.37	-0.23
Evaporation ($mm\ day^{-1}$)	Arctic	-0.23	-0.37	-0.12
	N. Midlatitudes	-0.23	-0.32	-0.16
	Tropics	-0.42	-0.67	-0.28
	S. Midlatitudes	-0.23	-0.33	-0.15
	Antarctic	-0.06	-0.12	-0.01
	Polar Regions	-0.14	-0.23	-0.08
	Global	-0.29	-0.37	-0.23
Precipitation Minus Evaporation ($mm\ day^{-1}$) land only	Arctic	-0.24	-0.46	0.00
	N. Midlatitudes	-0.05	-0.15	0.07
	Tropics	-0.08	-0.36	0.06
	S. Midlatitudes	0.07	-0.01	0.14
	Antarctic	-0.15	-0.34	0.00
	Polar Regions	-0.19	-0.35	0.00
	Global	-0.09	-0.13	-0.05
Net Primary Productivity ($kg\ C\ m^{-2}\ a^{-1}$) land only	Arctic	-0.10	-0.37	0.00
	N. Midlatitudes	-0.05	-0.14	-0.02
	Tropics	0.14	-0.05	0.54
	S. Midlatitudes	0.00	-0.08	0.09
	Antarctic	0.00	0.00	0.00
	Polar Regions	-0.05	-0.18	0.00
	Global	0.01	-0.04	0.12

Table S5. Root mean square (RMS) differences of variables for *abrupt4xCO2* relative to *piControl*. Values are calculated by the formula

$$RMS = \sqrt{\frac{\Sigma\Sigma(abrupt4xCO2 - piControl)^2 \cdot dA}{\Sigma\Sigma dA}}$$

where summation is taken over latitude and longitude, and *dA* indicates area weighting of the anomaly in each grid box. *abrupt4xCO2* and *piControl* refer to values of the field for the all-model ensemble mean for that particular experiment.

Variable	Region	Annual Average	DJF Average	JJA Average
TOA Net	Global	3.72	6.10	6.91
Radiation	Land	3.42	5.67	6.90
$(W\ m^{-2})$	Ocean	3.84	6.26	6.91
Temperature	Global	4.82	5.45	4.60
(K)	Land	6.18	6.71	6.06
	Ocean	4.13	4.84	3.84
Precipitation	Global	0.51	0.58	0.78
$(mm\ day^{-1})$	Land	0.40	0.45	0.53
	Ocean	0.55	0.63	0.87
Evaporation	Global	0.28	0.36	0.35
$(mm\ day^{-1})$	Land	0.19	0.19	0.27
	Ocean	0.31	0.41	0.38
P-E	Global	0.53	0.62	0.84
$(mm\ day^{-1})$	Land	0.32	0.40	0.47
	Ocean	0.59	0.69	0.96
NPP	Global	0.42	0.39	0.55
$(kg\ C\ m^{-2}\ a^{-1})$	Land	0.42	0.39	0.55
	Ocean	N/A	N/A	N/A

Table S6. Root mean square (RMS) differences of variables for *G1* relative to *piControl*. Values are calculated by the formula

$$RMS = \sqrt{\frac{\Sigma\Sigma(G1 - piControl)^2 \cdot dA}{\Sigma\Sigma dA}}$$

where summation is taken over latitude and longitude, and *dA* indicates area weighting of the anomaly in each grid box. *G1* and *piControl* refer to values of the field for the all-model ensemble mean for that particular experiment.

| Variable	Region	Annual Average	DJF Average	JJA Average
TOA Net	Global	1.89	3.18	3.35
Radiation	Land	1.97	2.79	2.98
(W m^{-2})	Ocean	1.85	3.33	3.49
Temperature	Global	0.43	0.51	0.45
(K)	Land	0.51	0.60	0.59
	Ocean	0.39	0.47	0.38
Precipitation	Global	0.23	0.27	0.32
(mm day^{-1})	Land	0.20	0.27	0.27
	Ocean	0.24	0.26	0.33
Evaporation	Global	0.17	0.19	0.20
(mm day^{-1})	Land	0.21	0.22	0.24
	Ocean	0.15	0.17	0.19
P-E	Global	0.18	0.23	0.28
(mm day^{-1})	Land	0.15	0.21	0.24
	Ocean	0.20	0.24	0.30
NPP	Global	0.46	0.46	0.56
(kg C m^{-2} a^{-1})	Land	0.46	0.46	0.56
	Ocean	N/A	N/A	N/A

Table S7. Root mean square (RMS) differences of variables for *G1* relative to *abrupt4xCO2*. Values are calculated by the formula

$$RMS = \sqrt{\frac{\Sigma\Sigma(G1 - abrupt4xCO2)^2 \cdot dA}{\Sigma\Sigma dA}}$$

where summation is taken over latitude and longitude, and *dA* indicates area weighting of the anomaly in each grid box. *G1* and *abrupt4xCO2* refer to values of the field for the all-model ensemble mean for that particular experiment.

| Variable	Region	Annual Average	DJF Average	JJA Average
TOA Net Radiation ($W\ m^{-2}$)	Global	4.10	7.53	7.08
	Land	3.24	7.10	6.34
	Ocean	4.40	7.71	7.36
Temperature (K)	Global	4.71	5.24	4.53
	Land	5.88	6.29	5.79
	Ocean	4.13	4.74	3.89
Precipitation ($mm\ day^{-1}$)	Global	0.54	0.65	0.77
	Land	0.42	0.52	0.53
	Ocean	0.58	0.69	0.85
Evaporation ($mm\ day^{-1}$)	Global	0.38	0.43	0.43
	Land	0.23	0.23	0.31
	Ocean	0.43	0.49	0.47
P-E ($mm\ day^{-1}$)	Global	0.49	0.62	0.76
	Land	0.27	0.37	0.41
	Ocean	0.57	0.70	0.86
NPP ($kg\ C\ m^{-2}\ a^{-1}$)	Global	0.15	0.13	0.21
	Land	0.15	0.13	0.21
	Ocean	N/A	N/A	N/A
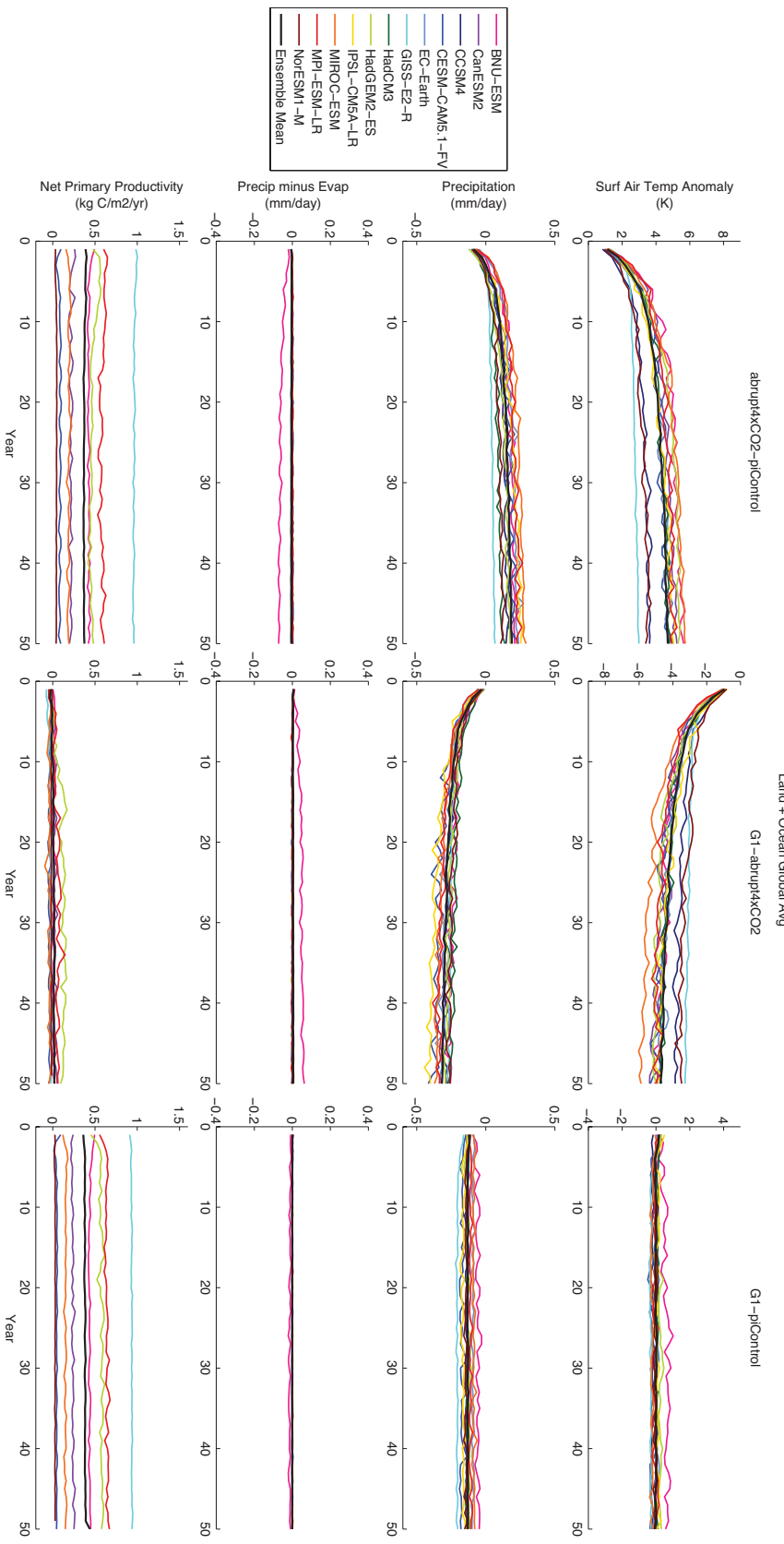
Figure S1. Global (land + ocean) average time series for surface air temperature (K; first row), precipitation (mm day^{-1}; second row), precipitation minus evaporation (mm day^{-1}; third row), and net primary productivity (kg C m^{-2} yr^{-1}; bottom row) for all available model output.
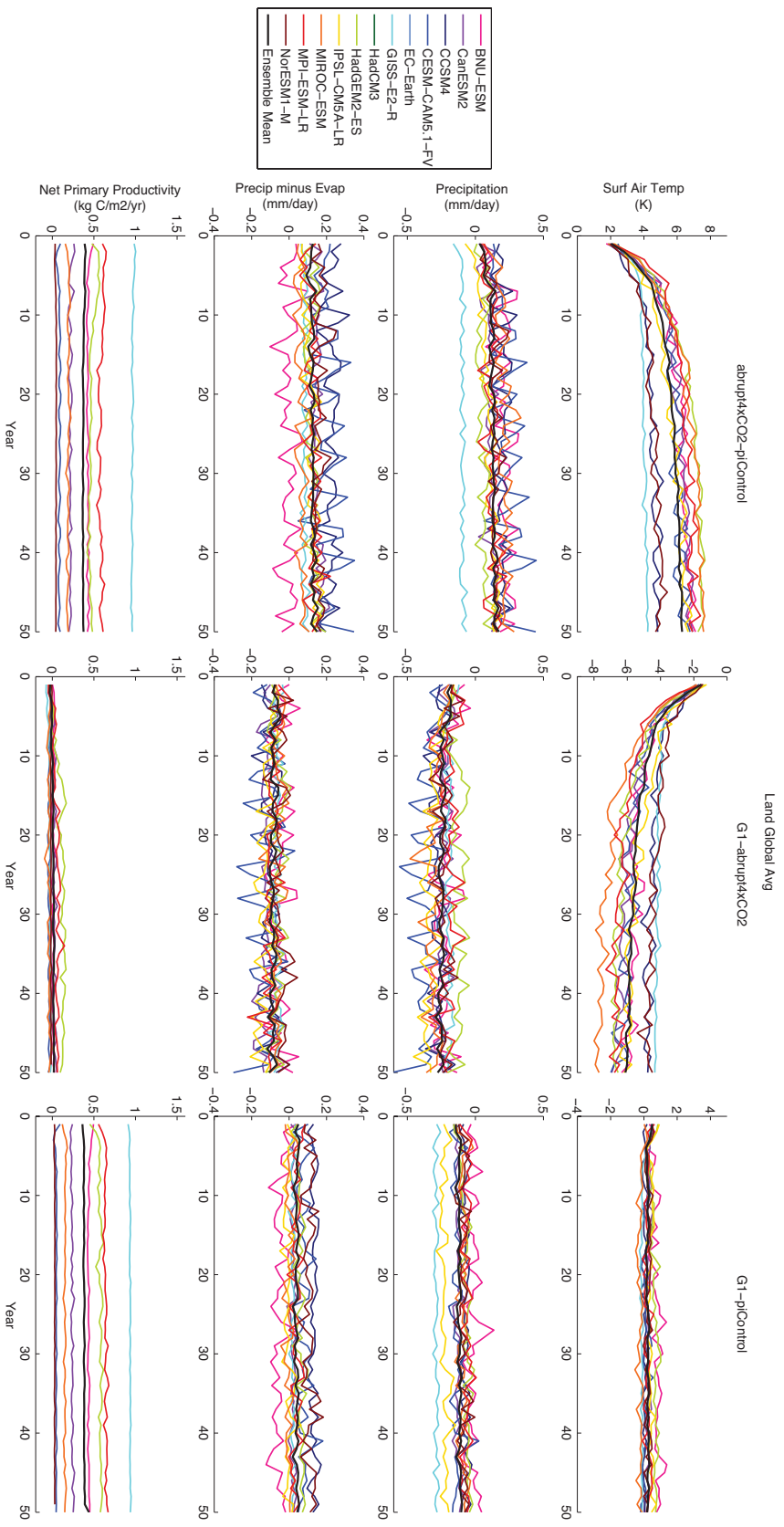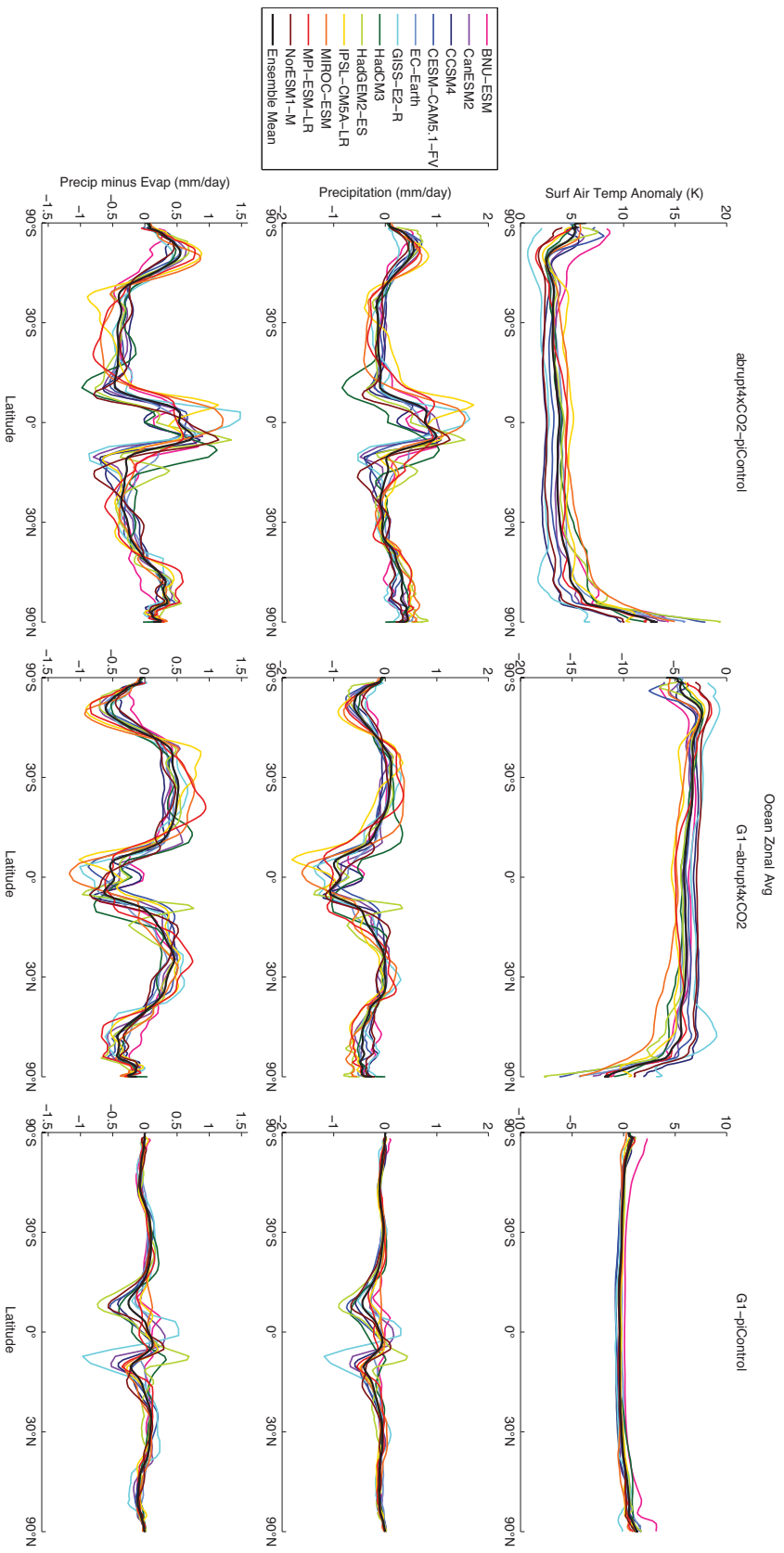
Figure S2. Land average time series for surface air temperature (K; first row), precipitation (mm day^{-1}; second row), precipitation minus evaporation (mm day^{-1}; third row), and net primary productivity (kg C m^{-2} yr^{-1}; bottom row) for all available model output.
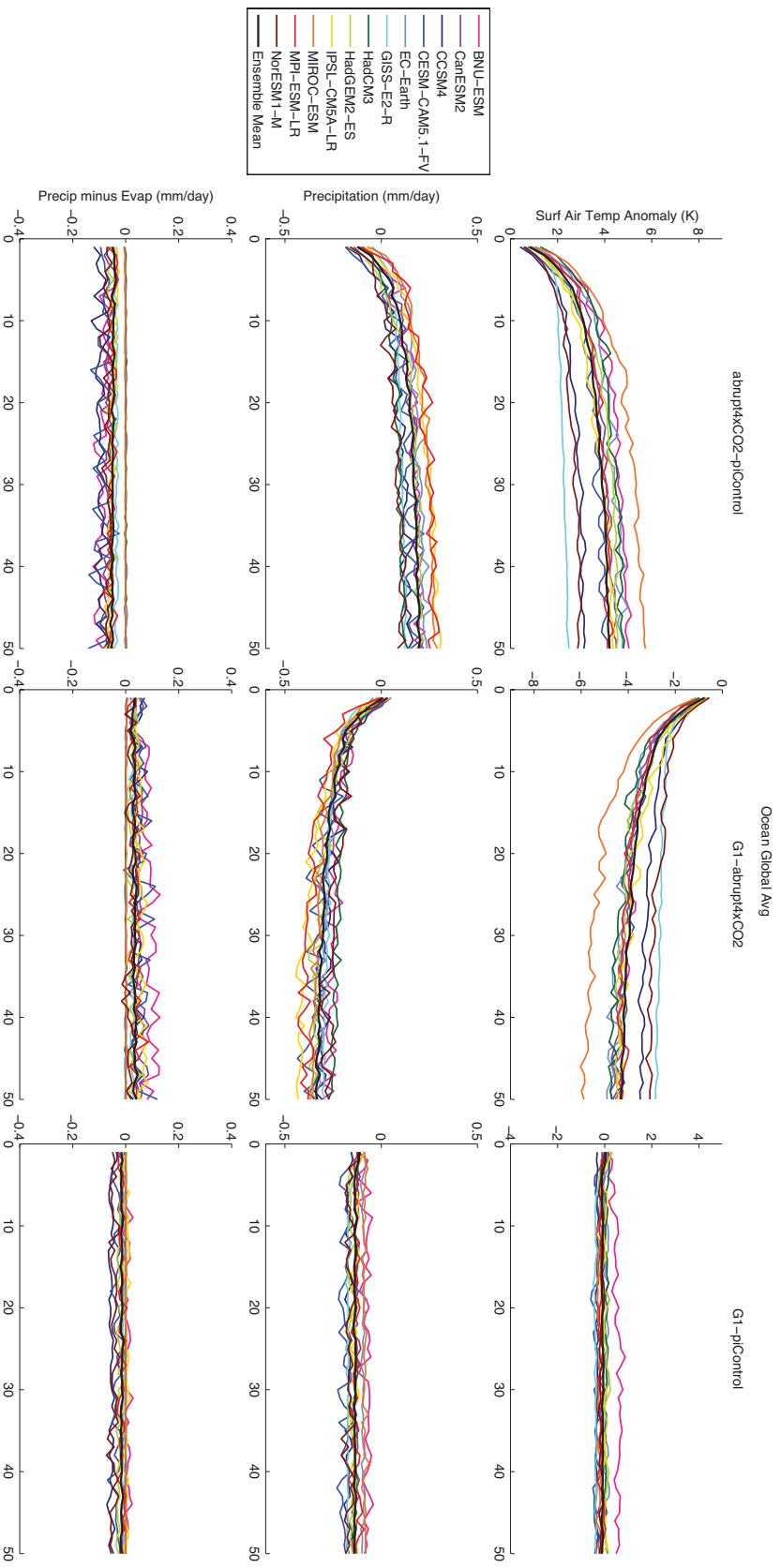
Figure S3. Ocean average time series for surface air temperature (K; first row), precipitation (mm day^{-1}; second row), and precipitation minus evaporation (mm day^{-1}; bottom row) for all available model output.
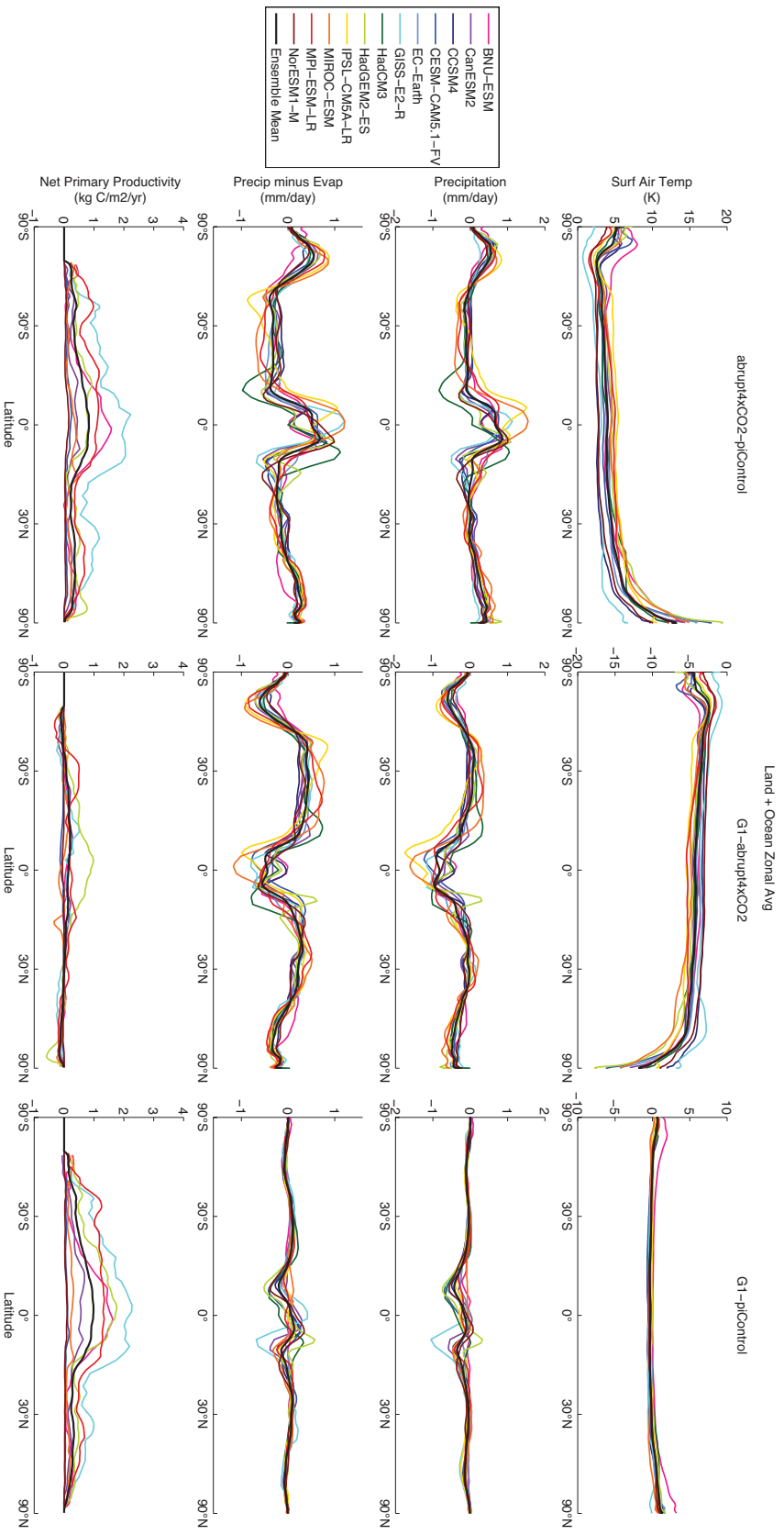
Figure S4. Zonal land + ocean average surface air temperature (K; first row), precipitation (mm day^{-1}; second row), precipitation minus evaporation (mm day^{-1}; third row), and net primary productivity (kg C m^{-2} yr^{-1}; bottom row) for all available model output. All values shown are averages over years 11-50 of the simulation. The x-axis is weighted by cosine of latitude.
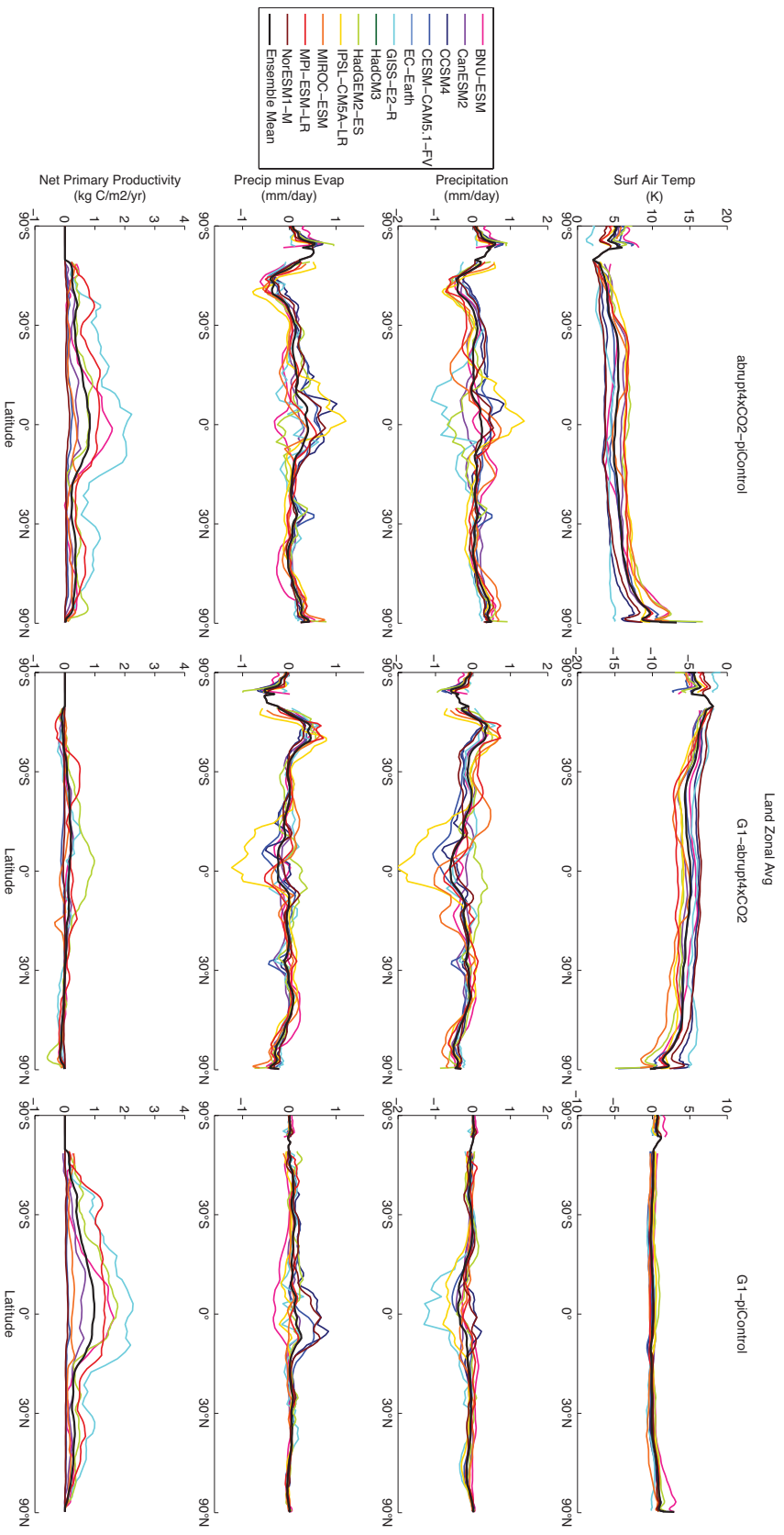
Figure S5. Zonal land average surface air temperature (K; first row), precipitation (mm day^{-1}; second row), precipitation minus evaporation (mm day^{-1}; third row), and net primary productivity (kg C m^{-2} yr^{-1}; bottom row) for all available model output. All values shown are averages over years 11-50 of the simulation. The x-axis is weighted by cosine of latitude.

Figure S6. Zonal ocean average surface air temperature (K; first row), precipitation (mm day^{-1}; second row), and precipitation minus evaporation (mm day^{-1}; bottom row) for all available model output. All values shown are averages over years 11-50 of the simulation. The x-axis is weighted by cosine of latitude.