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The statistical emulators of GGCMI phase 2: responses of year-to-year variation of crop yield to CO_2, temperature, water, and nitrogen perturbations

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Supplementary materials

Table S1 The global median R across all grids and perturbations over current croplands.

GGCM	Winter wheat				Spring wheat				Maize				Rice			
	C	T	W	N	C	T	W	N	C	T	W	N	C	T	W	N
APSIM-UGOE	0.93	0.92	0.93	0.89	0.91	0.92	0.93	0.88	0.96	0.95	0.96	0.94	0.97	0.97	0.97	0.96
CARAIB	0.95	0.95	0.96	-	0.92	0.97	0.96	-	0.93	0.92	0.92	-	0.92	0.94	0.91	-
EPIC-IIASA	0.96	0.96	0.96	0.98	0.92	0.96	0.97	0.98	0.97	0.96	0.97	0.96	0.97	0.97	0.97	0.95
EPIC-TAMU	0.95	0.95	0.95	0.93	0.87	0.91	0.94	0.89	0.95	0.84	0.96	0.93	0.93	0.92	0.94	0.87
GEPIC	0.93	0.93	0.91	0.9	0.87	0.88	0.93	0.86	0.96	0.89	0.95	0.91	0.95	0.9	0.95	0.88
LPJ-GUESS	0.96	0.95	0.96	0.93	0.82	0.92	0.95	0.88	-	-	-	-	-	-	-	-
LPJmL	0.97	0.96	0.96	0.96	0.87	0.95	0.97	0.87	0.91	0.92	0.94	0.93	0.92	0.92	0.95	0.93
ORCHIDEE-crop	0.97	0.97	0.97	0.97	-	-	-	-	0.89	0.89	0.89	0.89	0.92	0.92	0.92	0.92
pDSSAT	0.96	0.95	0.95	0.95	0.77	0.88	0.92	0.83	0.90	0.85	0.89	0.88	0.88	0.89	0.93	0.85
PEPIC	0.95	0.94	0.95	0.94	0.87	0.9	0.95	0.94	0.93	0.90	0.95	0.93	0.92	0.91	0.94	0.93

* "-" denotes the lack of raw GGCM simulation

Table S2 The global median MAE (t/ha) across all grids and all perturbations over current croplands.

GGCM	Winter wheat				Spring wheat				Maize				Rice			
	C	T	W	N	C	T	W	N	C	T	W	N	C	T	W	N
APSIM-UGOE	0.24	0.26	0.24	0.2	0.20	0.21	0.21	0.19	0.24	0.25	0.24	0.25	0.14	0.12	0.11	0.14
CARAIB	1.06	0.2	0.22	-	0.15	0.1	0.17	-	1.59	0.14	0.17	-	1.14	0.16	0.23	-
EPIC-IIASA	0.17	0.16	0.16	0.16	0.15	0.09	0.09	0.10	0.15	0.15	0.15	0.20	0.12	0.1	0.11	0.18
EPIC-TAMU	0.2	0.19	0.19	0.13	0.31	0.16	0.14	0.19	0.36	0.53	0.25	0.19	0.13	0.09	0.09	0.1
GEPIC	0.21	0.17	0.19	0.15	0.25	0.15	0.12	0.18	0.35	0.27	0.23	0.21	0.23	0.18	0.15	0.17
LPJ-GUESS	0.14	0.12	0.11	0.07	0.46	0.09	0.08	0.09	-	-	-	-	-	-	-	-
LPJmL	0.18	0.16	0.17	0.15	0.24	0.19	0.16	0.14	0.4	0.25	0.22	0.22	0.16	0.09	0.09	0.1
ORCHIDEE-crop	0.05	0.05	0.05	0.05	-	-	-	-	0.20	0.20	0.20	0.20	0.14	0.10	0.10	0.10
pDSSAT	0.35	0.36	0.35	0.28	0.51	0.14	0.12	0.2	0.46	0.51	0.49	0.44	0.39	0.37	0.34	0.37
PEPIC	0.21	0.19	0.2	0.14	0.29	0.14	0.11	0.12	0.42	0.27	0.23	0.17	0.26	0.20	0.18	0.16

* "-" denotes the lack of raw GGCM simulation

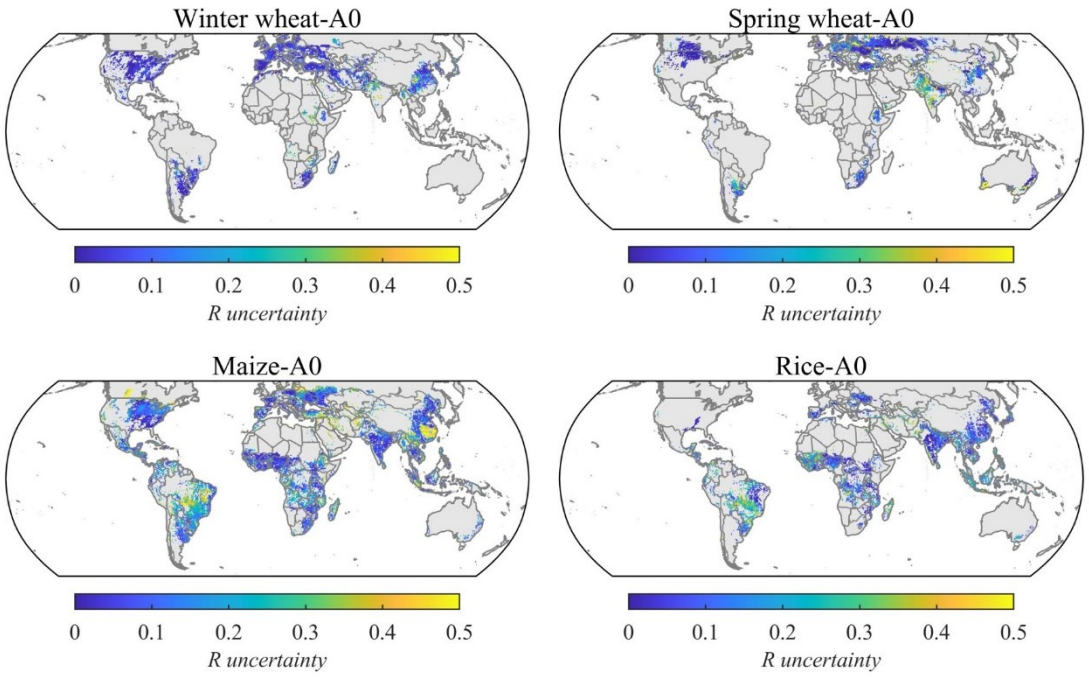

Figure S1 Uncertainty of correlation coefficient (*R*) across multi-model ensemble in the baseline over current cropland. The uncertainty was measured by the standard deviation of *R*s across multi-models.

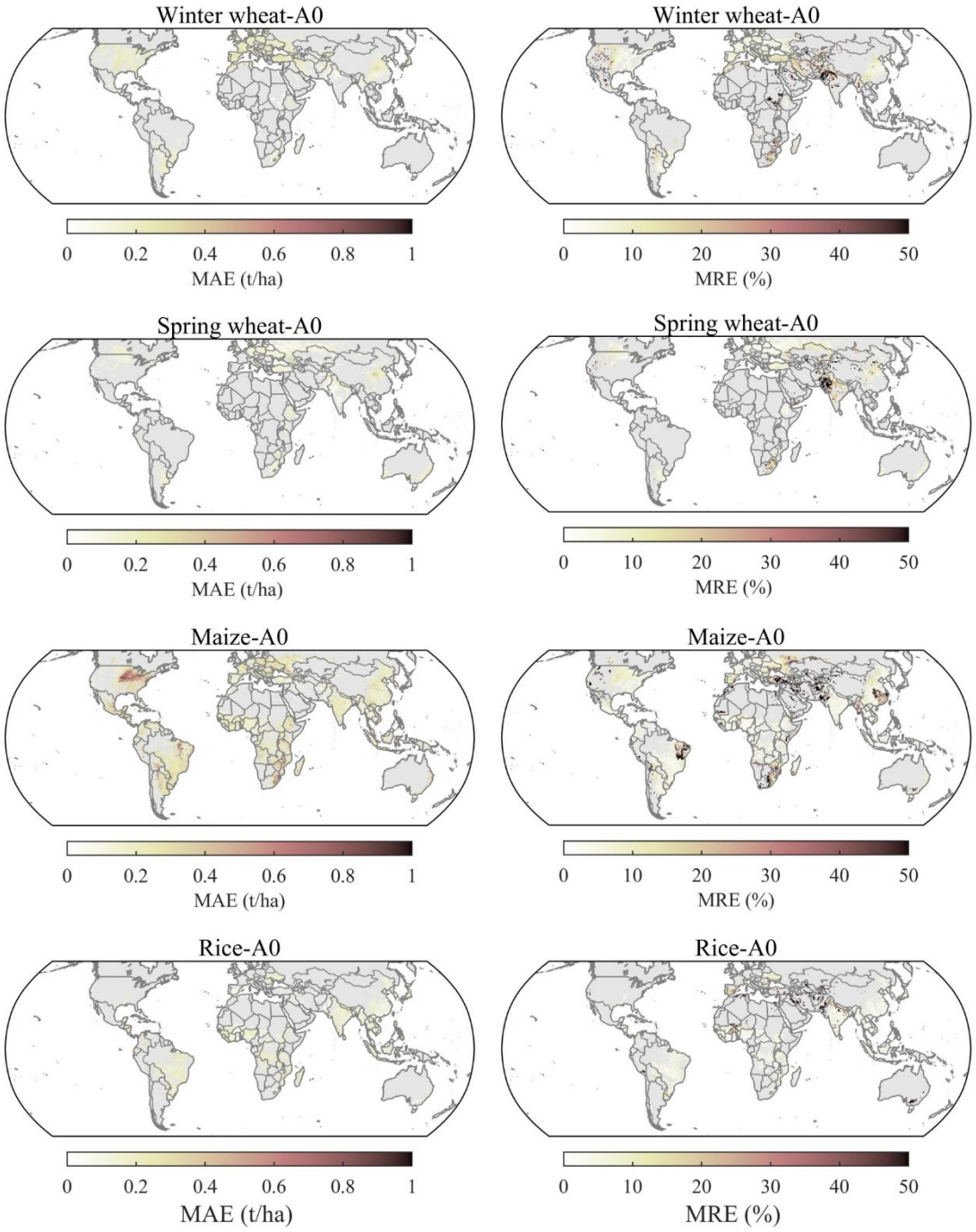

Figure S2 Spatial distribution of MAE and MRE over current croplands in the baseline. MAE: mean absolute error. MRE: mean relative error.

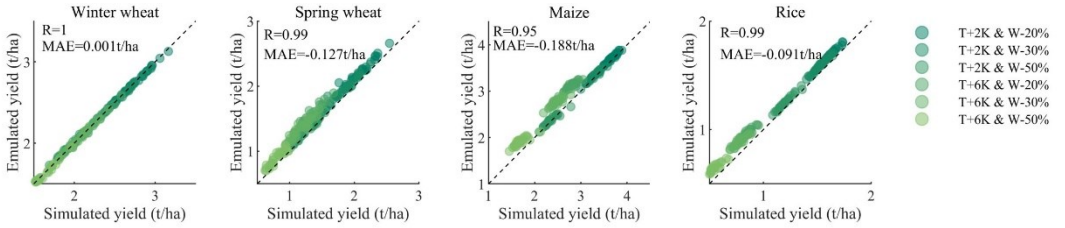

Figure S3 Performance of emulator (LPJmL-A0) in reproducing the year to year variation of global

mean yield from 1981 to 2010 under varied T, W perturbations and T+W perturbations.

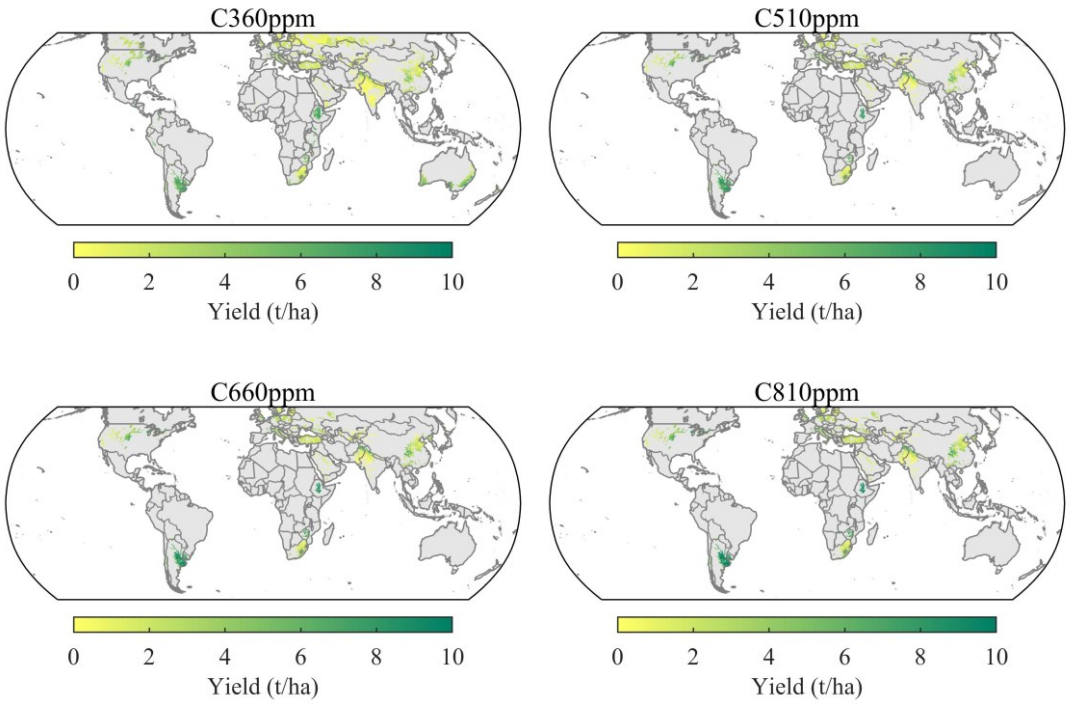

Figure S4 The spatial distribution of simulated yield under CO2 perturbations. The spatial extent has declined sharply under C510ppm, C660ppm and C810ppm relative to the C360ppm. Particularly, in Russia, Canada, India and Australia.

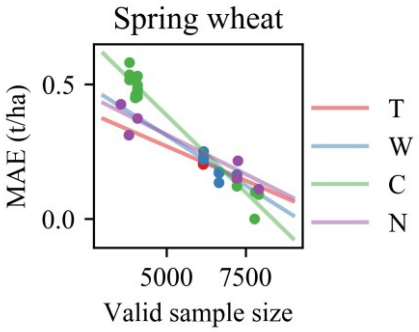

Figure S5 Dependence of median MAE and valid sample size. Dots denote the median MAE of one emulator across all grids under each perturbation. The valid sample size denotes the number of valid gridded yield for each perturbation.