



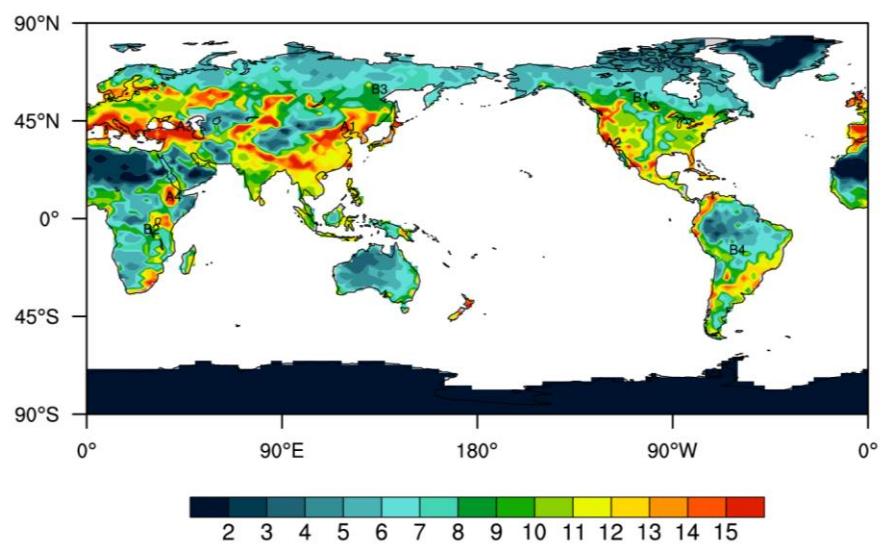
*Supplement of*

## **Climate impacts of parameterizing subgrid variation and partitioning of land surface heat fluxes to the atmosphere with the NCAR CESM1.2**

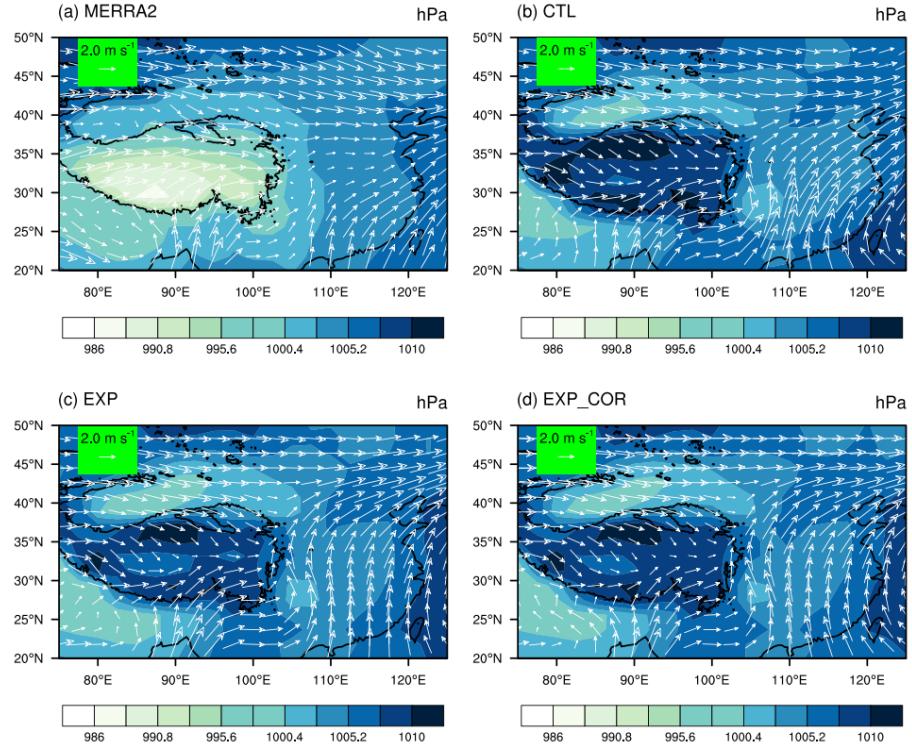
Ming Yin et al.

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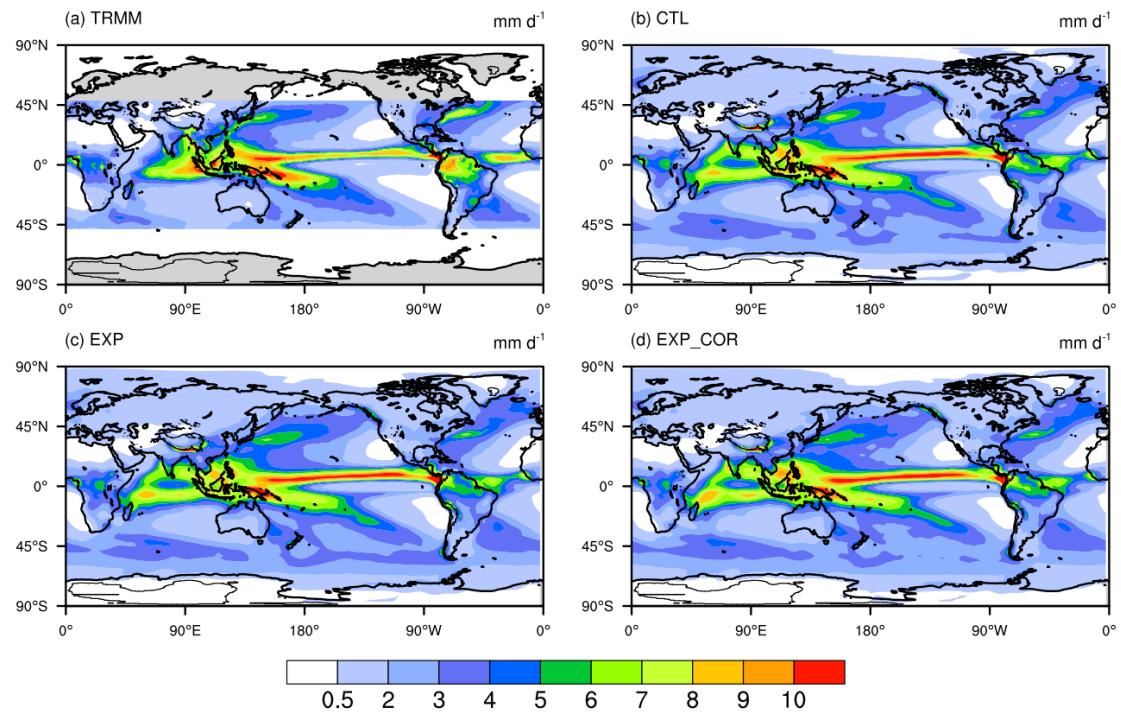
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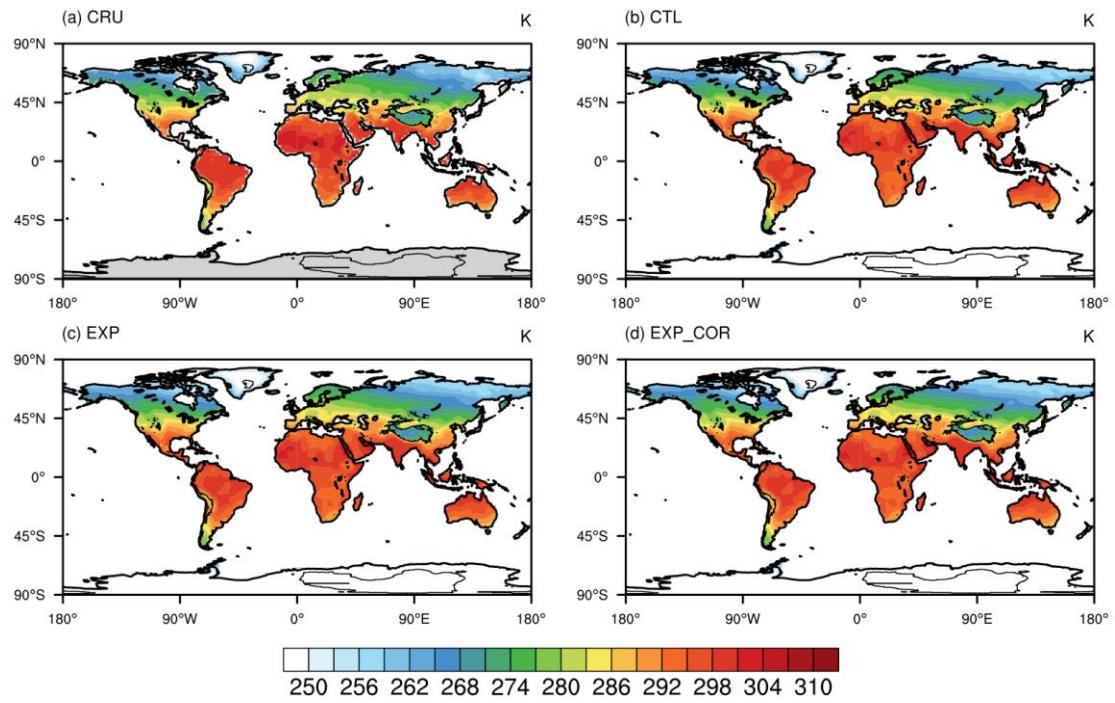
**Figure S1.** Number of PFTs in each grid cell. “A\*” and “B\*” denote the grid cell with 16 and 8 PFTs, respectively.



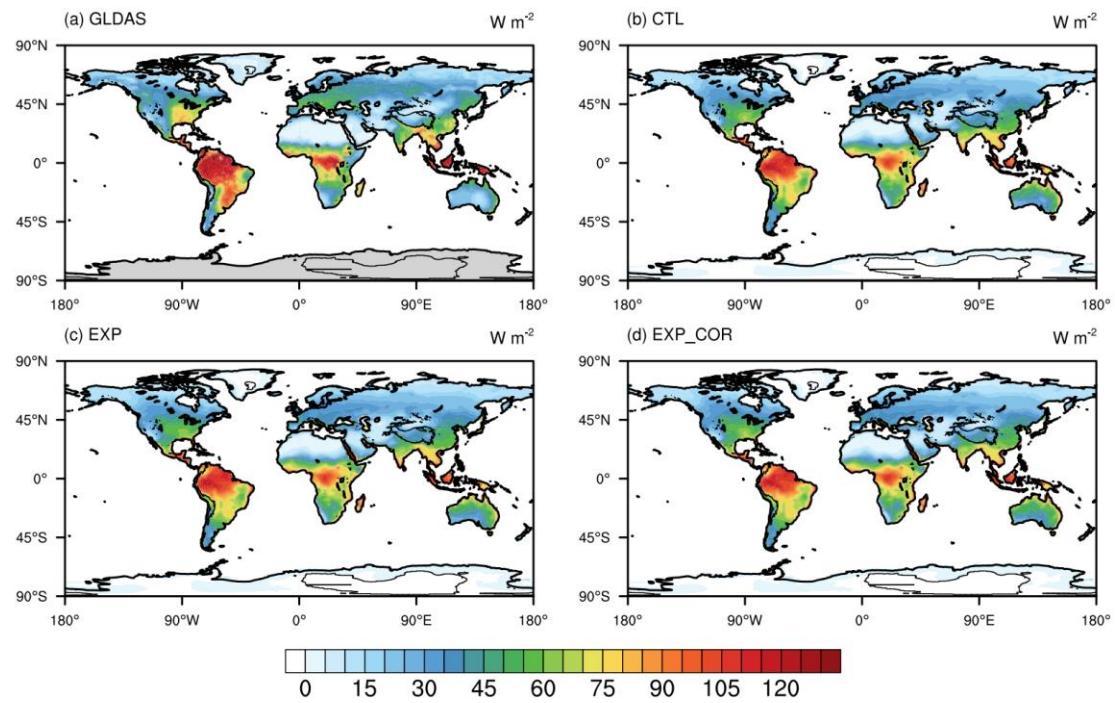
**Figure S2. Spatial distributions of the JJA-mean SLP superposed by the vector  $\vec{V}$  for (a) MERRA2, (b) CTL, (c) EXP and (d) EXP\_COR. The vector  $\vec{V}$  is defined in Eq. (3).**



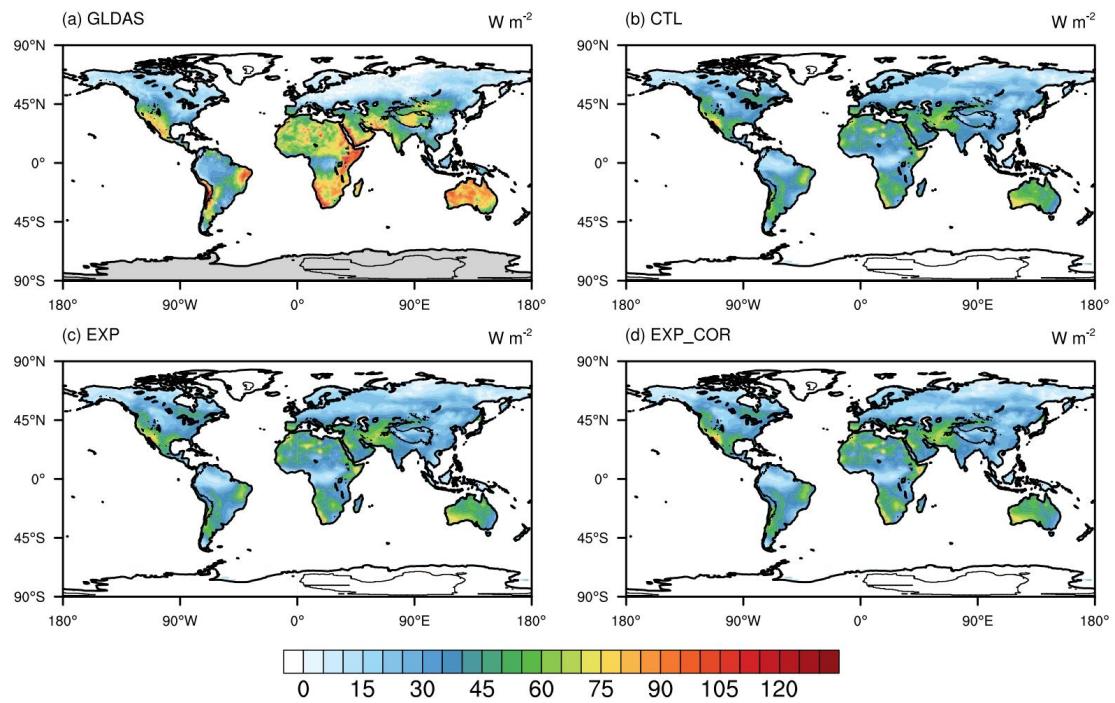
**Figure S3.** Spatial distributions of annual mean precipitation for (a) TRMM, (b) CTL, (c) EXP and (d) EXP\_COR.



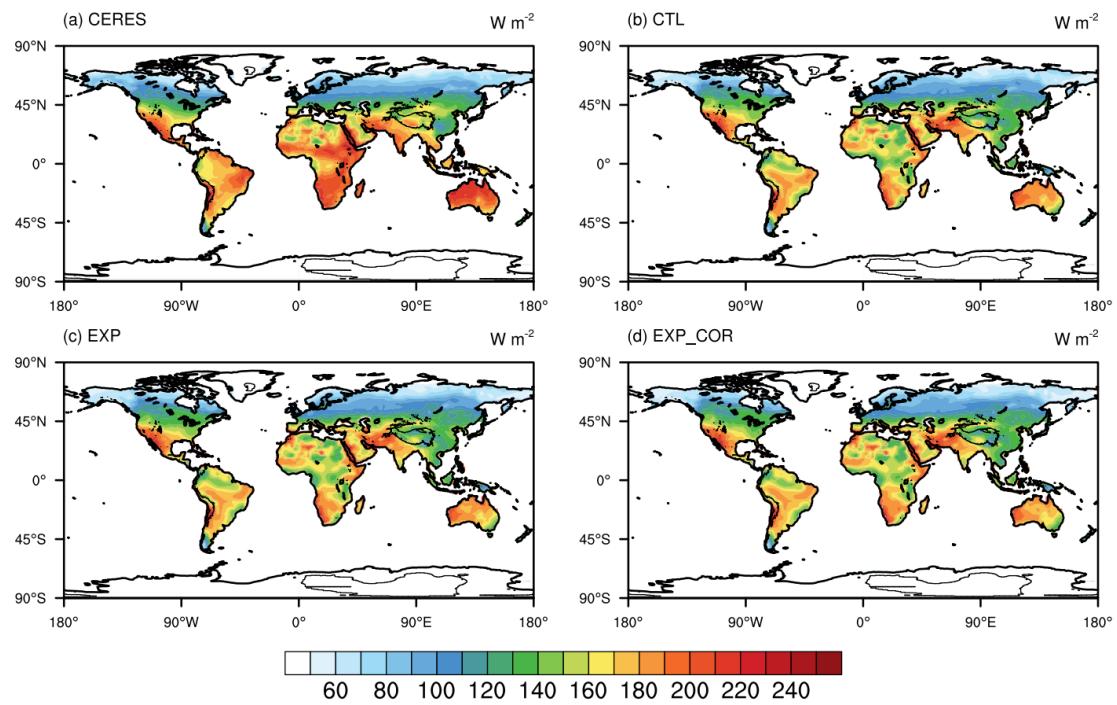
**Figure S4. Spatial distributions of annual mean 2 m temperature for (a) CRU, (b) CTL, (c) EXP and (d) EXP\_COR.**



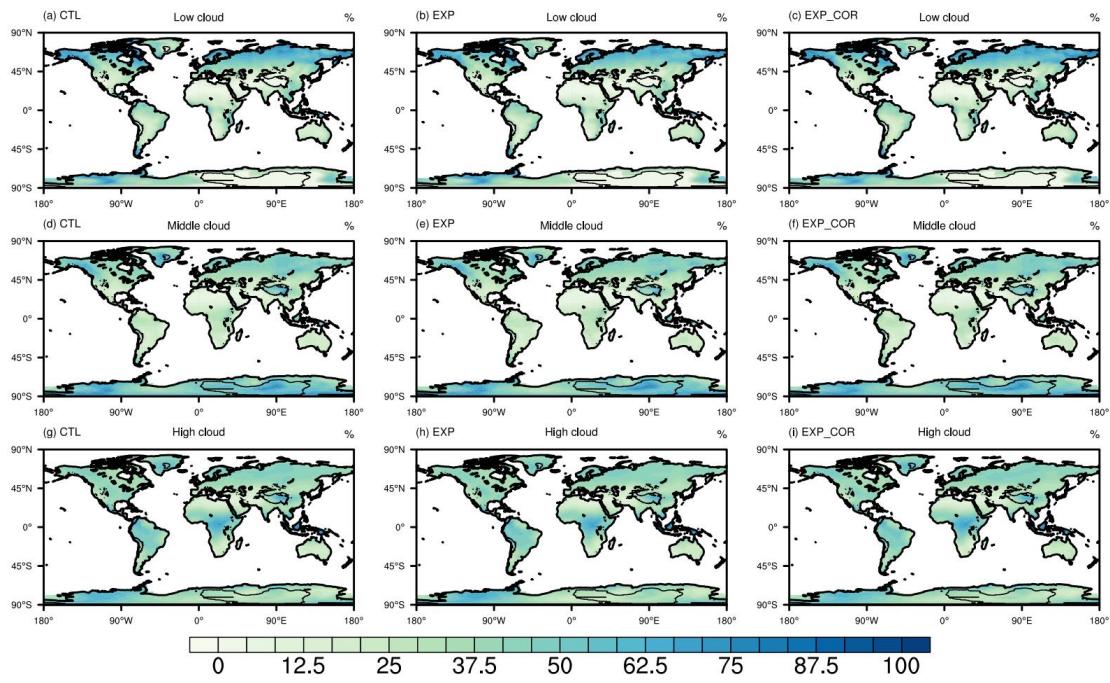
**Figure S5. Spatial distributions of annual mean latent heat fluxes for (a) GLDAS, (b) CTL, (c) EXP and (d) EXP\_COR.**



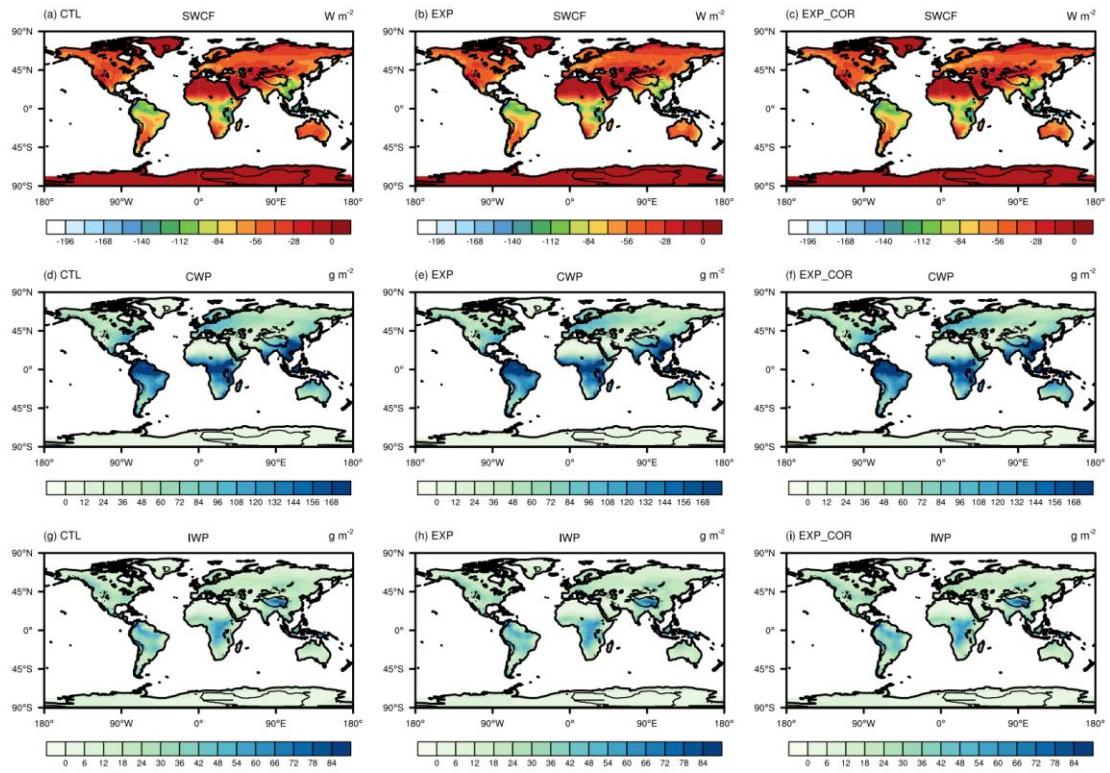
**Figure S6. Spatial distributions of annual mean sensible heat fluxes for (a) GLDAS, (b) CTL, (c) EXP and (d) EXP\_COR.**



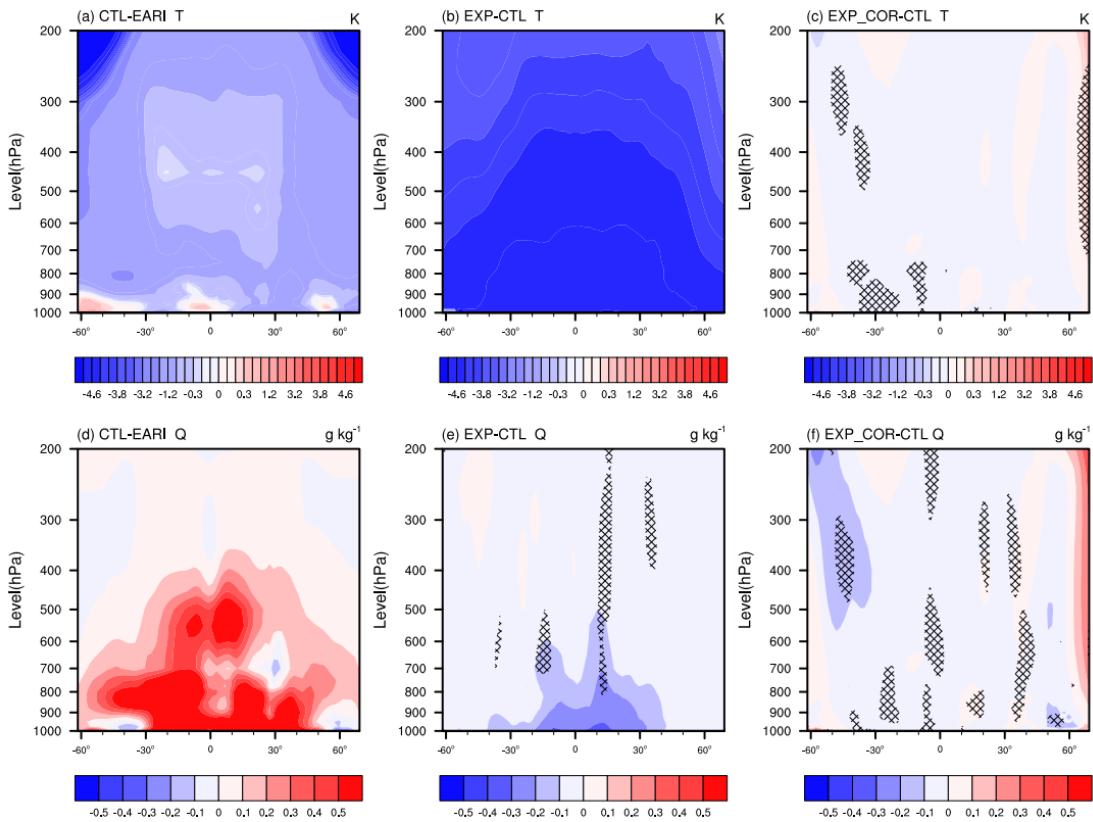
**Figure S7.** Spatial distributions of annual mean net surface shortwave fluxes for (a) CERES, (b) CTL, (c) EXP and (d) EXP\_COR.



**Figure S8. Spatial distributions of annual mean (a - c) low, (d - f) middle and (g - i) high clouds for CTL (left), EXP (middle) and EXP\_COR (right).**



**Figure S9. Spatial distributions of annual mean (a - c) shortwave cloud radiative forcing (units:  $\text{W m}^{-2}$ ), (d - f) total cloud water path (units:  $\text{g m}^{-2}$ ), and (g - i) ice water path (units:  $\text{g m}^{-2}$ ) for CTL (left), EXP (middle) and EXP\_COR (right).**



**Figure S10.** Annual and zonal mean cross-sections of the (a – c) temperature and (d – f) specific humidity differences for (a&d) CTL-ERAI, (b&e) EXP-CTL, and (c&f) EXP\_COR-CTL. The crossed areas are significant at the 95% level.

**Table S1.** The COR and RMSE values over the region (20°N-50°N, 75°E-125°E) for the CTL, EXP and EXP\_COR runs. MAM is for March-April-May, JJA for June-July-August, SON for September-October-November, and DJF for December-January-February. The best performance among the three experiments is highlighted in bold.

		COR			RMSE		
		CTL	EXP	EXP_COR	CTL	EXP	EXP_COR
Precipitation	MAM	<b>0.62</b>	<b>0.62</b>	0.56	<b>2.15</b>	2.29	2.34
	JJA	0.48	<b>0.60</b>	<b>0.60</b>	4.51	4.07	<b>3.71</b>
	SON	<b>0.56</b>	0.51	0.55	<b>1.89</b>	1.92	2.01
	DJF	<b>0.71</b>	0.66	0.64	<b>0.74</b>	0.79	0.86
	Annual	0.55	<b>0.63</b>	<b>0.63</b>	2.00	1.91	<b>1.82</b>
2 m Temperature	MAM	0.95	0.95	0.95	<b>3.09</b>	3.14	<b>3.09</b>
	JJA	0.91	0.91	0.91	<b>3.15</b>	3.16	3.28
	SON	0.96	0.96	0.96	<b>2.77</b>	19.18	2.78
	DJF	0.97	0.97	0.97	4.59	4.24	<b>4.17</b>
	Annual	0.96	0.96	0.96	2.89	5.93	<b>2.87</b>
Satent Heat Flux	MAM	<b>0.44</b>	0.43	<b>0.44</b>	<b>34.08</b>	34.73	34.43
	JJA	0.55	<b>0.60</b>	0.53	32.96	<b>31.54</b>	32.63
	SON	-0.01	0.02	<b>0.06</b>	21.68	22.21	<b>21.33</b>
	DJF	0.35	<b>0.37</b>	0.32	21.09	<b>20.78</b>	21.50
	Annual	0.02	<b>0.05</b>	0.03	25.84	25.88	<b>25.83</b>
Latent Heat Flux	MAM	0.72	0.73	<b>0.76</b>	17.69	17.27	<b>16.92</b>
	JJA	0.68	0.68	<b>0.69</b>	25.02	<b>24.19</b>	24.46
	SON	0.88	0.88	0.88	14.41	14.68	<b>14.12</b>
	DJF	0.84	<b>0.86</b>	<b>0.86</b>	9.06	<b>8.28</b>	8.39
	Annual	0.83	0.83	<b>0.84</b>	13.34	12.93	<b>12.80</b>
Net Surface Shortwave Flux	MAM	<b>0.78</b>	0.76	0.76	<b>25.46</b>	27.51	25.55
	JJA	0.69	<b>0.76</b>	0.71	27.28	<b>25.95</b>	26.38
	SON	<b>0.66</b>	0.63	0.61	<b>18.78</b>	22.21	19.78
	DJF	0.80	<b>0.83</b>	0.80	25.02	<b>22.83</b>	23.81
	Annual	<b>0.61</b>	<b>0.61</b>	0.57	<b>18.46</b>	18.64	18.59

**Table S2. Run time per step and throughput (unit: sec) for the CTL and EXP\_COR runs.**

	CTL	EXP_COR
Total	0.25642	0.48900
Convection	0.09949	0.19035
PBL	0.02286	0.09320
CLM	0.06643	0.06936
Dynamic	0.02696	0.02818
Communication time	0.01975	0.08248