



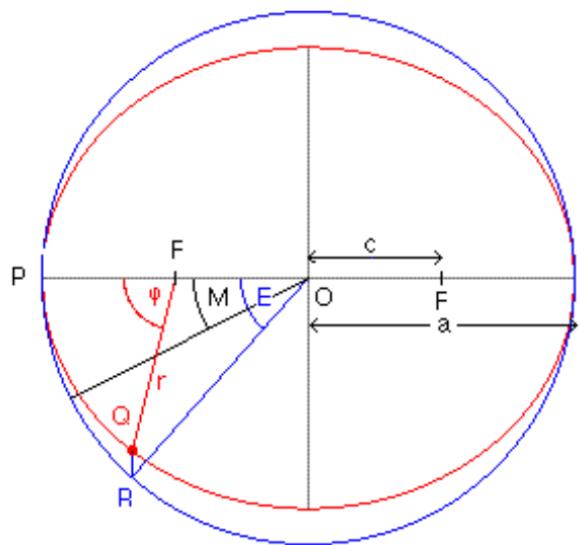
*Supplement of*

## **Calendar effects on surface air temperature and precipitation based on model-ensemble equilibrium and transient simulations from PMIP4 and PACMEDY**

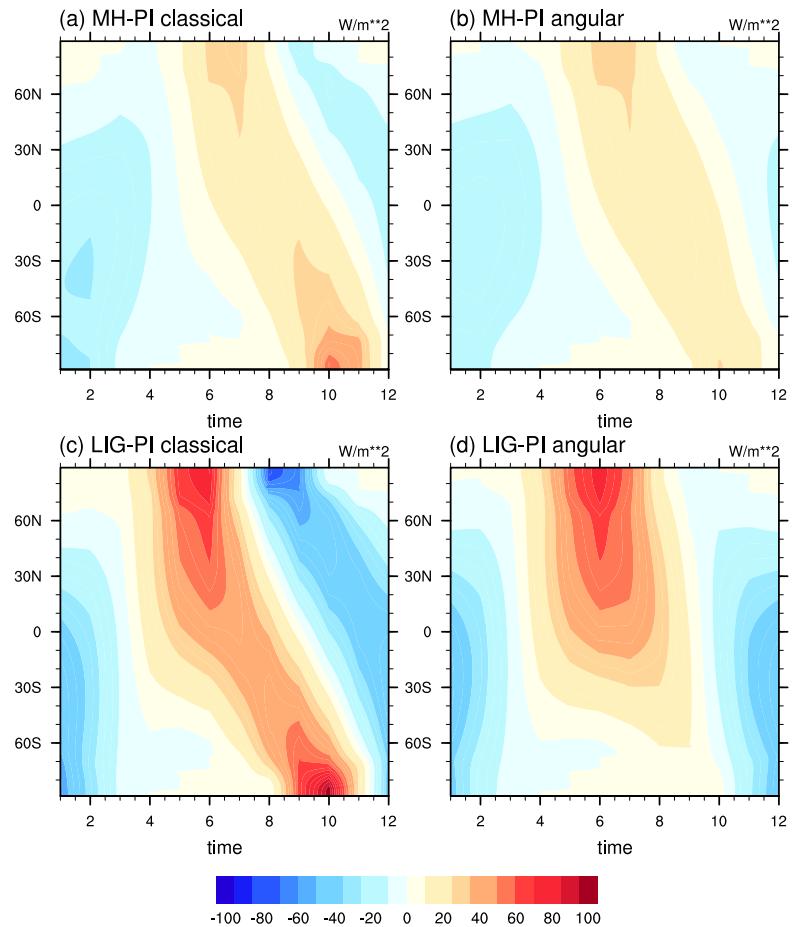
**Xiaoxu Shi et al.**

*Correspondence to:* Xiaoxu Shi (xshi@awi.de)

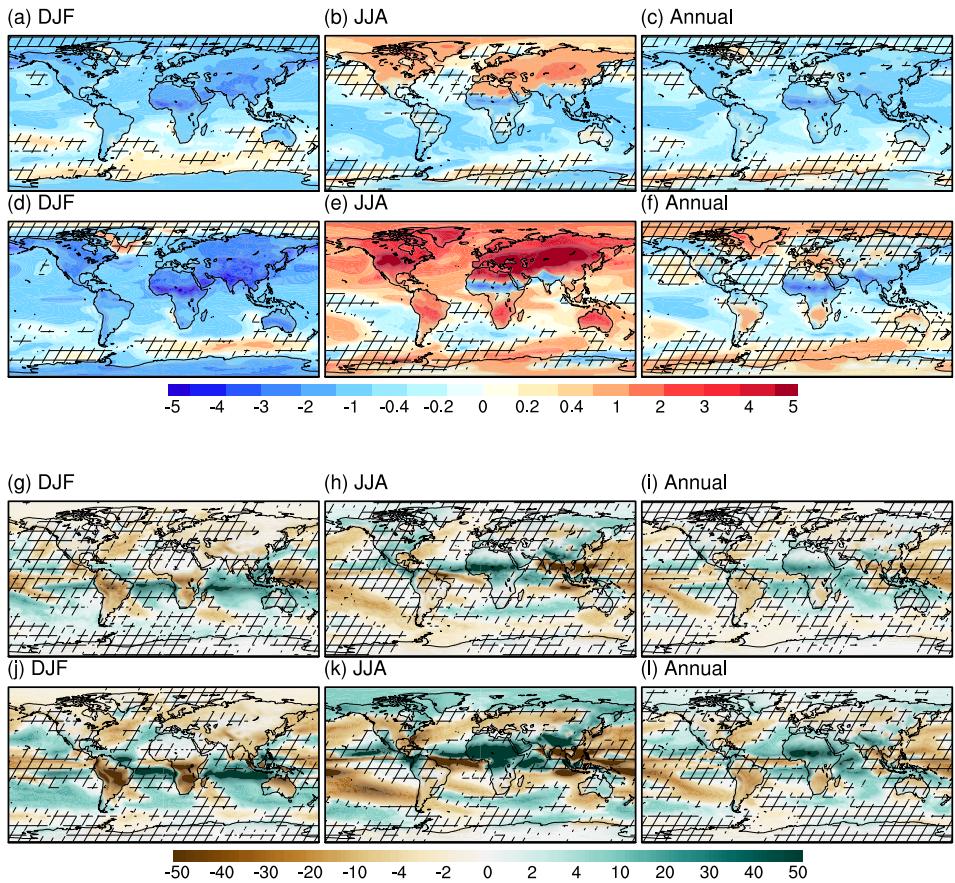
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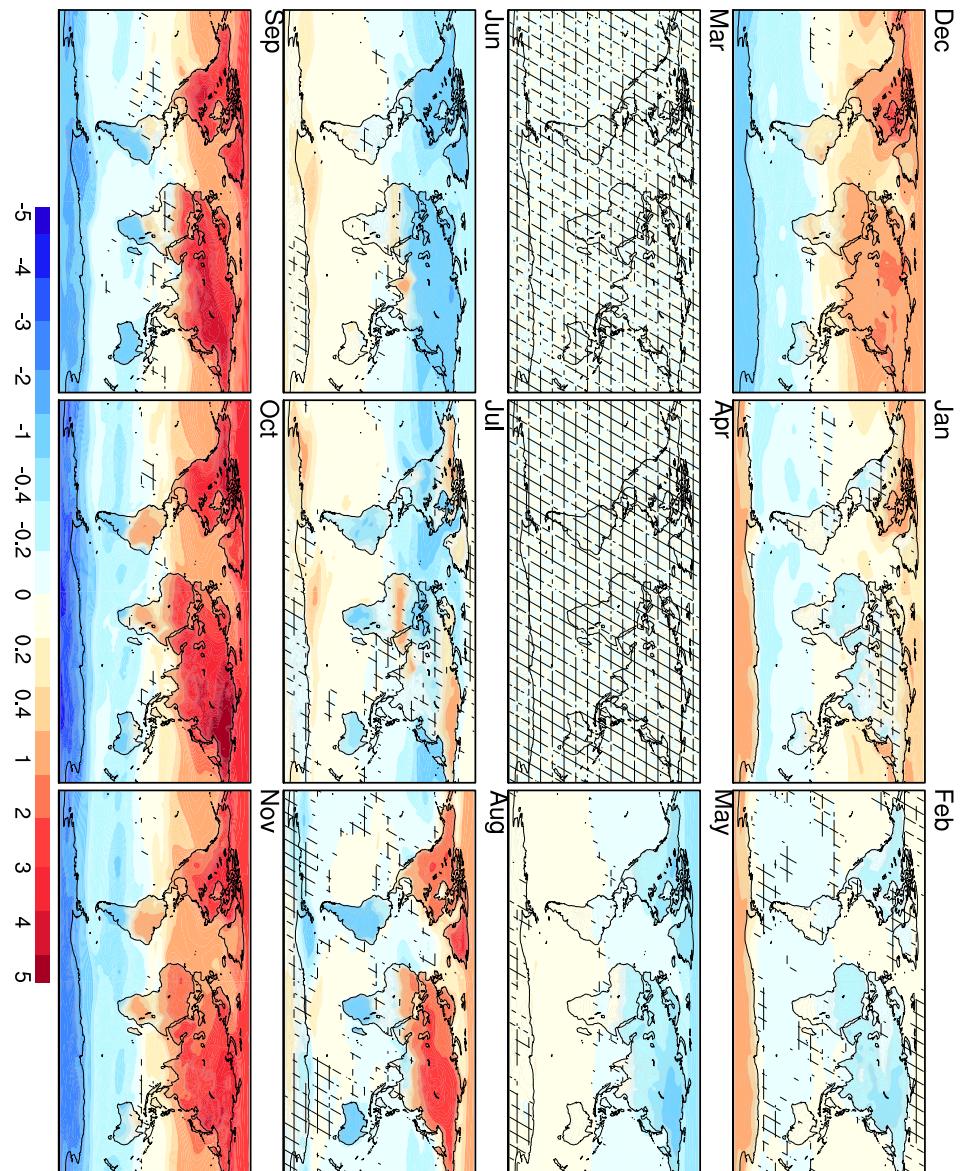
**Figure S1.** The mean anomaly (M), eccentric anomaly (E) and true anomaly ( $\theta$ ). Source: <http://www.jgiesen.de/kepler/kepler.html> (accessed on 28.01.2022)



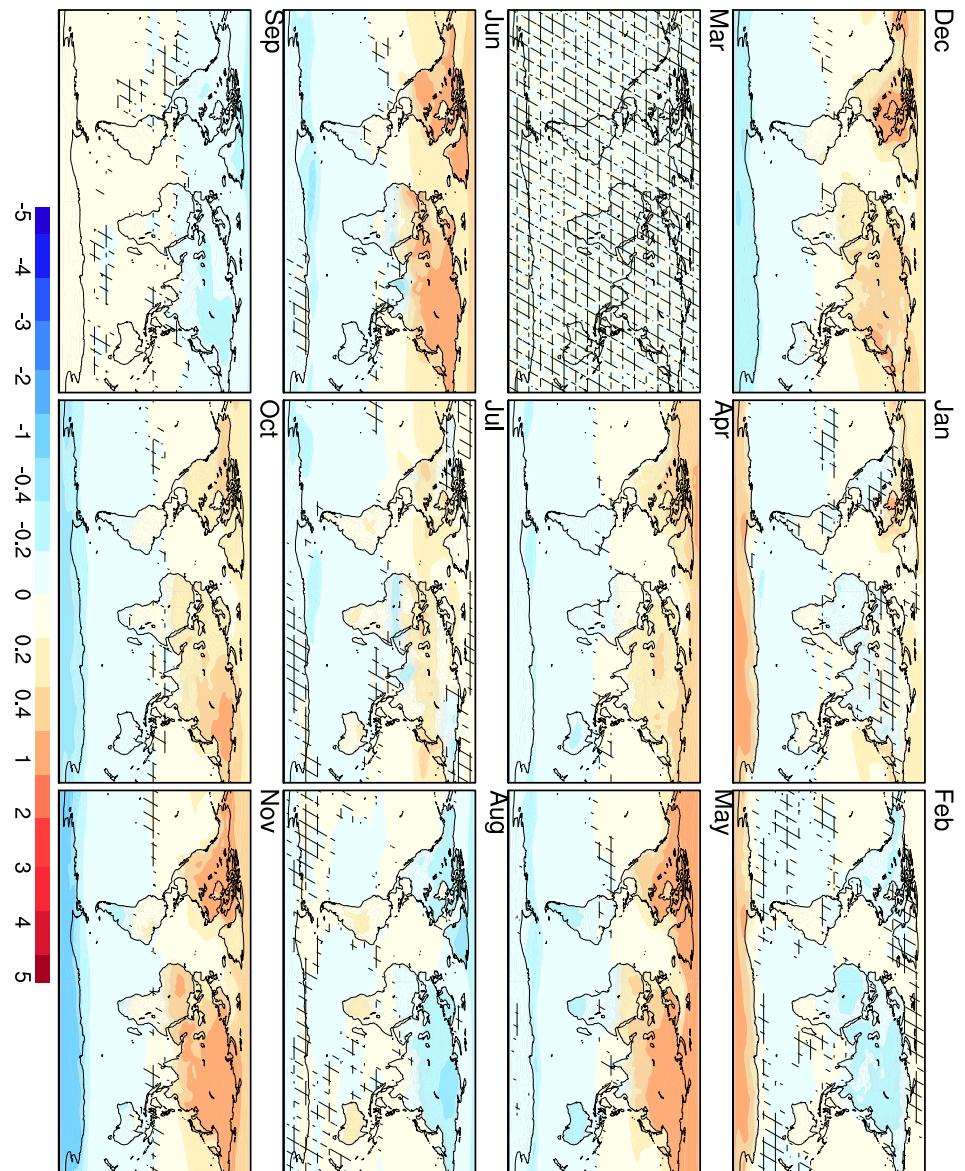
**Figure S2.** Insolation anomalies relative to PI in (a-b) MH and (c-d) LIG in classical and angular calendar.



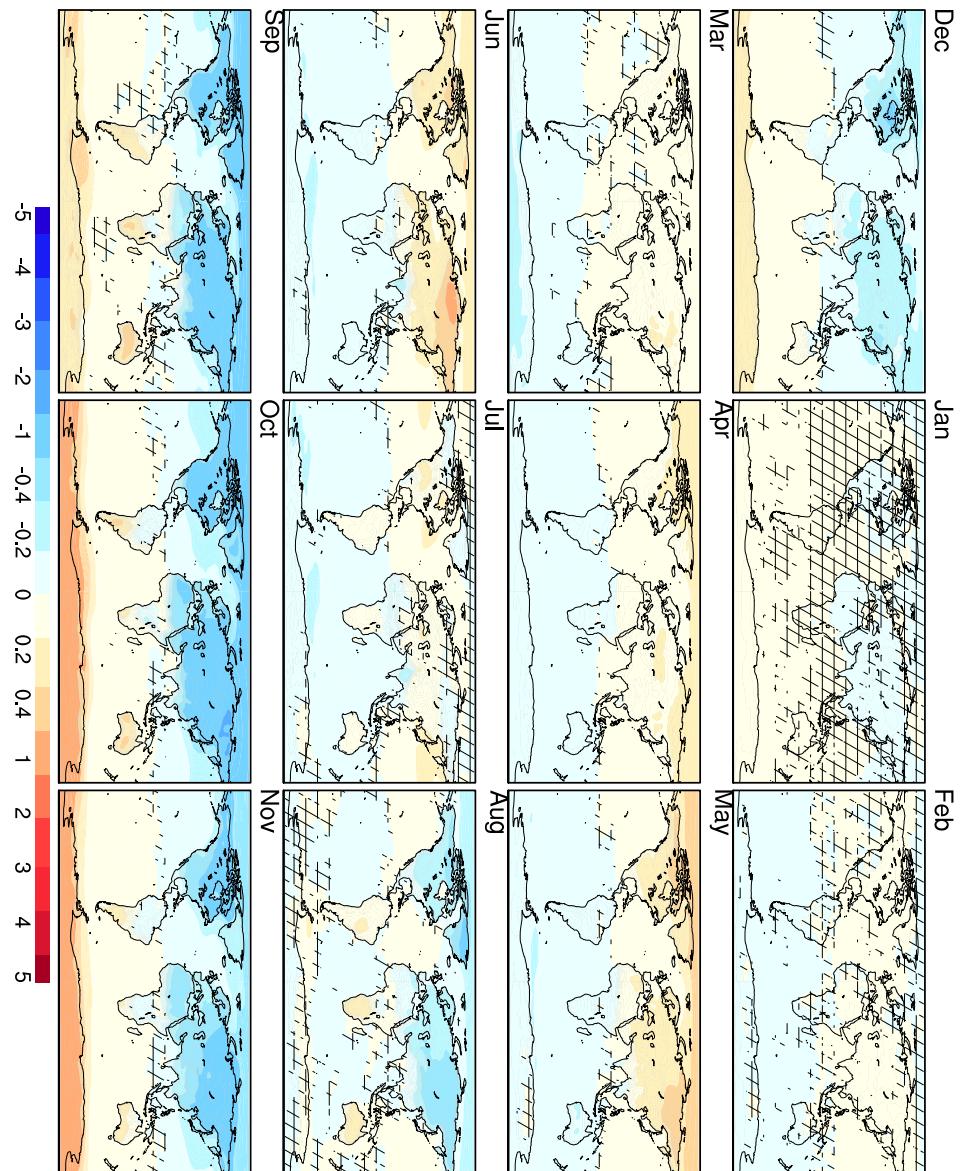
**Figure S3.** (a-c) Ensemble anomalies of surface air temperature between MH and PI for (a) DJF, (b) JJA, and (c) annual mean. Units: K. (d-f) As in a-c, but for anomalies of surface air temperature between LIG and PI. (g-l) As in a-d, but for precipitation. The unmarked area indicates that at least 7 models show the same sign. Units: mm/month.



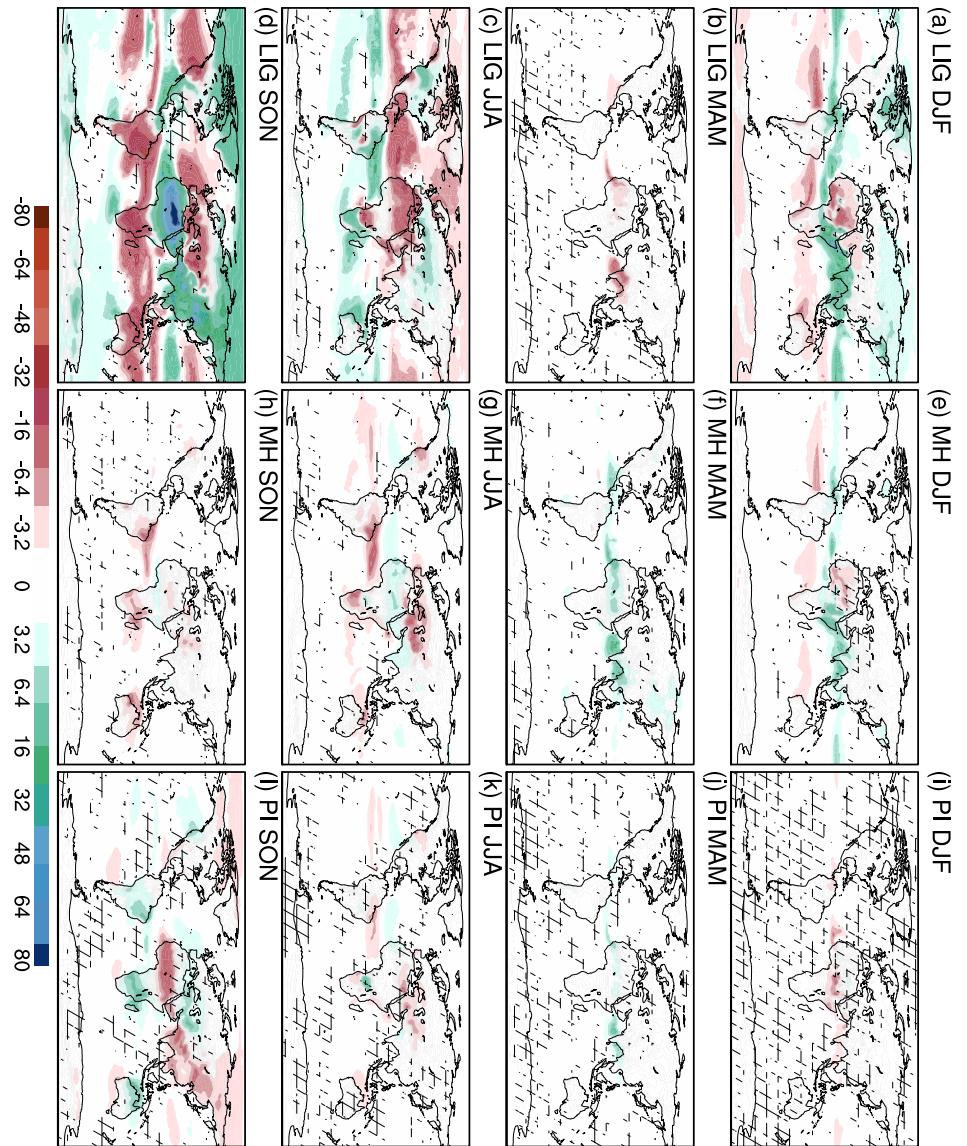
**Figure S4.** Ensemble anomalies of surface air temperature between angular and classical means in LIG for each month. The unmarked area indicates that at least 7 models show the same sign. Units: K.



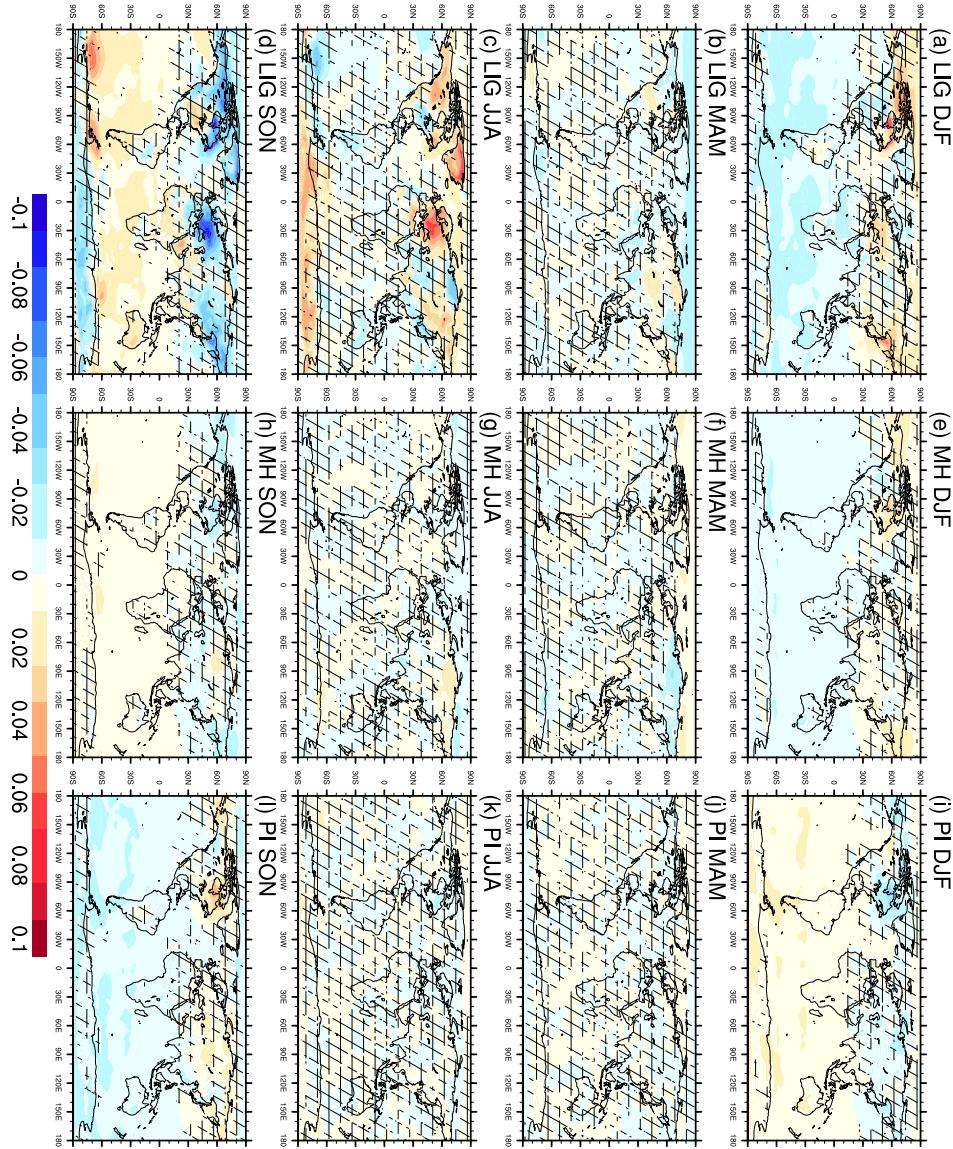
**Figure S5.** Ensemble anomalies of surface air temperature between angular and classical means in MH for each month. The unmarked area indicates that at least 7 models show the same sign. Units: K.



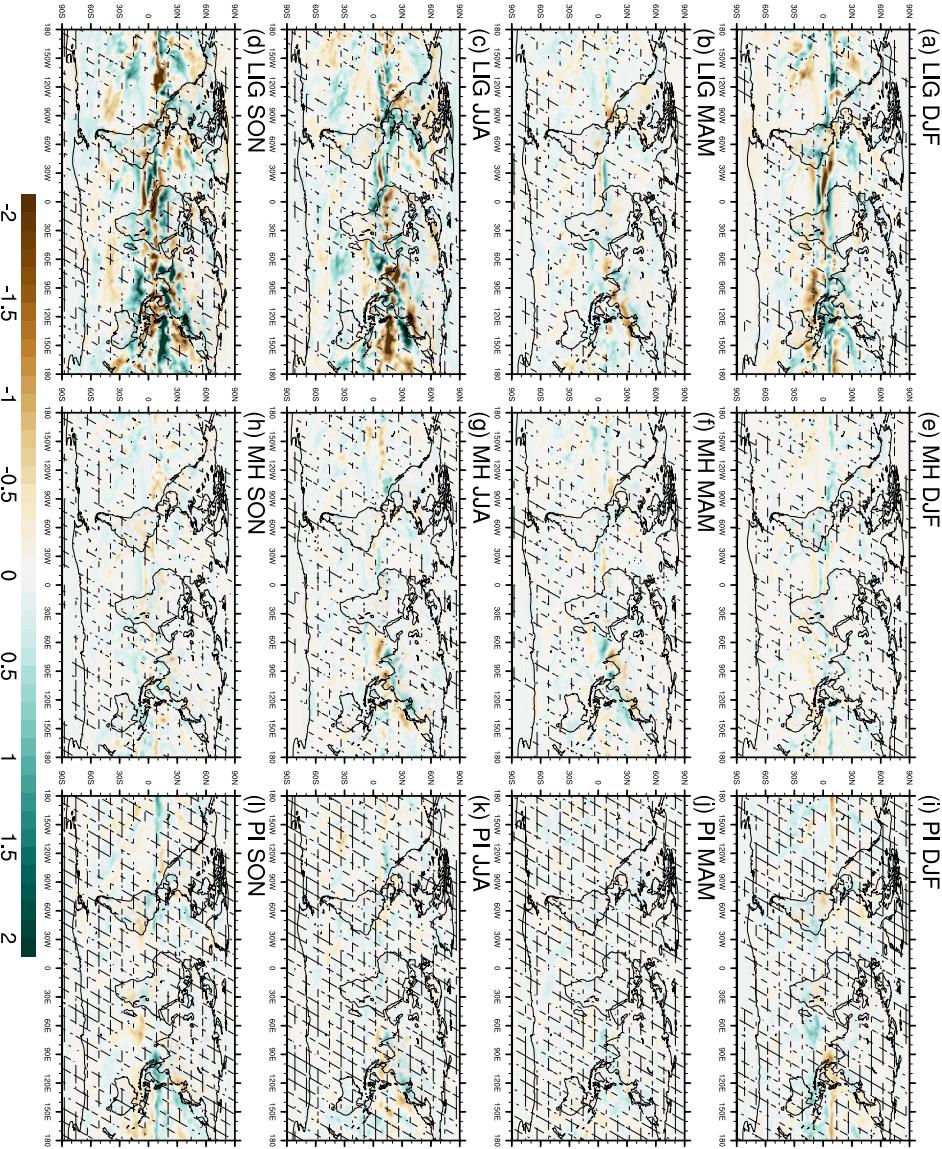
**Figure S6.** Ensemble anomalies of surface air temperature between angular and classical means in PI for each month. The unmarked area indicates that at least 7 models show the same sign. Units: K.



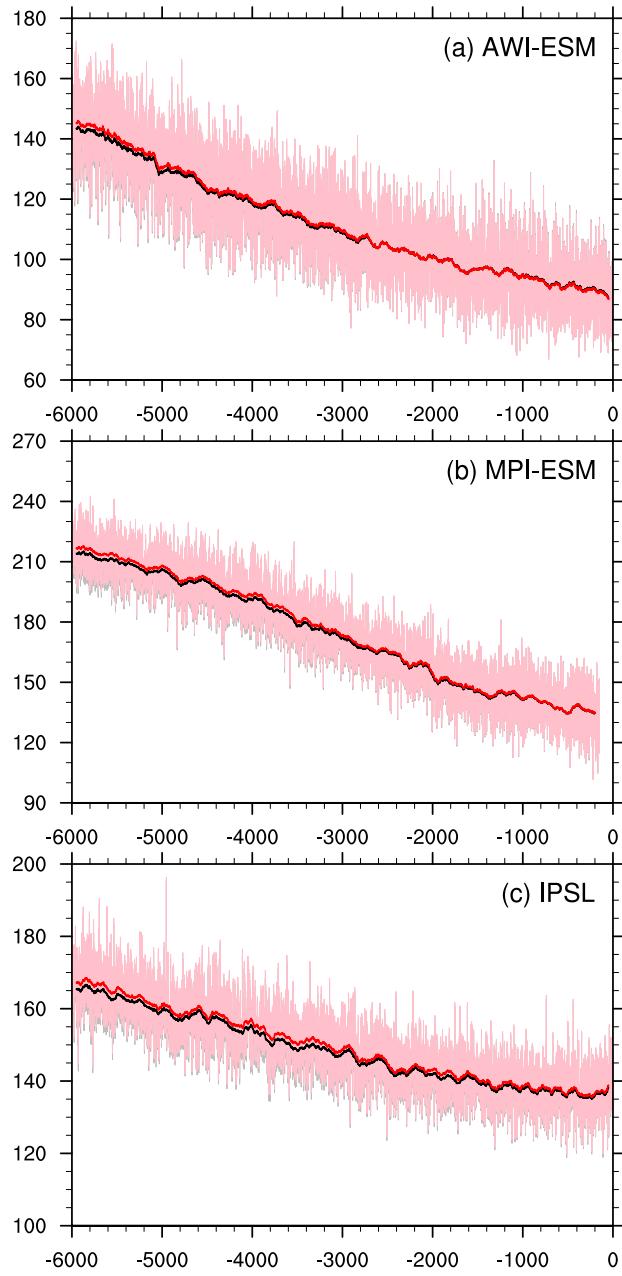
**Figure S7.** Ensemble percentage changes of precipitation between angular means and classical means for (a-d) LIG, (e-h) MH, and (i-l) PI. The unmarked area indicates that at least 7 models show the same sign. Units: %.



**Figure S8.** Ensemble anomalies of surface air temperature between day-length adjusted values and month-length adjusted values. The unmarked area indicates that at least 7 models show the same sign. Units: K.

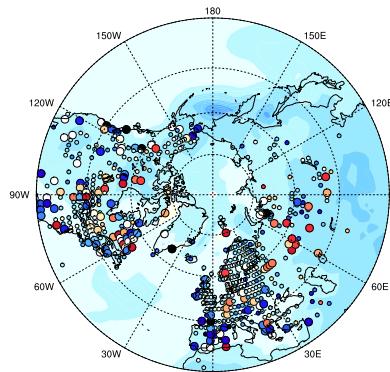


**Figure S9.** Ensemble anomalies of precipitation between day-length adjusted values and month-length adjusted values. The unmarked area indicates that at least 7 models show the same sign. Units: K.

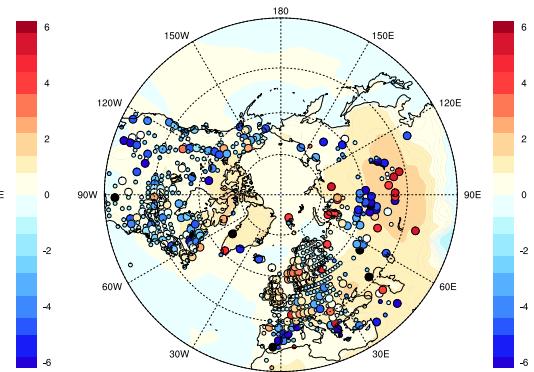


**Figure S10.** Time series of boreal summer precipitation in classical and angular means averaged over Africa monsoon zone ( $5\text{--}23.3^{\circ}\text{N}$ ,  $15\text{W}\text{--}30^{\circ}\text{E}$ ), weighted by month length, for (a) AWI-ESM, (b) MPI-ESM, and (c) IPSL-CM. Grey and pink lines stand for the original classical and angular means respectively. Smoothed curves with a running window of 100 model years are shown in black (for classical means) and red (for angular means). Units: mm/month.

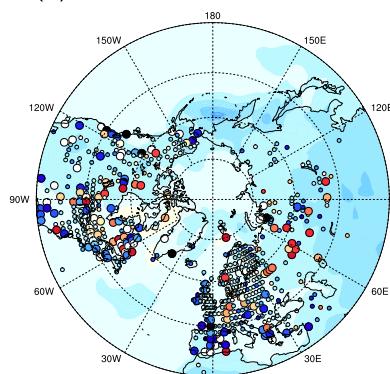
(a) DJF



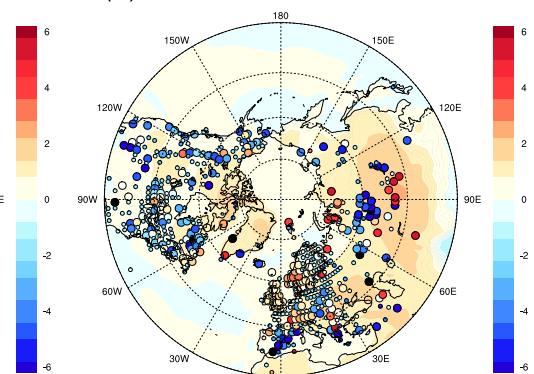
(b) JJA



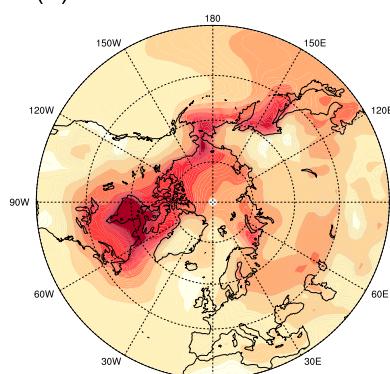
(c) DJF



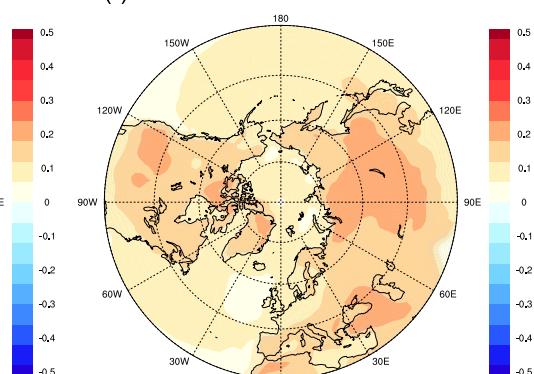
(d) JJA



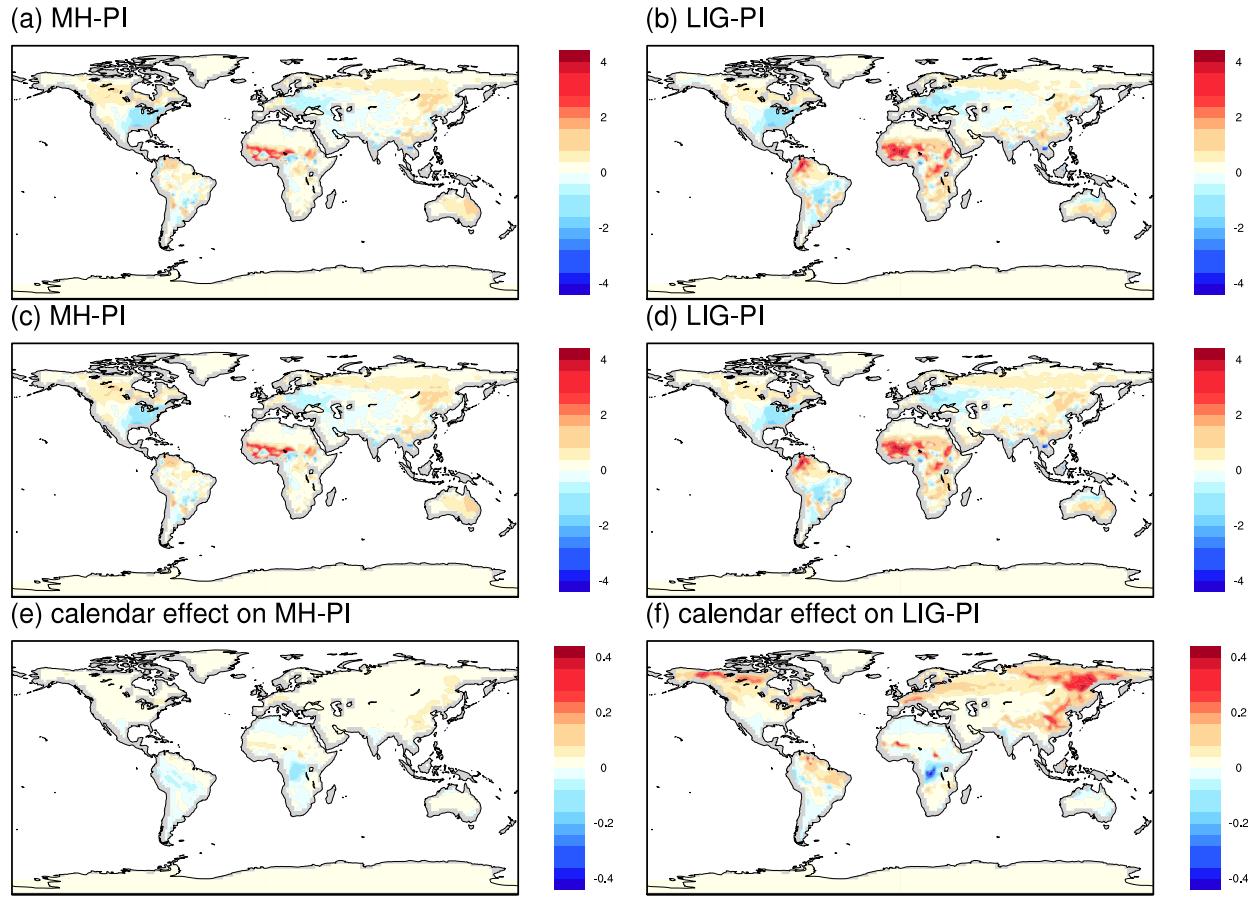
(e) DJF



(f) JJA



**Figure S11.** (a, b) Shading: Ensemble anomalies of surface air temperature (MH minus PI) under classical calendar. Circles: Reconstructed temperature anomalies (MH minus PI). (c, d) As in (a, b) but for angular means. (e, f) Anomalies between MH-PI angular means and MH-PI classical means. Units: K.



**Figure S12.** (a, b) Ensemble anomalies of SON leaf area index under classical calendar. (c, d) As in (a, b) but for angular means. (e, f) Calendar effect on the leaf area index anomalies. Units: 1.

Table S1 Details of model data availability.

model	data reference for PI, MH and LIG simulations	Digital Object Identifier (doi) for PI, MH, and LIG simulations
AWI-ESM-1-1-LR	Danek et al. (2020) Shi et al. (2020a) Shi et al. (2020b)	10.22033/ESGF/CMIP6.9335 10.22033/ESGF/CMIP6.9332 10.22033/ESGF/CMIP6.9331
CESM2	Danabasoglu (2019a) Danabasoglu (2019b) Danabasoglu (2019c)	10.22033/ESGF/CMIP6.11301 10.22033/ESGF/CMIP6.7674 10.22033/ESGF/CMIP6.7673
EC-Earth3-LR	EC-Earth Consortium (EC-Earth) (2019) EC-Earth Consortium (EC-Earth) (2020a) EC-Earth Consortium (EC-Earth) (2020b)	10.22033/ESGF/CMIP6.4847 10.22033/ESGF/CMIP6.4801 10.22033/ESGF/CMIP6.4798
FGOALS-f3-L	Yu (2019) Zheng and He (2019a) Zheng and He (2019b)	10.22033/ESGF/CMIP6.3447 10.22033/ESGF/CMIP6.12014 10.22033/ESGF/CMIP6.12013
FGOALS-g3	Li (2019) Zheng and Dong (2019a) Zheng and Dong (2019b)	10.22033/ESGF/CMIP6.3448 10.22033/ESGF/CMIP6.3409 10.22033/ESGF/CMIP6.3407
INM-CM4-8	Volodin et al. (2019a) Volodin et al. (2019b) Volodin et al. (2019c)	10.22033/ESGF/CMIP6.5080 10.22033/ESGF/CMIP6.5077 10.22033/ESGF/CMIP6.5076
IPSL-CM6A-LR	Boucher et al. (2018a) Boucher et al. (2018b) Boucher et al. (2018c)	10.22033/ESGF/CMIP6.5251 10.22033/ESGF/CMIP6.5229 10.22033/ESGF/CMIP6.5228
NESM3	Cao and Wang (2019) Cao (2019a) Cao (2019b)	10.22033/ESGF/CMIP6.8776 10.22033/ESGF/CMIP6.8773 10.22033/ESGF/CMIP6.8772

### References for Table S1.

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Shi, Xiaoxu; Yang, Hu; Danek, Christopher; Lohmann, Gerrit (2020a). AWI AWI-ESM1.1LR model output prepared for CMIP6 PMIP midHolocene. Earth System Grid Federation. doi:<https://doi.org/10.22033/ESGF/CMIP6.9332>

Shi, Xiaoxu; Yang, Hu; Danek, Christopher; Lohmann, Gerrit (2020b). AWI AWI-ESM1.1LR model output prepared for CMIP6 PMIP lig127k. Earth System Grid Federation. doi:<https://doi.org/10.22033/ESGF/CMIP6.9331>

Danabasoglu, Gokhan (2019a). NCAR CESM2-FV2 model output prepared for CMIP6 CMIP piControl. Earth System Grid Federation. doi:<https://doi.org/10.22033/ESGF/CMIP6.11301>

Danabasoglu, Gokhan (2019b). NCAR CESM2 model output prepared for CMIP6 PMIP midHolocene. Earth System Grid Federation. doi:<https://doi.org/10.22033/ESGF/CMIP6.7674>

Danabasoglu, Gokhan (2019c). NCAR CESM2 model output prepared for CMIP6 PMIP lig127k. Earth System Grid Federation. doi:<https://doi.org/10.22033/ESGF/CMIP6.7673>

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doi:<https://doi.org/10.22033/ESGF/CMIP6.5080>

Volodin, Evgeny; Mortikov, Evgeny; Gritsun, Andrey; Lykossov, Vasily; Galin, Vener; Diansky, Nikolay; Gusev, Anatoly; Kostrykin, Sergey; Iakovlev, Nikolay; Shestakova, Anna; Emelina, Svetlana (2019b). INM INM-CM4-8 model output prepared for CMIP6 PMIP midHolocene. Earth System Grid Federation.  
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