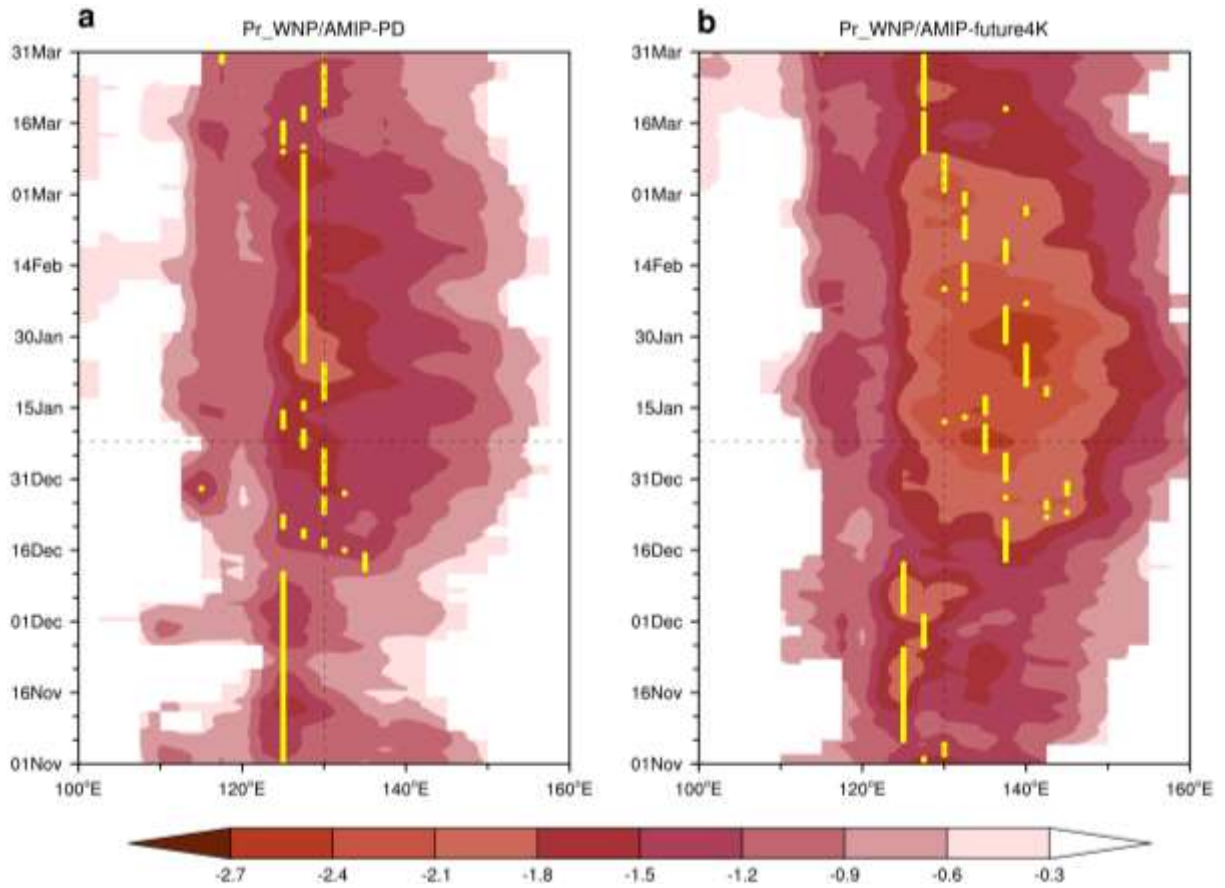
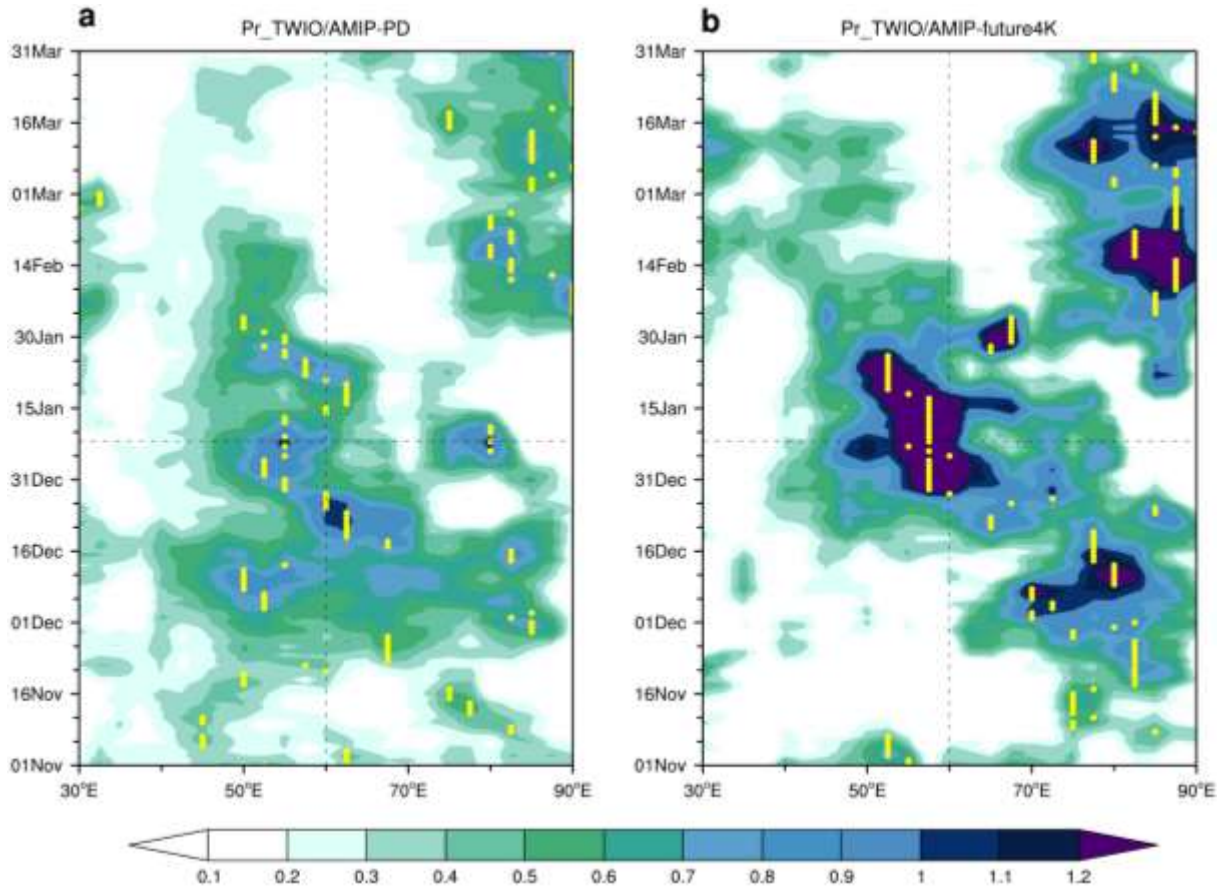




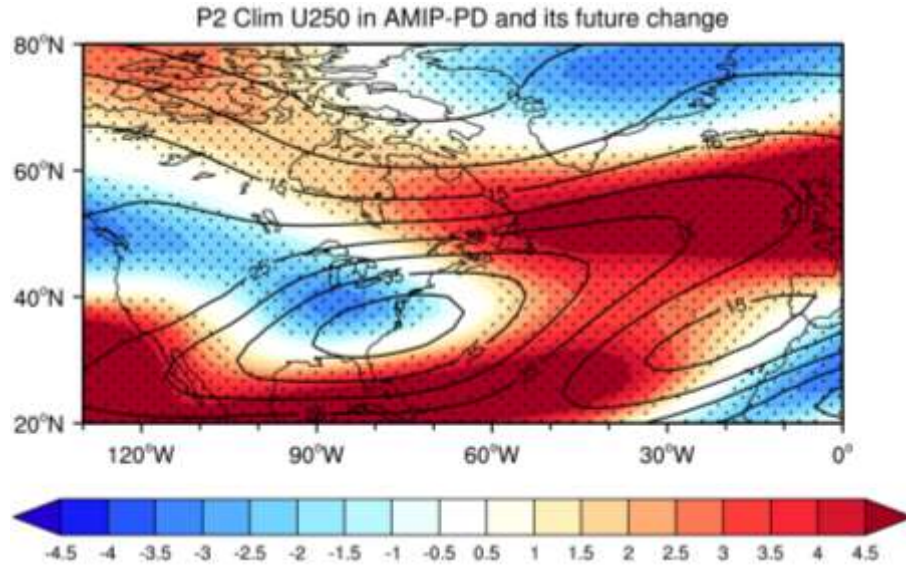
23

24 **Supplementary Figure 1** Regression coefficients of the western North Pacific meridional mean
 25 (0°–20°N) daily precipitation anomalies with respect to the DJF Niño-3.4 index for the MME of
 26 (a) AMIP-PD and (b) AMIP-future4K simulations. Note that only the significant values at the 90%
 27 confidence level are displayed. The yellow dot represents the zonal location of the maximum
 28 regression coefficient at each certain day. The horizontal black dashed line separates the whole
 29 winter period into early winter (P1) and late winter (P2). The vertical black dashed line marks
 30 130°E longitude for better comparison.

31

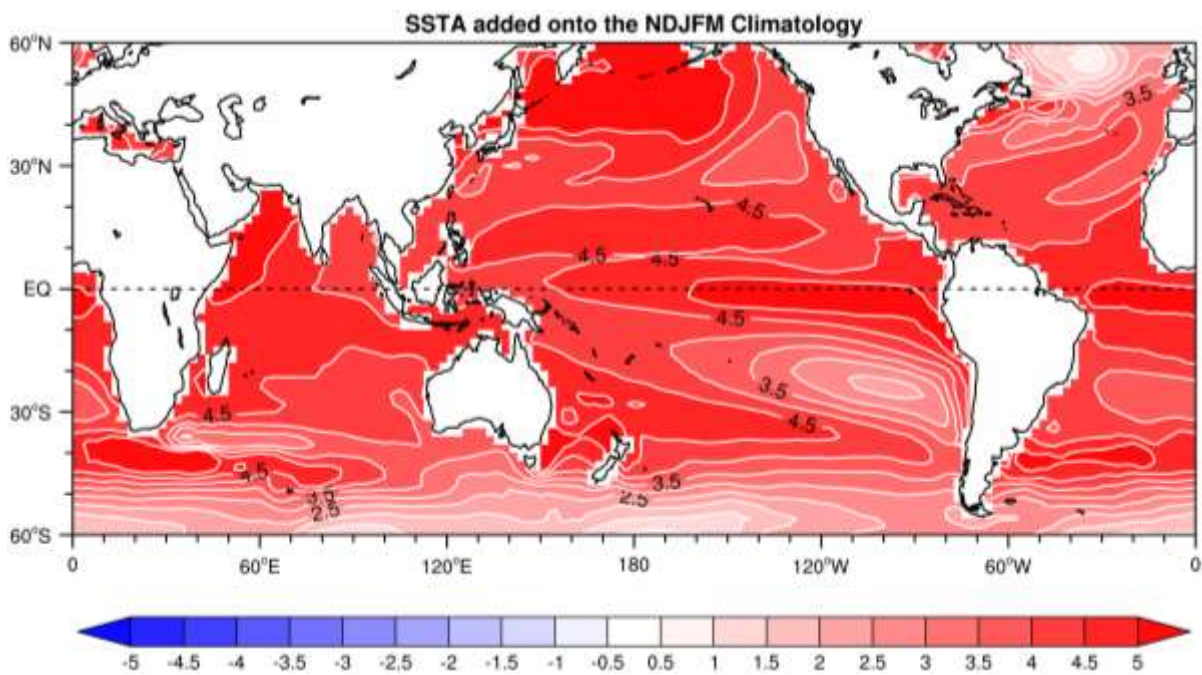


Supplementary Figure 2 Regression coefficients of the tropical western Indian Ocean meridional mean (5°S–5°N) daily precipitation anomalies with respect to the DJF Niño-3.4 index for the MME of (a) AMIP-PD and (b) AMIP-future4K simulations. Note that only the significant values at the 90% confidence level are displayed. The yellow dot represents the zonal location of the maximum regression coefficient at each certain day. The horizontal black dashed line separates the whole winter period into early winter (P1) and late winter (P2). The vertical black dashed line marks 60°E longitude for better comparison.



Supplementary Figure 3 Spatial pattern of climatological 250-hPa zonal wind (contours in ms^{-1}) during P2 for the MME of the AMIP-PD simulations. The shadings (units: ms^{-1}) show the P1 climatological 250-hPa zonal wind differences between the MME of the AMIP-future4K and AMIP simulations. The dots denote the zonal wind differences that are significant at the 90% confidence level.

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50 **Supplementary Figure 4** The wintertime (NDJFM) mean SST anomaly (shadings and contours

51 in K) added onto the climatology to force the AMIP-future4K simulations.

52

Supplementary Table 1 Seven CMIP6 AMIP and AMIP-future4K simulations used in the study.

Model	Institution	Ensemble Variant Label
BCC-CSM2-MR	BCC	r1i1p1f1
CanESM5	CCCma	r1i1p2f1
CESM2	NCAR	r1i1p1f1
HadGEM3-GC31-LL	MOHC	r5i1p1f3
IPSL-CM6A-LR	IPSL	r1i1p1f1
MIROC6	MIROC	r1i1p1f1
MRI-ESM2-0	MRI	r1i1p1f1