Supplementary information for Referee Comment #1 on "*Tipping the ENSO into a permanent El Niño can trigger state transitions in global terrestrial ecosystems*"

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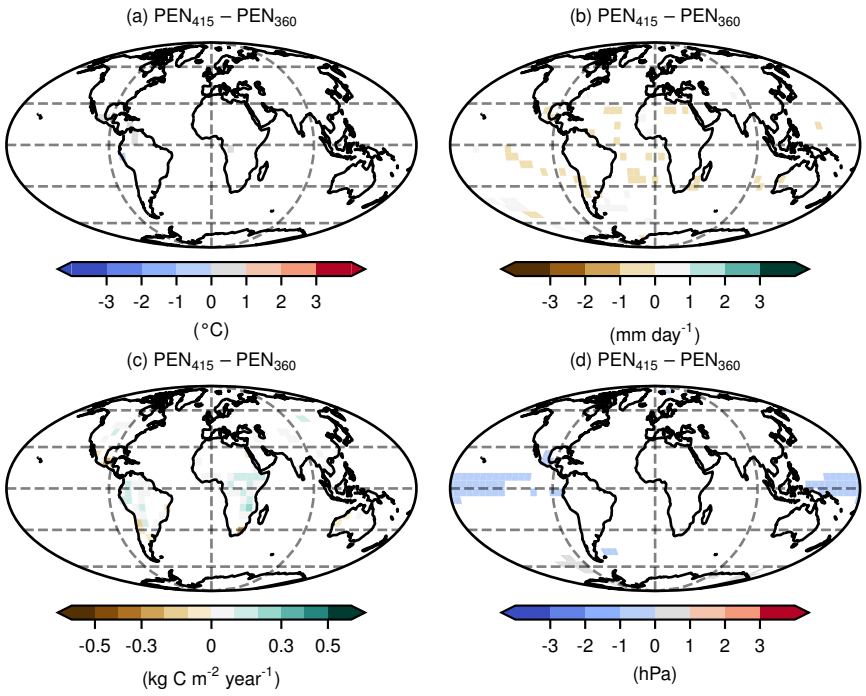

Figure C1. Differences among PEN simulations with different atmospheric CO_2 values for variables: (a) near surface temperature, (b) total precipitation rate, (c) gross primary production and (d) mean sea-level surface pressure. CO_2 values are shown as subscripts. White is for statistically non-significant differences (α = 0.05). Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. This figure will not be included in the revised manuscript, but perhaps as supplementary material.

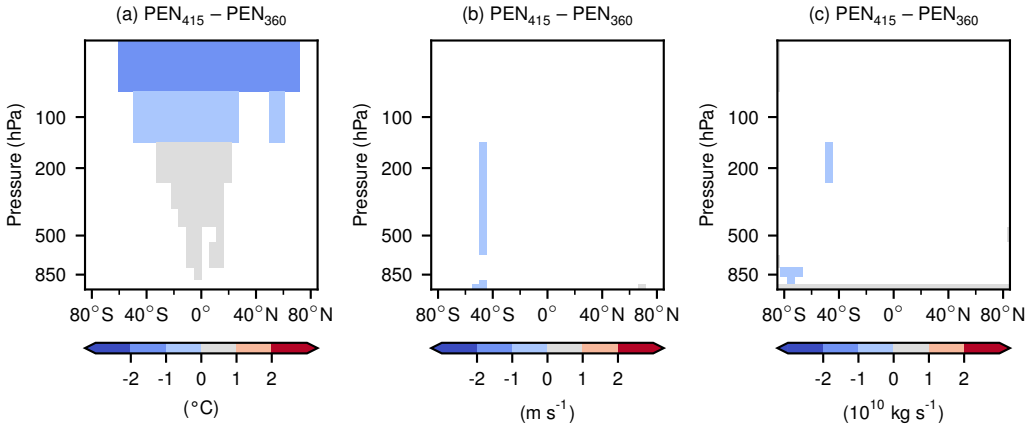

Figure C2. Differences among PEN simulations with different atmospheric CO_2 values for variables: (a) air temperature, (b) zonal wind speed and (c) zonal mean meridional mass streamfunction. White is for statistically non-significant differences (α = 0.05). This figure will not be included in the revised manuscript, but perhaps as supplementary material.

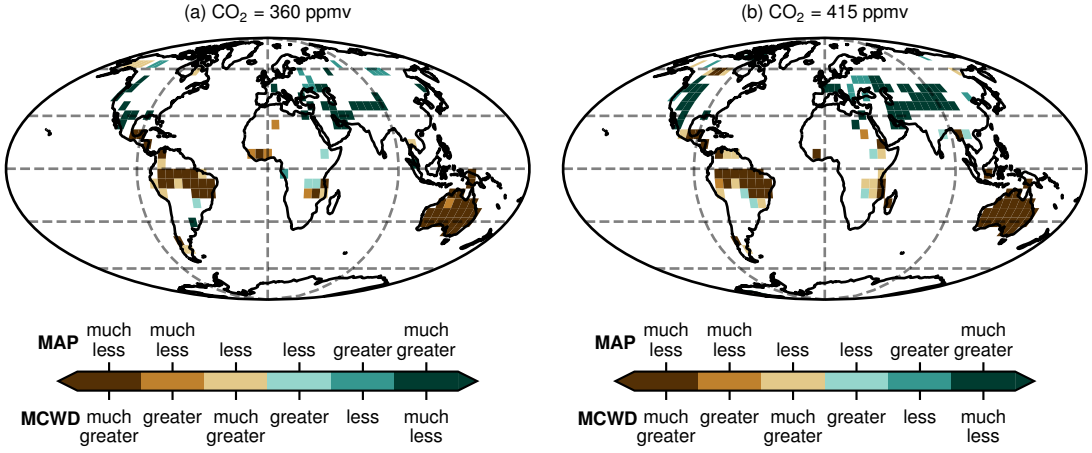

Figure C3. Comparison in water deficit results between simulations with different atmospheric CO_2 values: (a) 360 ppm and (b) 415 ppm. The meaning of colors is the same as explained in the manuscript. Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. This figure will not be included in the revised manuscript, but perhaps as supplementary material.

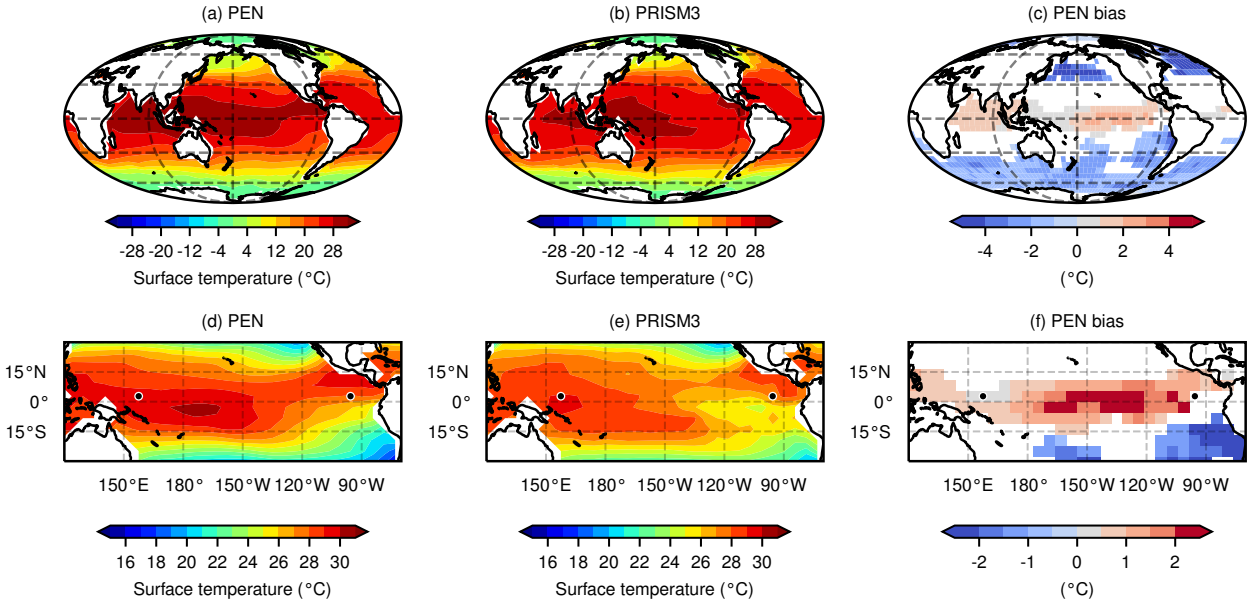

Figure C4. (top) Sea surface temperature forcing in (a) PEN simulation, (b) PRISM3 data set and (c) their differences. Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. (bottom) Equatorial Pacific sea surface temperature forcing in (d) PEN simulation, (e) PRISM3 data set and (f) their differences. Markers show the west (158° E, 2.8° N) and east (96° W, 2.8° N) sites used to compute the zonal gradient. In all bias panels white is for statistically non-significant differences ($\alpha = 0.05$). This figure will not be included in the revised manuscript, but perhaps as supplementary material.

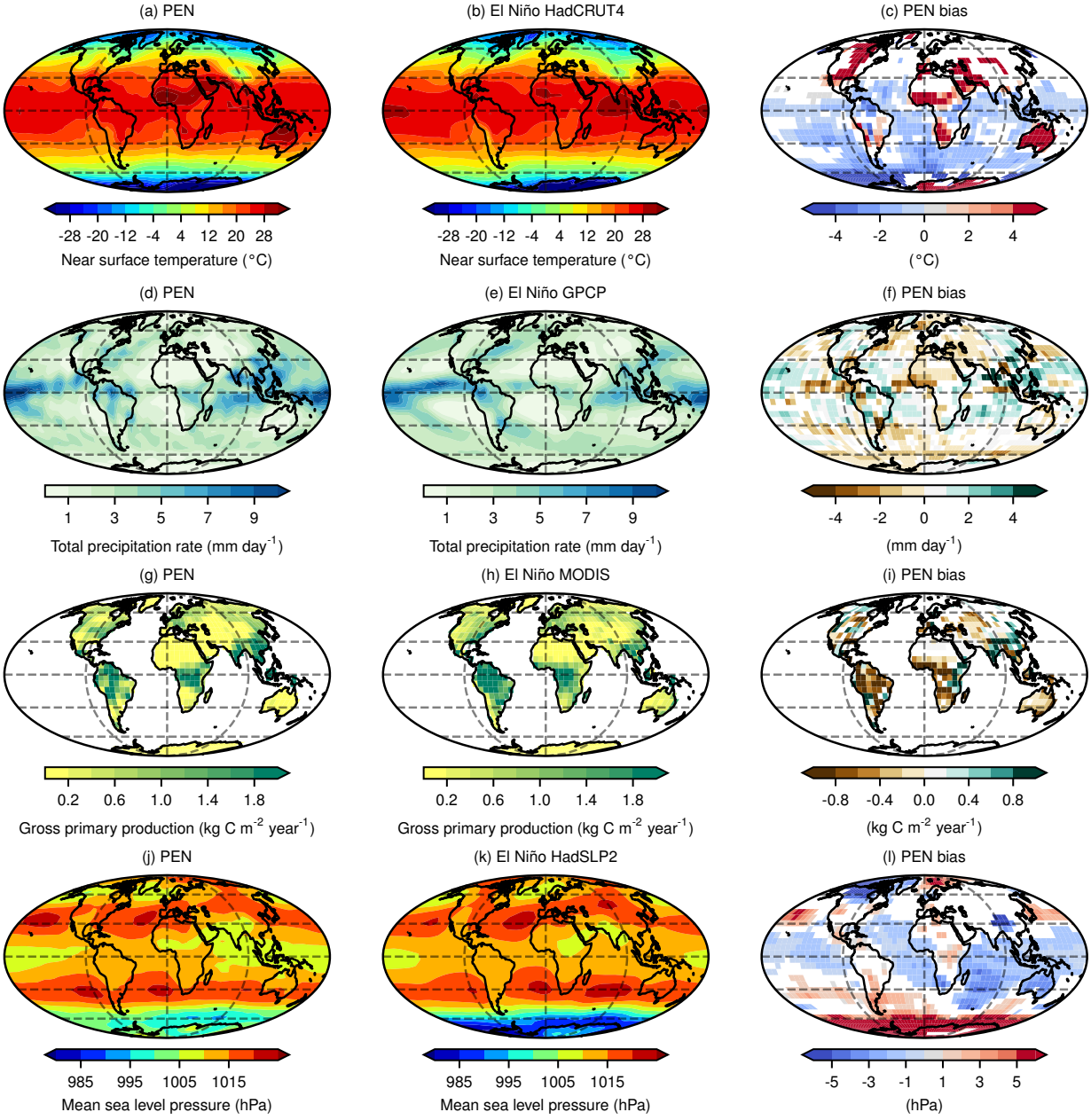

Figure C5. Annual mean results for PEN simulation compared with observational data for El Niño years: near surface temperature in (a) PEN, (b) HadCRUT4 mean of 1997 – 98 and 2015 – 16, and (c) PEN bias; total precipitation rate in (d) PEN, (e) GPGP mean of 1997 – 98 and 2015 – 16, and (f) PEN bias; gross primary production in (g) PEN, (h) MODIS mean of 2002 – 03 and 2009 – 10 and (i) PEN bias; and mean sea-level surface pressure in (j) PEN, (k) HadSLP2 mean of 1982 – 83 and 1997 – 98. Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. In all bias panels white is for statistically non-significant differences (α = 0.05). This figure will not be included in the revised manuscript, but perhaps as supplementary material.

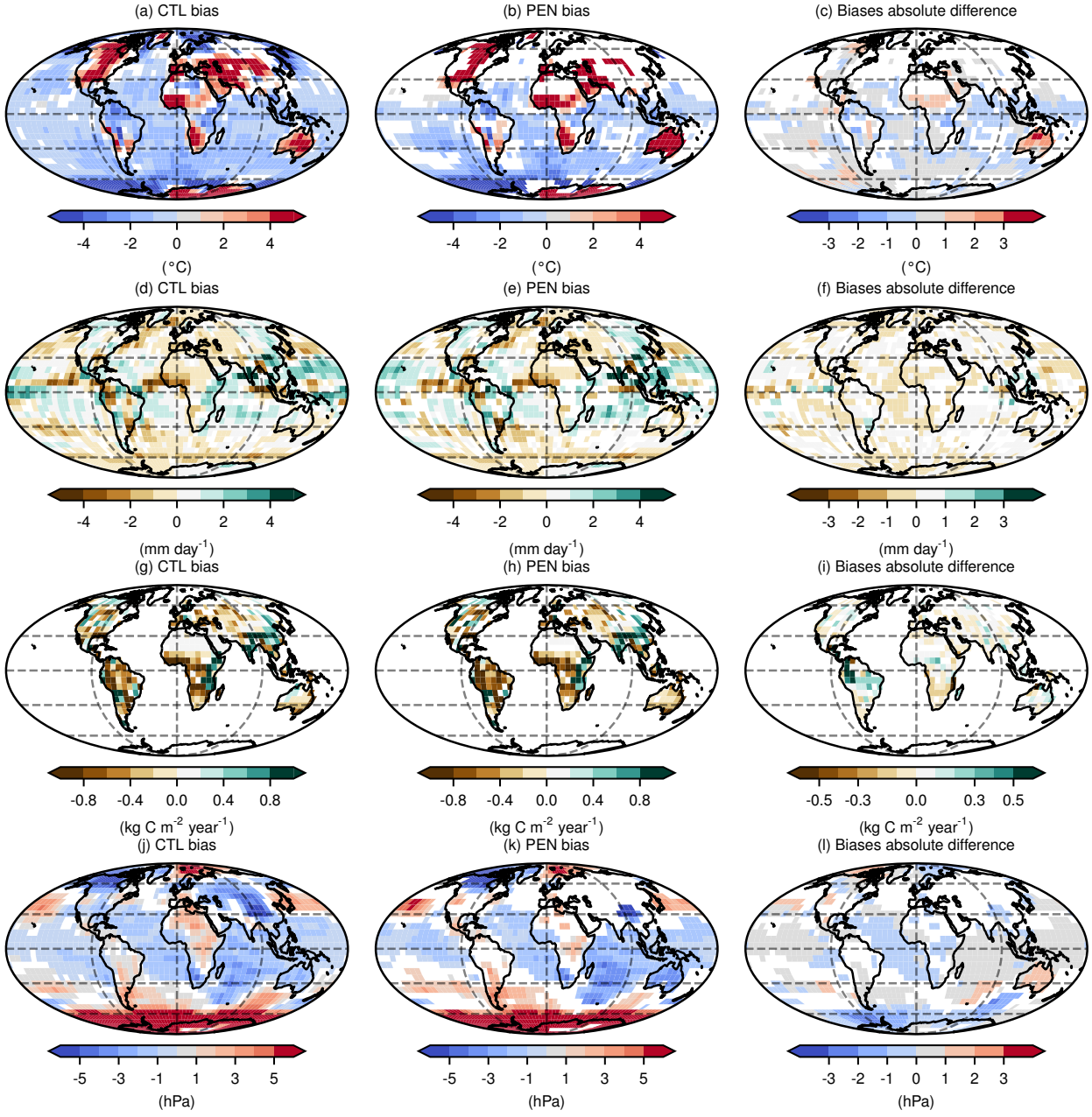

Figure C6. Bias panels from CTL simulation compared with PEN and their absolutes differences for variables: near surface temperature bias in (a) CTL, (b) PEN and (c) their differences; total precipitation rate bias in (d) CTL, (e) PEN and (f) their differences; gross primary production bias in (g) CTL, (h) PEN and (i) their differences; and mean sea-level surface pressure bias in (j) CTL, (k) PEN and (l) their differences. Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. In all panels white is for statistically non-significant differences (α = 0.05). This figure will not be included in the revised manuscript, but perhaps as supplementary material.

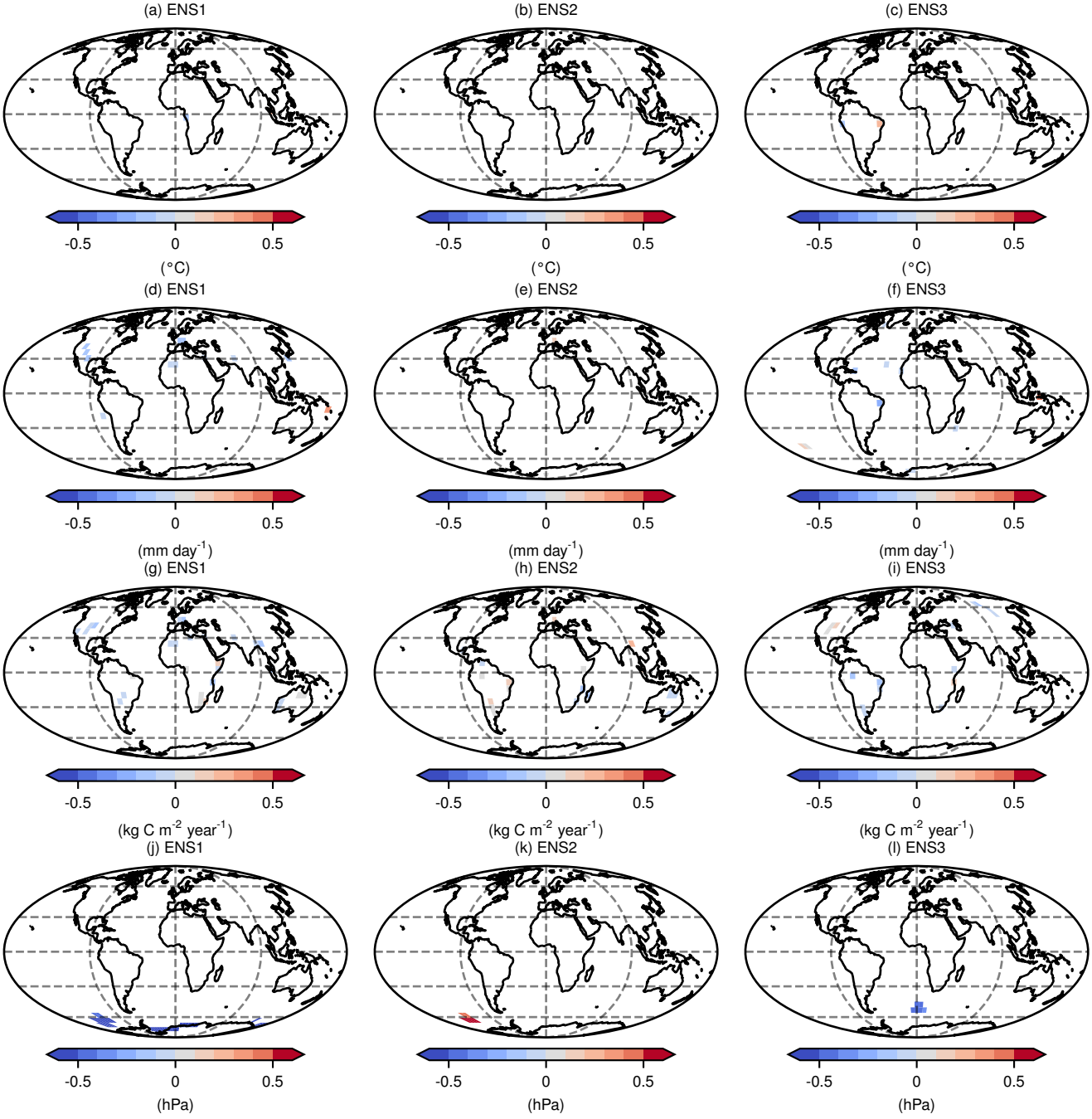

Figure C7. Annual mean differences of ensemble members versus the ensemble mean for CTL simulation for variables: near surface temperature (a, b, c), total precipitation rate (d, e, f), gross primary production (g, h, i) and mean sea-level surface pressure (j, k, l). Gridlines are spaced every 30° in the parallels from the Equator, and every 90° in the meridians from Greenwich. In all panels white is for statistically non-significant differences ($\alpha = 0.1$). This figure will not be included in the revised manuscript, but perhaps as supplementary material.

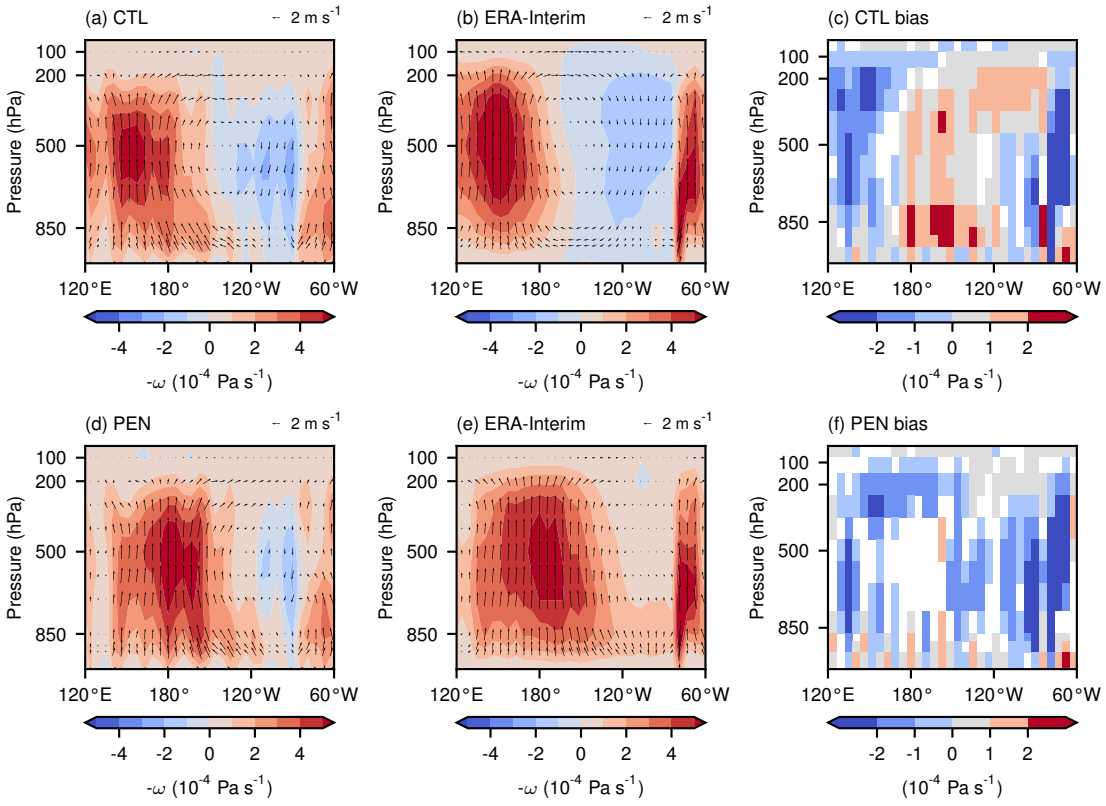

Figure C8. Meridional divergent circulation in the equatorial Pacific for (a) CTL simulation, (b) climatological ERA-Interim and (c) CTL bias in vertical velocity values; as well as for (d) PEN simulation, (e) ERA-Interim mean of 1997 – 98 and 2015 – 16, and (f) PEN bias in vertical velocity values. Vectors are plotted using the divergent meridional wind component and the negative vertical velocity in pressure units ($-\omega$), averaged over latitudes 5° S to 5° N. Filled contours show the magnitude and value of the vertical velocity. In all bias panels white is for statistically non-significant differences ($\alpha = 0.05$). This figure will be included in the revised manuscript.