Supplementary Information

Contrasting response of land and ocean hydrological cycle to a changing CO_2 pathway

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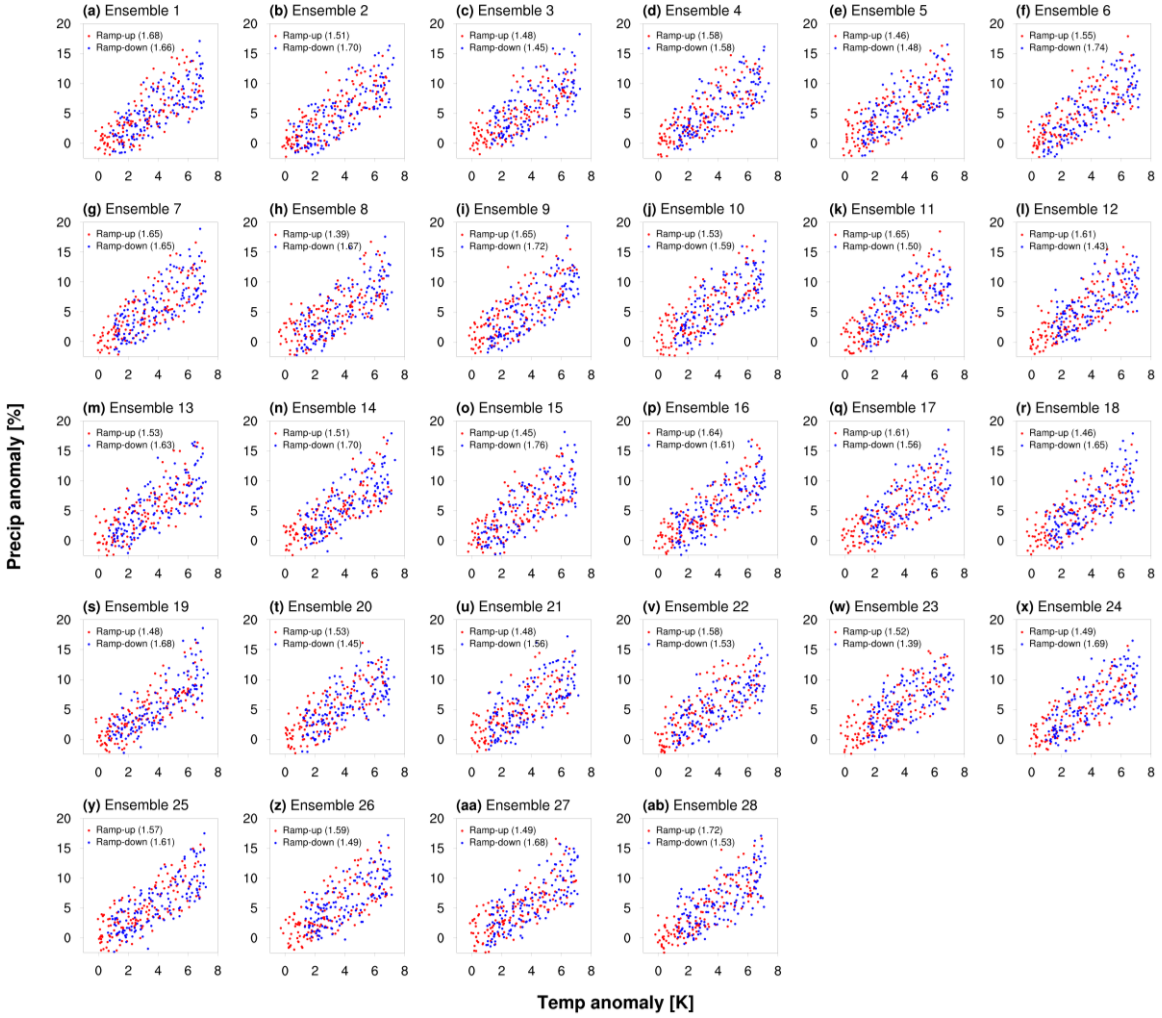
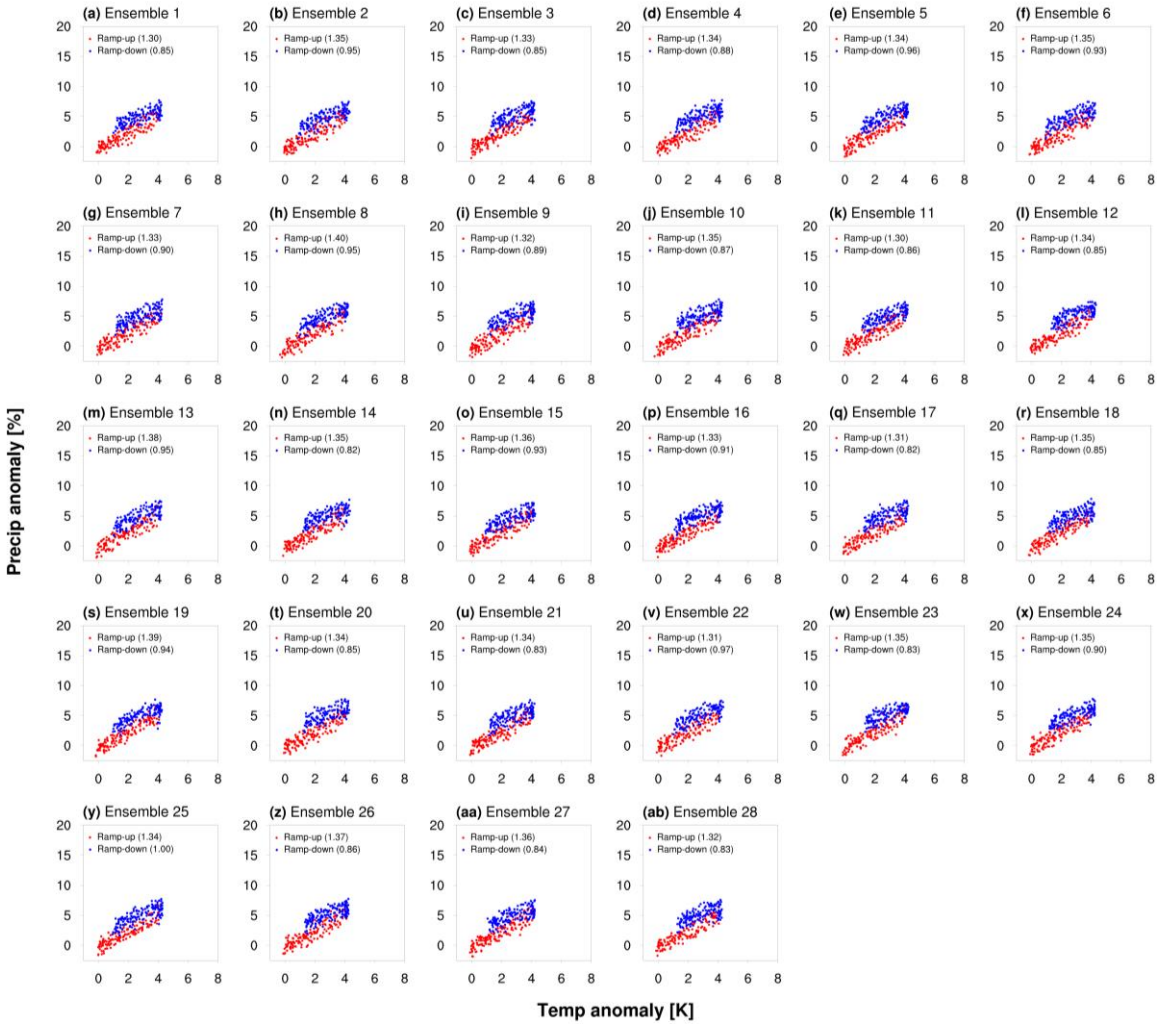
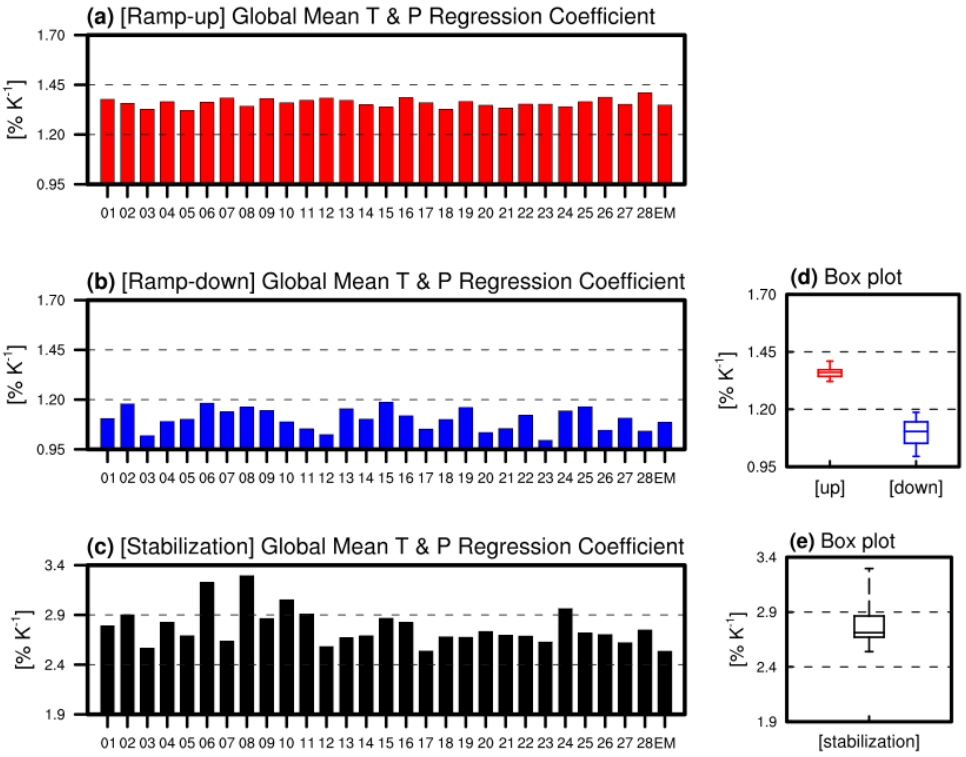


Supplementary Figure 1. Land precipitation and temperature relationship changes for CO_2 ramp-up and ramp-down periods. Land precipitation percentage changes and surface temperature anomaly changes during CO_2 ramp-up (red) and ramp-down (blue) for each ensemble member. Each dot represents the annual mean anomaly obtained by subtracting PD simulation climatology from each ensemble. The percentage anomaly is defined by the difference between each ensemble and PD simulation divided by PD simulation Bracket values represent linear regression coefficients between precipitation percentage changes and surface temperature anomaly.



Supplementary Figure 2. Ocean precipitation and temperature relationship changes for CO_2 ramp-up and ramp-down periods. Ocean precipitation percentage changes and surface temperature anomaly changes during CO_2 ramp-up (red) and ramp-down (blue) for each ensemble member. Each dot represents the annual mean anomaly obtained by subtracting PD simulation climatology from each ensemble. The percentage anomaly is defined by the difference between each ensemble and PD simulation divided by PD simulation. Bracket values represent linear regression coefficients between precipitation percentage changes and surface temperature anomaly.



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41 **Supplementary Figure 3. Global hydrological sensitivity. a-b** Apparent global hydrological
42 sensitivity (κ_{global}) for each ensemble member (1-28) and ensemble mean (EM) during CO_2
43 ramp-up (red) and ramp-down (blue) periods. **c** Global hydrological sensitivity (α_{global}) for each
44 ensemble member and ensemble mean during a stabilization period (black). **d** Box-and-whisker
45 diagram during CO_2 ramp-up (red) and ramp-down (blue) periods. **e** Box-and-whisker diagram
46 during the CO_2 stabilization period (black). The box plot and whiskers represent quartiles with
47 median and total range, respectively.

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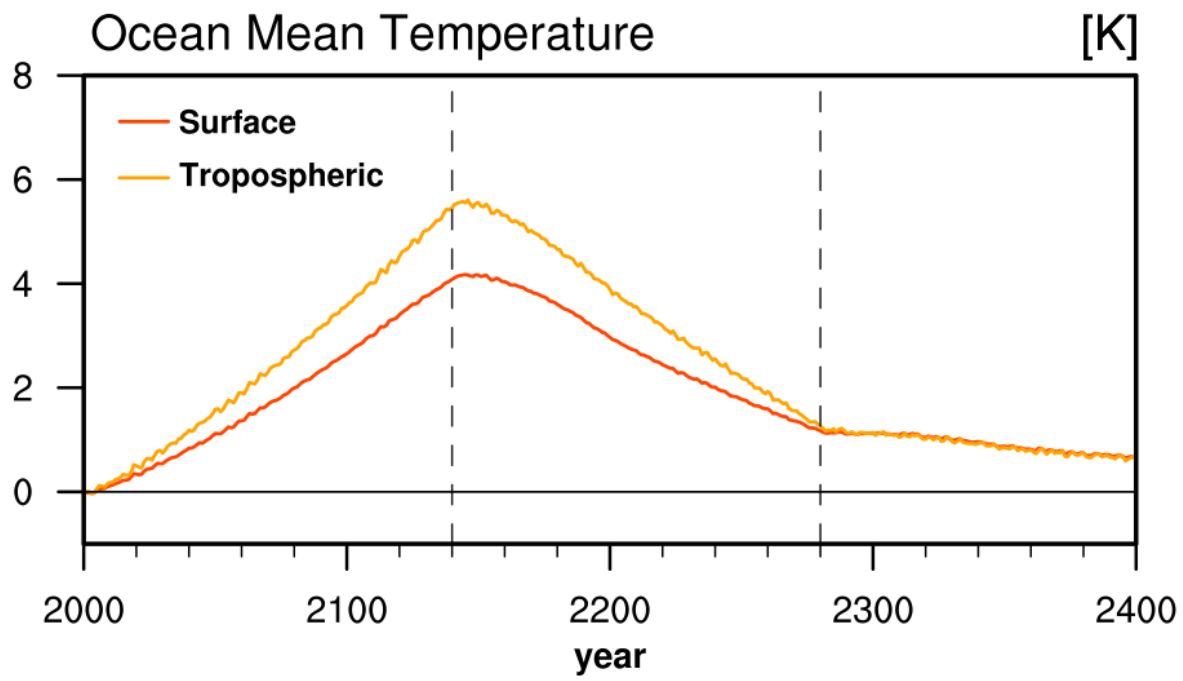
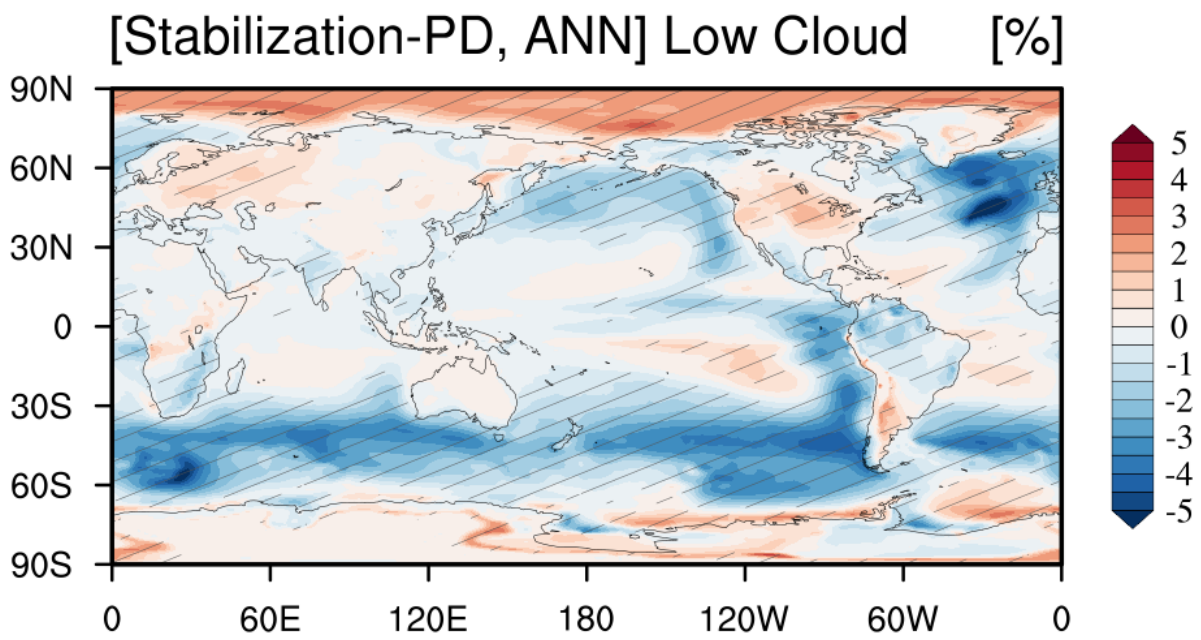
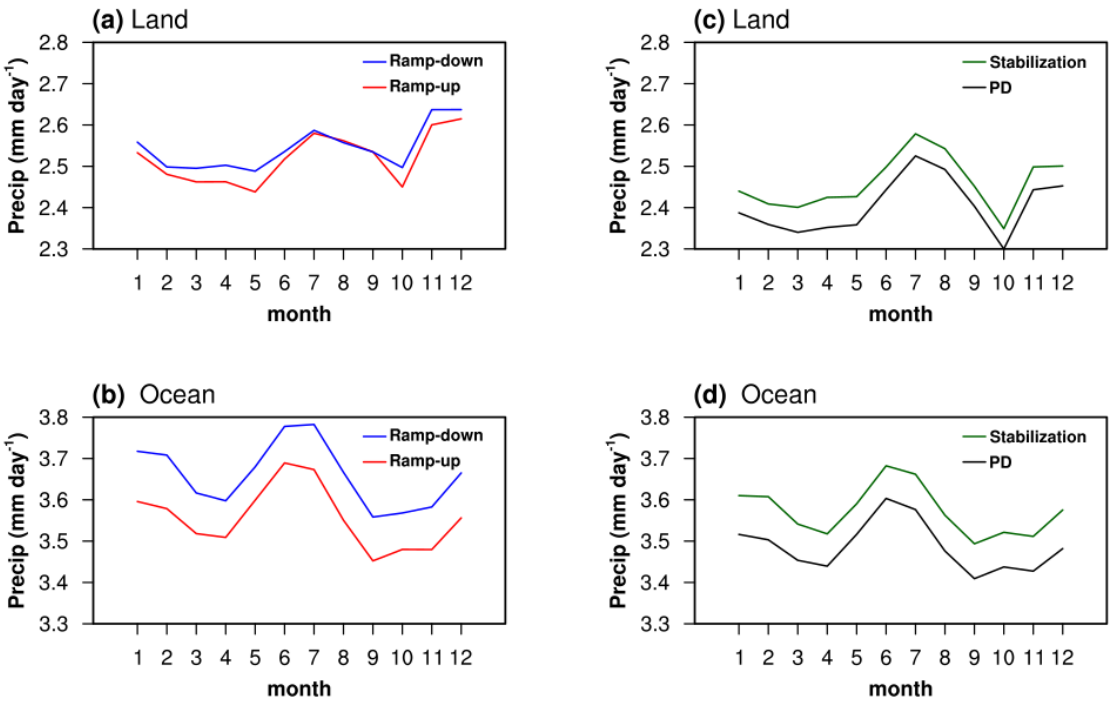


Supplementary Figure 4. Ocean temperature anomaly changes during CO_2 ramp-up, ramp-down and stabilization periods. Ocean surface temperature anomaly (red) and the tropospheric (850hPa-300hPa) temperature anomaly (orange) changes during the CO_2 ramp-up, ramp-down and stabilization periods. The annual mean anomaly was obtained by subtracting the PD simulation climatology from the ensemble mean.



Supplementary Figure 5. The reduction of the low level cloud amount. The percentage difference of a low level cloud amount between the stabilization period and a present day climate (i.e. PD simulation) (%, shaded). Hatch denotes the statistical significance at a 99% confidence level.



Supplementary Figure 6. Seasonal cycle of precipitation. The seasonal cycle of precipitation over **a** land and **b** ocean during the ramp-up (red) and ramp-down (blue) periods, respectively. **c-d** Same as **(a-b)** except but the PD simulation (black) and the stabilization (green) period.