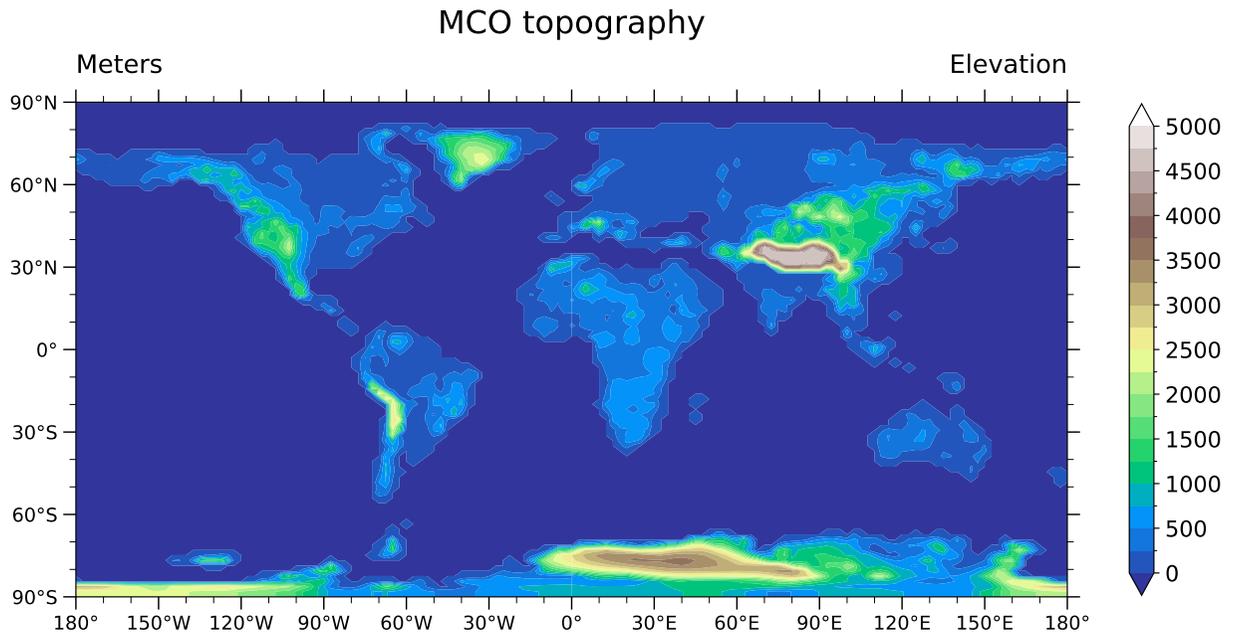
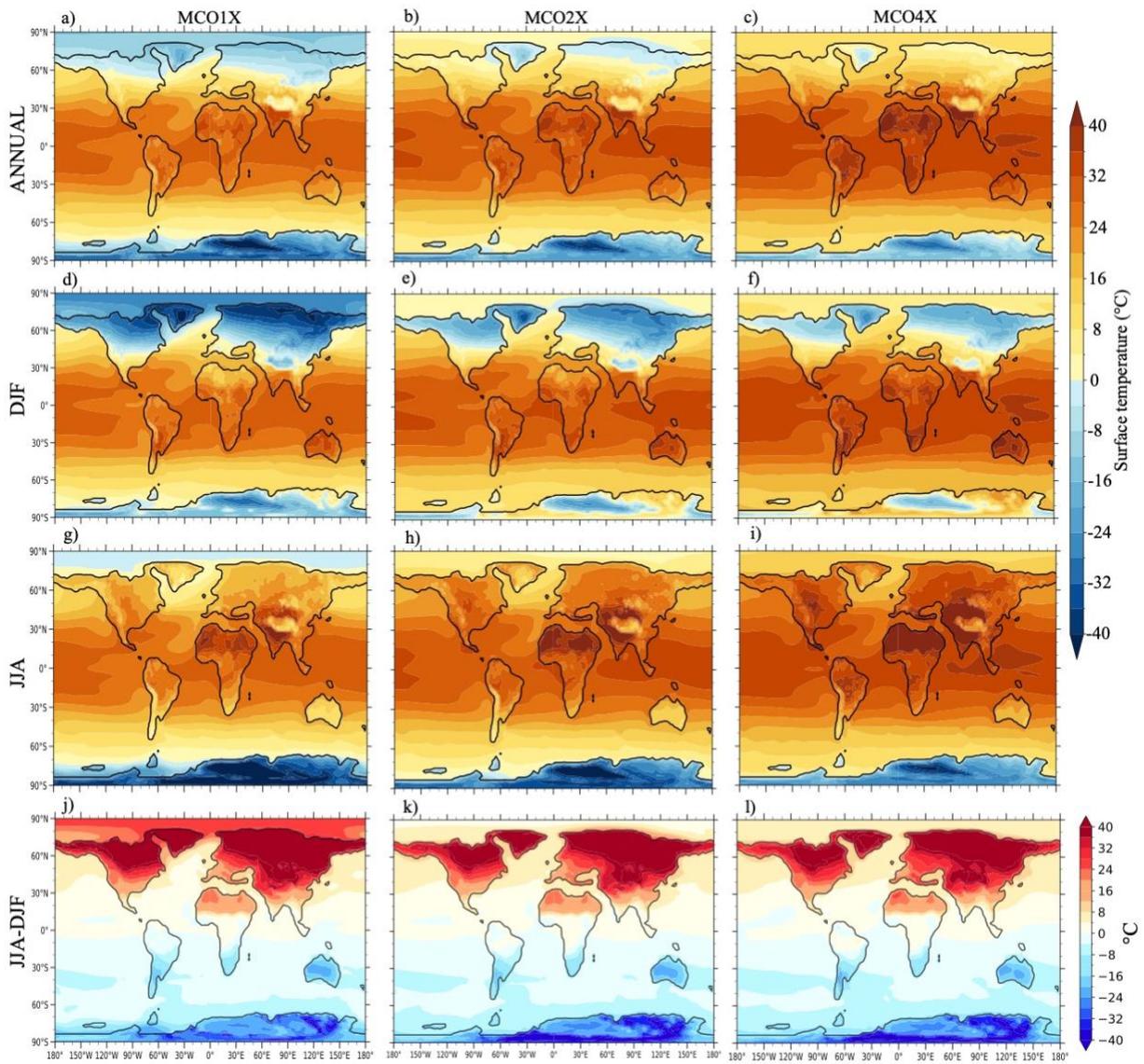


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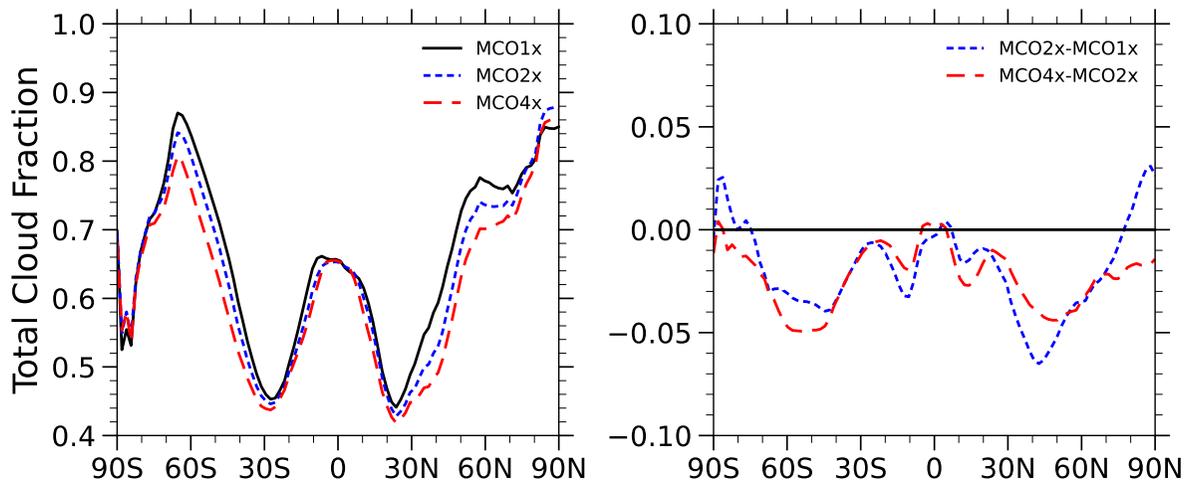
SUPPLEMENTAL FIGURES



3
4 Figure SP1. Mid-Miocene paleo-elevation used that is modified from Frigola et al. (2018)
5 boundary conditions. The Andes are raised to higher elevation compared to Frigola et al. (2018)
6 following Boschman (2021)

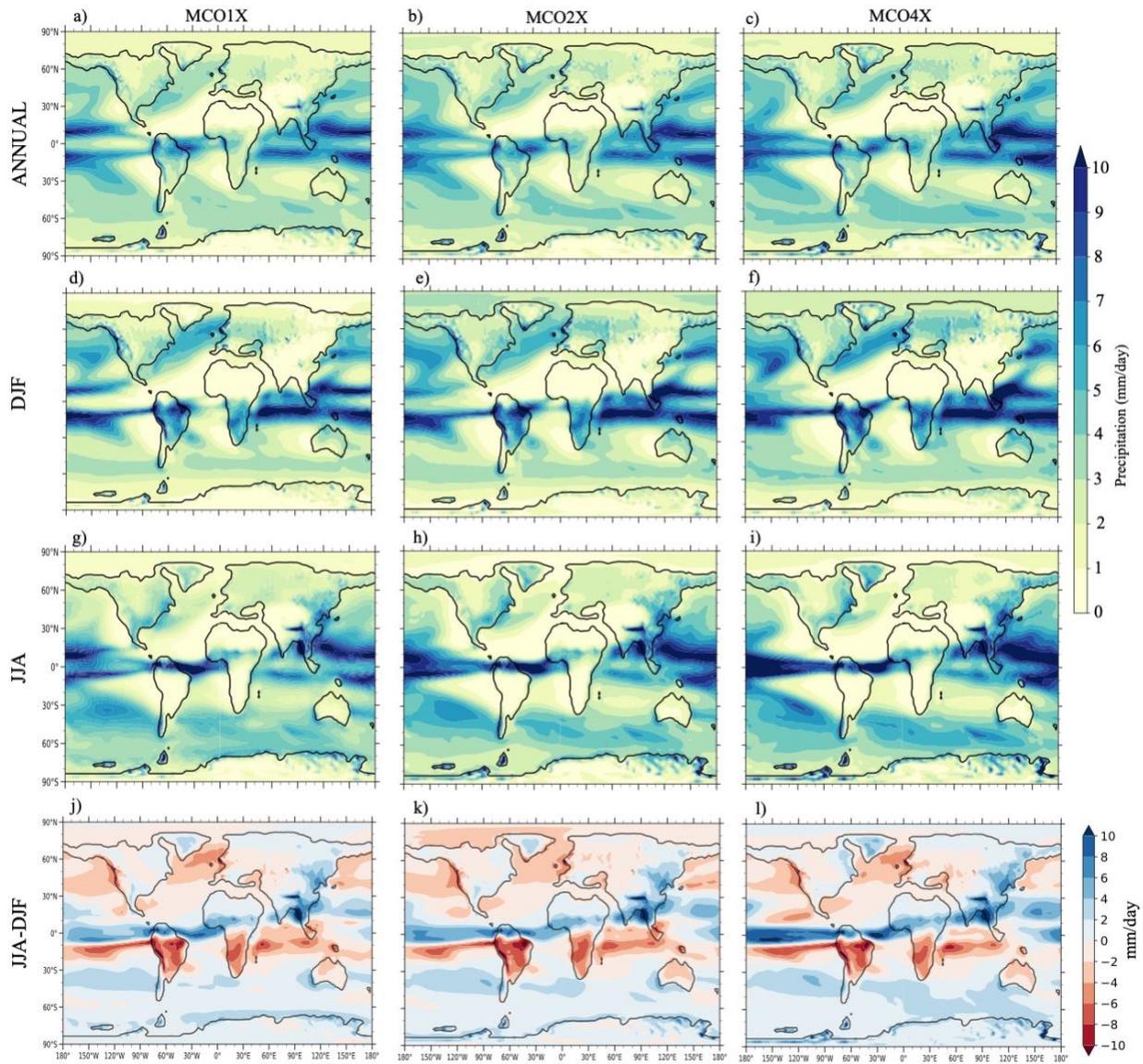


7
 8 Figure SP2. Mean annual (a, b,c) and seasonal (DJF; d,e, f; JJA; g, h, i) temperature climatologies
 9 during the MCO for 1x, 2x and 4x preindustrial CO₂ and differences between JJA and DJF (j, k, l)
 10

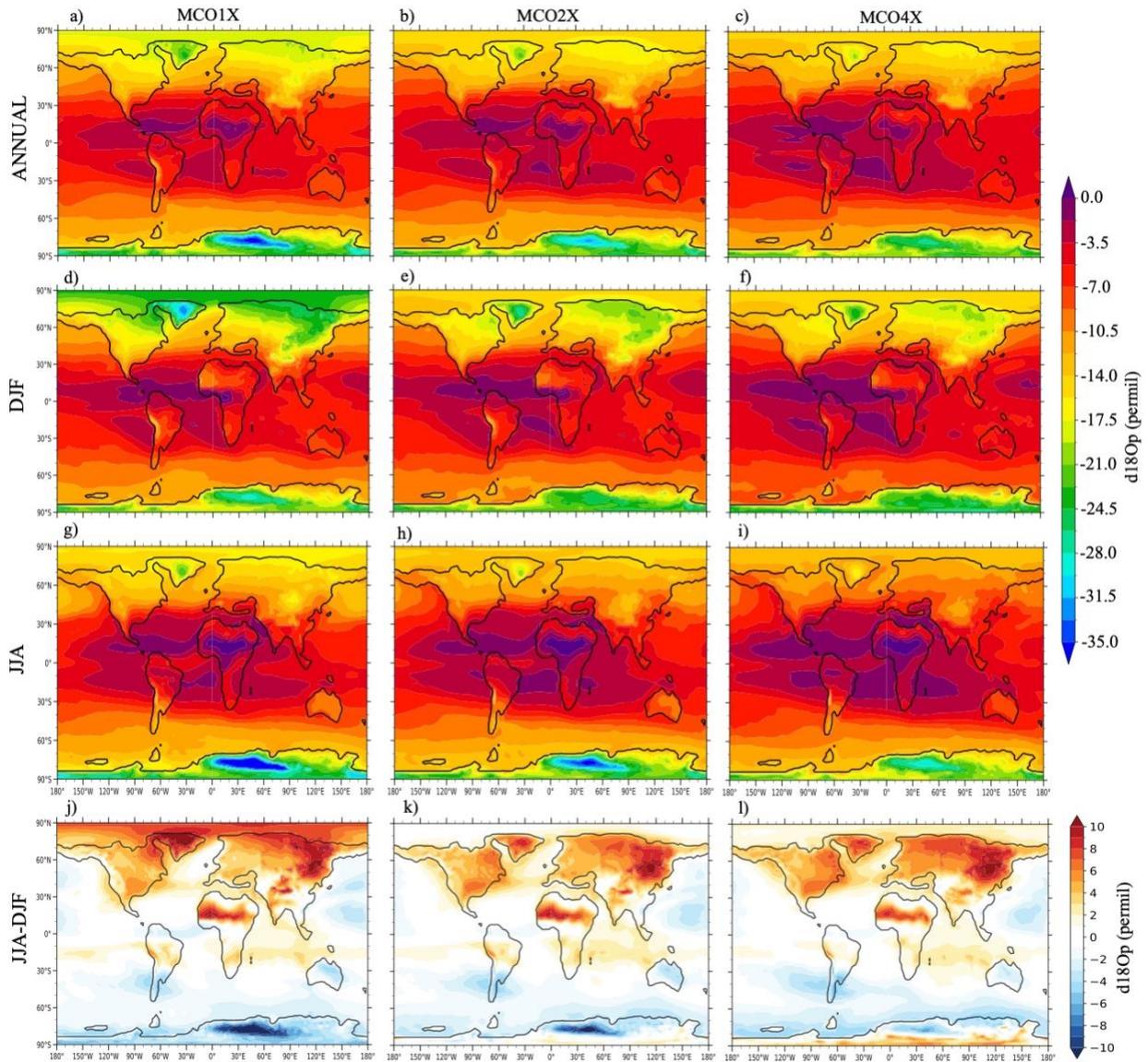


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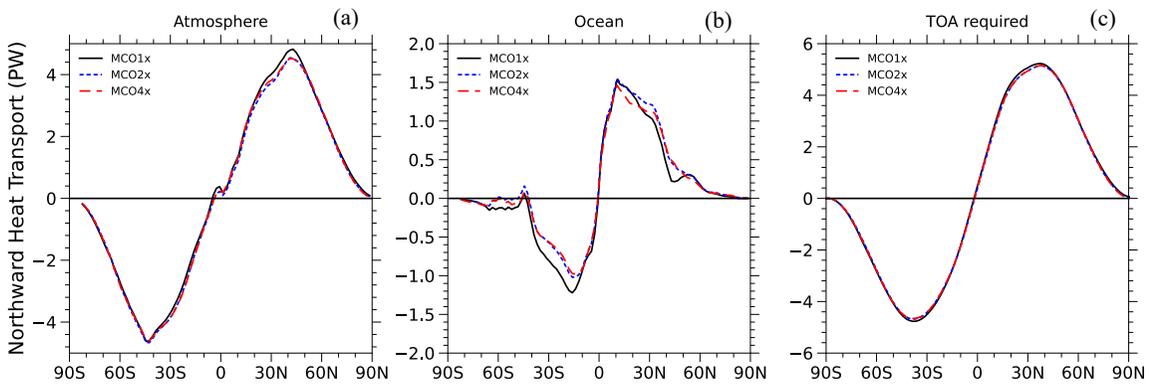
Figure SP3. Mean annual total cloud fraction (left) and the differences between the MCO1x and MCO2x and MCO4x and MCO2x experiments



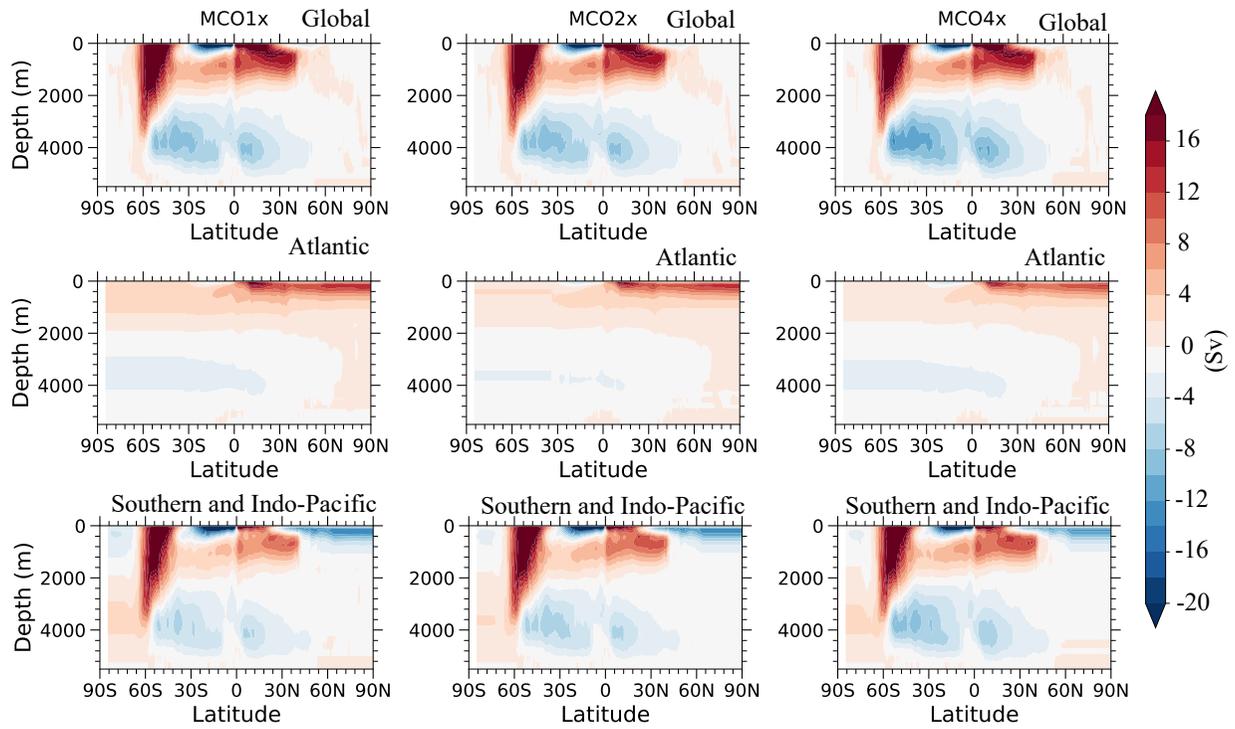
14
 15 Figure SP4. Mean annual (a, b, c) and seasonal (DJF; d, e, f; JJA; g ,h, i) precipitation
 16 climatologies during the MCO for 1x, 2x and 4x preindustrial CO₂ and differences between JJA
 17 and DJF (j. k, l).



18
19 Figure SP5. Same as Figure SP4 but for precipitation $\delta^{18}\text{O}$
20

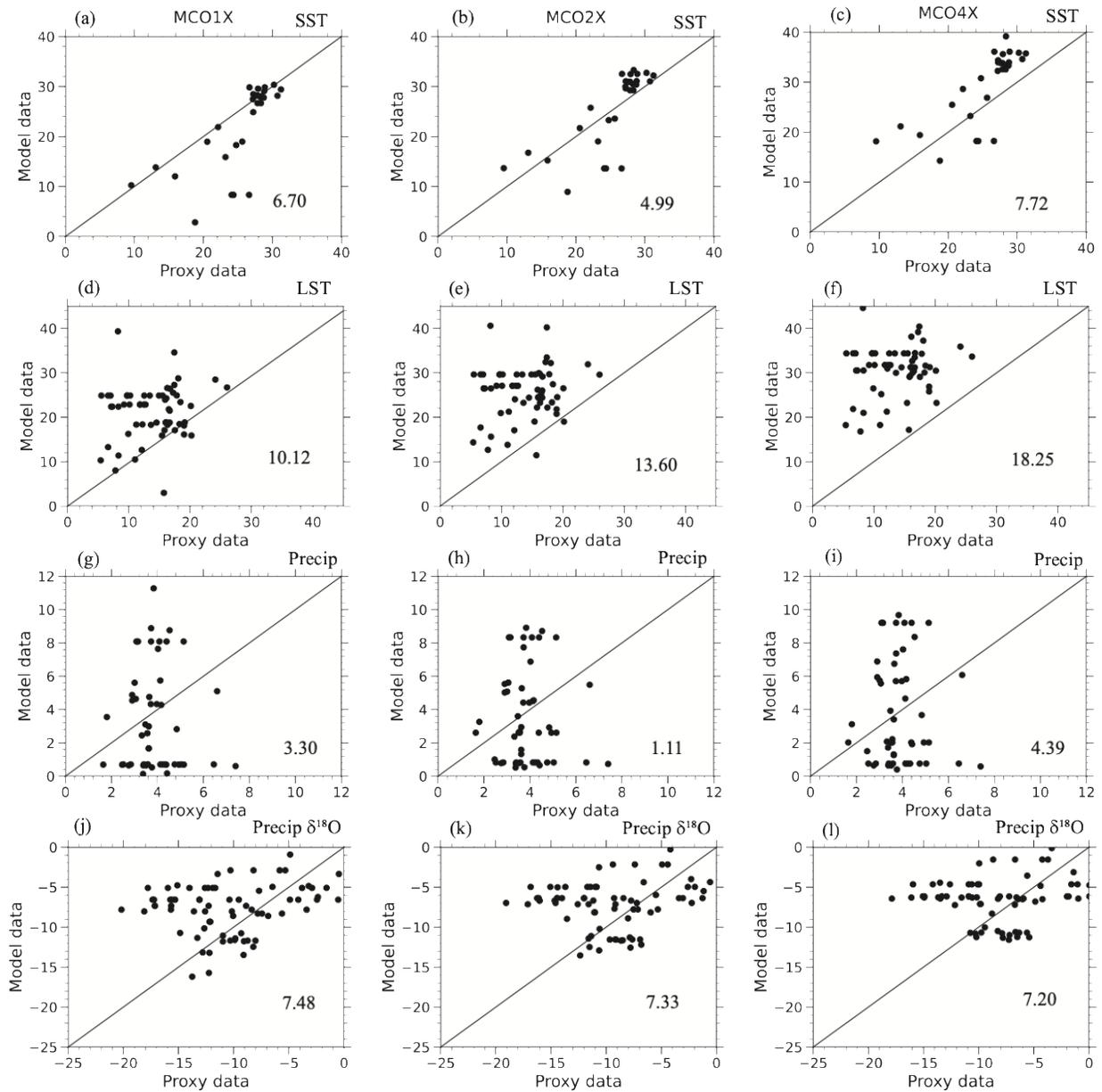


21
22 Figure SP6. Zonal mean meridional heat transport for atmosphere (a), implied ocean (b) and total
23 heat transport (c) during the MCO under 1x, 2x and 4x preindustrial CO_2

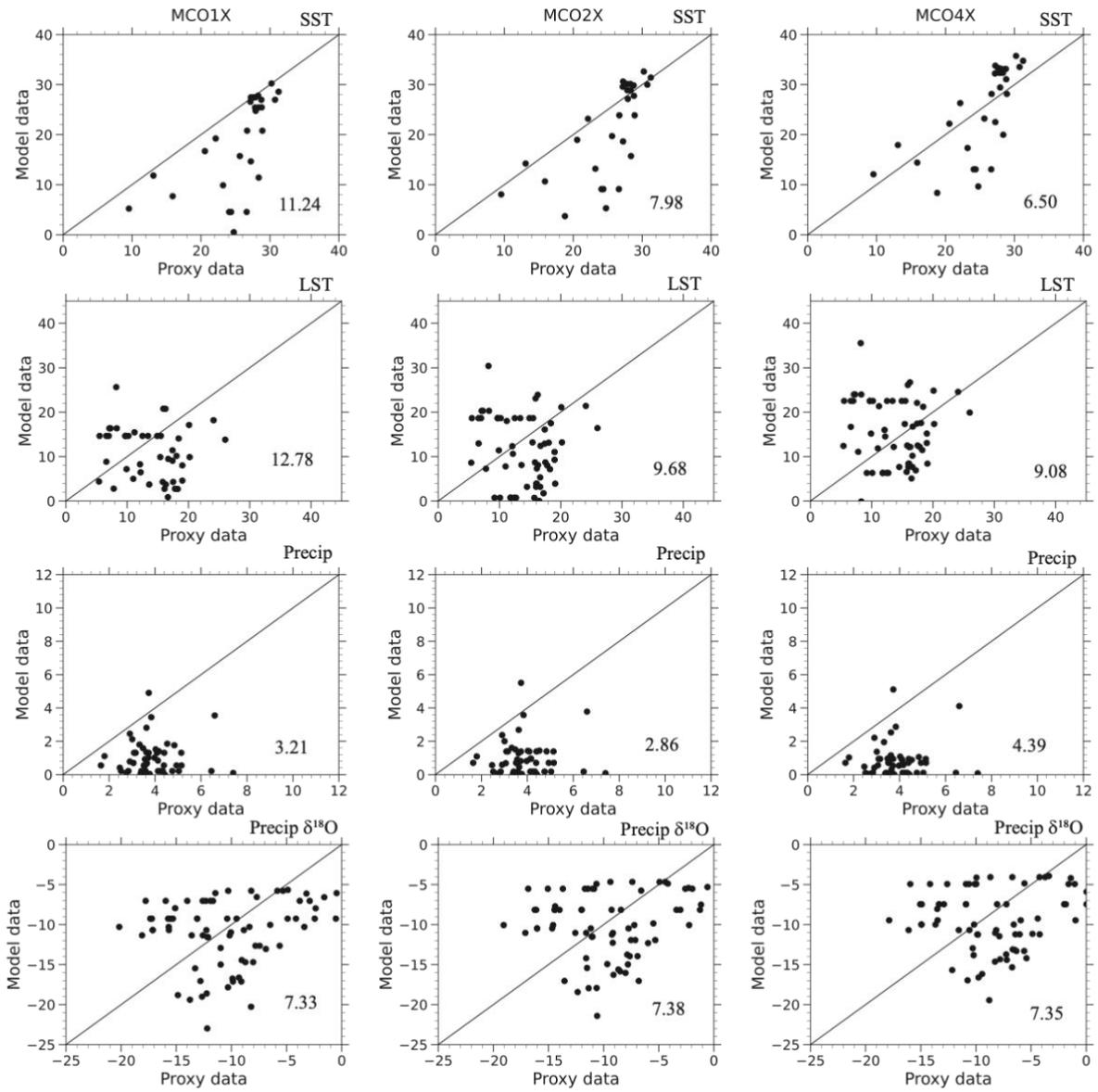


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Figure SP7. Zonal mean stream function for ocean overturning circulation for the three MCO experiments

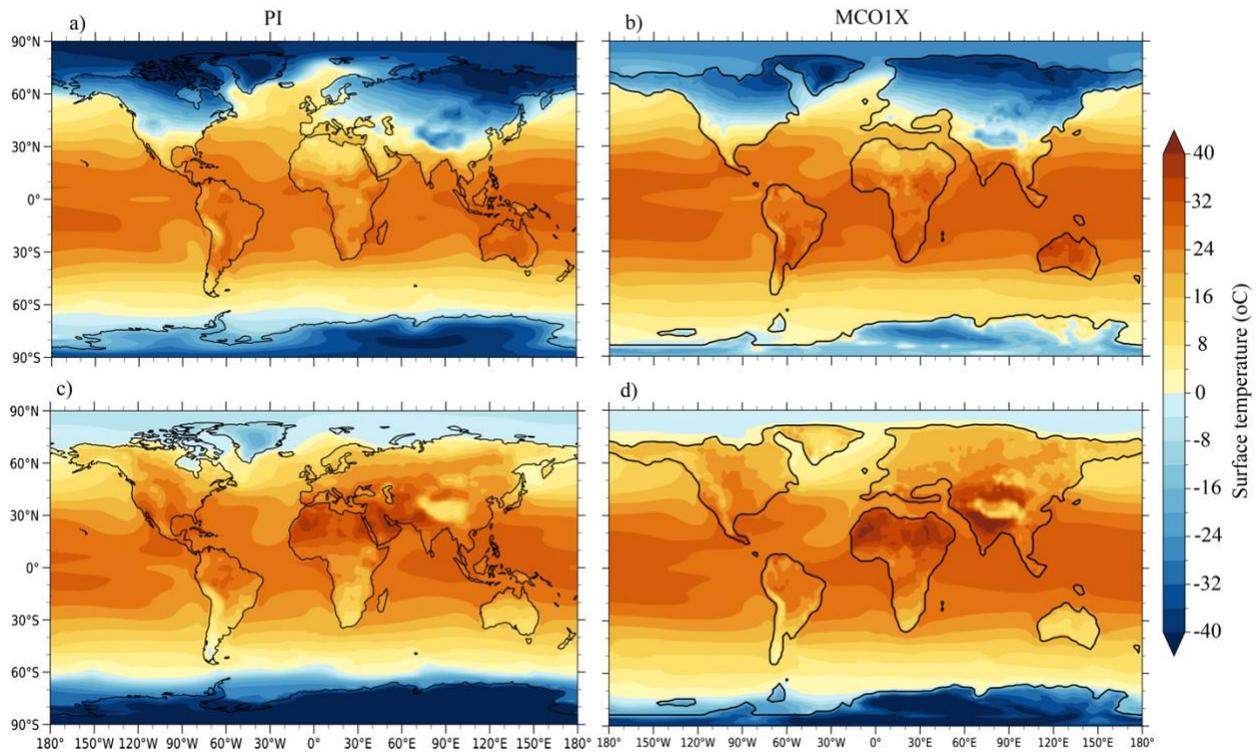


28
 29 Figure SP8. Simulated summer (JJA in the northern hemisphere and DJF in the southern
 30 hemisphere) sea surface temperature, land surface temperature, precipitation and precipitation
 31 δ¹⁸O against proxy reconstruction under the 1x, 2x and 4x preindustrial CO₂. The root mean square
 32 error over all the sites is shown on the lower right. Precipitation is averaged to daily precipitation
 33 in mm/day.
 34

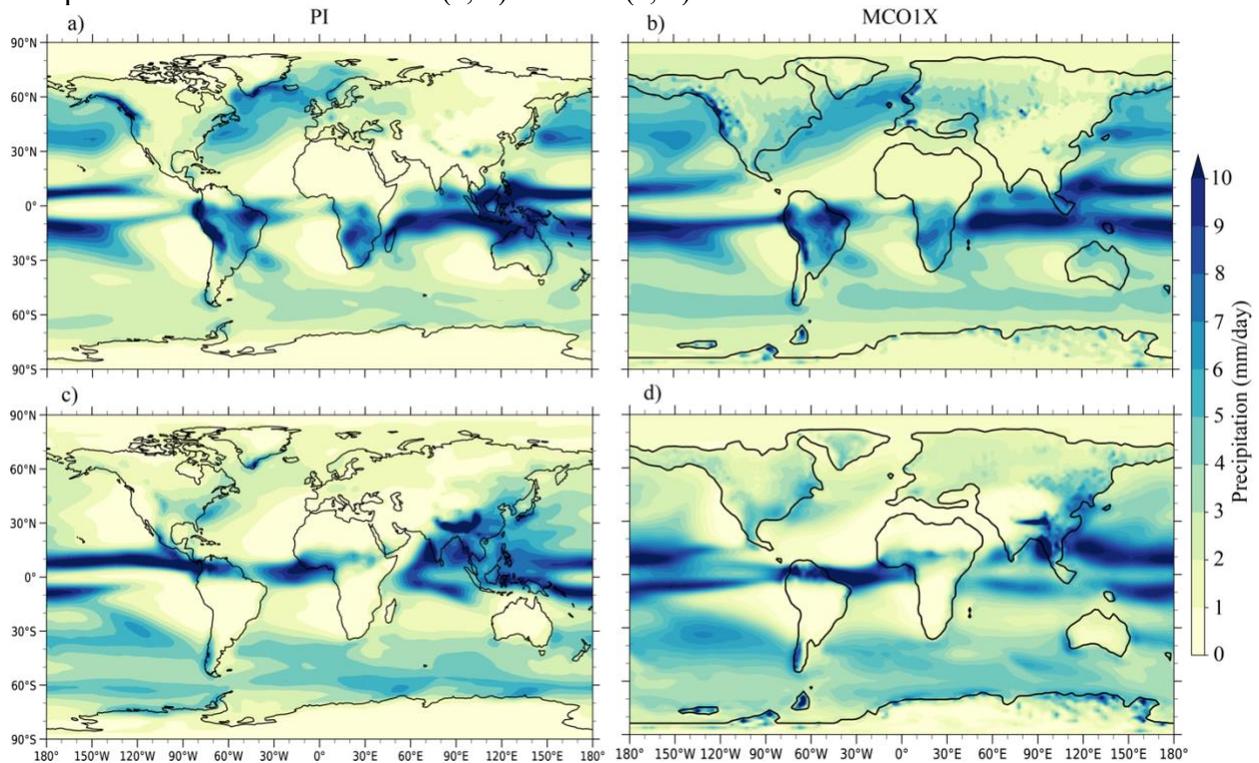


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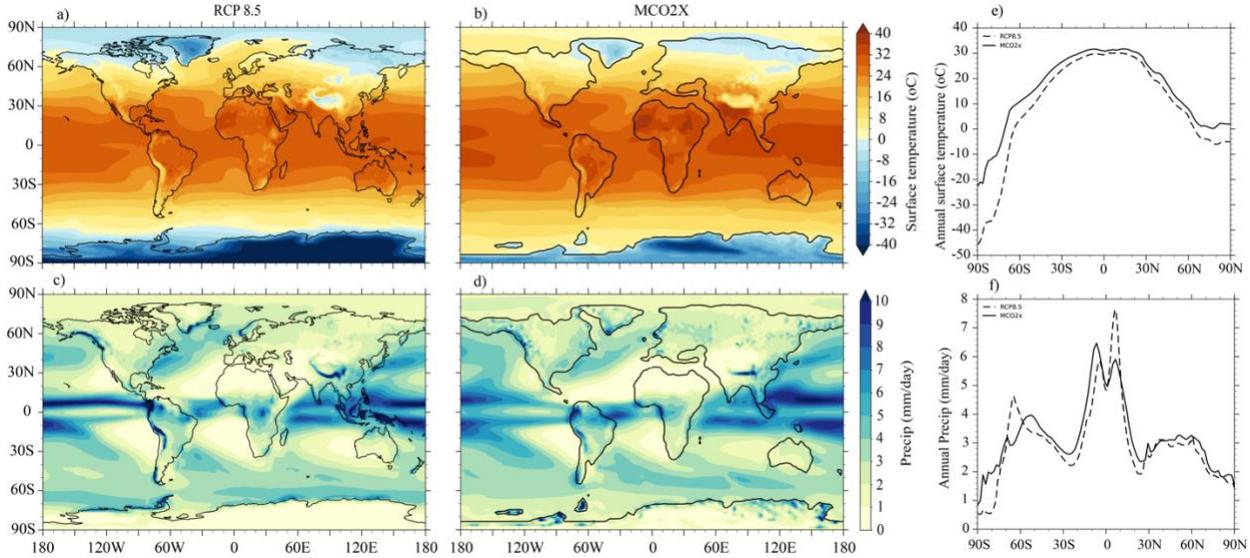
36 Figure SP9. Same as Fig. SP9 but for winter season



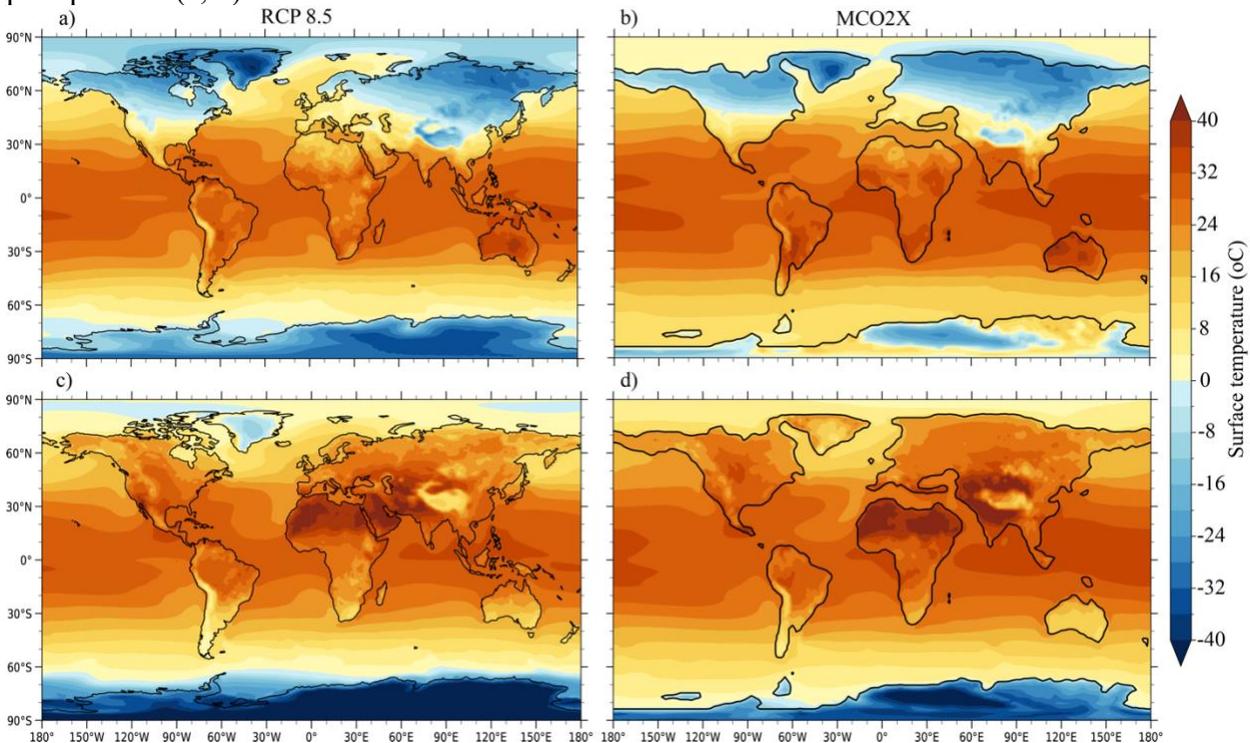
37
38 Figure SP10. Comparison of seasonal mean surface temperature during the MCO under 1x PI CO₂
39 and preindustrial climate for DJF (a, b) and JJA (c, d).



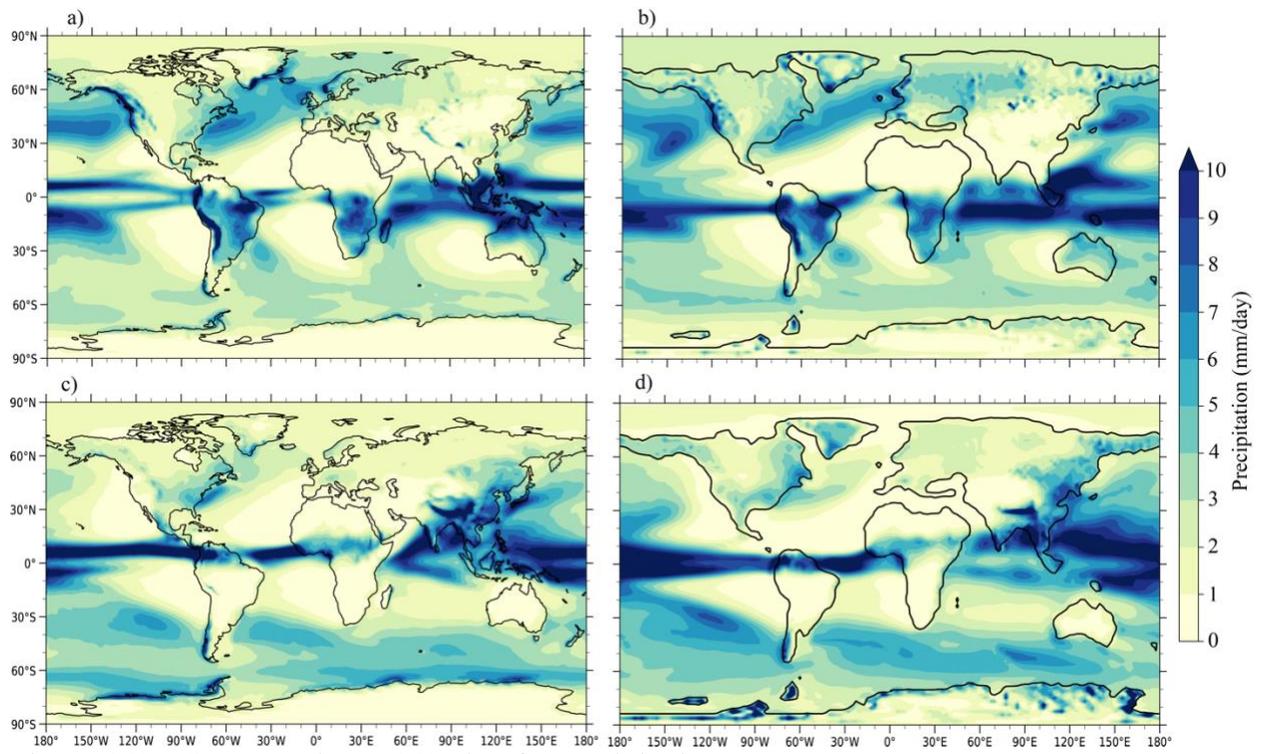
40
41 Figure SP11. Comparison of seasonal mean precipitation during the MCO under 1x PI CO₂ and
42 preindustrial climate for DJF (a, b) and JJA (c, d).
43



44 Figure SP12. Comparison of simulated MCO climate under 2x PI CO₂ and future projected climate
 45 under RCP8.5 for the period 2080-2100 for annual mean surface temperature (a, b), and
 46 precipitation (c, d)
 47



48 Figure SP13. Comparison of seasonal mean surface temperature during the MCO under 2x PI CO₂
 49 and projected future climate under RCP 8.5 for DJF (a, b) and JJA (c, d).
 50



51
52
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Figure SP14. Same as Figure SP10 but for precipitation.