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Supplemental Material for

Response of the Upper-Level Monsoon Anticyclones and Ozone to Abrupt CO2 Changes

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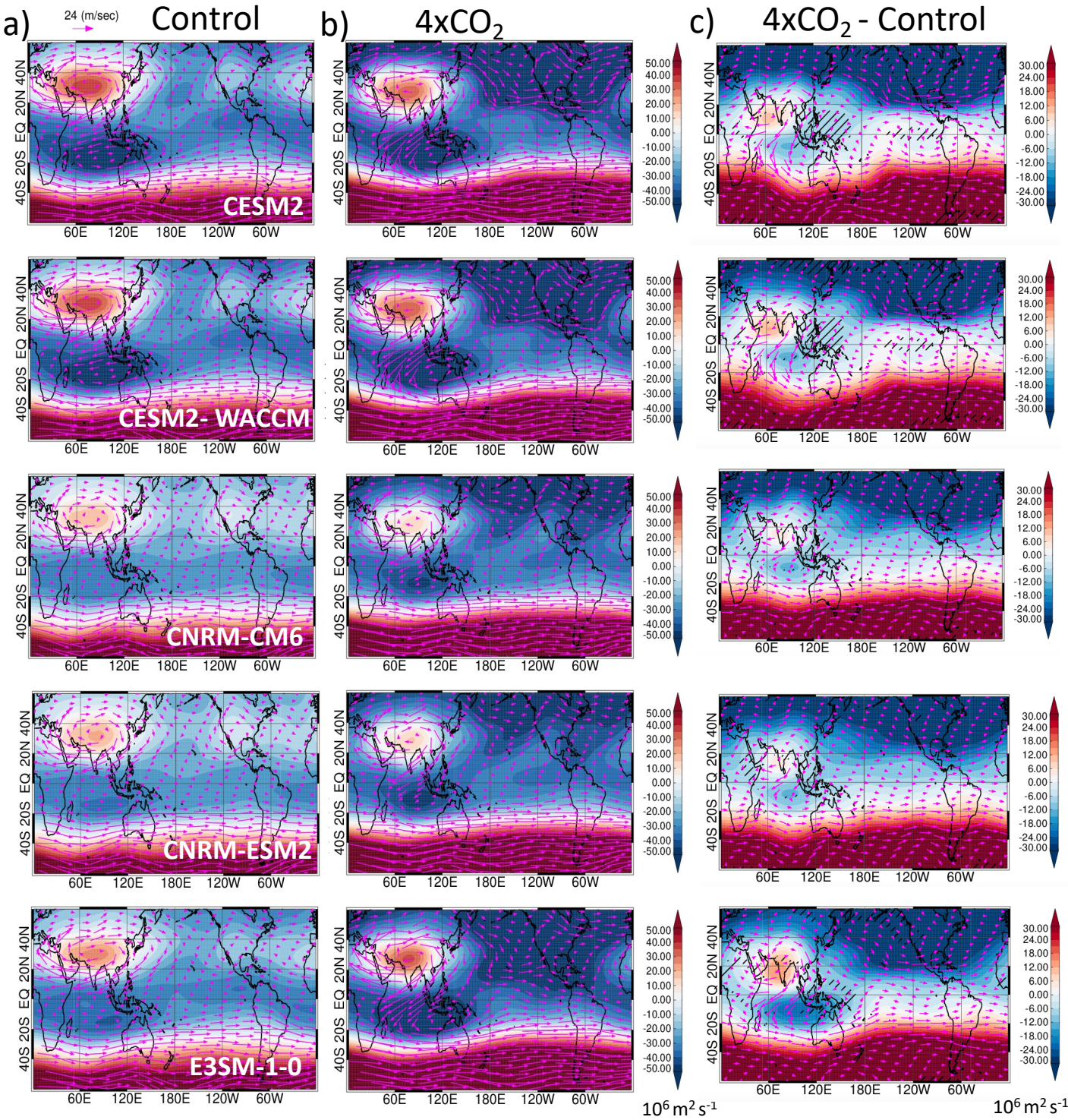

Figure S1 (1of 2). Stream function (shaded) and horizontal winds (vectors) at 100hPa during July-August averaged for 11 coupled ocean-atmosphere models: a) climatological average of the Control simulations, b) 50-year average of perturbed $4xCO_2$ simulations 100 years after quadrupled CO_2 forcing was applied to the Control, and c) the difference between $4xCO_2$ and control simulations. Reference wind vector is 24 ms^{-1}. Hatching indicates the differences that are not statistically significant at 95% confidence level based on Student's t-test.

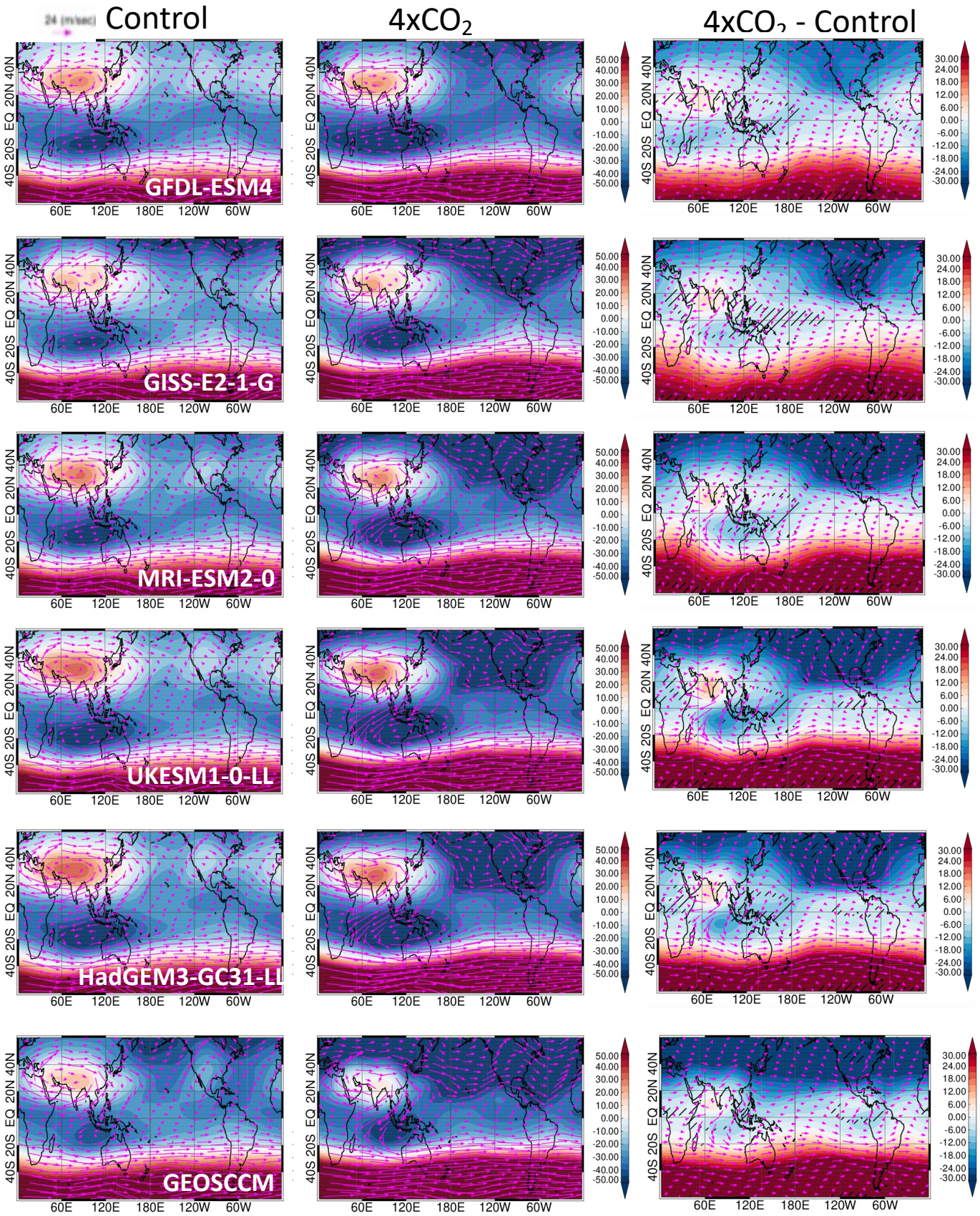

Figure S1 Continue (2 of 2)

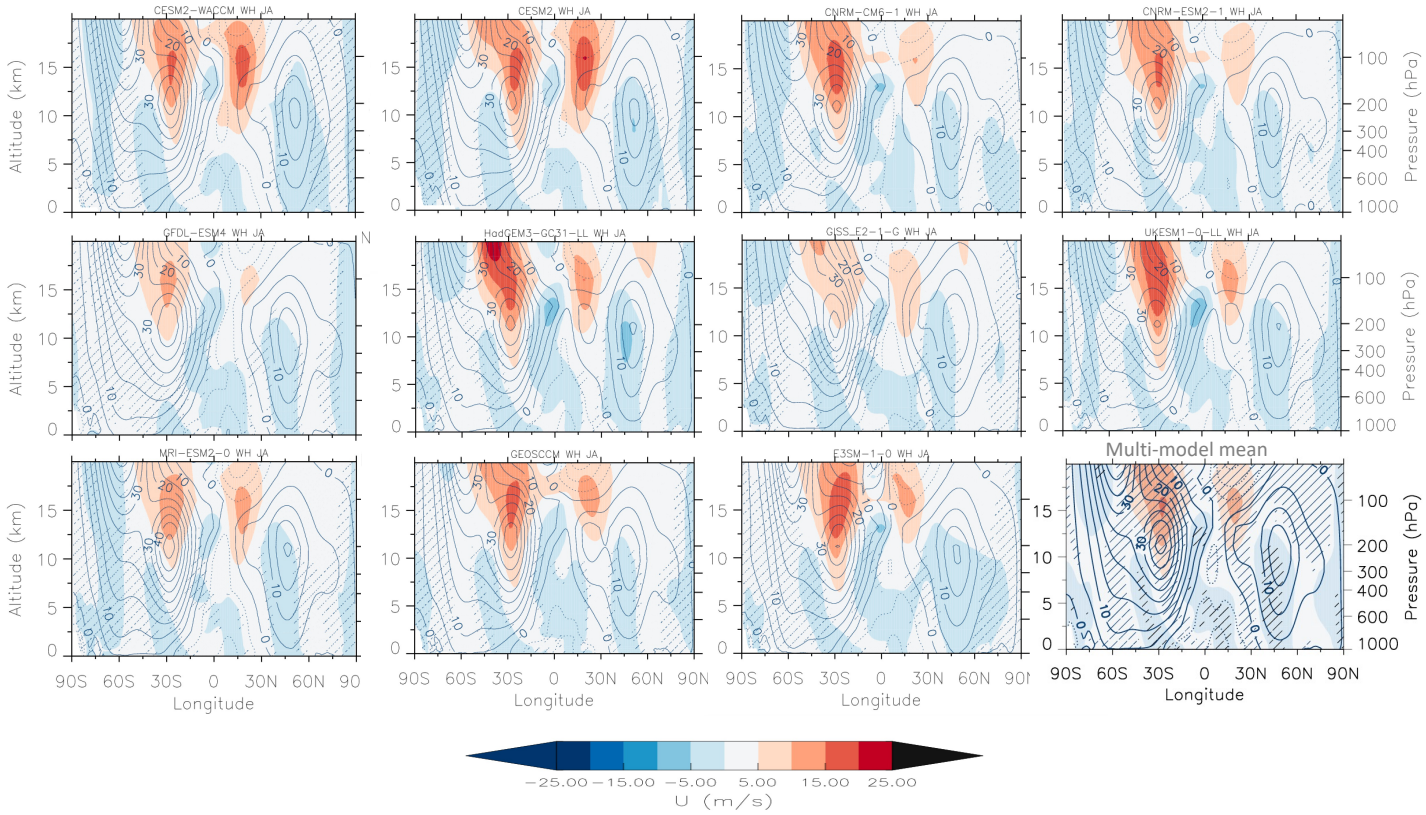

Figure S2. Latitude - height variations in the July-August zonal wind differences between the last 50-years of the 4xCO_2 and Control (4xCO_2 – Control) simulations (in shading), averaged over the western hemisphere for 11 coupled models and multi-model mean. Black contours correspond to zonal winds from the Control simulations with westerlies and easterlies shown as solid and dashed contours respectively. Stippling that overlays panels for individual models indicates regions with statistically insignificant differences between Control and 4xCO_2 experiments while hatching in the multi-model mean profile highlights regions where at least 9 out of 11 models agree on the sign of zonal wind response.

HadGEM3-GC31-LL: sensitivity experiments

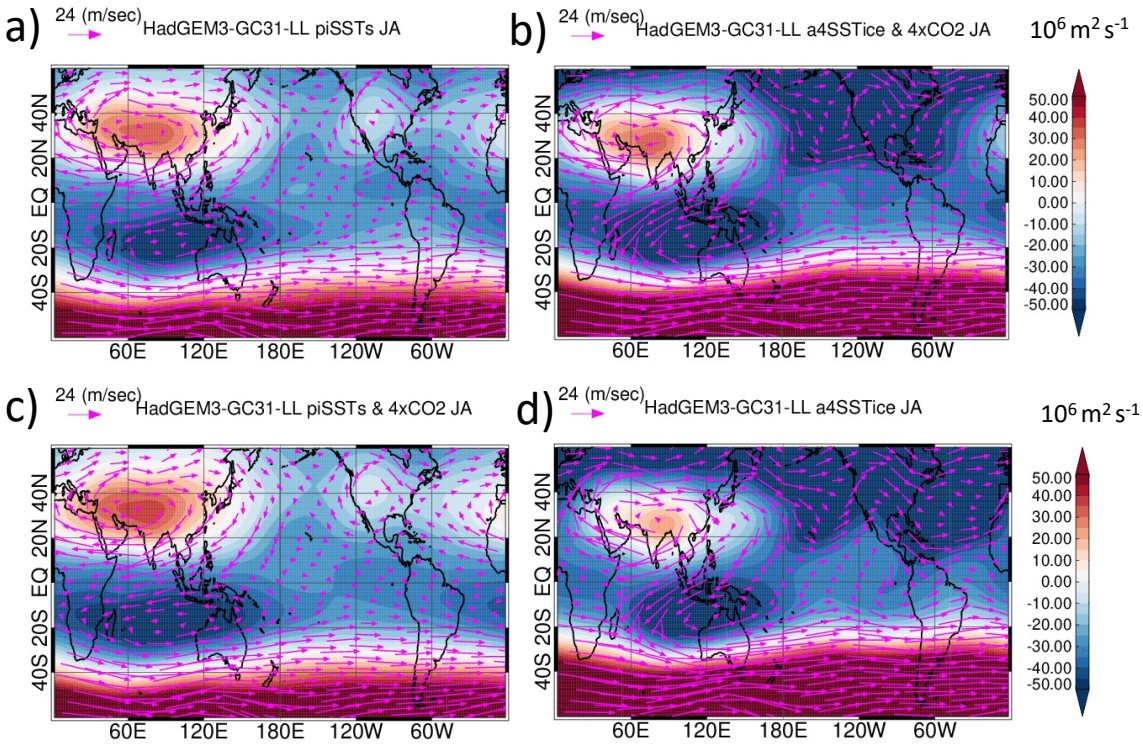

Figure S3a. Stream function (shaded) and horizontal winds (arrows) at 100hPa during July-August from HadGEM3-GC31-LL simulations with prescribed SSTs and CO_2: (a) preindustrial SSTs and CO_2 (piSSTice), b) SSTs from the end of 4xCO_2 coupled model run and 4xCO_2 (a4SSTice+4xCO_2), c) preindustrial SSTs and quadrupled CO_2 (piSSTice +4xCO_2), d) preindustrial CO_2 and SSTs from the end of 4xCO_2 couple model experiment (a4SSTice).

CESM2: sensitivity experiments

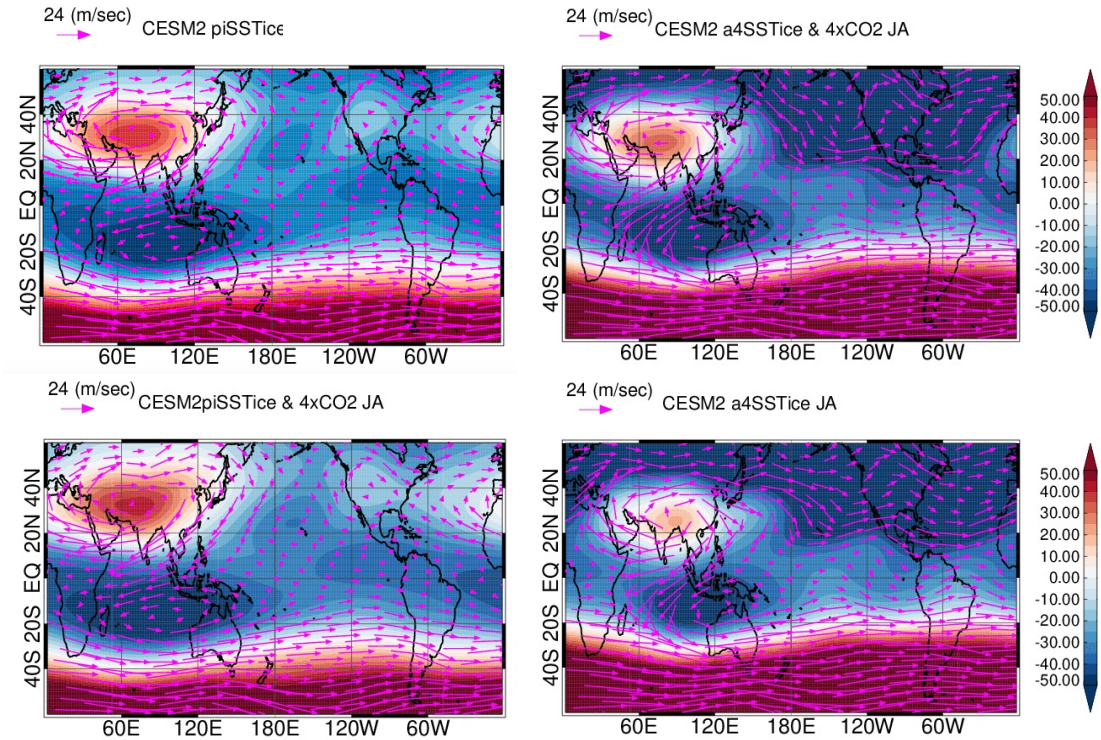

Figure S3b Same as FigS3 only for CESM2

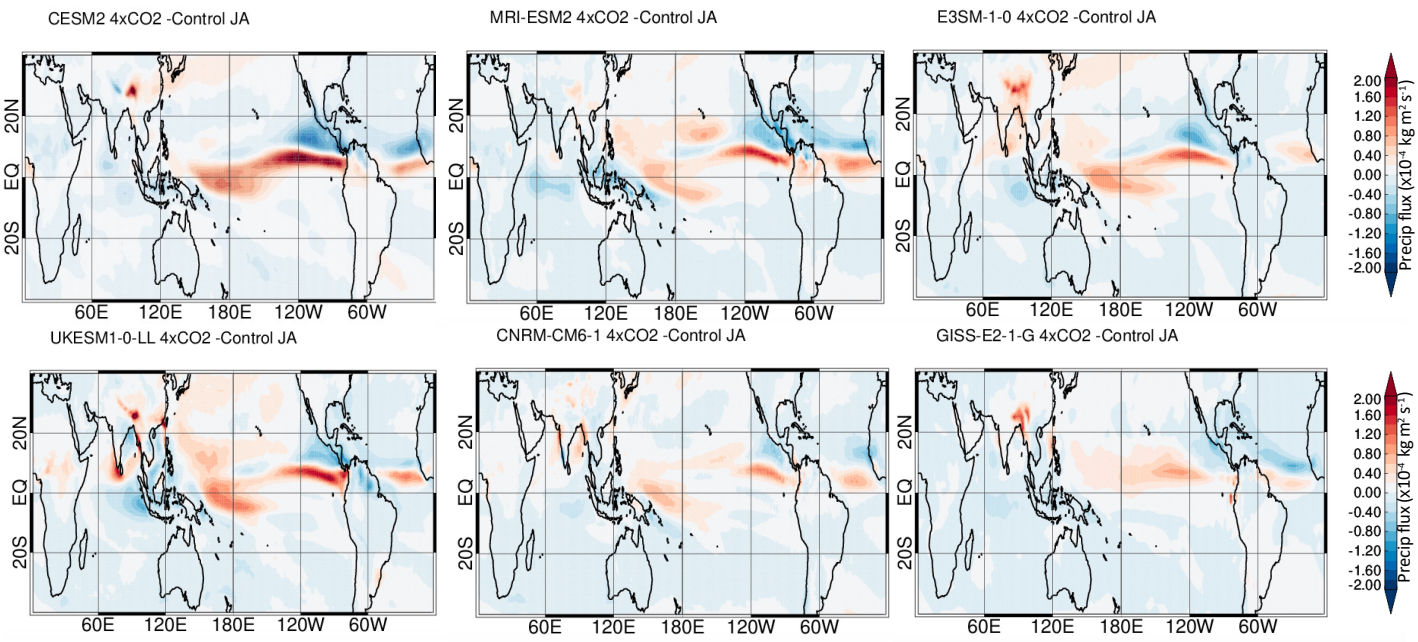

Figure S4. July –August precipitation flux response (in x10^{-4} kg m^2 s^{-1}) to the quadrupled CO_2 from 6 coupled models (4xCO_2 - Control).

Ozone response to the quadrupled CO_2 in the coupled GCMs

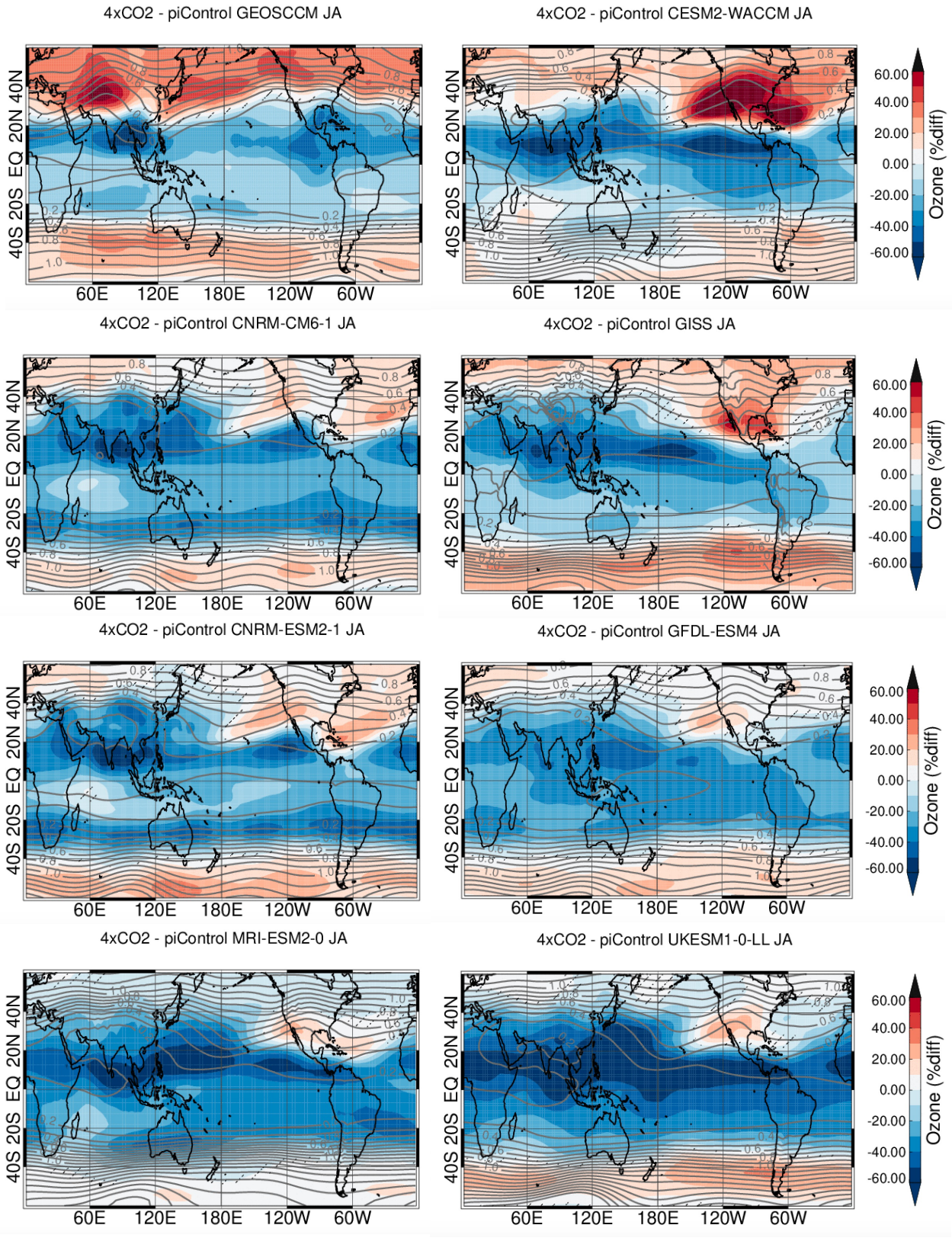

Figure S5. Ozone response (color shading, in % difference relative to the Control) to the quadrupled CO_2 from eight coupled models, relative to the Control simulation during July-August at 100hPa. Gray solid contours show climatological ozone mixing ratios (in ppmv) from Control simulations. Hatching indicates the differences that are not statistically significant at 95% confidence level based on Student's t-test.