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Supplement of

Decomposing the response of the stratospheric Brewer–Dobson circulation to an abrupt quadrupling in CO_2

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Supplement

CMIP5 Models				
1. ACCESS1-0	2. ACCESS1-3	3. CCSM4	4. CNRM-CM5	5. CSIRO-Mk3-6-0
6. CanESM2	7. EC-EARTH	8. GFDL-CM3	9. GFDL-ESM2G	10. GFDL-ESM2M
11. GISS-E2-H	12. GISS-E2-R	13. HadGEM2-ES	14. IPSL-CM5A-LR	15. IPSL-CM5A-MR
16. IPSL-CM5B-LR	17. MIROC-ESM	18. MIROC5	19. MPI-ESM-LR	20. MPI-ESM-MR
21. MPI-ESM-P	22. MRI-CGCM3	23. NorESM1-M	24. BCC-CSM1-1-M	25. BCC-CSM1-1
26. INMCM4				

Table S1: The CMIP5 global coupled ocean-atmosphere general circulation models used to construct the SST and SIC boundary conditions in this study.

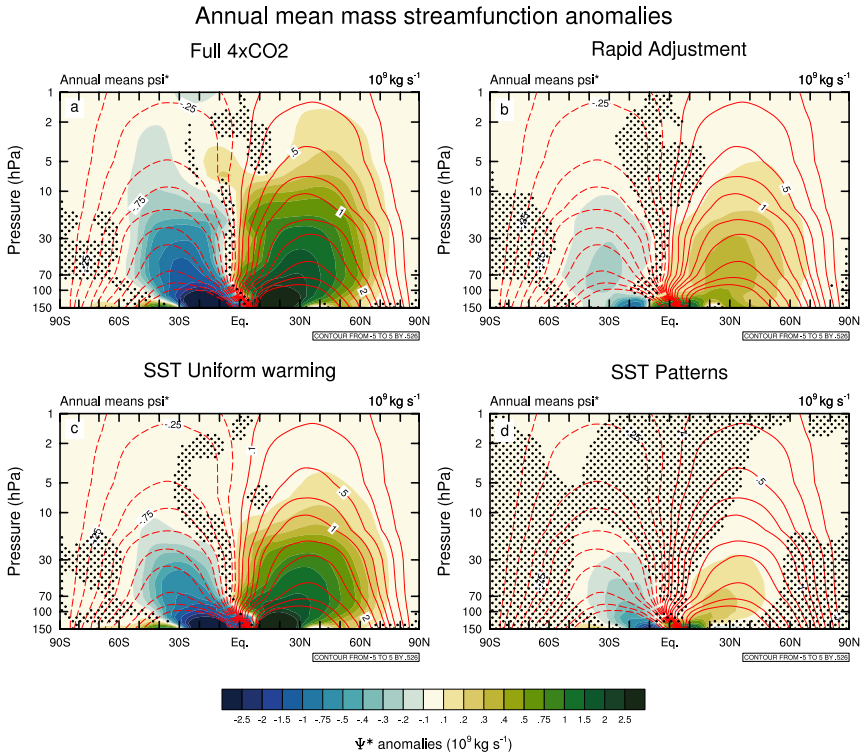

Figure S1: Annual mean residual mass streamfunction anomalies [10^9 kg s-1] between 150 – 1 hPa with respect to the piControl simulation for the (a) 4xCO_2 (run B), (b) rapid adjustment (run C), (c) Uniform SST warming (run D) and (d) SST pattern (run E) experiments. Stippling denotes where the differences are not statistically significant at the 95% confidence level using a two-tailed Student's t test. Red contours plotted at --5, -4, -3, -2, -1.5, -1, -0.75, -0.5, -0.25, -0.1, 0.1, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4 and 5× 10^9 kg s-1 show the piControl climatology with negative values showed in dashed contours.

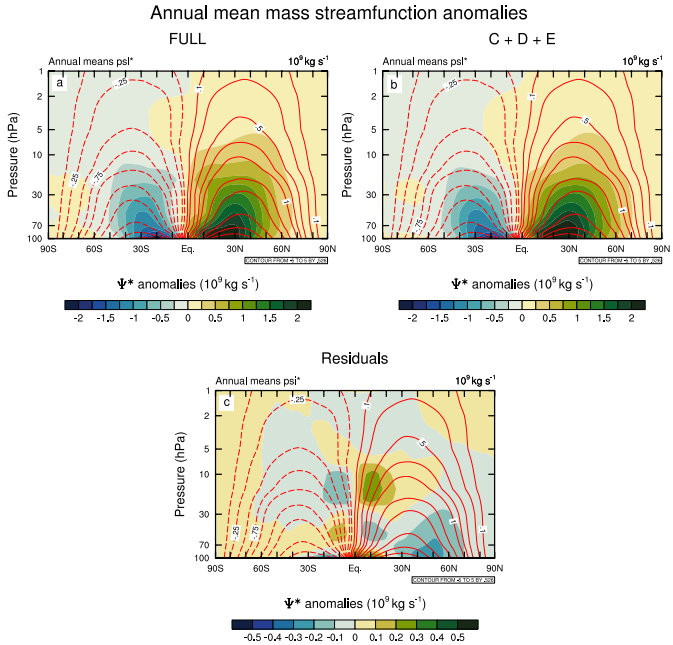

Figure S2: The residual mass streamfunction anomalies [10^9 kg s^{-1}] in (a) the full 4xCO2 experiment (as in Fig. 5a), (b) the sum of experiments C+D+E and (c) a – b differences. Note panel (c) has a different colour scale. This shows the decomposition of the streamfunction response in the full experiment into the three components analysed in the main text works to leading order.

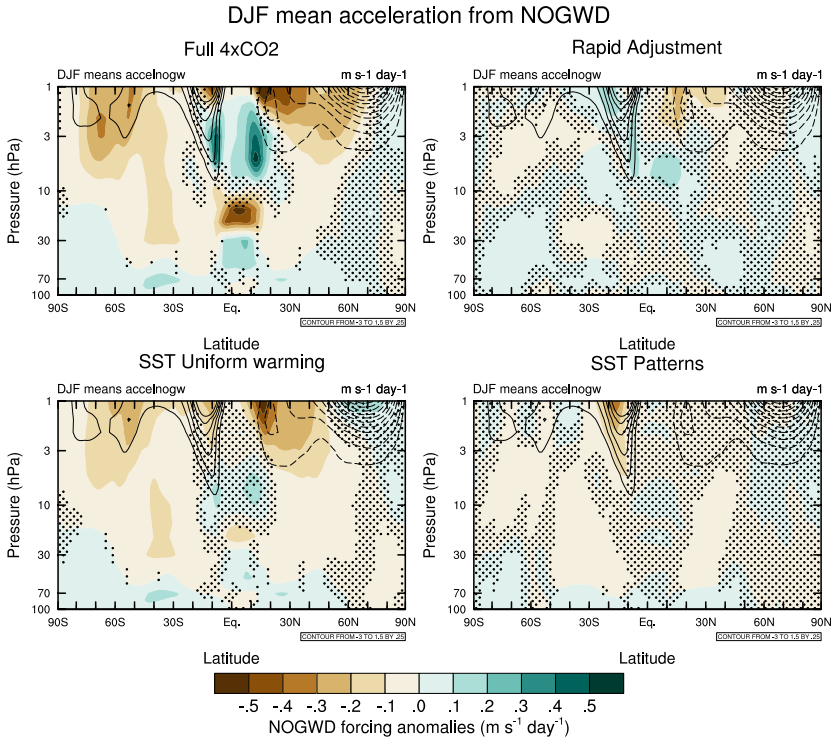

Figure S3: DJF average non-orographic GWD anomalies [m s^{-1} day^{-1}] (shading) in the four perturbation experiments. The NOGWD here is multiplied by the cosine of latitude to represent the torque exerted on the zonal flow. Contours show the piControl climatology with contours plotted from -3 to 1.5 in increments of 0.25 m s^{-1} day^{-1}. Hatching denotes where differences are not statistically significant at the 95% confidence level.

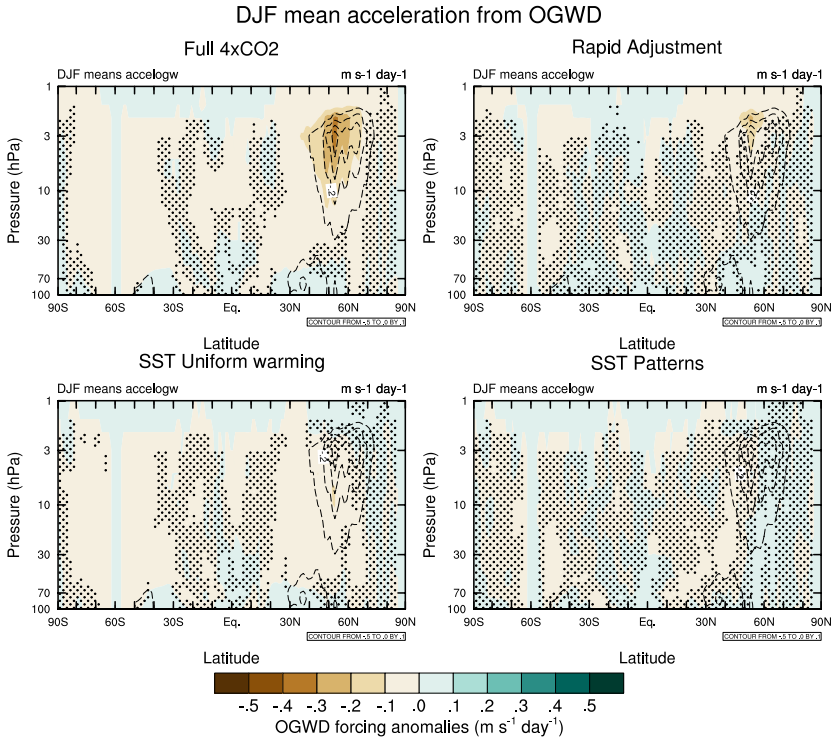

Figure S4: As in Figure S3, but for the DJF mean orographic GWD. Note the different piControl climatology contour range at the bottom right side.

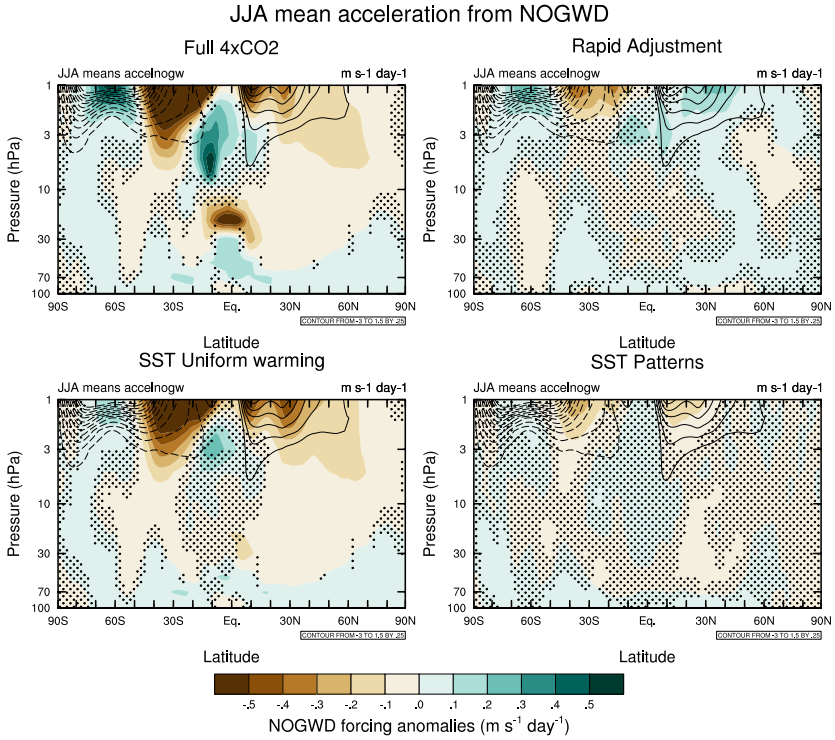

Figure S5: As in Figure S3, but for JJA.

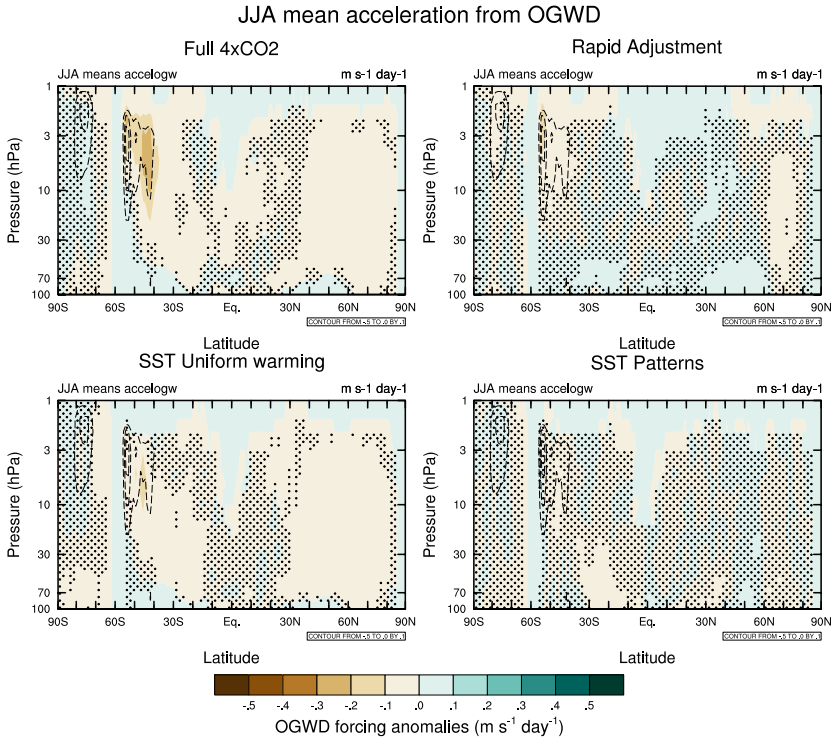

Figure S6: As in Figure S4, but for JJA.