Supplementary Material for Changes in the tropical upper tropospheric zonal momentum balance due to global warming

Abu Bakar Siddiqui Thakur[1,2] and Jai Sukhatme[1,2]

[1]Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bangalore 560012, India
[2]Divecha Centre for Climate Change, Indian Institute of Science, Bangalore 560012, India

Correspondence: Abu Bakar Siddiqui Thakur (thakur.abubakar@gmail.com)

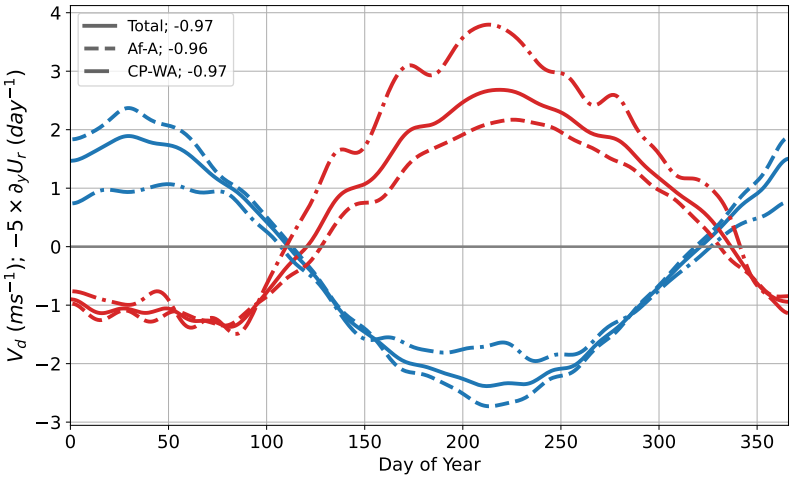

Figure S1. Climatological Day of Year variation of v_d (blue) and $-5 \times \partial_y u_r$ (red) zonally averaged over all longitudes (solid), A-Af (dashed), CP-WA (dash-dotted) and Africa (dotted). As Figures 1 and 3, all quantities are averaged over 150-300 hPa, about $\pm 5^{\circ}$. $-\partial_y u_r$ has been multiplied by 5 to ensure a vertical scale similar to v_d. A 20-day low-pass filter has been applied prior to presentation.

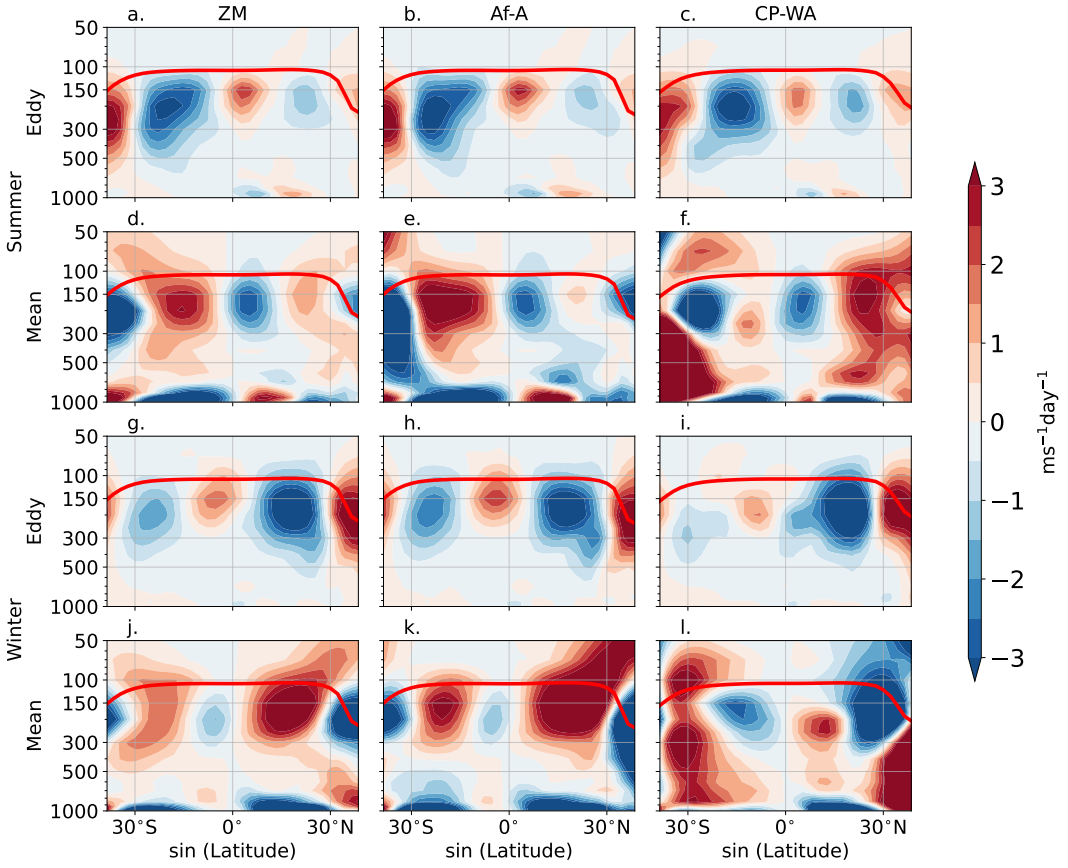

Figure S2. Seasonally and zonally averaged vertical structure of (a-c & g-i) eddy momentum flux convergence and (d-f & j-l) mean meridional momentum flux convergence for reanalysis, averaged over (top half) summer and (bottom half) winter. The quantities displayed are computed over (left column) the global longitudes, (middle) Af-A and (right) CP-WA, repectively. In each panel, the black curve is indicative of the multi-model mean tropopause height over the corresponding region (see Reichler et al., 2003).

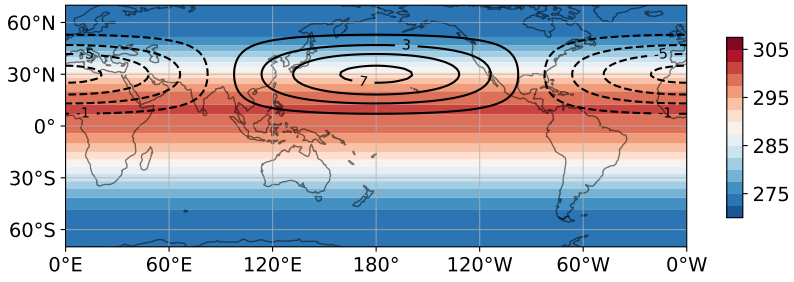

Figure S3. Zonally symmetric SST forcing (K) with peak at 10°N superimposed with a planetary scale wavenumber-1 SST perturbation located at 30°N (Wu and Shaw, 2016). Peak magnitude of the SST perturbation is 7.5K.

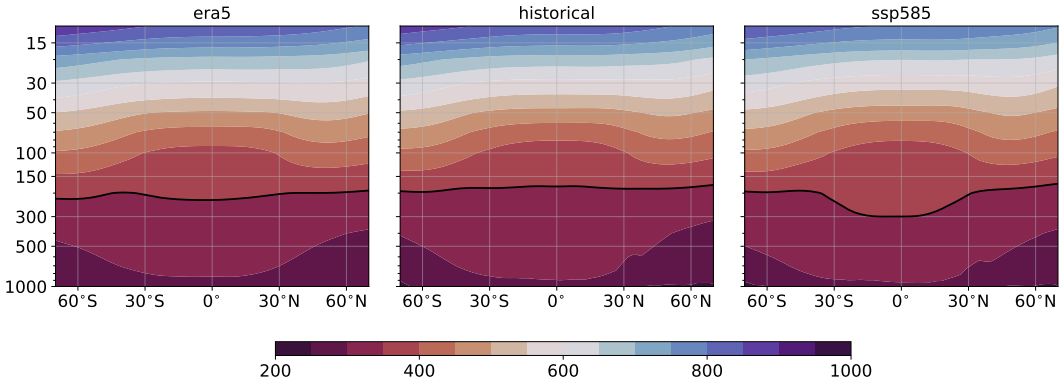

Figure S4. Latitude-height section of zonal mean potential temperature for (left) historical and (right) ssp585.

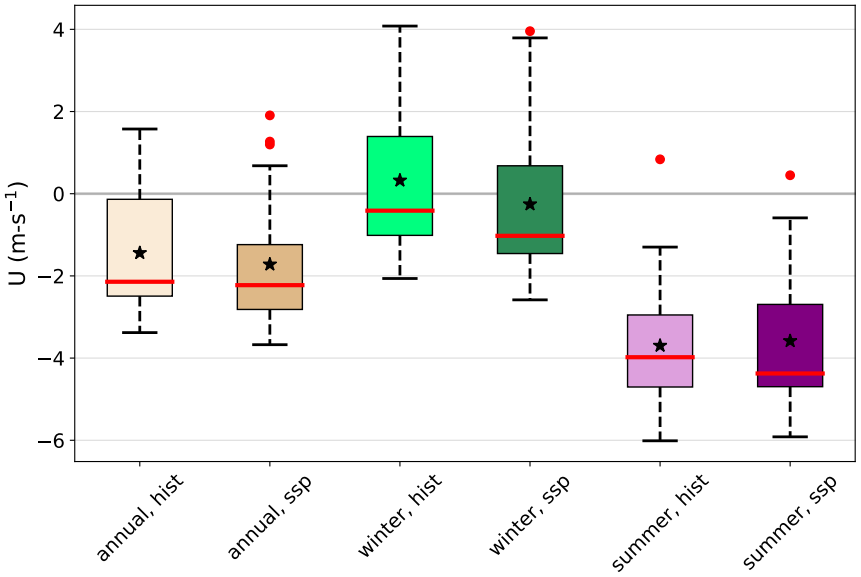

Figure S5. Temporally and zonally averaged zonal wind spread for the CMIP6 fully coupled simulations for averaged over $\pm 5^{\circ}$ of the equator and 150-300 mbar. The data represented are annual, winter, and summer season means for the control and forced multi-model ensembles. Points marked with black stars indicate the mean, while the horizontal red lines indicate the median. The lower value indicated by the box plot is the first quartile (Q_1), while the upper value is the third quartile (Q_3). For each box plot, the reach of the whiskers is 1.5xIQR beyond Q_1 and Q_3, where $IQR = Q_3 - Q_1$. The red dots are outliers.

References

Reichler, T., Dameris, M., and Sausen, R.: Determining the tropopause height from gridded data, Geophysical research letters, 30, https://doi.org/10.1029/2003GL018240, 2003.

Wu, Y. and Shaw, T. A.: The impact of the Asian summer monsoon circulation on the tropopause, Journal of Climate, 29, 8689–8701, https://doi.org/10.1175/JCLI-D-16-0204.1, 2016.