Figure S1: Zonal mean temperature response to RCP8.5 boundary conditions. (a-c) show climatological temperature, (d-f) show the response to RCP8.5 conditions, (g-i) response to RCP8.5 SSTs, and (j-l) response to RCP8.5 GHGs. The phases of the jet are shown in successive columns.

Sea surface temperatures (K)
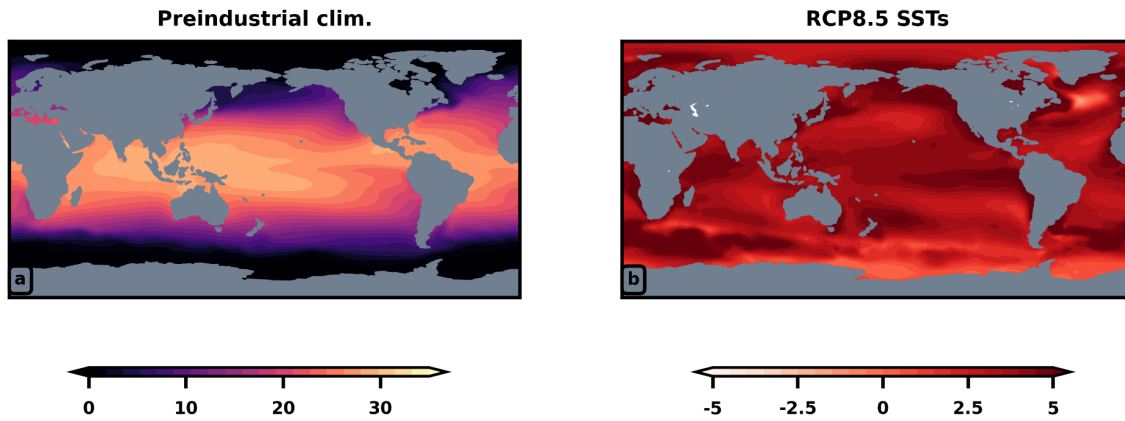
Figure S2: The preindustrial control annually averaged sea surface temperatures are shown on the left and the anomalous RCP8.5 sea surface temperatures that are superimposed on top of the preindustrial control sea surface temperatures are shown on the right.

Feb.-Mar. 180°E-240°E O3S (ppb) log-pressure (top) and tropopuase-relative (bottom)
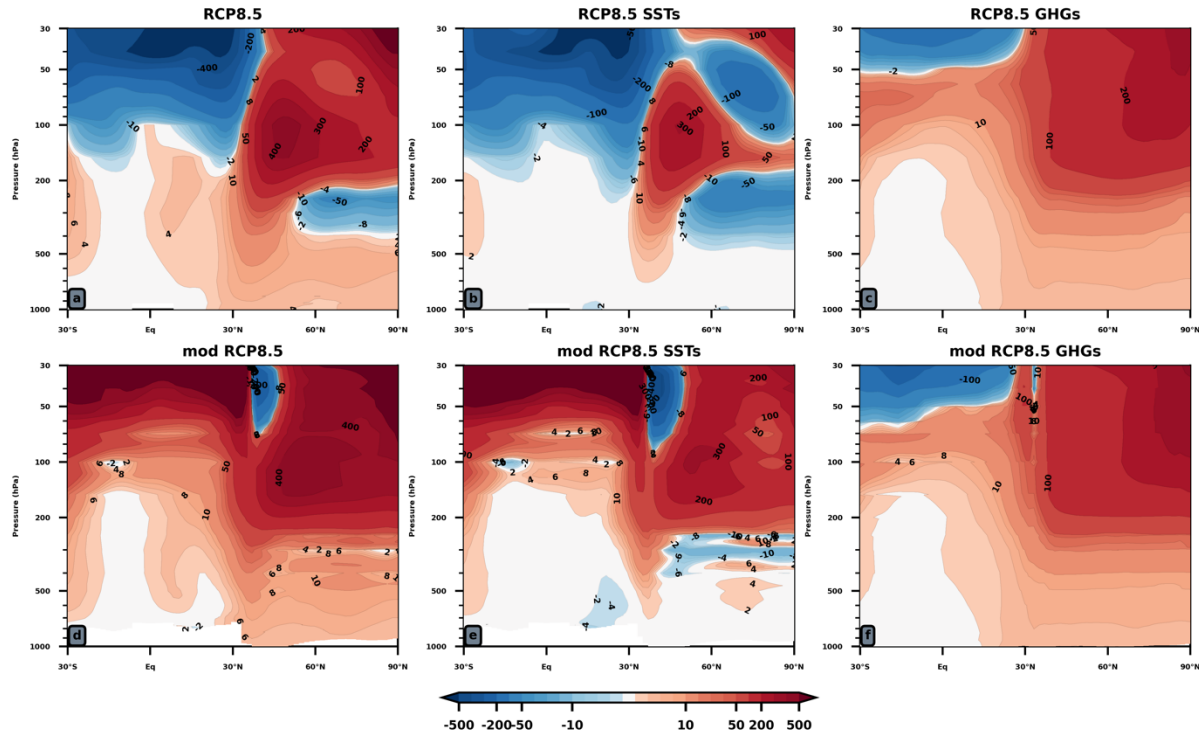
Figure S3: February to March averages of the zonally averaged 180ºE-240ºE O3S responses to RCP8.5 forcing, RCP8.5 SSTs, and RCP8.5 GHGs are shown in each of the three columns. The first row shows the response in the conventional log-pressure latitude system and the second row shows the responsescalculated in a tropopause relative height coordinate system and then remapped back to log-pressure coordinates.

Instructions on how to do this:

(1) Create a daily climatology of the field of interest (in this case, O3S) by averaging over years. Select the days of interest (e.g., February – March), and then average over the day axis to preserve (level x latitude x longitude) axes. Repeat for all experiments (RCP8.5, RCP8.5 SSTs, and preindustrial).
(2) Repeat step (1) for the temperature field as we will need the thermal tropopause data
(3) Remap the tropopause data to have a z-axis of heights (meters) rather than log-pressure. We used the Python scipy interp1d function for this purpose and interpolated to the nearest 5 meters. The results are similar, but messier if coarser resolution (e.g., 50 meters is used). At this point, it should be possible to make a map of tropopause heights.
(4) Now for a pair of experiments, say RCP8.5 and the preindustrial control, calculate the difference in tropopause heights at every grid point.
(5) Grab the RCP8.5 and preindustrial data from step (1). Using the differences in tropopause height from step (4), align the data sets in the vertical so their tropopauses are located at the same level. In this example with RCP8.5 and preindustrial data, for the

most part, the preindustrial data will have to be shifted upward from the surface by inserting NaN values near the surface.

(6) With the two data sets now aligned in the vertical along a tropopause relative coordinate axis, take the difference between the RCP8.5 and preindustrial O3S data sets.

(7) Remap the anomalies from step (6) back to altitudes and then to conventional log-pressure heights for display.

Feb-March modified 200 hPa O3S (ppb)
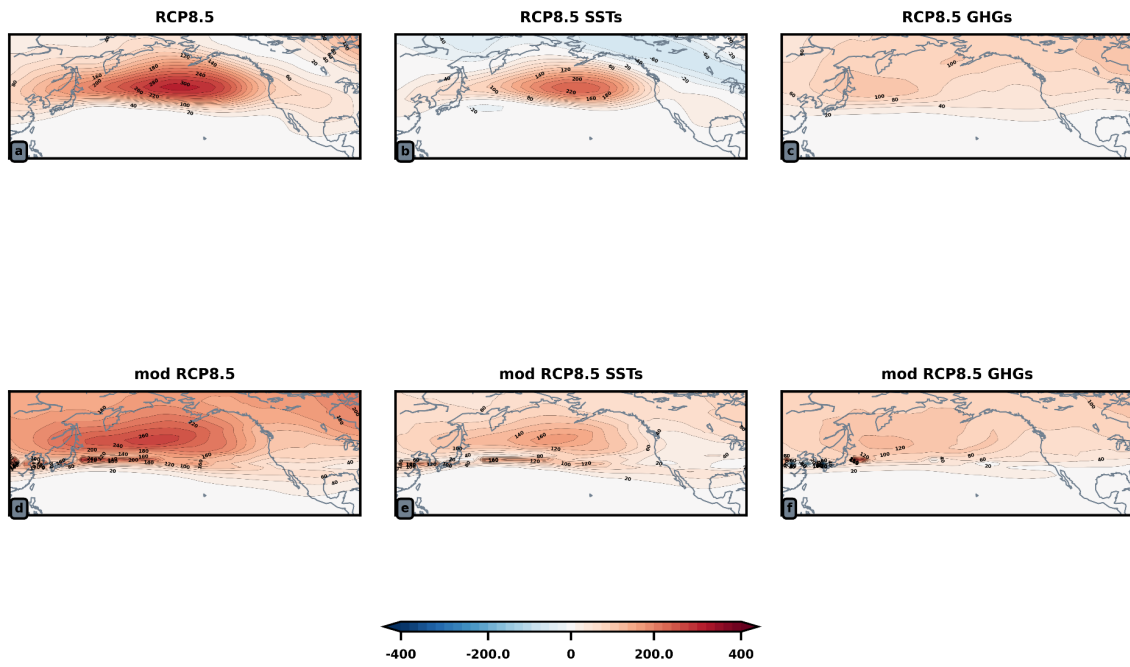
Figure S4: As in Figure S3, but for the 200 hPa O3S responses.

Feb-March modified 300 hPa O3S (ppb)
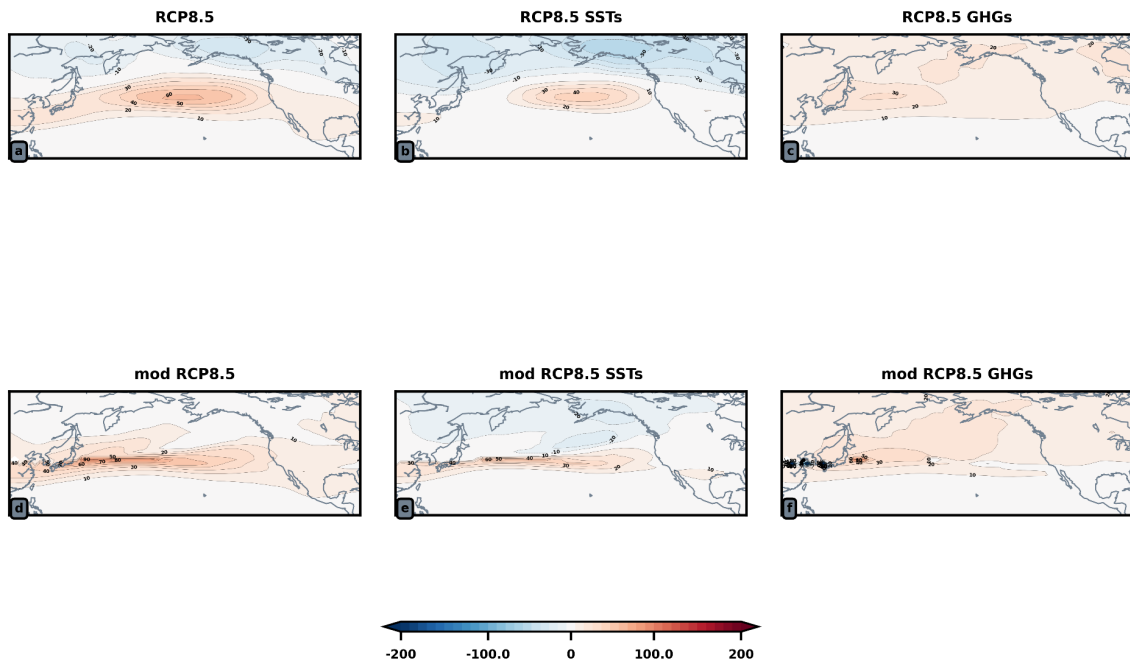
Figure S5: As in Figure S4, but for the 300 hPa O3S responses.