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Supplement of

Quantifying the spread in sudden stratospheric warming wave forcing in CMIP6

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S1. SSW evolution in models and reanalyses

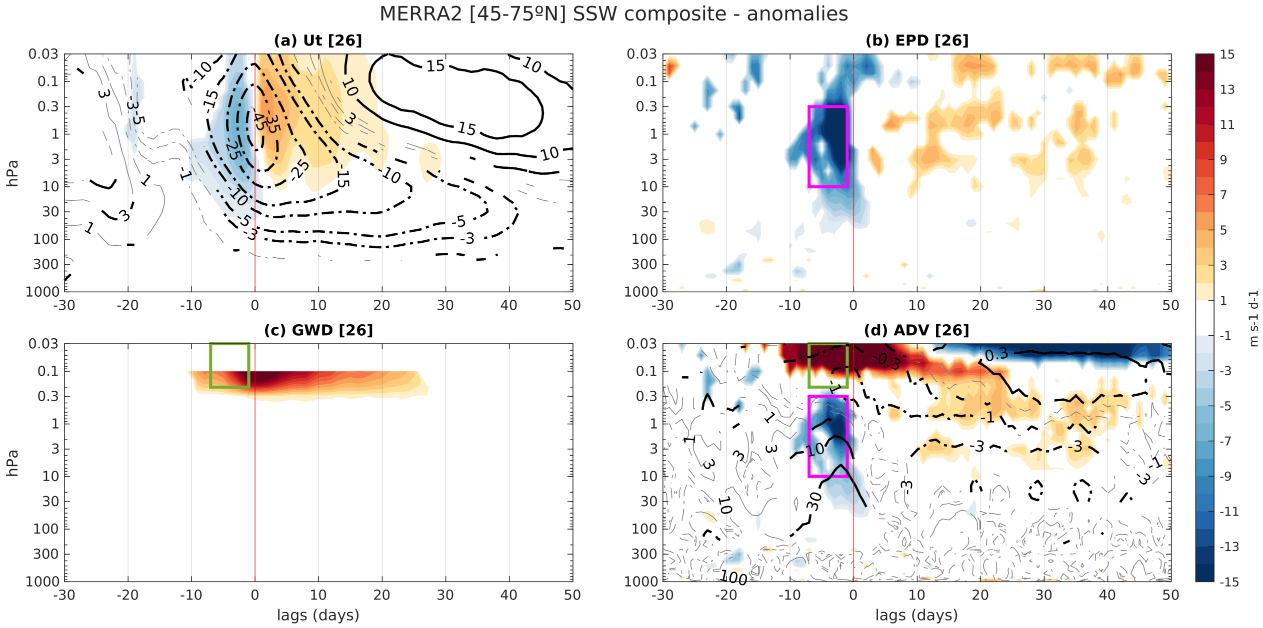

Figure S1: As in Figure 2 but for MERRA2 reanalysis.

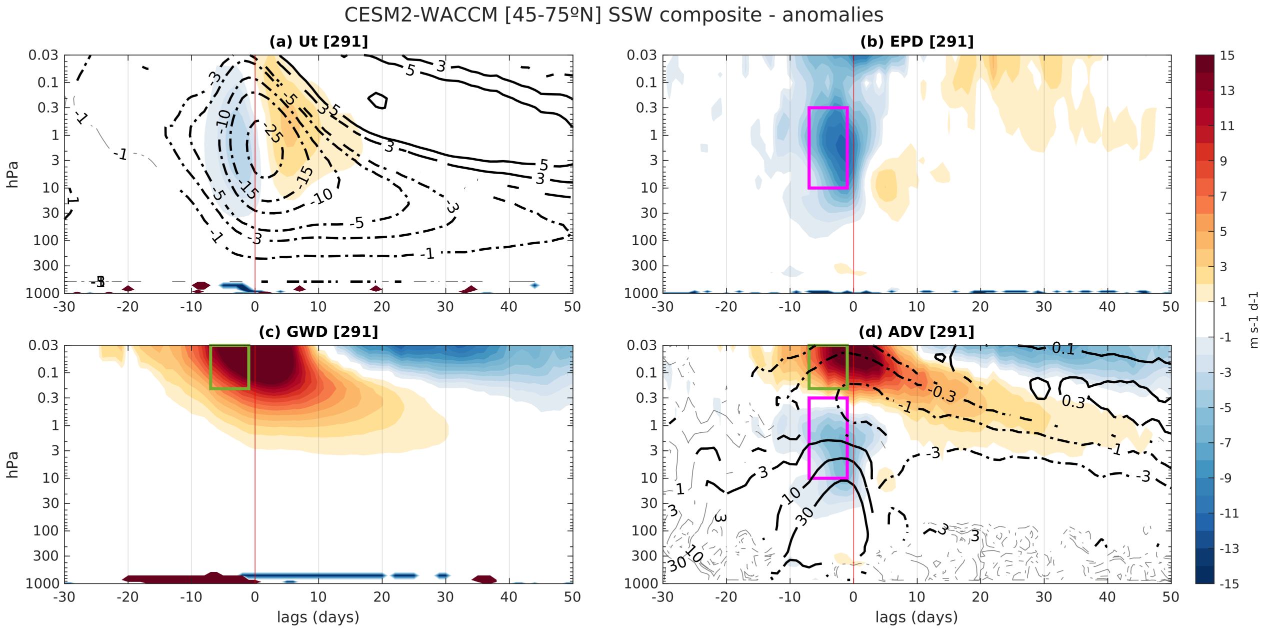

Figure S2: As in Figure 2 but for CESM2-WACCM model.

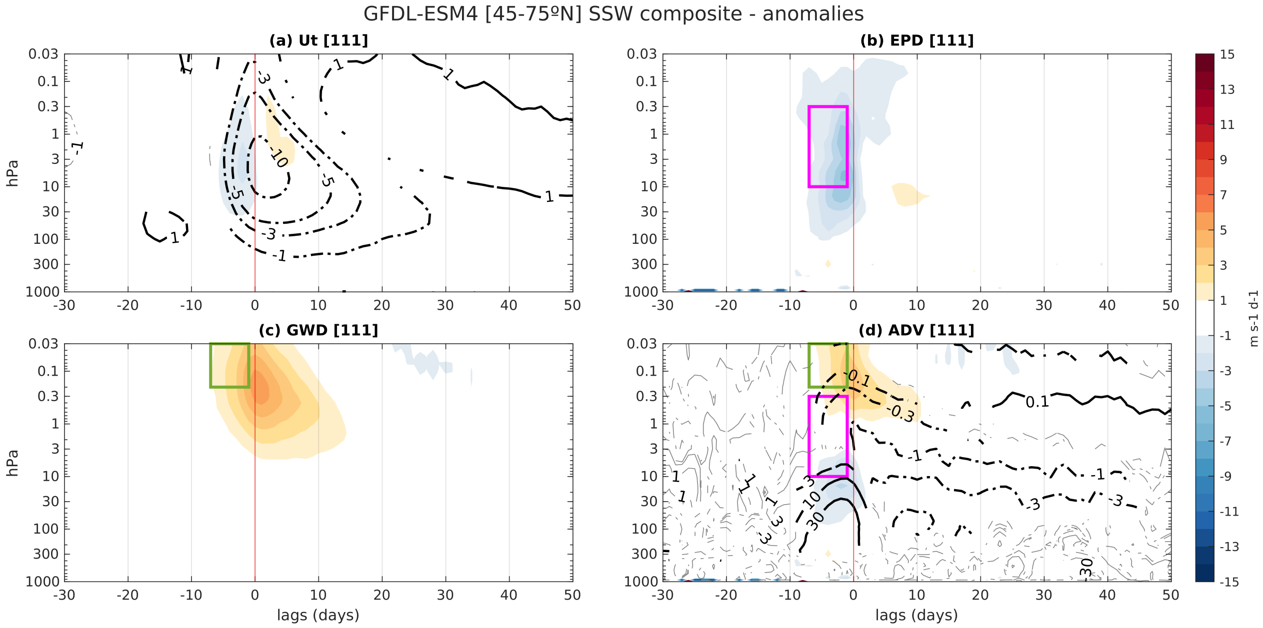

Figure S3: As in Figure 2 but for GFDL-ESM4 model.

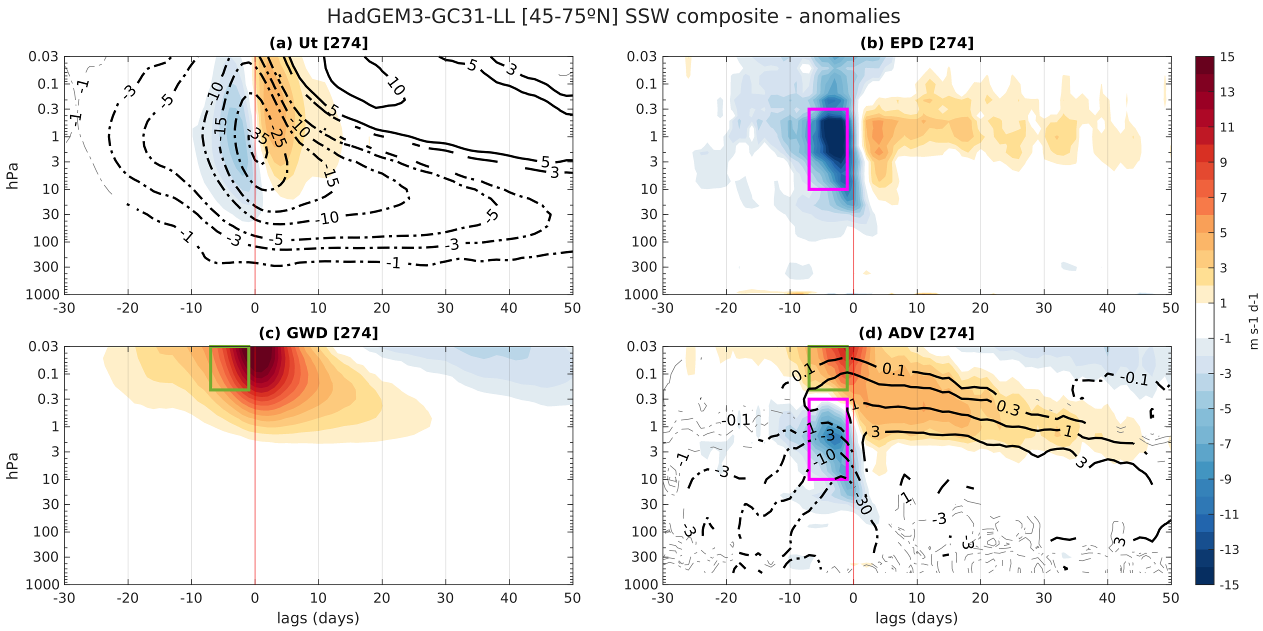

Figure S4: As in Figure 2 but for HadGEM3-GC31-LL model.

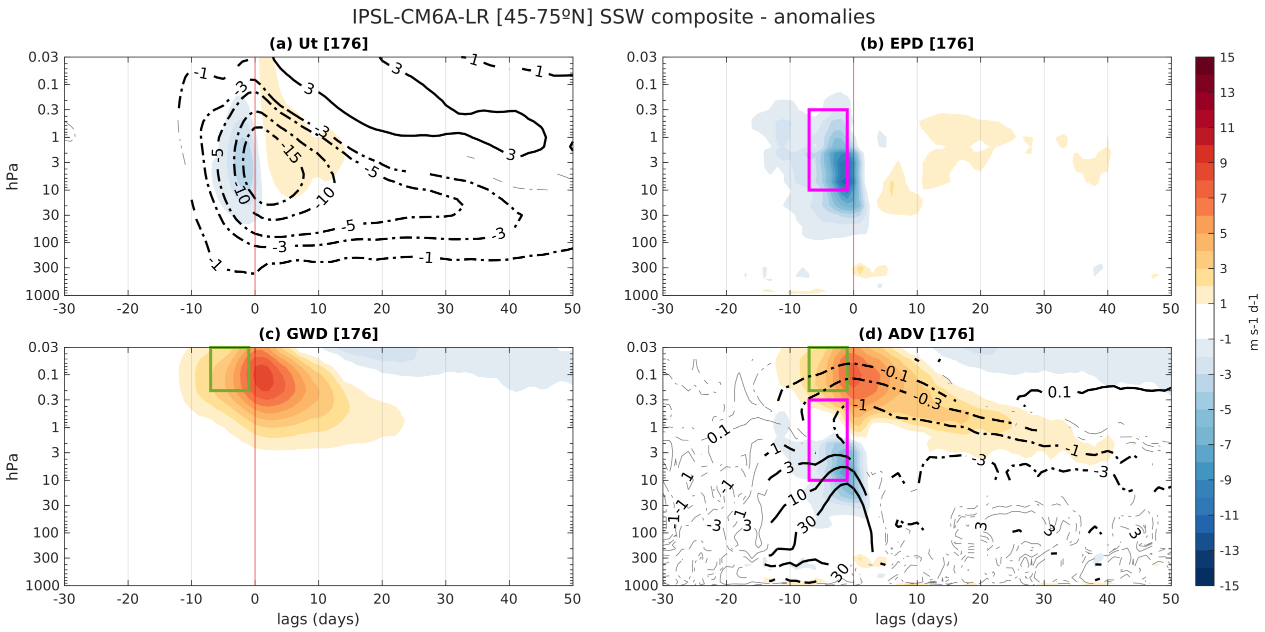

Figure S5: As in Figure 2 but for IPSL-CM6A-LR model.

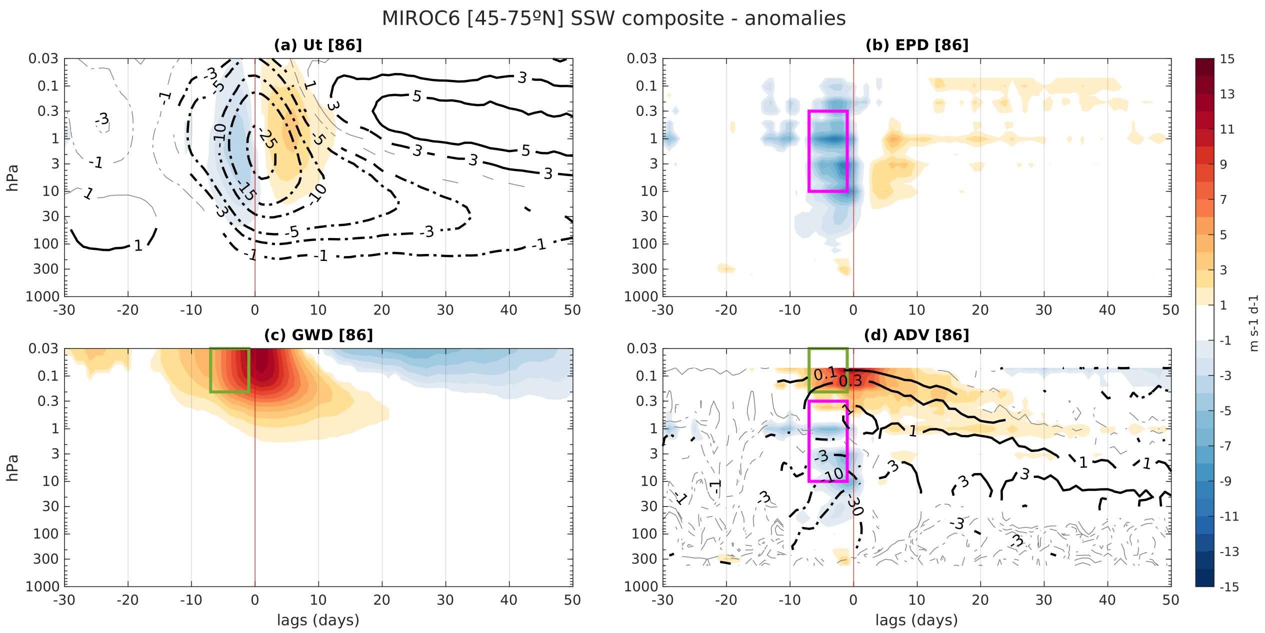

Figure S6: As in Figure 2 but for MIROC6 model.

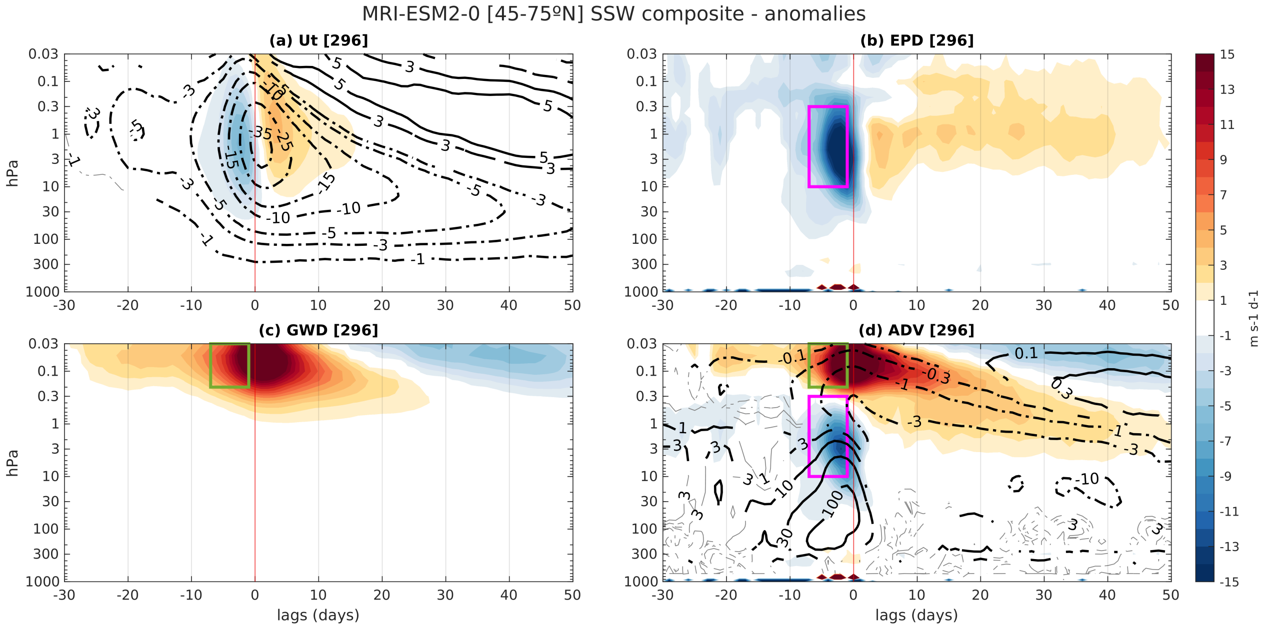

Figure S7: As in Figure 2 but for MRI-ESM2-0 model.

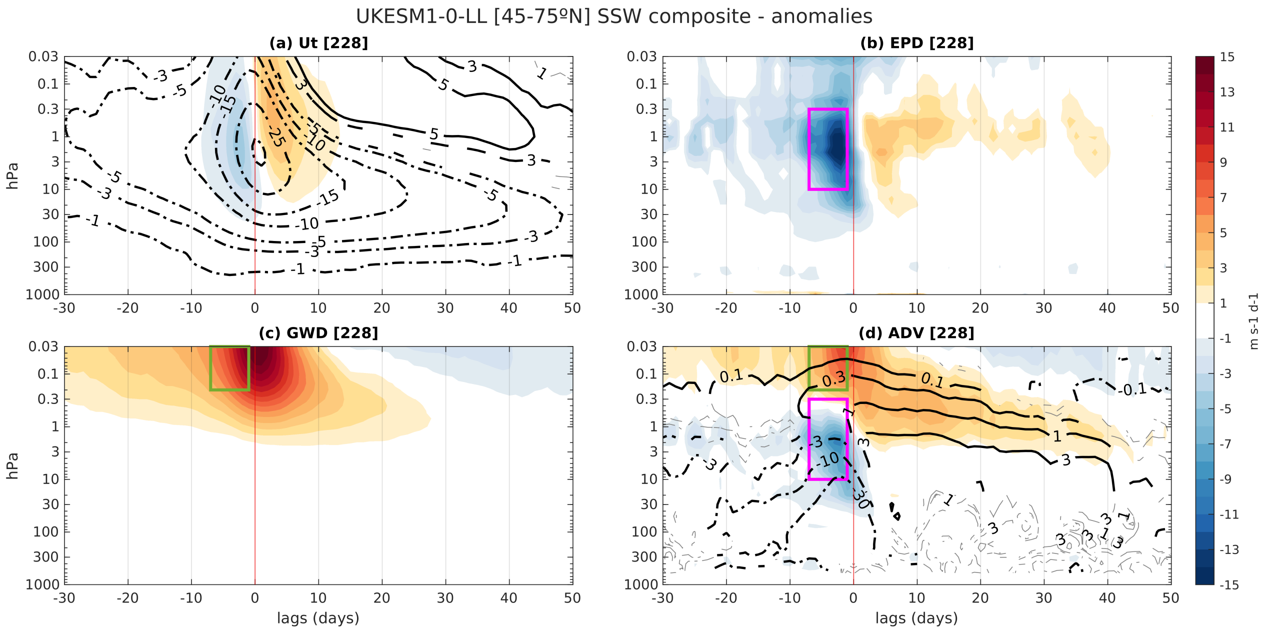

Figure S8: As in Figure 2 but for UKESM1-0-LL model.

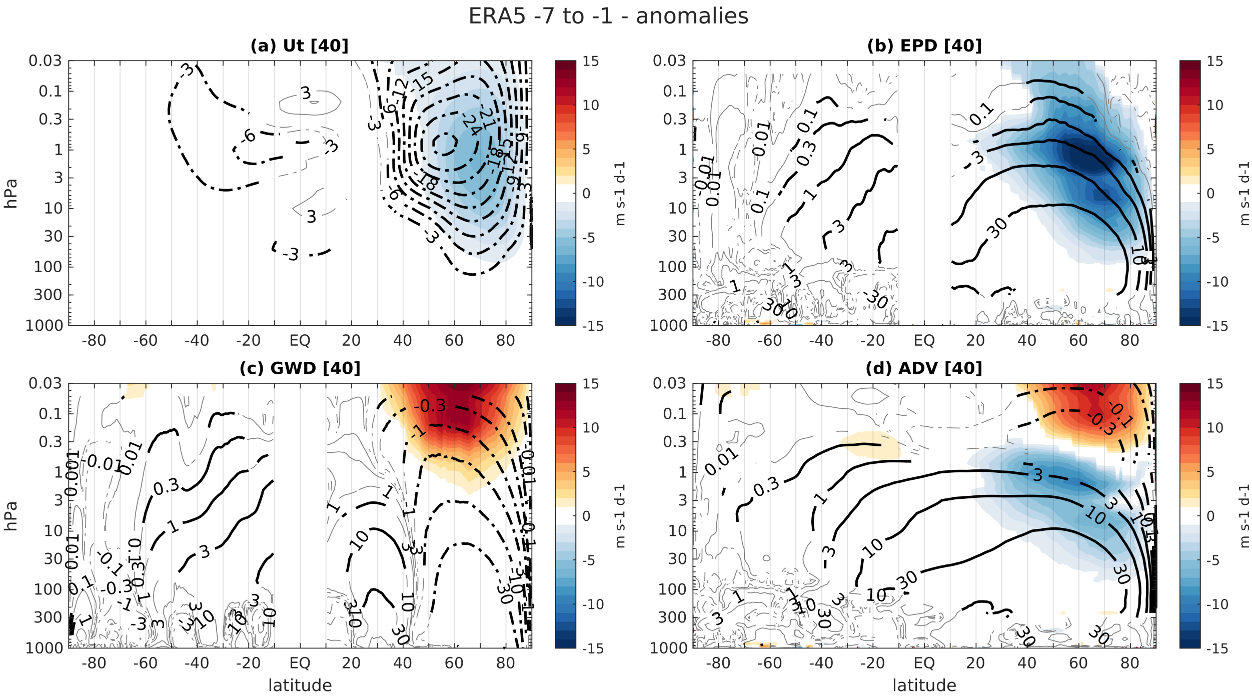

Figure S9: Latitude-height SSW composite of zonal mean [-7 to -1] lags averaged anomalies of (a) tendency of the zonal wind, (b) planetary Rossby waves 'drag', (c) gravity waves 'drag' and (d) the Coriolis torque of the residual circulation in shading for ERA5 reanalysis. Contours show anomalies of zonal wind in (a) and the mass stream function in (b-d). In (b) and (c) the mass stream function is calculated using only *EPD* and *GWD* as the forcing, respectively. Units are m s-1 d-1 for shading and m s-1, kg m-1 s-1 in (a,b-d) for contours, respectively. Shaded colors and black thick contours indicate values significant at 95 % confidence with a two-tailed t-test. The number of SSWs in the composite is shown in brackets.

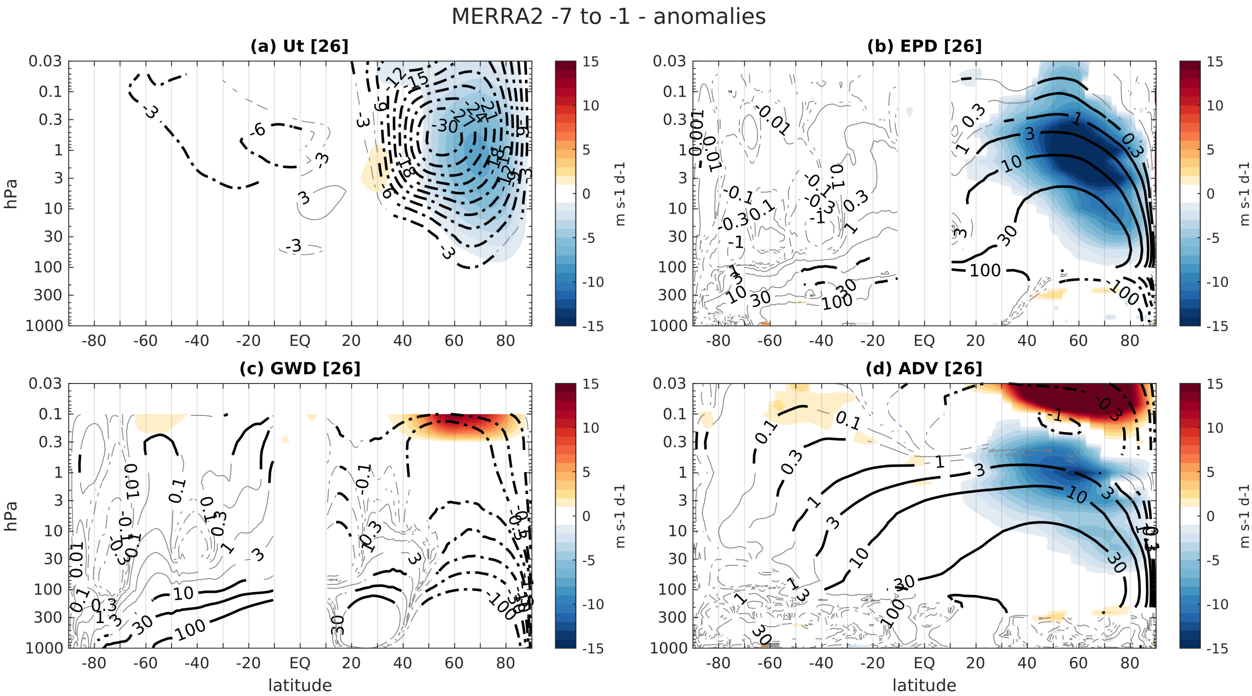

Figure S10: As in Figure S9 but for MERRRA2 reanalysis.

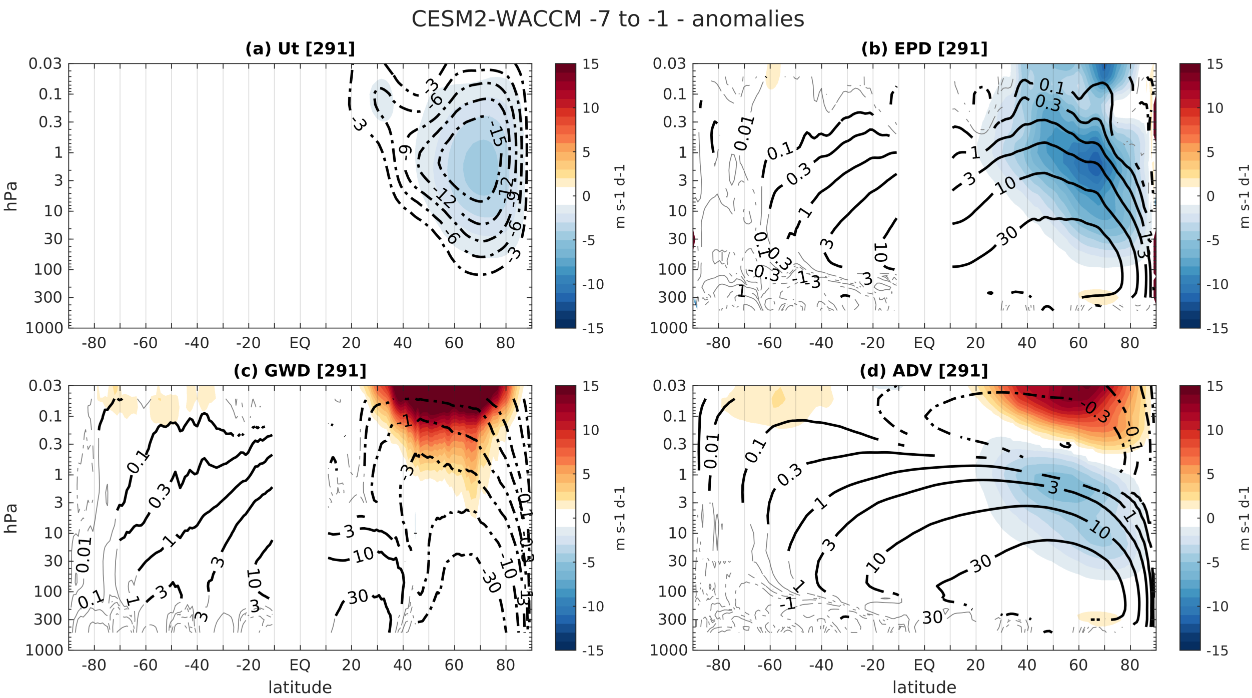

Figure S11: As in Figure S9 but for CESM2-WACCM model.

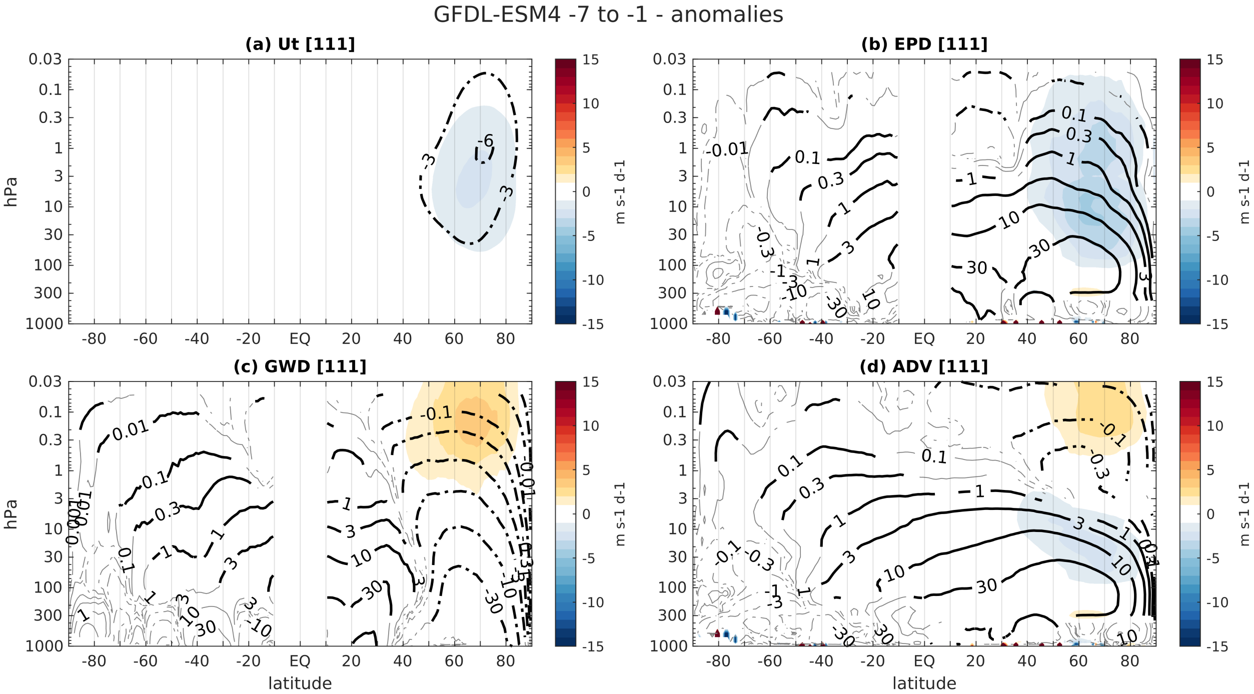

Figure S12: As in Figure S9 but for GFDL-ESM4 model.

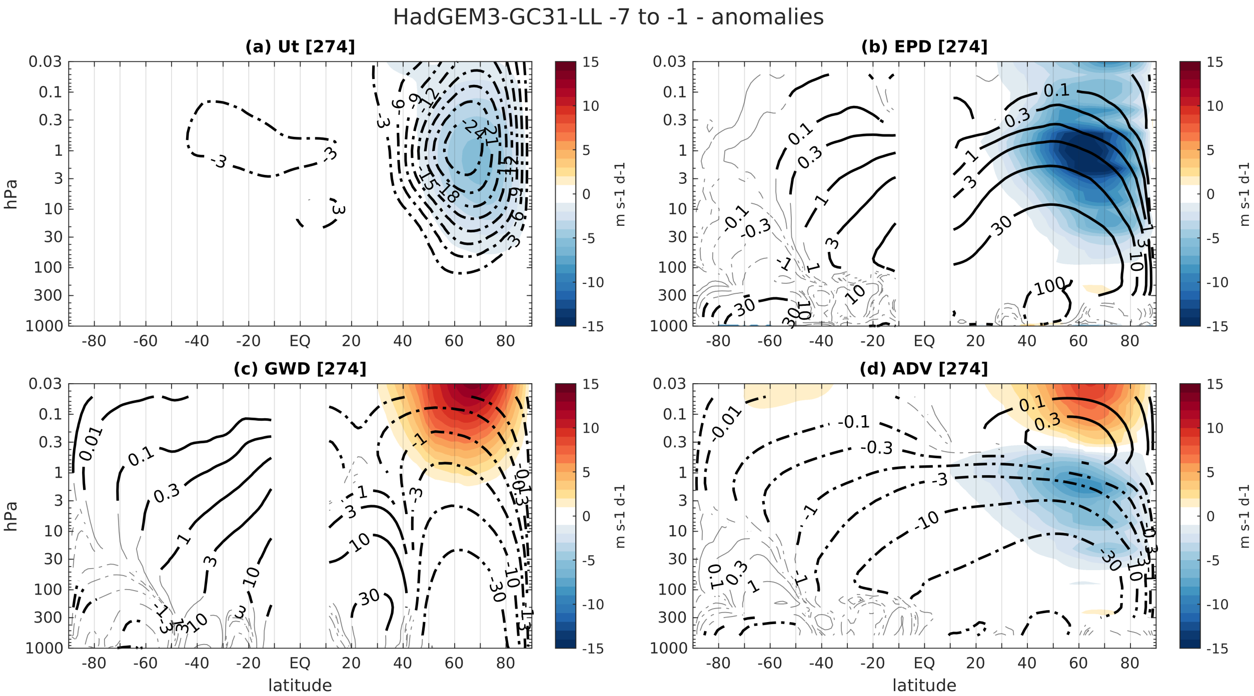

Figure S13: As in Figure S9 but for HadGEM3-GC31-LL model.

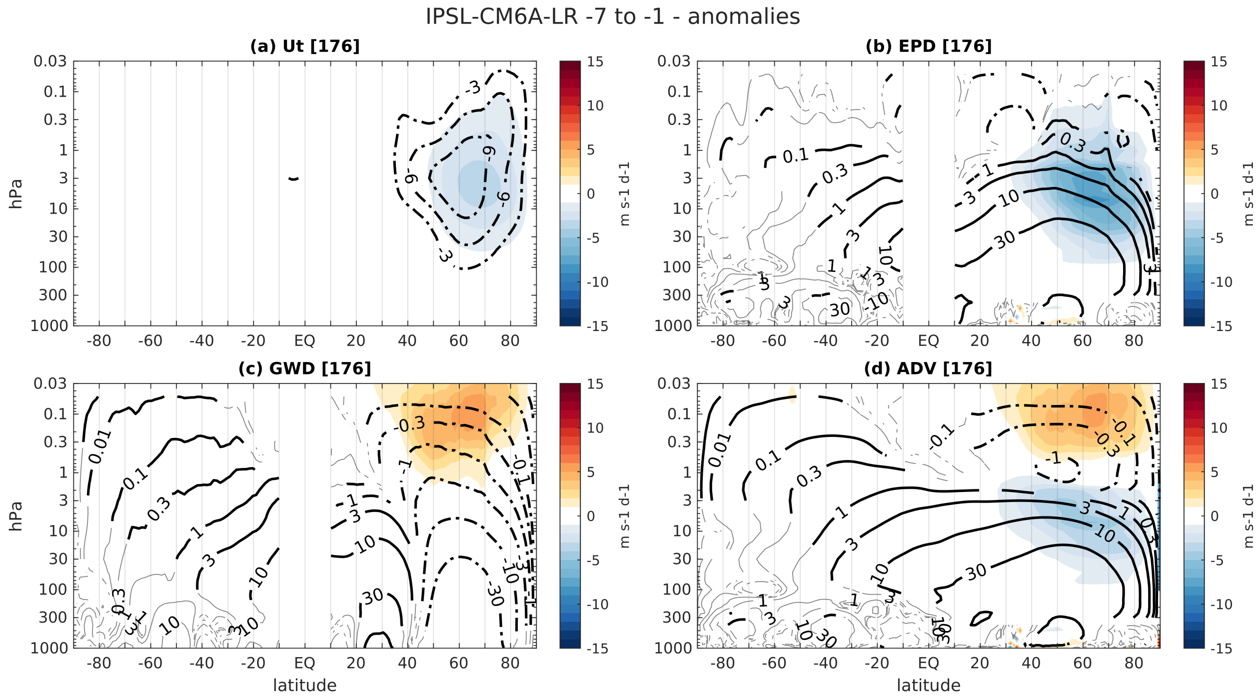

Figure S14: As in Figure S9 but for IPSL-CM6A-LR model.

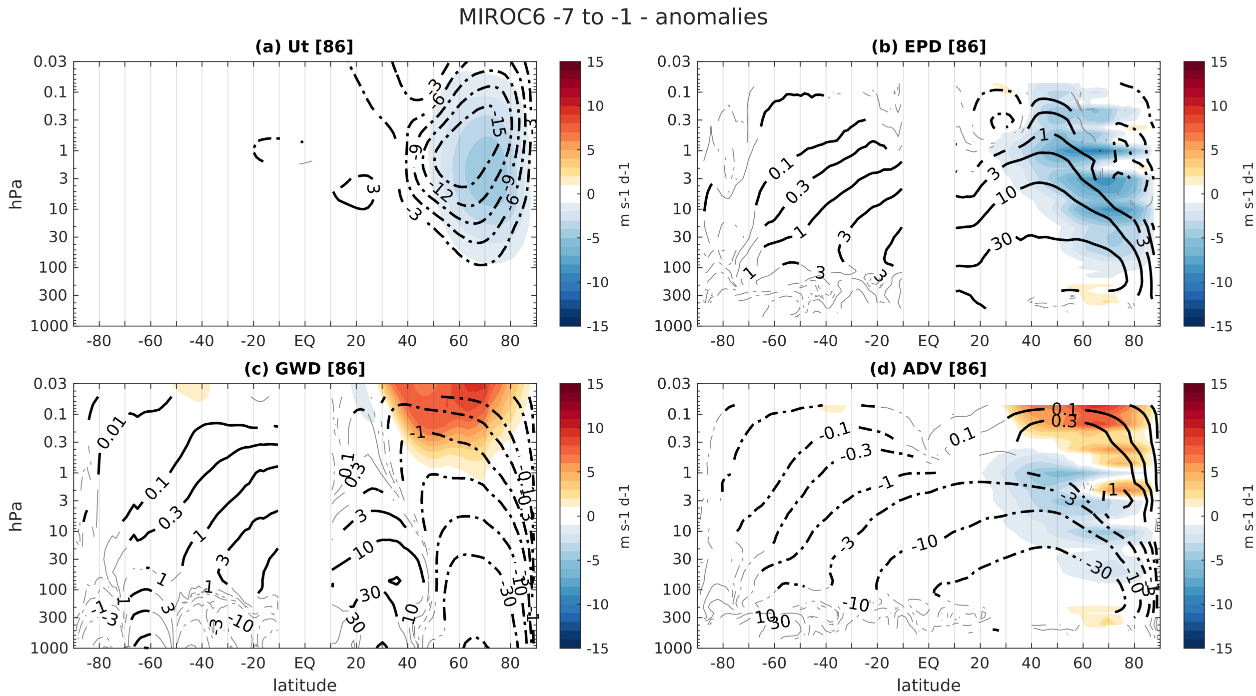

Figure S15: As in Figure S9 but for MIROC6 model.

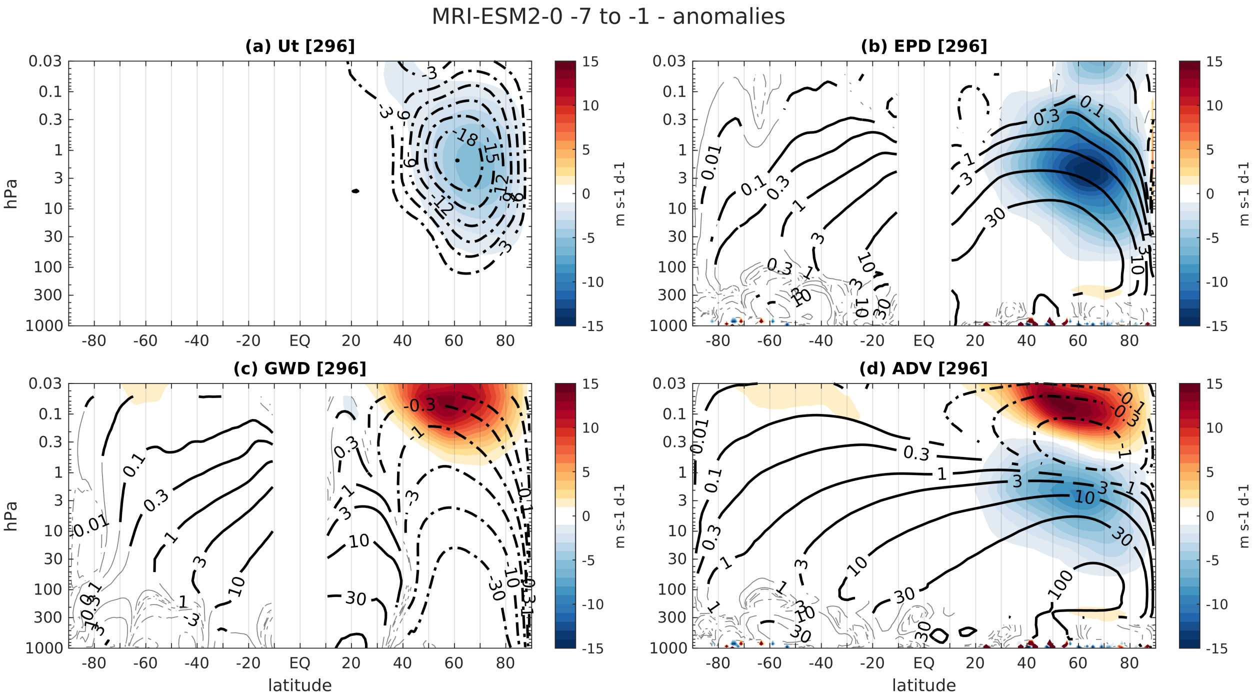

Figure S16: As in Figure S9 but for MRI-ESM2-0 model.

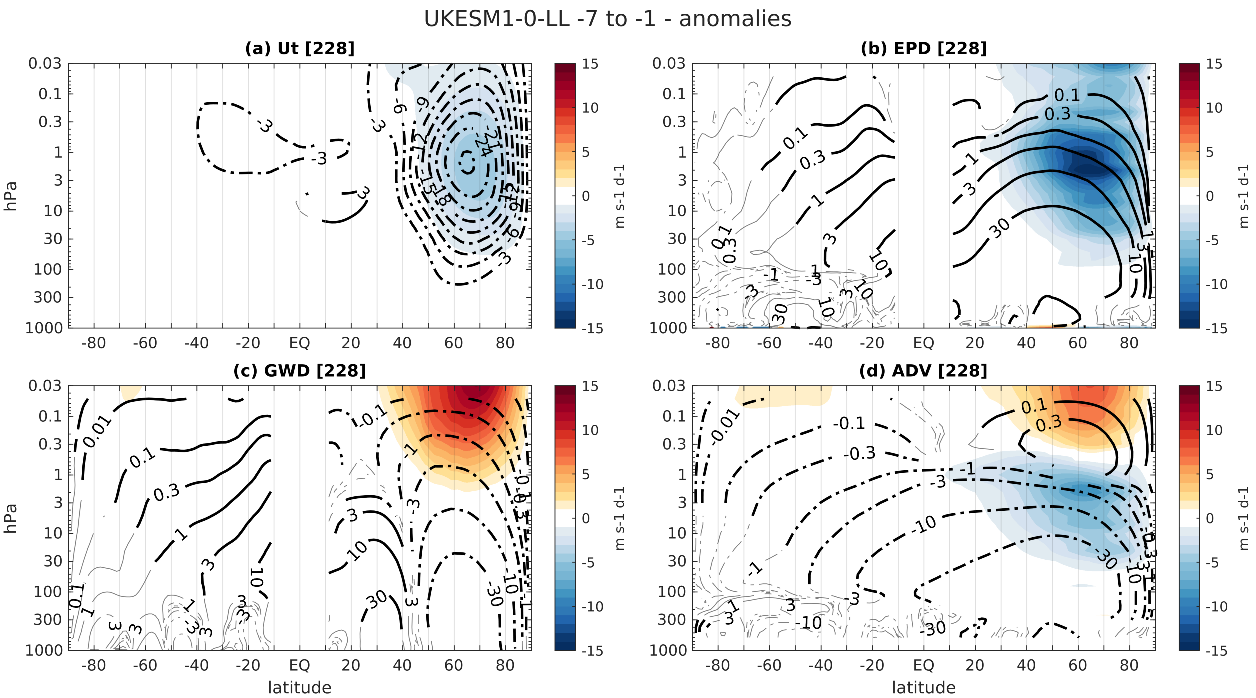

Figure S17: As in Figure S9 but for UKESM1-0-LL model.

S2. Model mean spread during the SSW development stage. SSD comparison

Sudden stratospheric decelerations (SSDs) were defined in Birner and Albers (2017) as when the 10-day wind change (Ut) drops below two standard deviations at 10 hPa, 45º-75ºN (60ºN here). This threshold is model independent with the following values.

ERA5	MERRA2	CESM2-WACCM	GFDL-ESM4	HadGEM3-GC31-LL	IPSL-CM6A-LR	MIROC6	MRI-ESM2-0	UKESM1-0-LL
-30.1	-28.6	-20.8	-18.3	-23.4	-24.5	-23.0	-25.5	-23.3

Table S1: Thresholds used in each model and reanalyses to identify SSDs representing two standard deviations of the 10hPa 60ºN zonal-mean 10-day wind decelerations.

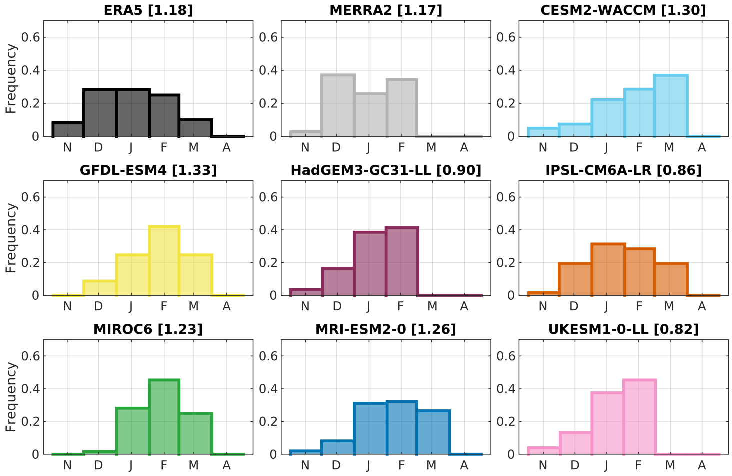

Figure S18: As in Figure 1 but for SSDs.

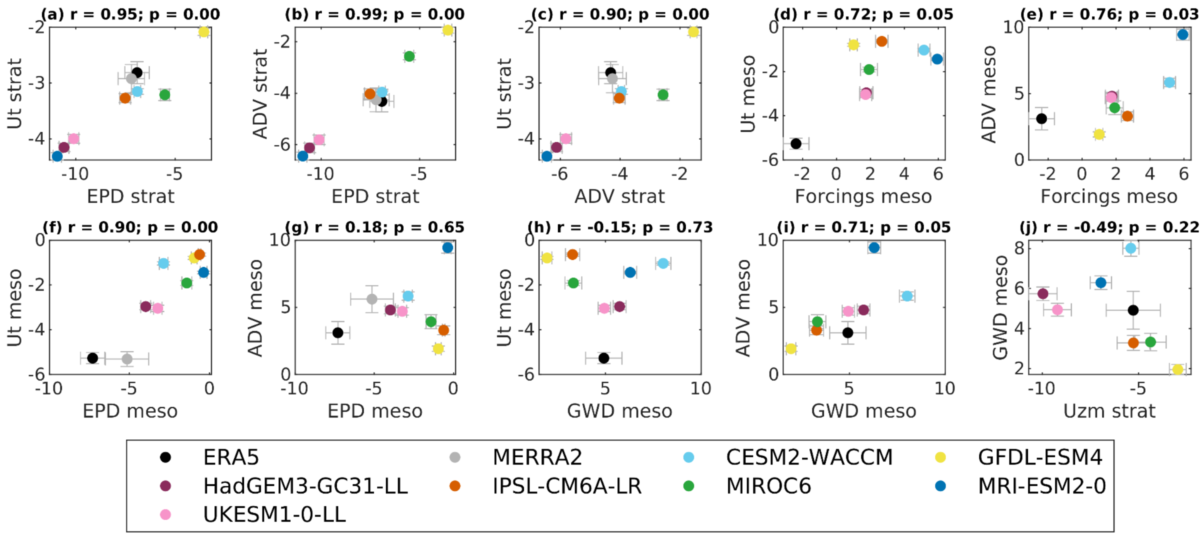

Figure S19: As in Figure 5 but for SSDs.

S3. Inter-event variability in models during the SSW development stage

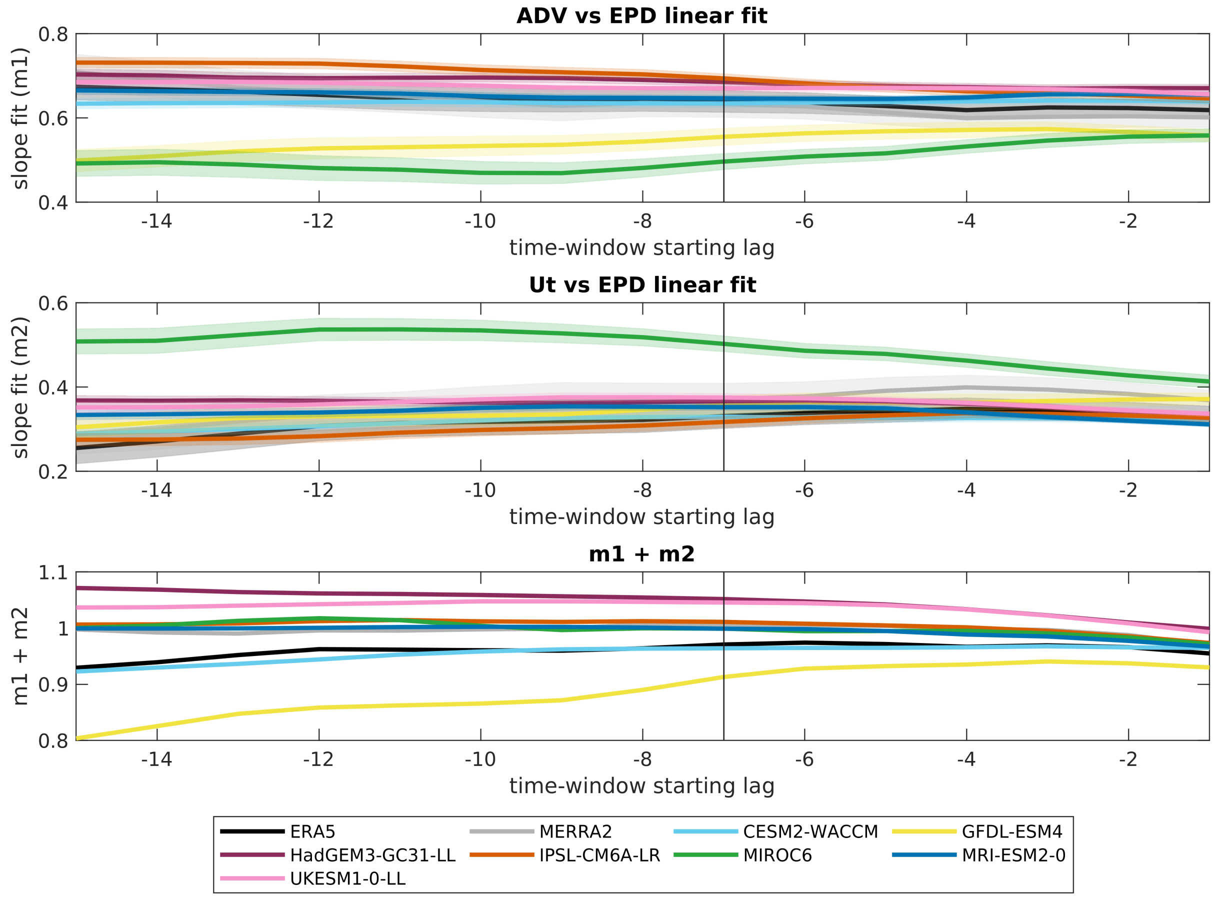

Figure S20: Sensitivity test on the linear fit slope for different time-window averages of the variables in the stratosphere ([10 0.3] hPa). The x-axis indicates the lag at which the time-window starts, keeping the end in -1 lag, i.e., [x -1] lags. The y-axis shows the value of the slope for the linear fit, with the standard error in shaded.

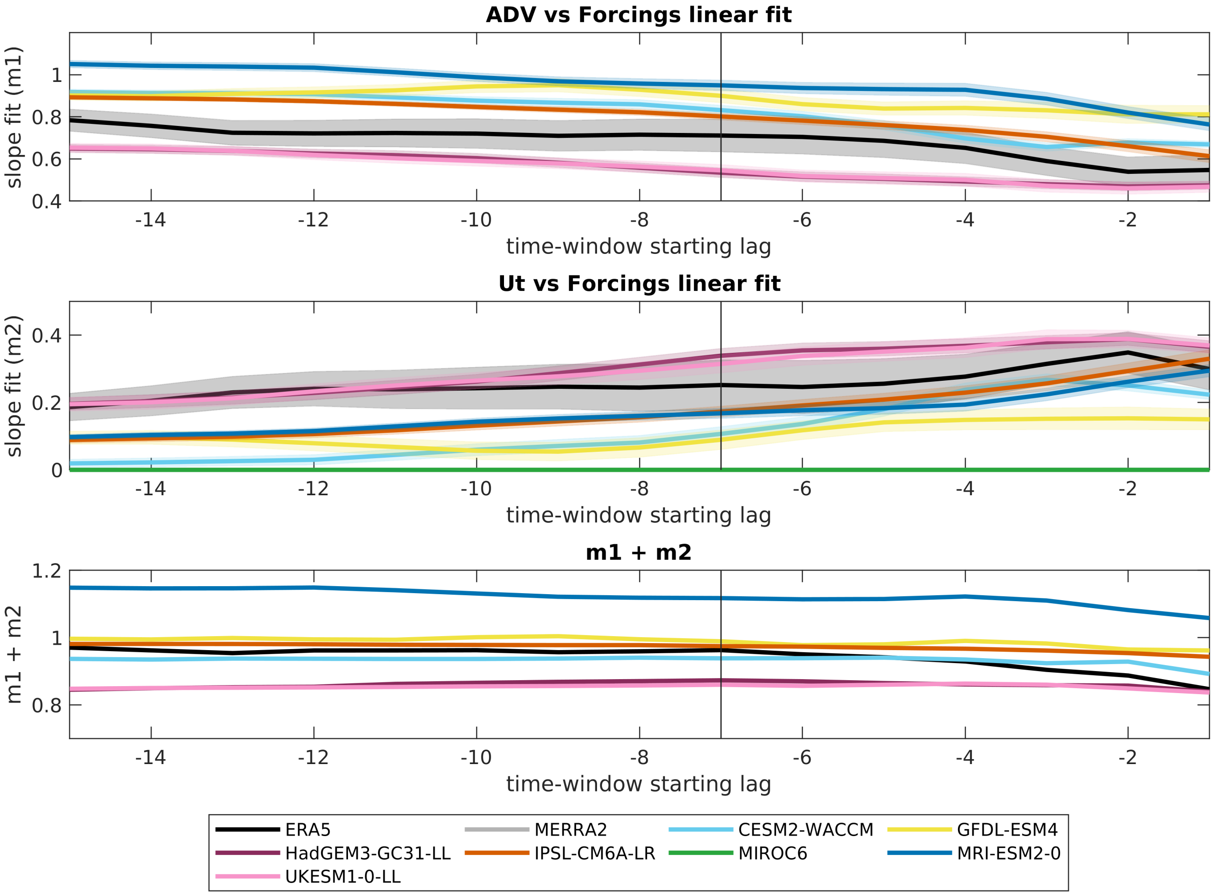

Figure S21: As in Fig. S18 but for the mesosphere ([0.2 to 0.03] hPa) and the total forcing ($EPD+GWD$).