

Supporting Information for "Ozone-forced Southern Annular Mode during Antarctic Stratospheric Warming Events"

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Contents of this file

1. Text S1 to S2
2. Figures S1 to S2
3. Table S1

Text S1 - Correlation between IOD and SAM: To determine the correlation between the Indian Ocean Dipole and the Southern Annular Mode, we compare the monthly Marshall SAM index (<http://www.nerc-bas.ac.uk/public/icd/gjma/newsam.1957.2007.txt>, downloaded 2021-06-17) and the Dipole Mode Index (https://psl.noaa.gov/gcos_wgsp/Timeseries/Data/dmi.had.long.data, downloaded 2021-06-17) on monthly, seasonal, and yearly timescales, with the results shown in Table S1.

Text S2 - Stratospheric ozone vs. SAM in ERA5: Besides the years 2002 and 2019 which are known for their SWEs, two earlier years are also marked with extremely high

polar cap total column ozone values (marked red in Fig. S1, left). All four years show the vertical dipole of polar cap geopotential height anomalies seen in 2019, albeit in a less prominent way. While it is only as obvious in 1979, it is still visible during the first and last ozone peaks in 1988 (beginning September and November) and during the very short large ozone peak in 2002 (last few days of September and first few days of October).

	monthly	DJF	MAM	JJA	SON	yearly
	0.104	0.358	0.209	0.204	-0.096	0.247

Table S1. Correlation coefficients between IOD and SAM.

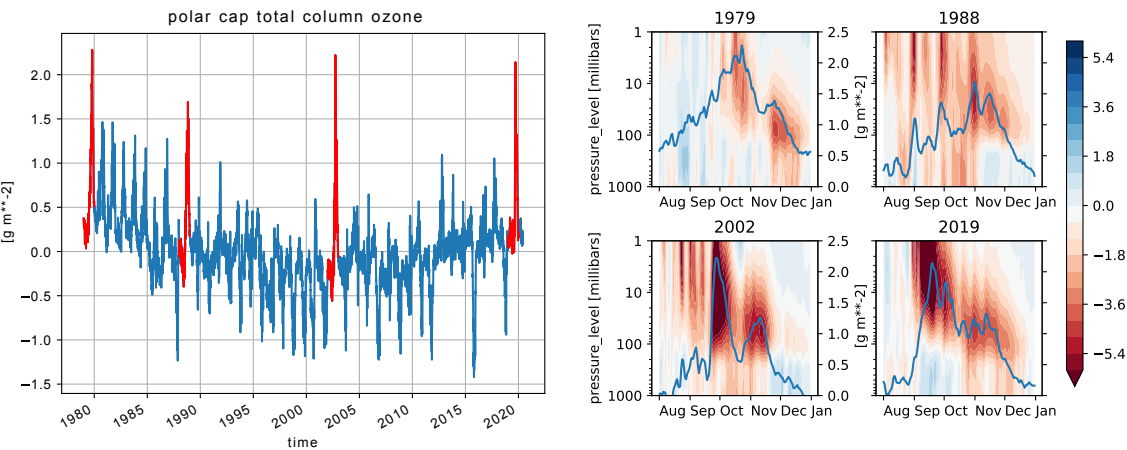
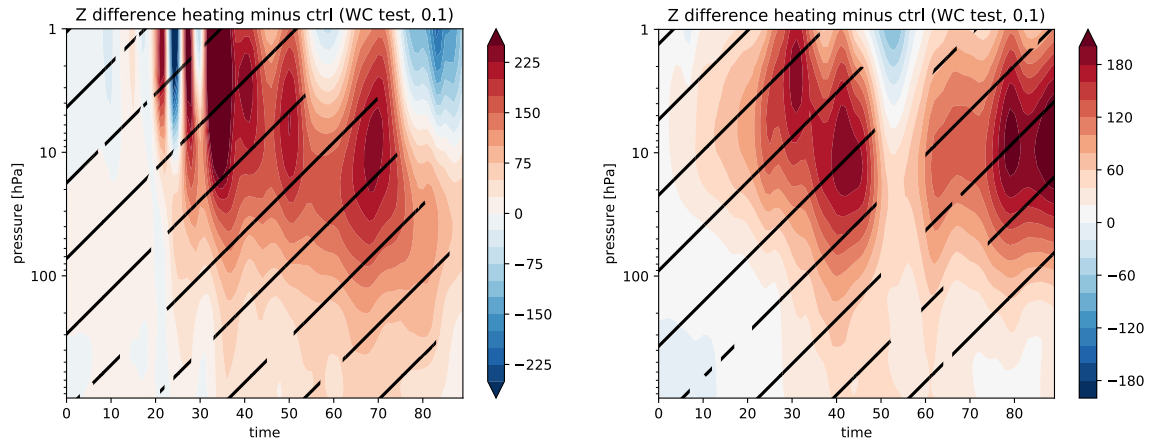


Figure S1. ERA5 polar cap total column ozone and geopotential height anomalies. (left) Total column ozone timeseries for the complete record (minus 1979-2020 seasonal climatology). (right) Same as Fig. 1a) but for the four years of large peaks in the ozone timeseries (marked red on left).



(a) Same as Fig. 2(b) but starting in August.

(b) Same as Fig. 2(b) but starting in October.

Figure S2. Polar cap geopotential height anomalies for simulations with MiMA where solar forcing corresponds to 30 days earlier (i.e. August, left) or later (October, right).

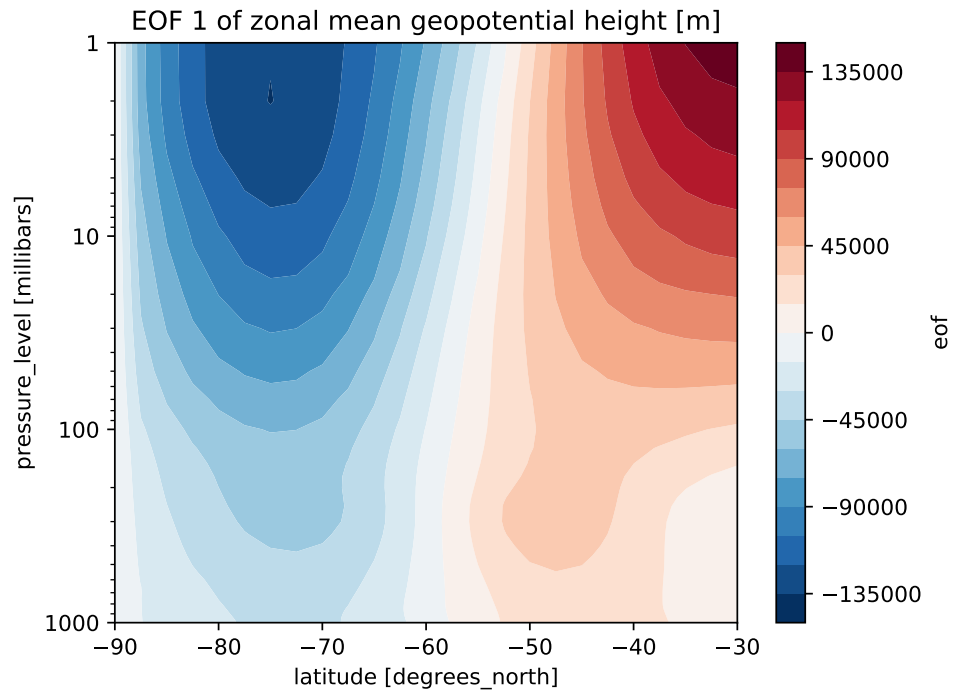


Figure S3. First Empirical Orthogonal Function (EOF) of de-seasonalised zonal mean geopotential anomalies from ERA5 data (1979-2019)). The standardised timeseries of the first principle component at each pressure level is identified as the Southern Annular Mode index.