



*Supplement of*

## **The role of the stratospheric state in upward wave flux prior to Sudden Stratospheric Warmings: a SNAPSI analysis**

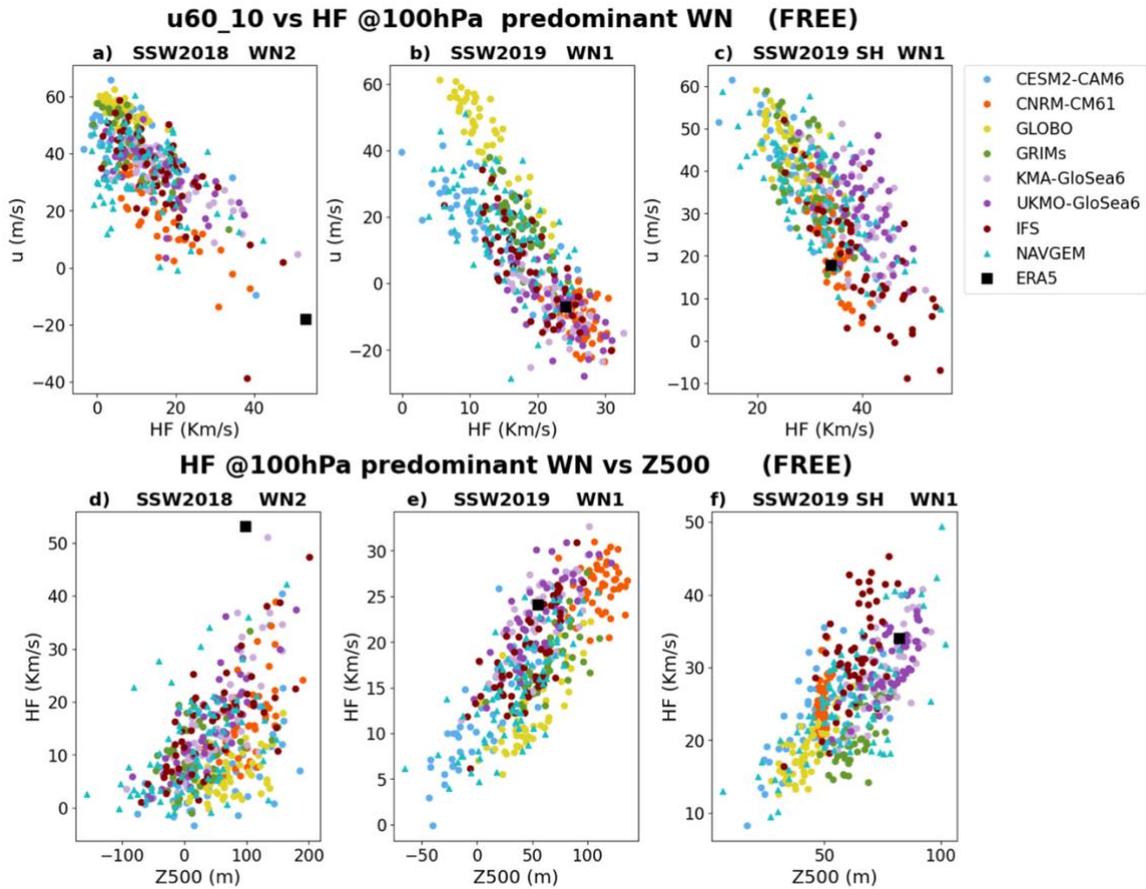
**Blanca Ayarzagüena et al.**

*Correspondence to:* Blanca Ayarzagüena (bayarzag@ucm.es)

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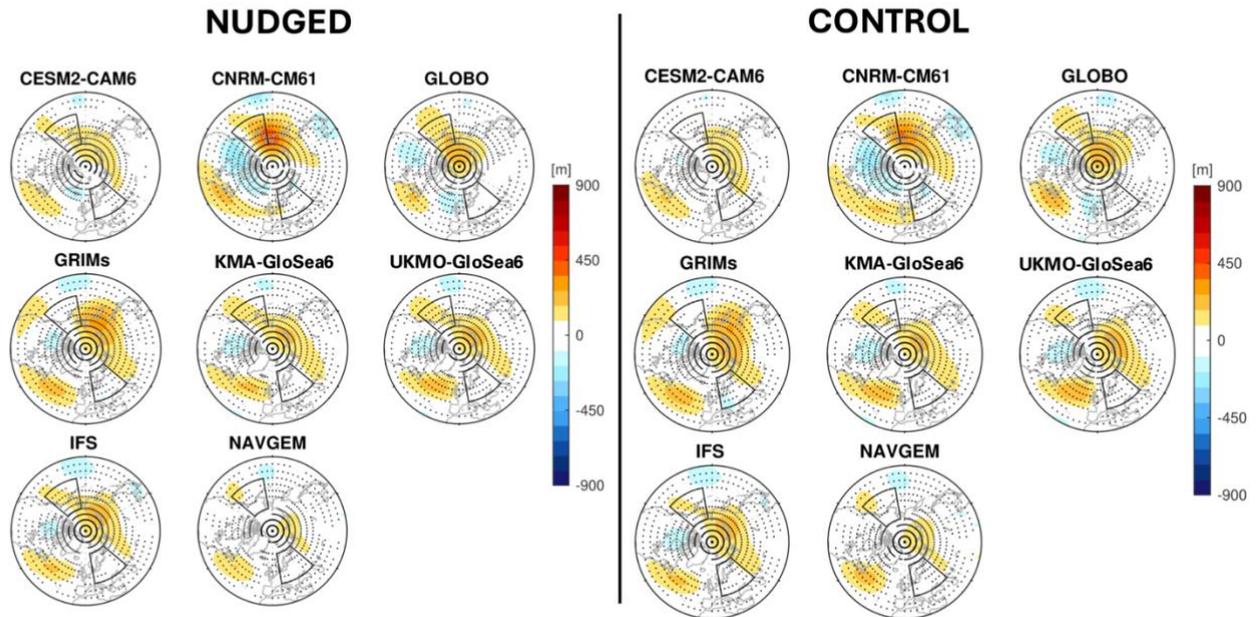
## Contents of this file

Figures S1 to S5



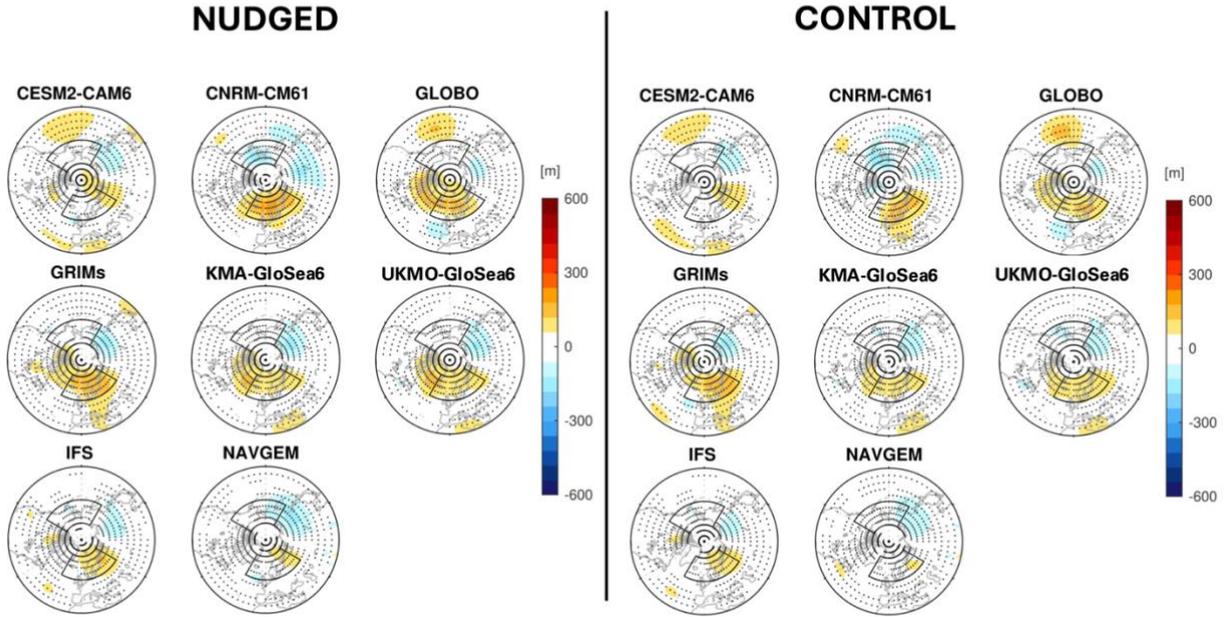
- 5 Figure S1. Scatter plots of (a)-(c)  $u_{60_10}$  (m/s) averaged during the SSW onset date vs heat flux at 100hPa (K m/s) for the predominant wavenumber and averaged during the burst of tropospheric wave activity associated with each SSW. (d) – (f) Same as (a)-(c) but for the heat flux at 100hPa (K m/s) vs the combined Z500 anomalies (m) of the corresponding tropospheric precursors. In all plots each marker represents a single ensemble member and the black square corresponds to the ERA5 value. Overall, the variables represented in plots follow in general a linear relationship.

# SSW2018



15 **Figure S2. Composite maps of Z500 anomalies (m) for the period 3rd-13th February 2018 for the (left) NUDGED and (right) CONTROL experiments. Black boxes delimit the area of the tropospheric precursors of the SSW assessed in Fig. 8 of the manuscript. The tropospheric pattern preceding the SSW2018 is very similar in the three experiments (compare with contours in Figure 5 for the FREE experiment), although different from the ERA5 one. Thus, the stratospheric state does not seem to highly influence the tropospheric circulation prior to the SSW2018.**

# SSW2019



20 **Figure S3.** Same as Figure S2 but for the period 18th-30th December 2018. The patterns are very similar to those shown in Fig.6 for the FREE experiment and to those associated with a vortex deceleration.

# SSW2019 SH

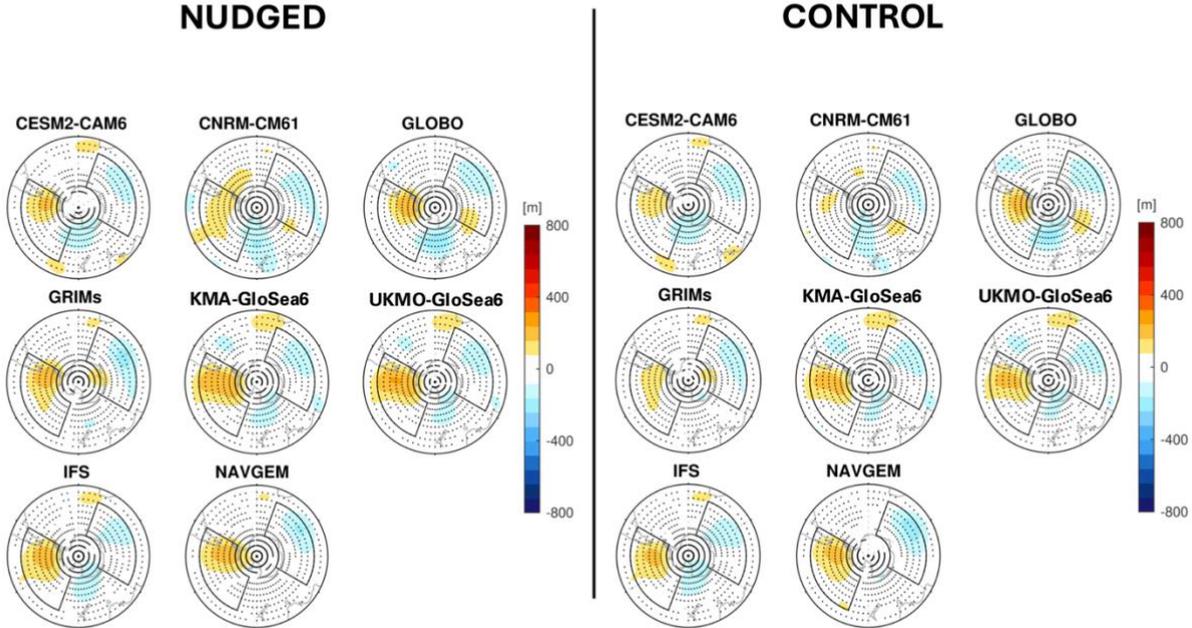
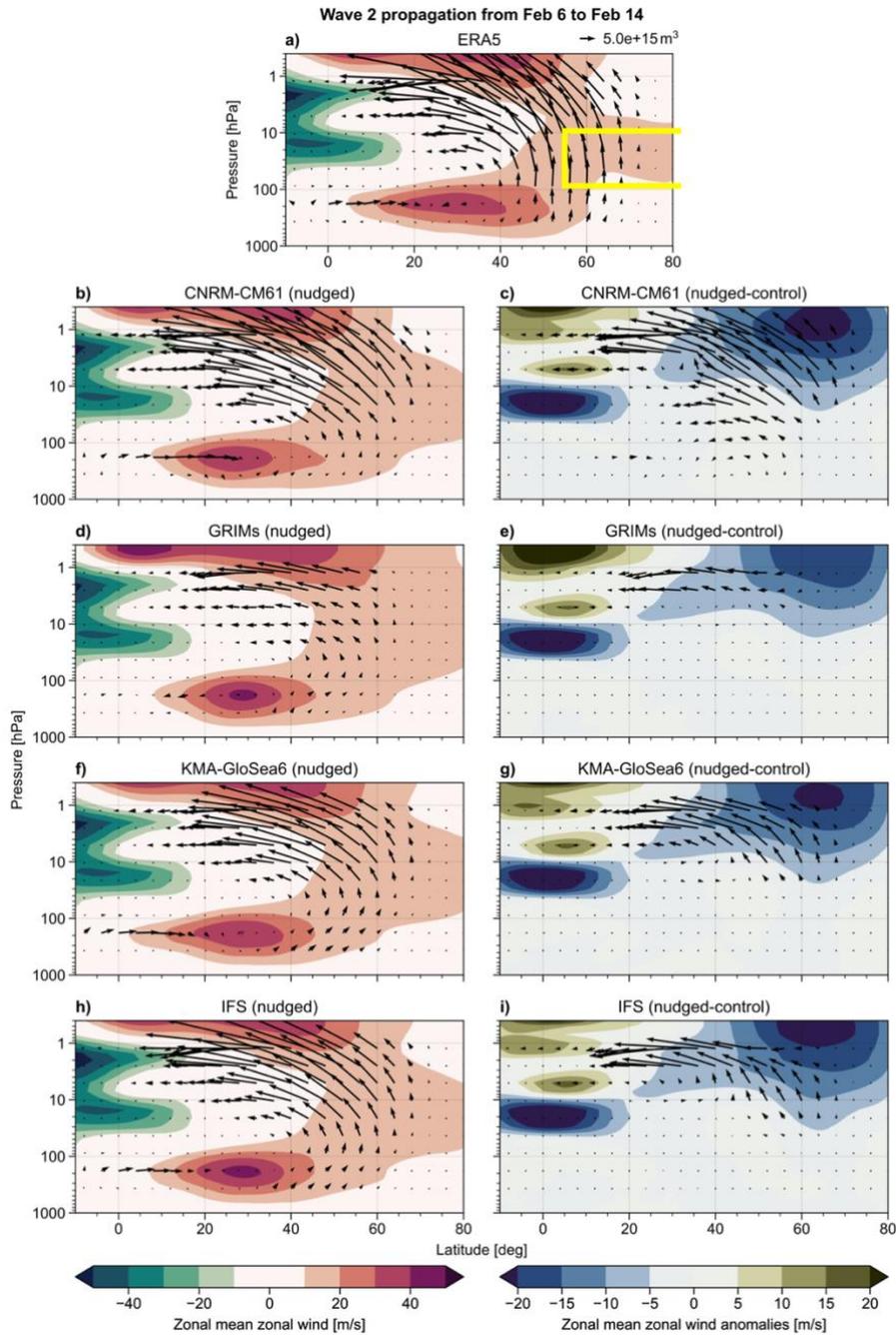


Figure S4. Same as Figure S3 but for 1st - 10th September 2019. Similar conclusions are derived to those of SSW2019 (Figure S3).



25 **Figure S5.** (a) Eliassen-Palm flux (arrows,  $\text{m}^3$ ) for the WN2 wave component and zonal mean zonal wind (shading,  $\text{m s}^{-1}$ ) for 6th-14th February 2018 in ERA5. (left column) Same as (a) but for the NUDGED experiment of CNRM-CM6-1, GRIMs, KMA-GloSea6, and IFS. (right column) NUDGED-minus-CONTROL differences of Eliassen-Palm flux and zonal mean zonal wind. NUDGED experiments in all models except for GRIMs show an increase in the magnitude of the wave activity with respect to CONTROL ones from mid-stratosphere, whereas the wave activity injected from the troposphere remains similar. The yellow box delimits the region for calculating the EP flux budget.