

高解像度気候モデルを用いた成層圏突然昇温回復過程の研究

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Study of recovery processes after the major stratospheric sudden warming using a high-resolution GCM

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Stratospheric sudden warmings (SSWs) have occurred almost every year in the 2000s. The SSWs in Jan. 2004, Jan. 2006, and Jan. 2009 showed a common feature that the stratopause and the polar-night jet were reformed at an altitude of about 80km after the SSWs. While the polar stratosphere is supposed to be warmed by the meridional circulation driven by the momentum deposit due to planetary waves, it is not clear how the subsequent warming and westerly acceleration around 80km is caused.

In the T213L256 CCSR/NIES/FRCGC AGCM which was integrated over three years, the SSW similar to that mentioned above has occurred. Figure 1 shows the time-pressure sections of zonal wind, temperature, residual meridional and vertical velocities around the SSW in the GCM. Relative contributions of meridional circulation and different kinds of waves to the westerly acceleration after the SSW were investigated using a momentum budget analysis based on the transformed Eulerian-mean equations. It showed that, while the planetary waves with zonal wavenumber 1-3 mostly contributed to the momentum budget during the SSW, the westerly acceleration above 50km after the SSW was caused as a small residual of the wave drag and the momentum advection due to the meridional circulation. On the other hand, it is found that the Eliassen-Palm flux divergence induced by the zonal wavenumber 1 planetary wave significantly contributed to the quick recovery of the westerly wind below 50km just after the SSW.

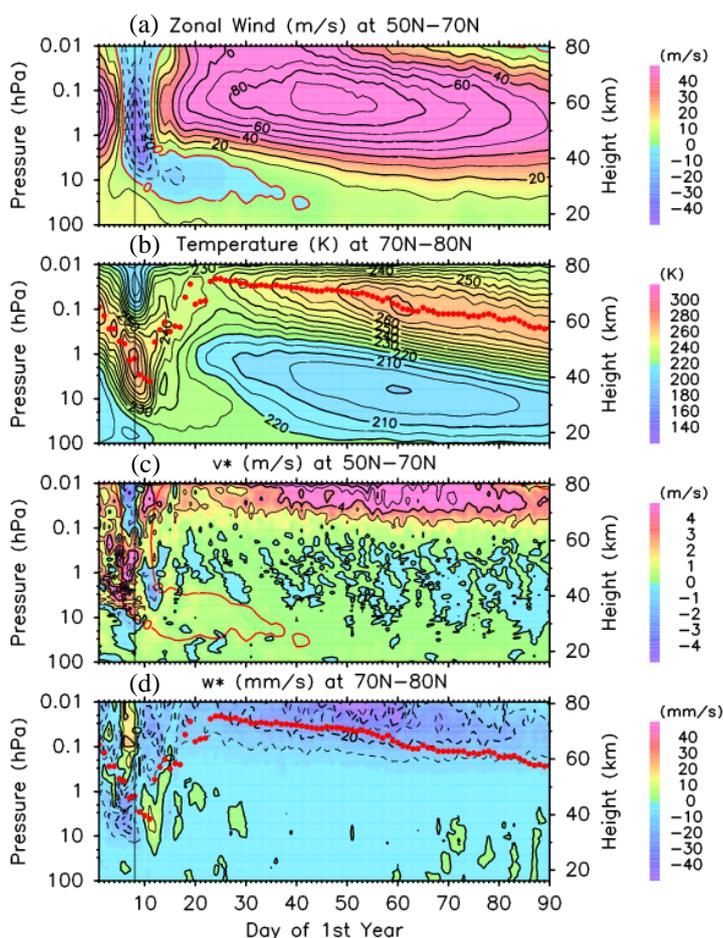


Fig. 1: Time-pressure sections of (a) zonal-mean zonal wind at 50N-70N, (b) zonal-mean temperature at 70N-80N, (c) residual meridional velocity at 50N-70N, and (d) residual vertical velocity at 70N-80N. Contour intervals are (a) 10 m s^{-1} , (b) 5 K , (c) 2 m s^{-1} , and (d) 10 mm s^{-1} . Red circles represent the stratopause. Thin solid lines represent the central date of the SSW.