

Stratospheric Warmings in the Southern Hemisphere and Coupling to the Mesosphere

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Major stratospheric sudden warmings are striking features of the dynamical and thermal state of the northern hemisphere winter middle atmosphere and are examples of strong vertical coupling between different atmospheric levels. In the Southern Hemisphere (SH), however, there has been only one major warming, which occurred in winter 2002. Nevertheless, minor warmings do occur relatively frequently in the SH. We investigate the occurrence of warmings and dynamical coupling in the middle atmosphere of the high-latitude southern hemisphere winter. We find patterns that are common to minor SH stratospheric warming events and using superposed epoch techniques define average characteristics of the anomalies and related wave activity in the MLT (mesosphere and lower thermosphere). Using UKMO (United Kingdom Meteorological Office) assimilated data for the stratosphere we concentrate on the zonal-mean structure and dynamics of high-latitude stratosphere. Medium frequency (MF) radar winds measured at Davis (69S) are used to investigate the corresponding variability in the MLT. Data from the twenty-year period 1994-2014 are used. Over 20 minor warmings are found in this period and 15 ‘cooling’ events. Our results suggest that planetary wave driving has a strong impact on the stratospheric temperatures. Strong (weak) upward wave propagation leads to enhanced (reduced) stratospheric heat fluxes during anomalous warm (cold) events. Composites of the wind anomalies in the 80-100 km region show clear signatures of enhanced (reduced) mesospheric planetary wave activity during stratospheric warming (cooling) events and that the mesospheric wind reversal precedes the wind and temperature changes in the stratosphere.

Key Words: stratospheric warmings, southern hemisphere, coupling