

Evidence for Dynamical Coupling of Stratosphere-Mesosphere and Lower thermosphere (MLT) during 2010 minor Stratospheric Warming in Southern Hemisphere

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The coupling between stratosphere and mesosphere-lower thermosphere (MLT) was studied in the southern hemisphere (SH) during 2010 minor sudden stratospheric warmings (SSW). Three episodic SSWs were noticed from early August to late October in ECMWF data and the specified dynamics-Whole Atmosphere Community Climate Model (SD-WACCM) simulations. Utilizing wind data measured by a meteor radar at King Sejong Station (62.22°S, 58.78°W), we find that the mesospheric zonal winds at 82 km significantly differ from those of normal years due to enhanced planetary wave (PW) activity before the SSWs and secondary PWs in the mesosphere afterwards. The zonal winds in the mesosphere reversed approximately a week before the SSW occurrence in the stratosphere as has been observed in 2002 major SSW. The Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy (GAIA) simulates similar zonal wind reversal that occurred in the lower thermosphere at 100-140 km two or three days before the associated SSW event. Since the periods of minor SSWs are characterized by low solar and geomagnetic activity, the observed and simulated variability in the MLT region is mainly due to SSW. We also find signatures of mesospheric cooling in association with SSWs using the Microwave Limb Sounder (MLS) measurements. However, according to the GAIA simulations, warming instead of cooling took place in the lower thermosphere around 120- 140 km after few days of SSW event. Thus, the observation and model simulation indicate for the first time that the minor SSW also affects dynamics of the MLT region over SH in the same way as the major SSW.

Keywords: Sudden Stratospheric Warming (SSW), Mesosphere and Lower Thermosphere, Meteor Radar, Stratosphere-MLT Coupling, GAIA simulations, MLT dynamics