

Evaluation of Global Mean Temperature Cooling in lower thermosphere just after Stratospheric Sudden Warming due to Tidal wave's vertical thermal advection using GAIA model

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Saburo MIYAHARA and Ying-Wen CHEN reported that Kyushu-GCM data analysis showed Variation of Global Mean Temperature connected with Stratospheric Sudden Warming (SSW) at 2015 Spring conference of the Meteorological Society of Japan. The report concludes that vertical thermal advection of semi-diurnal tide ( zonal wave number = 2 ) causes about 50 % of Global Mean Temperature Cooling in the lower thermosphere.

Kyushu-GCM can express meteorological phenomena from the ground to 150 km height. In order to verify its conclusion of Kyushu-GCM case in higher atmosphere than 150 km, GAIA ( 75 layers ) model is used. It can describe meteorological states up to 500 km height and then the analysis has been done about the Global Mean Temperature Cooling in the lower thermosphere just after SSW caused by tidal wave's vertical thermal advection. Therefore it has been confirmed that the semi-diurnal tide (zonal wave number = 2) disturbance dominantly contributes to the cooling as same as the case of Kyushu-GCM up to about 200 km height.

The semi-diurnal tide works cooling higher than 200 km, but diurnal tide ( zonal wave number =1 ) works strongly warming and net migrating tide disturbance also works warming. Then in this case the global mean temperature cooling in the lower thermosphere cannot be explained due to the vertical thermal advection of tidal wave disturbance. All non-migrating tide almost does not only work cooling but also warming. Walterscheid (1981) proved theoretically that vertical thermal advection of internal gravity wave disturbance caused cooling in lower thermosphere.

Thus this research result may suggest that many internal gravity waves are dominant and work cooling in the lower thermosphere. Vertical resolution of GAIA(75 layers) is much lower than Kyushu-GCM( 250 layers ). The analyses of GAIA(150 layers) will be also shown at the conference hall.

Keywords: Stratospheric Sudden Warming, Atmospheric Tidal Wave, GAIA model