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Interannual variability of mid-stratospheric temperature anomaly over Northern high latitudes

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A study on the interanual variability of temperature in the mid-stratosphere over northern hemisphere high latitude during winter period has been carried out. Zonal mean temperature and wind are used from ECMWF (European Center for Medium Range Weather Forecast) ERA-40 reanalysis archive for the period of 1969-2001 with a spatial resolution of 2.5x2.5 latitude and longitude. ECMWF interim reanalysis data of daily temperature and zonal wind for the period of 1989-2009 are also supplemented. Mid stratospheric (10 hPa) zonal wind and temperature anomaly had calculated 60-90oN for the entire longitudes belt from 0-360 for both the data set. The temperature anomaly dominated by stratospheric warming pulse with corresponding zonal wind reversals. Most of the studies were linked with lower stratospheric cooling, while the present study dealt with stratospheric temperature at mid stratospheric level (10 hPa). The mid stratospheric level has been a reference level for the classification of stratospheric warming. We are looking both the aspect of stratospheric warming occurrence days and the intensity and duration of cooling trend. The winter period of 1996/97 had a prolonged duration of negative anomaly (late July to march 1997) ranging eight months with a small increase in temperature in early November. The winter of 2003/04, 2005/06 and 2008/09 had long duration of pronounced cooling ranging more than three months. In recent decade stratospheric warming pulse is followed by strong cooling tendency. Correspondingly the occurrence of the cooling at 10 hPa levels has been increased. The year to year temperature variability shows seasonal warming i.e., warming in March and April. Another aspect of stratospheric warming we noticed is the effect over the tropical upper stratosphere. Tropical belt of upper stratosphere has experienced cooling of the order of ~5-6oC with varying duration relative to the occurrence day of each stratospheric warming. The effect of upper stratospheric cooling has been well extended to 30oS. Low latitude cooling has been strongly related to strength of polar vortex. The changes in temperature associated with the stratospheric sudden warming over the northern hemisphere polar latitudes also affect the stratosphere and tropospheric circulation features, which sometimes extends into the tropical region