URSI AP-RASC 2019, New Delhi, India, 09 - 15 March 2019

On the MLT region signatures of sudden stratospheric warming events as observed by a network of meteor wind radars

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Highly non-linear, large scale phenomena called sudden stratospheric warming (SSW) events are observed to cause significant changes in the thermal and dynamical structure of the mesosphere –lower thermosphere (MLT) region. Meteor wind radars serve as one of the most powerful tools for observing the dynamics of the MLT region. Using three meteor wind radars located at high, middle and low latitudes, we examine the response of the respective MLT regions to the 2008-09 major SSW event.

The reversal of zonal winds in the MLT region over the polar location Andenes ($69.3°N, 16.0°E$) precedes the peak warming at 60ºN, 10hPa and strong westward winds prevail during the warming period. The zonal wind reversal extends to the MLT region over the mid latitude station Socorro ($34.1°N, 106.9°W$), whereas no significant change is observed over the low latitude site Thumba ($8.5°N, 76.5°E$). Changes in meridional circulation in the polar MLT region are strongly dependent on the location of the stratospheric warming. Strong poleward winds are observed over Andenes during the warming event. Meridional wind reverses in the midlatitude MLT region after the peak warming in the polar stratosphere. For the lower latitude region, there is no reversal of mean meridional winds associated with the SSW event, but enhanced short period fluctuations are evident during the peak warming period.

Changes in semidiurnal oscillations and quasi 2-day waves in association with the major SSW event are also examined in the present study. Semidiurnal oscillations appear to be modulated globally in association with the major SSW of January 2009. Quasi 2-day wave response is most prominent in lower latitudes and diminishingly low in winter polar MLT. The significance of the present study lies in tracking the SSW signatures in the MLT region using a network of meteor wind radars right from Polar Regions to low latitudes.