Study of the Middle and Upper Atmosphere during Sudden Stratospheric Warming Episodes

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Abstract : The atmospheric layers are coupled to each other with the different dynamical, electrical, radiative and chemical processes. A large scale thermodynamical phenomenon in winter polar regions which affects the middle atmosphere vigorously is Sudden Stratospheric Warming (SSW). Two major SSW events were occurred during 1998-1999; one in December 1998 which is associated with vortex displacement and another in February- March 1999 associated with vortex splitting. Lidar study of these two major events from Mt. Abu (24.36^{0}N, 72.45^{0}E, ~1670 m amsl) has shown that though SSWs are mostly observed over high and mid latitudes, their effects can also be seen over India. We have studied ionospheric variations (primarily f_oF_2, h'F and hpF_2) over Ahmedabad (23.1^{0}N, 72.58^{0}E) during these events. Ionospheric disturbances have been found after four-five days of peak temperature. An increase (decrease) in critical frequency (f_oF_2) during morning (afternoon) has been noticed which may be in response to the updrift (down drift). Effects are stronger during displacement event (1998) than during the splitting event (1999). We have also studied some recent events occurred during 2006 (January), 2009 (January) and 2013 (January) using temperature data from Sounding of Atmosphere using Broadband Emission Radiometry (SABER) satellite. Though some modeling work supports the hypothesis that planetary waves are responsible for atmosphere-ionosphere coupling, there is still more significant works to do to understand how exactly the coupling can take place.

Keywords : sudden stratospheric warming (SSW), polar vortex, ionosphere, critical frequency
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