The Response of Ionospheric TEC and 630 nm Airglow Emissions During the 2016 Stratospheric Sudden Warming

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A stratospheric sudden warming (SSW) is a thermal anomaly in the stratosphere during the winter months that is known to result in short time scale ionospheric variability. The magnitude and variation of SSWs can vary for different years. In this study, we examine the variability in ionospheric total electron content (TEC) and F region 630 nm airglow emission rates during the 2016 SSW. The occurrence days of the SSW and the variation of the SSW-inducing stationary planetary waves (SPWs) are identified using MERRA reanalysis data, revealing that the 2016 SSW was a minor warming in February followed by a final warming in March. The ionospheric TEC is examined using GPS Global Ionospheric Maps (GIM). 630 nm airglow emission rates are proportionate to atomic oxygen ion density in the F region, and are observed using airglow photometer data from Irkutsk, Russia (51.8^{o}N,103.1^{o}E). In order to compare the GIM TEC and airglow emission in Irkutsk, we select the location point (52.5^{o}N, 105^{o}E), which is near Irkutsk, to observe the TEC variation during the night time. We also examine the day to day and latitudinal variation of SPW amplitude and phase variation in the stratosphere. We find that the TEC increases during the SSW, but the 630nm emission intensity and the amplitude of SPW1 were increased before the SSW occurred. The variation of the ionospheric tidal and SPW components is also examined, to understand their contribution to the local ionospheric variation over Irkutsk.

Keywords: stratospheric sudden warming, ionospheric anomaly

