EGU21-3773
https://doi.org/10.5194/egusphere-egu21-3773
EGU General Assembly 2021

Ionospheric Variability: Response to Sudden Stratospheric Warming events during Solar Cycle 24

Sumedha Gupta[1], Arun Kumar Upadhayaya[2], and Devendraa Siingh[1]
[1]Indian Institute of Tropical Meteorology, Pune, India
[2]CSIR National Physical Laboratory, Delhi, India

With low solar activity and unusual progression, Solar Cycle 24 lasted from December 2008 to December 2019 and is considered to be the weakest cycle in the last 100 years. During such quiet solar background conditions, the wave forcing from lower atmosphere will have a perceivable effect on the ionosphere. This study examines the ionospheric response to meteorological phenomenon of Sudden Stratospheric Warming (SSW) events during Solar Cycle 24 (Arctic winter 2008/09 to 2018/19). Ionospheric response to each of these identified warming periods is quantified by studying ground – based Global Positioning System (GPS) derived vertical Total Electron Content (VTEC) and its deviation from monthly median (ΔVTEC) for four longitudinal chains, selected from worldwide International GNSS service (IGS) stations. Each chain comprises of eight stations, chosen in such a way as to cover varied latitudes both in Northern and Southern Hemispheres. A strong latitude – dependent response of VTEC perturbations is observed after the peak stratospheric temperature anomaly (ΔT_{max}). The semidiurnal behaviour of VTEC, with morning increase and afternoon decrease, is mostly observed at near-equatorial stations. This vertical coupling between lower and upper atmosphere during SSW is influenced by prominent 13-14 days periodicities in VTEC observations, along with other periodicities of 7, 5, and 3 days. It is seen that the ionospheric response increases with increase in solar activity. Further, under similar ionizing conditions, quite similar ionospheric response is observed, irrespective of ΔT_{max} and type of SSW event being major or minor. However, under similar SSW strength (ΔT_{max}), no prominent pattern in ionospheric response is observed. The causative mechanism for the coupling processes in the atmosphere during these SSW events is discussed in detail.