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

Response of low latitude ionosphere during intense geomagnetic storms

Abha Singh[1,2], Sanjay Kumar[1], Sudesh K. Singh[2] and A. K. Singh[*1]
[1]Atmospheric Research Lab., Department of Physics, Banaras Hindu University, Varanasi-221005, U.P., India.
[2]Department of Physics, T. D. P. G. College, Jaunpur, U.P., India. [*]e-mail: singhak@bhu.ac.in

Ionospheric disturbances in association with geomagnetic storms has been a subject of close attention of the space scientists for several decades, because they have serious effects on various ground- and space-based technological systems operating over high, low and equatorial zone[1-2]. In the present study, results pertaining to the effect of intense geomagnetic storms on the low latitude ionosphere during the ascending phase of solar cycle 24 are presented. The dual frequency signals from GPS satellites have been analyzed to retrieve the total electron contents (TEC) recorded at low latitude station Varanasi (Geographic latitude 25^0, 16′ N, longitude 82^0, 59′ E) situated near the equatorial ionization anomaly (EIA) crest region in India during the period from 2007-2015. Some intense storms having Dst-index < -100 nT observed during the above period have been selected and analyzed. The storm induced features in the vertical TEC (VTEC) have been studied considering the monthly mean VTEC value of quiet days as reference level. The possible reasons for storm time effects on VTEC have been discussed in terms of local time dependence, storm wind effect as well as dawn-dusk component of interplanetary electric field (IEF) Ey intensity dependence.

To study the effect of geomagnetic storms on VTEC, we have analyzed GPS data recorded at Varanasi during ascending phase of solar cycle 24 from 2007 - 2015. In this period total fourteen intense geomagnetic storms occurred. Out of 14, some intense storms occurred have been selected for detailed study. The details of these storms and associated perturbation in TEC are shown in Table 1.

Table 1: Details of the selected storms and associated perturbation in TEC.

Date of storm	**Date of SSC**	**Dst (nT)**	**Peak *Dst* local time**	**Maximum increase in TEC**
26 September 2011 (23:00 UT)	26 September (07:00 UT)	-118	Night	(~22 TECU)
15 July 2012 (18:00 UT)	14 July (17:00 UT) & 15 July (00:00 UT)	-133	Night	(~10 TECU)
19 February 2014 (08:00 UT)	18 February (14:00 UT)	-116	Day	(~13 TECU)
20 December 2015 (22:00 UT)	19 December (17:00 UT)	-170	Night	(~35 TECU)

During these geomagnetic storms, ionospheric TEC is found to increase as well as decrease. Storm induced electric field responsible for electrodynamical drift as well as storm induced mechanical effect from neutral wind have been used to explain the observed results [2-3]. However yet it is not possible to separate contribution from individual factors particularly at equatorial and low latitude region where electrodynamics is less studies and more complex and therefore need further investigation

References:

1. S. Basu, Su. Basu,, J.J. Markel, E. Mackenzie, P. Doherty, J.W. Wright, F. Rich, M.J. Keskinen, R.E. Sheehan, and A.J. Coaster, Large magnetic storm-induced night-time ionospheric flows at mid-latitudes and their impacts on GPS-based navigation systems; *J. Geophys. Res.* **113,** A00A06, 2008.
2. L. Scherliess, B.G. Fejer, Storm time dependence of equatorial disturbance dynamo zonal electric field. *J. Geophys. Res*. **102**, 2008, pp. 24037–24046.
3. S. Kumar, and A.K. Singh, GPS derived ionospheric TEC response to geomagnetic storm on 24 August 2005 at Indian low latitude stations. *Adv. Space. Res*, **47**, 2011, pp. 710-717.