Critical assessment of the temporal forecast of L-band scintillation and moving towards the spatial temporal forecast of the scintillation over the Indian region

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Bagiya et al. (M. S. Bagiya, R. Sridharan, S. Sunda, L. Jose, T. K. Pant and R. Chaudhary, Critical assessment of the forecasting capability of L-band scintillations over the magnetic equatorial region – Campaign results, J. Atmos. Sol. Terr. Phys., 110-111, 15-20, 2014) critically evaluated the L-band scintillation forecast method proposed by Sridharan et al. (R. Sridharan, Mala S. Bagiya, S. Sunda, "A novel method based on GPS TEC to forecast L-band scintillation over the equatorial region through a case study", J. Atmos. Sol. Terr. Phys., 80, 230–238, 2012) using the special campaign mode observations from Trivandrum (8.5^{o}N, 76.91^{o}E, dip latitude 0.5^{o}N). To minimize the uncertainties due to moving satellite platform (TEC & S4 observations from GPS satellites), they used fluctuating component of the foF2 from the ground based ionosonde(76.9^{o}E) to represent the electron density perturbations and ionospheric scintillation at L1 from the geostationary satellite GSAT-8(75.46^{o}E). To correlate the scintillation over the GSAT IPP (ionospheric piercing point) to the forecast perturbations over the ionosonde, the required zonal velocity of the perturbations was estimated using GSAT and GPS scintillation data during one of the close-by GPS passes and taken to represent the particular solar epoch and season. By adopting the above changes, it has been noted that the forecasting capability of L-band scintillation has remarkably improved vindicating the role of perturbations in the evolution of the scintillation. The non-occurrence of scintillations on some occasions is understood in terms of background ionospheric/thermospheric conditions. A threshold upward velocity for the evening F-region as early as 1730-1830 h, has been worked out to be 5 ms^{-1} for the ESF to get triggered. Since it is known that the electron density perturbations travel eastward and when the integrity of wave train of the perturbations is retained, any particular feature that passes over Trivandrum would have crossed over another location west of Trivandrum at an earlier time dictated only by the zonal velocity. With this, it is fairly reasonable to generate the probable spatial pattern and guess the temporal evolution of L-band scintillation. The prediction on the total duration has been derived on the prevailing good correlation between the total duration of scintillation and the base height of the F-region (h'F) at 1930 LT and this has been explained in terms of the favourable background neutral atmospheric conditions. Following Bagiya et al. (M. S. Bagiya, R. Sridharan, S. Sunda, "Pre-assessment of the 'strength' and 'latitudinal extent' of L-band scintillation – a case study", J. Geo. Res., Vol. 118, 1-8, 2013), the relation between h'F at 1930 LT and the probable maximum latitudinal extent of the scintillation has enabled specification of the upper limit for the latitude region that is likely to be affected by the scintillation. It is believed that the presented results hold enough potential to generate reliable temporal- spatial L-band scintillation forecast maps and provide the necessary alerts to the satellite based air navigation users.