

A First Cut Model for Short and Medium Range TEC Forecast over Indian Sub-continent

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In the satellite based Augmentation System (SBAS), need for accurate estimate of TEC to mitigate the range error estimate for precision guidance of commercial aviation has always been felt. The Wide Area Augmentation System (WAAS), currently in use for this purpose, provides reasonably accurate estimate of ionospheric delay in the mid-latitude regions under geomagnetically quiet conditions. At the low latitude regions, models currently used in SBAS system fail to provide a reasonable estimate for the delay in GPS signals caused by Total Electron Content of the Ionosphere. The reason for inaccuracy lies with the zonal equatorial electric field which controls the transport of plasma from the low latitude to high latitude regions. The other factors which do directly influence low latitudes are the episodic events like Spread-F and Scintillation. An effort has been made to evolve a self-sustained and robust model to provide estimates of TEC over Indian equatorial region. Using the TEC measurements at 18 different stations across the length and breadth of India, under a joint co-ordinated program named GAGAN (GPS Aided Geo Augmented Navigation), which constitute both the crest and trough of the Equatorial Ionization Anomaly, a model has been devised which successfully predicts the TEC between 8 – 30 deg. latitude and 60 - 100 deg. longitude zone. In this model, observations at 77 deg. longitude zone are considered as reference and the solar zenith/ neutral wind control are applied to estimate changes in TEC at different longitude sectors from that at 77 deg. longitude. To estimate solar zenith/ neutral wind control, a first principle based model PIM (the Parametric Ionospheric Model) is used. The model predicted values agree well with the observed measurements by ± 3 TEC values. This real-time Ionospheric model may prove useful to provide on-line estimate of range errors in GPS signals for aviation purposes, particularly in the Indian Equatorial/ Low Latitude region.