Ionospheric TEC forecasting model based on linear time-series and ARMA methods over a Low latitude GNSS Station

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Forecasting of ionospheric time delays has become a significant importance in satellite based navigation and communication system applications. Several researchers have been developed and implemented univariate Total Electron Content (TEC) forecasting models successfully over low, mid and high latitude regions. Therefore, identifying an effective multivariate forecasting technique is very essential to protect the GNSS users under various geophysical conditions. In this paper, a new ionospheric TEC forecasting model based on linear time-series and Autoregressive and Moving Average (ARMA) is proposed and implemented using Bangalore International GNSS Service (IGS) station data (geographic 13.02^{o}N, 77.57^{o}E; geomagnetic latitude 4.4^{o}N) during an extended period (2009-2016) in the 24th solar cycle. ARMA model can provide high accuracy in forecasting the localised ionospheric TEC variations from its estimated coefficients in the proposed forecast model. The major factors, namely, solar Extreme Ultraviolet (EUV) irradiance (F10.7p), geomagnetic activity (Ap), periodic oscillations (annual, semiannual and terannual oscillations) and secular trend are considered in the model as input parameters along with real time TEC observations. The proposed model is twofold: first, the impact of different solar, geomagnetic, trend and periodic factors on TEC has been investigated from linear model. Second, ARMA method is applied for forecasting the each factor. The forecasted individual factors are combined to obtain forecasted TEC values. The correlation coefficient of the estimated TEC from the proposed model TEC and the observed Global Positioning System (GPS) -TEC is around 98%. The magnitudes of semiannual variation have been reflected to be high during the High Solar Activity (HSA) period. It is also found that the geomagnetic effect on TEC is relatively low. The proposed ionospheric TEC forecasting model would be useful for characterizing the low-latitude ionospheric variations.