Modeling and mapping the ionospheric TEC based on eigen mode analyses

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Eigen mode analyses, such as Empirical Orthogonal Function (EOF) and Canonical Correlation Analysis (CCA), have been applied to the historical data of the ionospheric total electron content (TEC) observed from a GPS network in Asia-Australia Sector. The obtained results, i.e., the empirical eigen functions Ek(Lat, LT) which depicts both the latitudinal (Lat) and local time (LT) variation of TEC, and coefficient Ak(day) which represent the long term (auunal, solar cycle) variation of TEC, are very useful in the investigation of different scale ionospheric variations. The present work is devoted to the further use of the eigen functions Ek(Lat, LT) and the corresponding coefficient Ak(day). First the eigen functions Ek(Lat, LT) were used as base functions to expand TEC. This expanding provide a new technique to map the distribution TEC(Lat, LT) by fitting the model coefficients from GPS observation. A system was then set up for nowcasting the ionospheric TEC over China based on real time observation of 4 GPS stations along 120E meridian chain. Secondly, the coefficients Ak(day) were used to construct an empirical TEC model in Asia-Australia Sector. For this purpose we fit each coefficients Ak(day) with nonlinear functions of solar activity index F107 and the day of a year. The obtained empirical TEC model is available in prediction of precious TEC distribution. It is conclude that the application of eigen mode analyses in the present work, together with the GPS network observation, is valuable in the monitoring the weather and predicting the climatology in the ionosphere.