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Author: Ms. Rethika Tamilselvan
ISRO Satellite Centre (ISAC), India, rethika_am07@yahoo.co.in

Mr. Saumyaketu Mishra
Indian Space Research Organization (ISRO), India, saumyakm@isac.gov.in
Mrs. Nirmala Srinivasan
ISRO Satellite Centre (ISAC), India, nirmalas@isac.gov.in
Mr. Rathnakara S.C.
ISRO Satellite Centre (ISAC), India, ratnakar@isac.gov.in
Mr. Ailyam Subramaniam Ganeshan
Indian Space Research Organization (ISRO), India, ganeshisro@yahoo.com

ENHANCED COEFFICIENT BASED IONOSPHERE ALGORITHM FOR INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM (IRNSS)

Abstract

Ionosphere error correction for single frequency (L5) users of the IRNSS in the whole of IRNSS service area will be provided through a set of eight coefficients broadcasted in navigation signal. These coefficients will be computed using a batch least square algorithm. This coefficient based ionospheric correction provides about 50-60% rms of error removal along the user's line-of-sight. As the coefficient based model was originally designed for worldwide basis of ionosphere error correction, some parameters in the model are constantly fixed to suit the global ionosphere behavior. Since the scope of utilization of the coefficient based ionosphere model is restricted to the IRNSS service area, these constants can be tuned to reflect the exact ionospheric behavior over India. Based on the study of true ionosphere behavior over Indian region two parameters in the global ionosphere model namely, A1 (constant night time delay) and A4limit (period of diurnal ionosphere delay variation) are found to vary significantly from those values fixed for global parameters in the model. In this paper, three different schemes for performance enhancement of the coefficient based ionosphere model, through the parameters identified, have been proposed. First Scheme is based on the fine tuning of the identified parameters for Indian region and replacing them in the user algorithm. Second and third scheme uses A1 and A4limit as a part of navigation messages and uplinked along with the other 8 parameters. In the second scheme A1 and A4limit are observed over the restricted data interval excluding the day of application. Third scheme is similar to the second scheme except A1 and A4limit are estimated along with 8 parameters in a batch least square manner. The three schemes have been analyzed using Indian regional ionosphere data obtained from GAGAN (GPS aided and GEO augmented navigation) TEC station data and GAGAN INRES (Indian reference station) data. The data was classified based on dates which represent different seasons within a year namely vernal equinox, summer solstice, autumnal equinox and winter solstice. Based on the exhaustive empirical analysis with real measurements, it was found that uniformly all three schemes provide about 65-75% of error removal along the user's line of sight. Also the data covers much portion of the current solar cycle though peak solar cycle data was unavailable, which provides further a scope of analysis of these schemes in the forthcoming solar maximum.