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Ionospheric TEC Assimilation and Now-casting System over China and adjacent areas

Ionospheric data assimilation is a now-casting technique to incorporate irregular ionospheric measurements into certain background model, which is an effective and efficient way to overcome the limitation of the unbalanced data distribution and to improve the accuracy of the model, so that the model and the data can be optimally combined with each other to produce a more reliable and reasonable system specification.

In this study, a regional total electron content (TEC) now-casting system over China and adjacent areas (70E-140E and 15N-55N) is developed on the basis of data assimilation technique. The International Reference Ionosphere (IRI) is used here as background model, and the GNSS data are derived from both the Space Environment Monitoring Network of Chinese Academy of Sciences (SEMnet) and International GNSS Service (IGS) data. A three-dimensional variation algorithm is used to implement the data assimilation. The regional gridded TEC maps and the position errors of single-frequency GPS receivers can be generated and publicized online in quasi-real time with the spatial resolution being 1×1 in longitude and latitude, and updated every 15 min.

It is the first ionospheric now-casting system in China based on data assimilation algorithm, which can be used not only for real-time monitoring of ionosphere environment over China and adjacent areas, but also in providing accurate and effective specification of regional ionospheric TEC and error correction for satellite navigation, radar imaging, shortwave communication, and other relevant applications.