



## **Spectral Combination of Global and Regional Ionospheric Models Using Slepian Theory**

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This study suggests a new method for combining function-based regional and global ionospheric models, based on spherical Slepian theory. As the first step of this method, the Global Ionosphere Models (GIMs) of the International GNSS Service (IGS) are transformed to the Spherical Slepian Functions (SSFs), which are named modified GIMs. Then, the observations of the regional GPS networks are expanded in the same SSFs. The maximum degree of the regional model is 15, which is equal to the maximum degree of the GIMs. In the end, the modified GIM and the developed regional model are combined in the spectral domain.

The new method is applied to the Arctic region. In the regional modeling, six GPS stations from the Canadian High Arctic Ionosphere Network (CHAIN) and four GPS station from the European Reference Frame (EUREF) network are used. The observation files belong to the day 334 in 2015. The models have been validated with three stations from the CHAIN and the EUREF as check stations. The check stations were used in neither the regional model nor the GIM.

According to the obtained result, the RMSE of GIM, modified GIM and the regional model are 3.7, 2.2 and 1.9 TECU (Total Electron Content Unit =  $10^{16}$  electron/m<sup>2</sup>), respectively. However, the RMSE of the combined model is 1.4 TECU, which shows a significant improvement compare to the other models. The proposed method remarkably improves the quality of the ionospheric modeling in the Arctic region. This may lead to a better understanding of the ionospheric phenomena.

Keywords: Regional Modeling, GIM, Spherical Slepian Functions