

# A method to get the drift velocity of ionospheric irregularities from three spaced GNSS-TEC receivers

Jinghua LI, Guanyi Ma, Jiangtao Fan, Qingtao Wan, Xiaolan Wang  
National Astronomical Observatories, Chinese Academy of Sciences

Spaced Global Positioning System (GPS) scintillation receivers have been used in the research of the ionospheric irregularities. Ionospheric scintillation receivers are usually expensive. It is difficult to settle spaced scintillation receivers widely to research the evolution characteristics of the ionospheric irregularities. Here, a method based on three-spaced common GNSS dual-frequency receivers is present, to obtain the drift velocity of the ionospheric irregularities. Firstly, GPS-TEC is obtained firstly in 30 seconds interval, depending on the sampling rate of the receiver. Then, ROTI index is computed to determine the existence of the irregularities. The correlation coefficients between the TECs from the same satellite and three spaced receivers are calculated to get the time delay of the TECs for the three stations. And finally, the apparent drift velocity of the ionospheric irregularities is obtained from the time delay and the distance of the ionospheric piercing points.

This method can be used to get the velocity of the ionospheric irregularities with large spatial-temporal scales. The distance between the spaced receivers is about tens to two hundreds of kilometers. The TEC data segment used to get the correlation coefficients is longer than 40 minutes. The apparent velocity is estimated in each 40 minutes for the TECs with the coefficient larger than 0.8, using the distance of the IPPs corresponding to the 40<sup>th</sup> sampling points in the TEC session and the time delay.

The program to calculate the velocity is carried out in Matlab software. The code can run automatically with the input of receiver's ID and the PRN number of the satellites. To test the validation of this program, the results are compared with the published results during the irregularities events on 20-21 March 2001. The apparent velocity of the ionospheric irregularities is consistent with that from the same characteristic points from similar TEC. We also find that not all irregularity events can result in similar TEC for spaced receivers sampling at 30s. More irregularity events will be used to prove the method in future.

Recently, we set three spaced GNSS receivers in the southwest of China to continue this research. These receivers can receive the signals of BD satellites at 1s sampling rate. The GOEs provide us good data without the effects of the satellite's movements. These data will be used in our next research.