The multi-scale analysis and contrast of GPS TEC data from different stations

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With the technical application and development of GPS, the TEC data, the total electron content of the ionosphere, has been measured routinely and used widely in ionosphere studies. Many kinds of mathematical analysis methods are used to analyze GPS TEC data, especially to reveal the various regulation and the relation between the sun activity and the ionosphere characteristics. Because wavelet transformation can withdraw the regular variation information from the signal availably, we can use it to get the variety regulation of the TEC period in order to separate the variety mode of each dimension.

The GPS TEC data used in this paper comes from different area stations. These stations are lying on three meridians–120ºE,15ºE, 70ºW and on mid- latitude and low-latitude. The result of the Fourier transformation of the data shows that the GPS TEC data has regular and clear periodic multi-scale variety. The variety of the data includes periods related to time and to space. These periods are almost the same as the rule of solar activity.

To further study, wavelet transformations are used to perform the GPS TEC data that we mentioned previously. From the result we get spectrum maps, major frequency variety maps extracted from original data and multi-scale variety maps. Compared with these variety curves of data from different stations and the data results such as major and secondary frequency, lowest frequency phase and particular frequency scale, we get the rule of the variety of the GPS TEC data and try to find the influential factor of the data. The result shows that the variety of GPS TEC data, including both the one-dimensional and one-station temporal data and special data, gets remarkable multi-scale variation frequency which obviously relates to the sun and geomagnetism activity. The analysis of the same method between the index of the sun and geomagnetism activity and GPS TEC data also shows this relation.