



## **Modeling of the spatial state of the ionosphere using regular definitions of the VTEC identifier at the network of continuously operating GNSS stations of Ukraine**

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Due to the wide application of global navigation satellite systems (GNSS), the development of the modern GNSS infrastructure moved the monitoring of the Earth's ionosphere to a new methodological and technological level. The peculiarity of such monitoring is that it allows conducting different experimental studies including the study of the ionosphere directly while using the existing networks of reference GNSS stations intended for solving other problems.

The application of the modern GNSS infrastructure is another innovative step in the ionospheric studies as such networks allow to conduct measurements continuously over time in any place. This is used during the monitoring of the ionosphere and allows studying the global and regional phenomena in the ionosphere in real time.

Application of a network of continuously operating reference stations to determine numerical characteristics of the Earth's ionosphere allows creating an effective technology to monitor the ionosphere regionally. This technology is intended to solve both scientific problems concerning the space weather, and practical tasks such as providing coordinates of the geodetic level accuracy.

For continuously operating reference GNSS stations, the results of the determined ionization identifier TEC (Total Electron Content). On the one hand, this data reflects the state of the ionosphere during the observation; on the other hand, it is a substantial tool for accuracy improvement and reliable determination of coordinates of the observation place.

Thus, it was decided to solve a problem of restoring the spatial position of the ionospheric state or its ionization field according to the regular definitions of the TEC identifier, i.e. VTEC (Vertical TEC).

The description below shows one of the possible solutions that is based on the spherical cap harmonic analysis method for modeling VTEC parameter. This method involves transformation of the initial data to a spherical cap and construction of model using associated Legendre functions of integer order but not necessarily of integer degree. Such functions form two orthogonal systems of functions on the spherical cap. The method was tested for network of permanent stations ZAKPOS.