Procedure transformation the parameters of the ionosphere with GNSS -observations

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Introduction

The solving problem coordinate-time supports based on continuous GNSS observations are based on the processing of large data sets of measurements. One of the possible results of this processing there are numerical characteristics which are influence on signal propagation in ionosphere - the value of TEC (STEC and VTEC - total electron content). These characteristics reflect the dynamics of the ionization of the atmosphere, which is important in terms monitoring near-Earth space.
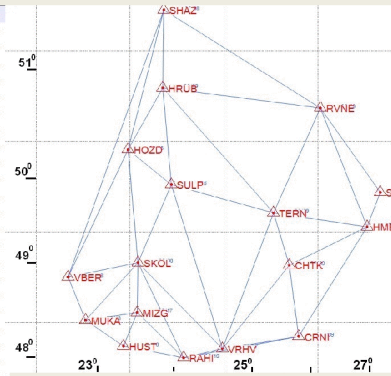
Objective

For each hour intervals of 1 s on a separate station (a network of 17 stations) are creating two files which are processed in real-time with slant (STEC) and reduced to the zenith - vertical (VTEC) values of the total electron content. The array of values TEC (STEC and VTEC) such significant, that there is actual task of preparing these parameters the ionosphere for their further analysis and use.

Example file STEC

GNSS Network

Example file VTEC

About the research

To solve this problem, we proposed methodology based on a set of programs that make STEC and VTEC measurement data into a form comfortable for analysis. The program which are reading data from those text files "automatically generates" a two programs of computation Matlab. On the one hand - a usual format change data in a text file. In terms of computing - a record of data in the form of is clearly announced large numerical arrays.

Procedure

The first of these programs using assignment operators are described the discrete functionalities dependence VTEC change over time. These two-dimensional arrays of data, time series clearly announced in the text of the program. A next of these time series constructed spline interpolation at all their sites. In the second program executed described above spline approximation with a wider step determining the functional dependencies. In this approximation is also used a weak smoothing. A compensated for specific measurement data errors due to the peculiarities of electronic tract antenna-receiver and near environment of the station. Simultaneously, another approximation calculated with considerable smoothing of the spline data. It is necessary to allocate daily change of the parameter VTEC.

As a result of consistent execution of these two programs created two objects spline- approximation. One of them with high precision approximates the measurement data. Other - contains approximation of smoothed values of data measurement. Through this approach for further calculations VTEC enough to read the named objects approximations of their files and identify VTEC at an arbitrary point in time due to computing spline functions according to their argument, as defined by splines reflect changes VTEC analytically given functions.