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Overview of ionospheric total electron content (TEC) derivation system using dense GNSS receiver networks

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We are developing a database of ionospheric total electron content (TEC) using dense GNSS receiver networks on the NICT Science Cloud system. We have automatically collected more than 7000 ground-based GNSS receivers' data in the world, and converted into two-dimensional TEC maps. High-resolution TEC maps are available in Japan, North America, and Europe, where GNSS receivers are densely deployed. These TEC maps and global TEC maps are available through the web site, http://seg-web.nict.go.jp/GPS/DRAWING-TEC. These high-resolution TEC maps make it possible to get a full view of 100-1000 kmscale ionospheric disturbances.

TEC maps over Japan are made using more than 1200 GNSS receivers' data. The database consists of two versions, that is, quasi real-time and final versions. The quasi real-time and final versions provide TEC maps with a time lag of less than four hours and four days, respectively. Now we are developing a real-time version, which can provide TEC data with a time lag of less than one minute. Moreover, we also develop TEC models to forecast TEC in Japan using Artificial Neural Network (ANN). The input parameters of ANN are proxies of the season, the solar activity, the solar wind activity, and the geomagnetic activity. For the learning process, we used absolute TEC data for about 20 years. Using the constructed ANN model, we achieved one-day TEC prediction over Japan.

Keywords: GNSS observation, the ionosphere, prediction model, total electron content, realtime monitoring