

## Dense Regional And Worldwide International GNSS-TEC observation (DRAWING - TEC) project

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Two-dimensional ionospheric total electron content (TEC) maps have been derived from ground-based GNSS receiver networks and applied to studies of various ionospheric disturbances since mid-1990s.

For the purpose of monitoring and researching ionospheric disturbances which can degrade GNSS navigations and cause loss-of-lock on GNSS signals, National Institute of Information and Communications Technology (NICT), Japan has developed TEC maps over Japan using the dense GPS network, GEONET, which consists of more than 1,200 GPS receivers and is operated by Geospatial Information Authority of Japan (GSI). Currently, we are providing high-resolution two-dimensional maps of absolute TEC, detrended TEC with 60, 30, 15-minute window, rate of TEC change index (ROTI), and loss-of-lock on GPS signal over Japan in realtime basis.

These data and quick-look maps are archived and available in the website of NICT (<http://wdc.nict.go.jp/IONO/>).

NICT has collected all the available GNSS receiver data in the world to expand the TEC observation area. Figure 1 shows the distribution of the GNSS stations (more than 6,000 stations as of 2012) whose data are collected by NICT. These GNSS data are provided by IGS, UNAVCO, SOPAC, and other regional data centers. Currently, however, dense GNSS receiver networks are available only limited areas such as Japan, North America, and Europe as shown in Figure 1. More GNSS receiver data are needed especially in the sparse regions (ex. Asia, Oceania, Africa, and South America) to study the overall spatial structure and temporal evolution of various ionospheric disturbances. The difficulty of collecting GNSS receiver network data in these regions attributes mainly to the two reasons: (1) a lack of information sharing of domestic GNSS receiver network in the international ionospheric researcher community and (2) a government and/or a data provider policy to provide the original GNSS data only for domestic researchers. In order to overcome this difficulty and to expand the high-resolution TEC observation area, NICT has recently started a project, Dense Regional And Worldwide International GNSS-TEC observation (DRAWING-TEC). This project mainly consists of the following three items:

1. Standardizing GNSS-TEC data for high-resolution TEC maps.
2. Developing a new high-resolution TEC mapping technique using the standardized TEC data.
3. Sharing the standardized TEC data and the data or the information of GNSS receiver network among the international ionosphere and GNSS researcher community.

# Japan Geoscience Union Meeting 2013

(May 19-24 2013 at Makuhari, Chiba, Japan)

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PEM05-P17

会場:コンベンションホール

時間:5月21日 18:15-19:30

Keywords: Ionosphere, GPS, GNSS, Total electron content