

Ionospheric Tomography over Japan with Constrained Least-squares Method for GPS-TEC data

Akinori Saito[1]; Nobuyuki Fujita[1]; Genta Ueno[2]; Takuya Tsugawa[3]; Michi Nishioka[1]

[1] Dept. of Geophysics, Kyoto Univ.; [2] ISM; [3] NICT

An Ionospheric tomography algorithm using the ground-based GPS Total Electron Content (TEC) data was developed to reconstruct the electron density distribution over Japan. GPS is a satellite-based navigation system that measures the traveling time of the radio wave between the GPS satellites and the GPS receivers. The distances between the satellites and the receivers are estimated from the traveling time, and the location of the receiver is determined. The GPS radio wave delays in the ionized atmosphere. Using this delay, the total amount of the electron along the radio wave propagation path can be estimated from the GPS data. This total electron content data can provide the information of the electron density distribution from 20,000km, the GPS satellite orbit, to the ground. We developed an algorithm to derive the three dimensional distribution of the electron density over Japan. The GPS data used in this study was measured by a GPS receiver network in Japan, GEONET, which is operated by Geographical Survey Institute, Japan. The density of the GPS receiver is high, and its coverage is wide enough to reconstruct the electron density with high resolution. The obtained electron density distribution was evaluated with the observational data measured by the other instruments, such as the MU radar, ionosondes, and satellite-borne detectors. The algorithm can also use the other observational data besides the GPS-TEC data. The result with the MU radar data and the GPS-TEC data showed better accuracy than that with only the GPS-TEC data. The reconstructed electron density structures for the medium-scale traveling ionospheric disturbance and the large-scale traveling ionospheric disturbance will be presented.