

ABSTRACTS (MASTER THESIS)

Creation and utilization of the database of three-dimensional electron density distribution based on GPS-TEC tomographic analysis**(Graduate School of Informatics,
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Accurate information of the ionospheric electron density distribution is necessary when correcting measurement errors of positioning with GPS receivers. On the other hand, the GPS is used to study structure of the ionosphere [1, 2]. We have developed three-dimensional (3D) tomography based on the GPS-TEC data. The real-time analysis of the 3D tomography of the ionosphere has just started from 2016. In this research, using the 3D ionospheric tomography analysis system developed by Suzuki [3], we created a database of analysis results of past GPS data and verified their accuracy. We also improved the area of the analysis range which is important when using this analysis result in other research.

In database creation, we could not effectively remove instrument bias of GPS data of a certain period. Therefore, we utilized absolute TEC data calculated by NICT for the tomographic analysis. By using a super computer, we also developed a software system to conduct the tomography by many core in parallel, and succeeded in shortening the analysis time by about 150 times.

In the verification of the analysis results from ionosonde and COSMIC occultation observation were compared with the analysis results of tomography. By performing this comparison, the regional and seasonal characteristics of the tomographic analysis are clarified. We found that tomography results showed good agreement with foF2 from ionosondes but height of the density peak was generally higher than the COSMIC occultation data.

For improve of the degree of freedom of the analysis range, we first developed a system that can display the analysis result as a vertical plane distribution on a line segment connecting arbitrary two points. Also, in order to expand the analysis area, we performed tomographic analysis by combining GPS data from Korea and Taiwan.

References

- [1] S. Miyazaki and K. Heki: Crustal velocity field of southwest Japan: Subduction and arc-arc collision, *Journal of Geophysical Research: Solid Earth*, **106**, 4305-4326, 2001.
- [2] H. Tsuji, Y. Hatanaka, T. Sagiya, and M. Hashimoto: Coseismic crustal deformation from the 1994 hokkaido-toho-oki earthquake monitored by a nationwide continuous GPS array in Japan, *Geophysical Research Letters*, **22**, 1669-1672, 1995.
- [3] S. Suzuki: Development of real-time three dimensional analysis system of the ionosphere over Japan based on GPS-TEC observations, Master thesis, Graduate School of Informatics, 2016.

Table 1. Electron density ratio average and standard deviation of tomography and ionosonde in each season, each region.

ave,sta	Yearly	Feb.Mar.Apr.	May Jun.Jul.	Aug.Sep.Oct.	Nov.Dec.Jan.
Okinawa	1.032, 0.211	1.076, 0.268	1.097, 0.161	1.013, 0.185	0.950, 0.204
Yamagawa	1.064, 0.184	1.081, 0.238	1.101, 0.141	1.056, 0.151	1.000, 0.190
Kokubunji	0.975, 0.184	1.003, 0.241	1.026, 0.146	0.969, 0.136	0.903, 0.168
Wakkanai	0.750, 0.267	0.863, 0.306	0.787, 0.233	0.697, 0.198	0.610, 0.249