R005-33
B 会場 ：9/25　 PM2 （15:45-18:15）
16:00〜16:15

イオノゾンデ同化 GNSS 電離圏 3 次元リアルタイムトモグラフィ解析の改良と事例解析

#野﨑　太成 [1), 斎藤　享 [2),Ssessanga　 Nicholas[3), 山本　衛 [4)
([1 京大・情・通信,([2 電子航法研,([3 オスロ大学物理学科 4D-Space,([4 京大・生存圏研,([5 京大・生存圏研

Improvement of 3-D ionospheric tomography based on GNSS-TEC with ionosonde data assimilation and case analysis

#Taisei Nozaki[1),Susumu Saito[2),Nicholas Ssessanga[3),Mamoru Yamamoto[4)
([1Course of Communications and Computer Engineering, Kyoto University,([2ENRI, National Institute of Maritime, Port, and Aviation Technology,([34D-Space, Department of physics, University of Oslo, Norway,([4Research Institute for Sustainable Humanosphere, Kyoto University,([5Research Institute for Sustainable Humanosphere, Kyoto University

Structures of the electron density in the ionosphere cause reflection, absorption, and delay of radio waves, which can lead to interference in radio communications. Therefore, the observation of the ionospheric electron density is of great importance. One of the methods to derive the ionospheric density profiles is the GNSS tomography, which estimates the three-dimensional structure of the ionosphere from the GNSS-TEC observation data.

The original algorithm employed to cover the Japanese archipelago and the nearby surrounding region was the constrained least-squared fitting method implemented by Seemala et al. (2014) and Saito et al. (2017). The method used the spatial gradient of the electron density as the constraint, and in addition, introduced boundary conditions at the top and the bottom to stabilize the results. While the original algorithm was stable and useful, it had problems with negative electron density in the solution and overestimated the ionospheric peak height when the ionospheric height was low.

To solve these problems, Ssessanga et al. (2021) proposed an algorithm based on a 3D-VAR method by assimilating ionosonde data. We further improved this algorithm by adjusting the background error covariance matrix(B), which specifies the correlation of voxels in vertical and horizontal directions.

This study presents the analysis results of improved algorithm based on GNSS-TEC plus ionosonde data. The peak-height of electron density is much more improved compared with the GNSS-only tomography algorithm.

We will also report case studies of 3-D ionospheric structure including those of the traveling ionospheric disturbance (TID) associated with the Tonga eruption in January 2022 derived by the improved algorithm.