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トモグラフィ手法の改良と準リアルタイム・サービスの開始

#野﨑 太成 [1)], 斎藤 享 [2)], 山本 衛 [3)]
([1 京大 RISH, ([2 電子航法研, ([3 京大・生存圏研

Improvement of GNSS-based Ionospheric Tomography algorithm and the Launch of Near-Real-Time Services

#Taisei Nozaki[1)], Susumu Saito[2)], Mamoru Yamamoto[3)]
([1Research Institute for Sustainable Humanosphere, Kyoto University, ([2Electronic Navigation Research Institute,National Institute of Maritime,Port,and Aviation Technology, ([3Research Institute for Sustainable Humanosphere, Kyoto University

The ionosphere is constantly undergoing variations influenced by solar activity and the lower layers of the atmosphere. The distribution of electron density in the ionosphere leads to phenomena such as reflection, absorption, and delay of radio waves. Particularly, radio waves in the L-band, commonly used in GPS satellite positioning, experience delays in the ionosphere, contributing to positioning errors. Therefore, for the advanced utilization of satellite positioning, it is essential to investigate the effects of the ionosphere.

Ssessanga et al. (2021) developed 3-D ionospheric tomography based on GNSS-TEC observation with ionosonde data assimilation, which can analyze 3-D ionospheric electron density distributions. This analysis realizes near-real time monitoring of the ionosphere and is expected to improve performance in satellite positioning or other applications.

In this study, we improved the observation matrix used in ionosonde data assimilation to make it more physically accurate, and examined how these changes affect distribution of the electron density. Additionally, as a consideration for further improvement, we investigated changes in analysis accuracy when using the previous time step's solution as the background model in a three-dimensional variational method. We discuss performances of the improved ionospheric tomography analysis. Finally, we start operating this tomography in near real-time base within the ENRI system. An overview of the system will be provided in the presentation.