**R005-19**
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# Assessing the performance of the double-thin-shell model for studying E-F coupling using two dense observation networks in Japan

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Electrodynamic coupling between the ionospheric E and F regions is widely accepted as the underlying mechanism for the generation of nighttime medium-scale traveling ionospheric disturbances (MSTIDs) at midlatitudes. Recently, the double-thin-shell approach has proved to be a useful tool for studying the E-F coupling process, allowing the simultaneous observation of electron density perturbations with broad and continuous coverage in both E and F regions. GEONET (GNSS Earth Observation Network System) is a dense network of ground-based GNSS receivers over Japan. However, previous results have shown that the reconstruction performance for Es with small amplitudes is limited when only GPS total electron content (TEC) measurements from GEONET are used. Fortunately, SoftBank Corp., a Japanese telecommunications provider, has recently developed a dense independent GNSS observation network to improve positioning services. The use of this network provides an opportunity to improve the resolution and accuracy of the double-thin-shell model. In this research, we analyze the potential of the improved double-thin-shell approach by incorporating multi-GNSS observation data from both GEONET and SoftBank. Solvability analysis and simulation results suggest that the spatiotemporal resolution and reconstruction performance have been greatly improved. By using real observations on July 3, 2022 for a typical nighttime MSTID event, the reconstruction results illustrate the ability and fidelity of the approach to discriminate between perturbations in the E and F regions, especially in complex background conditions near the solar terminator. Based on these assessments, we conclude that the incorporation of GEONET and SoftBank GNSS observation data holds significant potential for improving the double-thin-shell model and advancing our understanding of MSTIDs.

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