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Advancing Real-Time GNSS Single-Frequency Precise Point Positioning through Ionospheric Corrections

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Real-Time Single-Frequency Precise Point Positioning (PPP) is a cost-effective and promising method for achieving highly accurate navigation at sub-meter or centimeter levels. However, its success heavily relies on real-time ionospheric state estimations to correct delays in Global Navigation Satellite System (GNSS) signals. This research employs the Dynamic Mode Decomposition (DMD) model in conjunction with global ionospheric vertical total electron content (vTEC) Root Mean Square (RMS) maps to create 24-hour forecasts of global ionospheric vTEC RMS maps. These forecasts are integrated with C1P forecast products, and the performance of L1 single-frequency positioning solutions is compared across various ionospheric correction models. The study assesses the impact of assimilating predicted RMS data and evaluates the practicality of the proposed approach using the IGRG product. The results demonstrate that the IGSG RMS prediction-based model significantly enhances positioning accuracy for up to five hours ahead, yielding results comparable to alternative models. This approach holds promise for achieving high precision navigation.