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Poster
Space weather disturbances can significantly degrade Global Navigation Satellite System (GNSS) performance through ionospheric irregularities, scintillation, and rapid variations in total electron content, yet many existing scientific products remain difficult to translate into mission-relevant operational risk. We present an initial physics-aware AI/ML framework designed to convert ionospheric disturbance indicators into actionable GNSS resilience metrics for applications including precision agriculture, aviation, maritime navigation, and other position, navigation, and timing (PNT)-dependent systems.

The prototype combines physically interpretable inputs, including vertical TEC, TEC gradients, and scintillation-related parameters, with machine-learning models that estimate the likelihood and severity of GNSS degradation. Initial development uses a 12-month synthetic dataset to establish a transparent minimum viable framework and compare baseline methods, including logistic regression and random forest, with planned testing and refinement using observational data from Solar Cycle 25, including disturbed intervals, to evaluate model performance under real operational space weather conditions.

The framework is intended to move beyond black-box prediction by preserving the connection between geophysical drivers and operational outcomes. We describe the model architecture, feature engineering, and initial validation strategy, together with a roadmap toward multi-receiver spatial analysis, independent validation, and integration with real-time data streams. This work aims to help bridge the gap between ionospheric science and operational decision support by developing mission-specific risk products for end users affected by space weather impacts on satellite navigation.
Poster session day
Wednesday, April 29, 2026
Poster location
47
Meeting homepage
[2026 Space Weather Workshop]
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