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Utilizing Weak Signal Propagation Reporter for Monitoring Ionospheric Space Weather Impacts on Radio Communication

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The Weak Signal Propagation Reporter (WSPR) network provides a unique and extensive dataset for monitoring ionospheric conditions and their impact on radio communication. This study explores the potential of WSPR as a tool for assessing space weather effects on radio wave propagation, with a particular focus on its application in long-range HF communication. By analyzing WSPR transmission paths, signal-to-noise ratios, and propagation anomalies, we investigate the correlation between ionospheric disturbances and solar-terrestrial events. The dataset is leveraged to identify patterns associated with geomagnetic storms . This approach enables near-real-time monitoring of ionospheric variability and contributes to the development of early warning systems for space weather impacts on technological infrastructure. The results demonstrate how WSPR can enhance our understanding of ionospheric dynamics and provide valuable insights for the mitigation of space weather-related disruptions in communication and navigation systems.

To further support space weather monitoring and ionospheric impact assessment, we present products like the SRC Polar Radio Link (PRL), an monitoring tool available via ESA's Space Weather Service Network (https://swe.ssa.esa.int/). This system utilizes WSPR at 1.8 MHz to assess radio link conditions in the polar region by analyzing single-hop reflections over Scandinavia. The tool provides hourly median Signal-to-Noise Ratio (SNR) values, enabling direct measurements of propagation conditions.

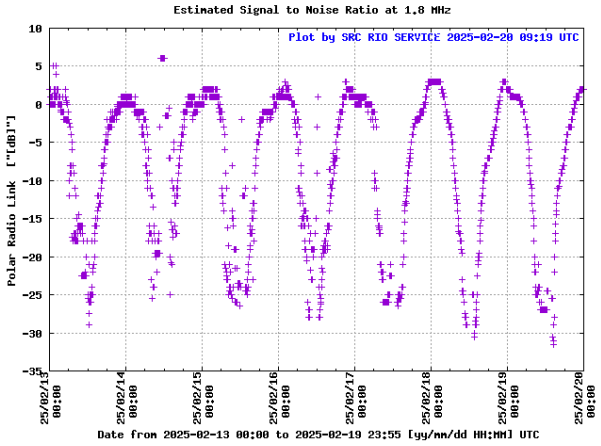

Figure 1. Sample data visualisation from PRL product

This dataset is can be supportive for evaluating ionospheric disturbances' effects on radio links, optimizing network performance, and improving communication resilience in high-latitude regions. By continuously monitoring signal quality, users can identify trends, troubleshoot connectivity issues, and refine system parameters to mitigate space weather impacts on critical infrastructure.

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