4th URSI AT-RASC, Gran Canaria, 19-24 May 2024

Information Theory Analysis of the Drivers of Scintillation

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Understanding the cause of atmospheric signal scintillation is important in improving the quality of satellite communications. A variety of information theory tests were performed between various ionospheric parameters (TEC and ionospheric velocity) and chain scintillation data (S4 and σφ) to analyze linear and non-linear correlations between the data from 2013 to 2021. The coordinates of the data were first converted to AACGM and magnetic local time and were then binned into quarter a degree by one hour bins. Both linear correlation and mutual information tests were used on data spanning a range of magnetic latitude and magnetic local time, with results from multiple days aggregated to form a collective set. Preliminary results indicate that there is correlation between the TEC rate and the σφ phase scintillation index around noon magnetic local time and ~70 degrees magnetic latitude with waiting times from zero up to 1 hour. When analyzing either storm or substorm intervals alone within the same timeframe, the correlation features previously observed were strengthened.