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Poster
The increase in the prevalence of Region 2 Field-Aligned Currents (R2 FACs), or Birkeland currents, connecting the magnetosphere and ionosphere are correlated to a previous strong southward magnetic field component in the solar wind. The question remains whether we can predict the timing of these events during non-storm time substorms to help predict lag, outages, and scintillation. We assume that since the solar wind magnetic field turns southward and transfers energy through frozen-in plasma across the polar region, we can cross-correlate the two to determine the lag leading to an accurate prediction of aurora and substorms. Initially, solar wind data from the Advanced Composition Explorer (ACE) satellite and auroral intensity data collected by a meridian spectral photometer at Poker Flat Research Range (PFRR) in Fairbanks, Alaska were collected. Cross-correlations between the data sets were performed to determine the lag between the detection of southward solar wind magnetic field and their appearance to determine the cause of R2 FACs in relation to when reconnection happens. In the initial study, three dates in 2014 were selected for a cross-correlation analysis and it was determined that diffuse auroral intensity (inferred from meridian spectral photometers) detection lags the southward turning of the solar wind by approximately two hours, which is approximately the time of a substorm expansion phase. Our updated study in 2024 narrows dates from a code directory to select non-storm time substorms and subsequently performs a time-lagged cross-correlation between the nightside R2 FACs and the day-side reconnection. Updated datasets also include summary plots from AMPERE to show magnetospheric activity as well as SuperMAG and ground magnetometer datasets from Poker Flat, AK to focus on the activity and timing of R2 FACs. Although refinement of the analysis is required, the ability to accurately determine the lag between southward solar wind magnetic field and their occurrence can help refine auroral prediction, which in turn can help mitigate issues for satellite-based communications, protection of the power grid, and position, navigation, and timing system errors caused by ionospheric scintillation.

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