Grace
Gratton
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Poster
It is now well-established that the ambient solar wind is dynamic and highly structured at mesoscales, forming the ground-state of space weather as they continually buffet Earth's magnetosphere, the moon, and Mars. Characterizing the solar origins and solar wind properties of geoeffective mesoscale structures is essential for eventually forecasting their arrival and space weather impact at various satellites. However, the use of a model is required to bridge in situ solar wind, magnetosphere, and/or Earth upper-atmospheric measurements with their source at the Sun. In this interdisciplinary work, we characterize a series of events observed by the Balloon Array for Radiation-belt Relativistic Electron Losses (BARREL) instrument – in which Bremsstrahlung X-rays observed in Earth's upper atmosphere (generated by relativistic electron precipitation from the radiation belts) exhibit periodicities that match those detected upstream in solar wind density fluctuations (i.e. PDSs). We use the Wang-Sheeley-Arge (WSA) model to derive the sources of these events at the Sun. We characterize 118 events from 2013–2020 based on their solar sources (i.e. active region, quiet Sun, or coronal hole), heliospheric context (spacecraft separation from the HCS and S-web), and L1 in-situ solar wind properties. We find that >80% of these events originate from the magnetic open-closed boundary, a highly dynamic region where interchange reconnection drives the release of the solar wind. Nearly 90% of the events were driven by slow solar wind with plasma that is FIP enhanced, indicative of closed-field coronal origin. We discuss these findings and others in the context of PUNCH science goals, highlighting how our approach can help interpret the sources of mesoscale solar wind structures observed by the spacecraft.

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