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Galactic Cosmic Ray Modulation Near the Heliospheric Current Sheet

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Galactic cosmic ray (GCR) flux is modulated by the heliospheric magnetic field (HMF) over decadal time scales, due to long-term, global HMF variations, but also over time scales of a few hours due to structures crossing Earth such as coronal mass ejections or the heliospheric current sheet (HCS). The HCS separates the outward and inward polarities of magnetic field from the Sun and hence is a large scale feature which extends out through the heliosphere. Due to the close association between the HCS, the streamer belt, and the band of slow solar wind, HCS crossings are often associated with corotating interaction regions where fast solar wind catches up and compresses slow solar wind ahead of it. However, not all HCS crossings are associated with strong compressions. Therefore we present a catalogue of HCS crossings which are categorised in two ways: Firstly, using the change in magnetic polarity, as either away-to-toward or toward-to-away magnetic field directions relative to the Sun and, secondly, using the strength of the associated solar wind compression, which has not been studied previously. For strong-compression HCS crossings, a peak in neutron counts preceding the HCS crossing is observed, followed by a large drop after the crossing, attributable to the so-called 'snow-plough'effect. For weak-compression HCS crossings, where magnetic field polarity effects are more readily observable, we instead observe that the neutron counts have a tendency to peak in the away magnetic field sector. By splitting the data by the dominant polarity at each solar polar region, it is found that the increase in GCR flux prior to the HCS crossing is primarily from strong compressions in cycles with negative north polar fields due to drift effects.

Collaboration

– not specified –

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