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[Abstract]

Different Structural Elements of Corotating Interaction Regions: A Study on Characteristics and Geoeffectiveness 2008 – 2024

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Abstract: Corotating interaction regions (CIRs) arise in interplanetary space where high-speed and slow solar wind streams interact, leading to compressing plasma and magnetic fields. In this study, we investigate the properties of CIRs using *in situ* data from the WIND spacecraft, covering the period from January 2008 to December 2024. We analyze the correlation between basic solar wind (SW) parameters in different regions of CIRs specifically, ahead of and behind the stream interface (SI). Additionally, we also assess the associated variations in geoeffectiveness and cosmic ray neutron flux. For this purpose, we made a list of 832 solar wind disturbances incorporated into an online catalog for general use. After classifying these disturbances into CIRs, interplanetary coronal mass ejections (ICMEs), interactions, and complex events, we focused on 564 CIRs (68% of all SW events) with clearly identifiable SI. The correlation coefficients of magnetic field strength, $B_{\max}$, the proton thermal speed, $v_{th\max}$ and solar wind speed, $v_{\max}$, between the region in front and behind the SI are characterized by: cc = 0.85, 0.66 and 0.78, respectively. Notably, the proton density,

Np_{max}, exhibited two distinct CIR populations, with correlation coefficients of *cc* = 0.83 and 0.96. Furthermore, our results indicate that the most significant decreases in the Dst index and cosmic ray neutron flux typically occur between the SI and the reverse shock of the CIR.

Keywords: Corotating interaction regions, Solar wind disturbance, Stream interface, Cosmic ray

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