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Characteristic features of NM counts in relation to CMEs and Magnetic fields

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Characteristic features of NM counts in relation to CMEs and Magnetic fields

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Abstract
CMEs are magnetized structures, which can affect the heliospheric conditions, producing large fluctuations in the heliospheric magnetic field. CMEs traveling at different speeds tend to merge into what are known as complex ejecta, which are seen often in the interplanetary medium during times of high solar activity (Burlaga et al. 2001). The increase of the magnetic field during the passage of an ejecta at 1 AU is related to the GCR intensity decrease (Cliver et al. 2003). Traditionally, GCR intensityhas been compared with sunspot number (SSN) and other solar activity indices, such as solar flares, 10.7 cm radio flux, and so on (see Belov 2000 and references therein). CMEs are large-scale phenomena that change the configuration of the interplanetary magnetic field (IMF) and clearly modulate the cosmic-ray intensity on short-term (few day) timescales. Therefore, it is natural to think that CMEs may also contribute to longer term modulation, in particular by contributing to the propagating barriers (GMIRs) that are believed to be the cause of the long-term modulation. The global network of neutron monitors (NMs) have provided data to the heliophysics community for over sixty years to study the time variations of the galactic cosmic ray (GCR) intensity. Simpson recommended a standard NM for worldwide use during the International Geophysical Year (IGY, 1957-58). NM data have been used extensively for the time variation studies ranging from minutes to decades. Coronal Mass Ejections are vast structures of plasma and magnetic fields that are expelled from the sun into the heliosphere, which is detected by remote sensing and in-situ spacecraft observations. The present study is related with four different types of CMEs namely Asymmetric 'Full' Halo CMEs, Partial Halo CMEs, Asymmetric and Complex 'Full' Halo CMEs and 'Full' Halo CMEs on cosmic ray neutron monitor intensity. The data of three different ground based neutron monitors having different cutoff rigidity threshold and CME events observed with instruments onboard and Wind spacecraft have been used. The superposed epoch (Chree) analysis has been applied to the arrival times of these CMEs. The occurrence frequency of three different types of CMEs used in the present analysis depicts very complex behavior. Significant fluctuations in cosmic ray intensity is observed few days after the onset of asymmetric full halo and few days after the onset of full halo CMEs. The fluctuations in cosmic ray intensity are more prior to the onset of both types of the CMEs. However, during Partial Halo CMEs the cosmic ray intensity peaks, few days prior to the onset of CMEs and depressed few days prior to the onset of CMEs, whereas in case of asymmetric and complex full CMEs, the intensity depressed 2 days prior to the onset of CMEs and enhanced 2 days after the onset of CMEs. The deviations in cosmic ray intensity are more pronounced in case for asymmetric and complex full halo CMEs compared to other CMEs. The cosmic ray intensity shows nearly good anti-correlation with interplanetary magnetic field strength (B) during asymmetric full halo CMEs and partial halo CMEs, whereas it shows poor correlation with B during other CMEs. The interplanetary magnetic field strength B shows significant correlation before and after the onset of these CMEs.

Keywords: cosmic ray, coronal mass ejections, interplanetary magnetic field.

Collaboration

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