Galactic Cosmic Ray Variation Caused by Different Structural Elements of Isolated Earth-Impacting Coronal Mass Ejection

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In this work we investigate the characteristics of galactic cosmic rays (GCR), within different structural elements of isolated Earth-impacting interplanetary coronal mass ejections (ICMEs). Observations from different satellite viewpoints are used to determine if the CME in our study is Earth directed or not. For Earth-directed CMEs, a kinematical study was performed for estimation of the CME arrival time at 1 AU and to link the CME with the corresponding in situ solar wind signatures, as well as variation in cosmic rays (CR) flux. Based on the extrapolated CME kinematics, we identified interacting CMEs and flank encounter CMEs, which were excluded from further analysis. Using this approach, a set of 17 isolated Earth-impacting CMEs were unambiguously identified and related to the corresponding in situ solar wind and CR flux variations. We divided the isolated Earth-impacting ICME structure on three different structural elements defined as: the turbulent sheath (TS), the frontal region (FR), and the magnetic obstacle (MO) itself. Hence, we analyzed in more detail the variation of magnetic field strength, the plasma characteristics and CR flux within these three different segments of ICME. The analysis revealed well-defined correlations between variations of the CR caused by TS and the rest of the ICME segment (joined FR and MO), with very high correlations of cc ~ 0.8. A mathematical model, capable of describing the distribution of the cosmic-ray density in different segments of ICME is considered.

Keywords: Galactic cosmic ray**,** Coronal mass ejection, Magnetic obstacle, Neutron monitors