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[Abstract]

Preliminary Characterization of Forbush Decreases in June 2025 from Ground-Based Measurements

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Abstract: In 2025, the solar cycle reached its maximum, driving significant solar activity characterized by intense events from active regions and coronal holes. On May 30, 2025, a powerful M8.1 solar flare triggered a fast coronal mass ejection (CME), impacting Earth on June 1, 2025, and escalating geomagnetic activity to G4 (severe) storm levels [South African National Space Agency, 2025]. This interplanetary CME induced a notable Forbush decrease, a transient reduction in cosmic ray flux caused by heliospheric disturbances [Belov et al., 2022]. The event was recorded globally by a network of ground-based neutron monitors and at the Belgrade Muon Station, Serbia, which continuously measures secondary cosmic ray muon fluxes with distinct median rigidity [Veselinović et al., 2023]. In this work we present a

comparative analysis of neutron monitor and muon detector data that enabled the determination of the rigidity spectrum. Linear regression was applied to derive power indices, facilitating a comprehensive evaluation of large-scale CME impacts on galactic cosmic ray modulation. These findings allows more comprehensive assessment of how large-scale coronal mass ejections influence the modulation of galactic cosmic rays, and also can enhance our understanding of solar-terrestrial interactions and improve space weather forecasting capabilities.

Keywords: Forbush decrease, Rigidity spectrum, Cosmic rays modulation

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