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Estimating the Recovery Time of Forbush Decrease Events through Cosmic Ray Diffusion

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The solar magnetic field is complex and, due to the motion of the solar plasma, it continually twists and accumulates magnetic energy in regions of strong instability. During periods of maximum solar activity, Coronal Mass Ejections (CMEs) occur frequently; these are phenomena in which large quantities of plasma, together with part of the solar magnetic field, are expelled into interplanetary space. When these plasma structures reach Earth, they partially shield Primary Cosmic Rays (PCRs). When PCRs collide with the Earth's atmosphere, they produce the so-called Secondary Cosmic Rays (SCRs). For PCRs with energies up to 100 GeV, pion production occurs. Charged pions decay into positively and negatively charged muons, accompanied by muon neutrinos and antineutrinos, respectively. We detect these muons using a detector at the Southern Space Observatory (OES/INPE), located in São Martinho da Serra, RS, Brazil. This detector is part of the Global Muon Detector Network (GMDN), whose other detectors are installed in Nagoya, Japan; Hobart, Australia; and Kuwait City, Kuwait. Since muons are generated from the interaction of PCRs with the Earth's atmosphere, the reduction in the arrival of these primary cosmic rays causes a decrease in muon counts at ground level. This phenomenon is known as a Forbush Decrease. This work aims to study the recovery time of the PCR flux after the passage of a CME.

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