CORRELATION ANALYSIS OF SOLAR WIND PARAMETERS AND SECONDARY COSMIC RAYS FLUX

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Abstract. Galactic cosmic rays (GCRs) entering the heliosphere are disturbed by solar wind and Sun's magnetic field, see Potgieter 2013 Coronal mass ejections (CMEs) structure and shockwave can additionally modulate GCRs, which could results in a transient decrease followed by a gradual recovery in the observed galactic cosmic ray intensity, known as Forbush decrease (FD) see Maričić et al.2014. CMEs are regularly observed via in-situ measurements of plasma and magnetic field in near-Earth space so it is important to understand the relationship between the FDs and near-Earth particles flux associated with these CMEs.

During last 24th Solar cycle, unprecedented extent of heliospheric observations has been achieved thanks to the several new satellites in orbit and CMEs can be observed throughout the heliosphere from the Sun to the Earth, allowing us to relate ground observations to remote sensing data, for Mars see Freiherr von Forstner et al. 2019. We analyzed the dynamics of the variation of galactic cosmic rays (GCR) combining in situ measurement of the particles species present in solar wind with ground observations (worldwide neutron monitor (NM) network and Belgrade's muon detector). This dynamics compared for several CMEs induced FD events. Variations in interplanetary plasma and field parameters during, before, and after the Forbush decreases were examined. Correlation between the 1-hour variations of GCR and several different one-hour averaged particle fluxes was found during FDs and it depends on energy of the particles of the solar wind as well as cut-off rigidities of secondary cosmic rays detectors on ground. These correlations were compared with correlation between same parameters during quiet period of the solar activity. This cross-correlation analysis can help in better understanding of Earth-affecting CMEs and space weather but also to predict GCR flux during extreme solar events.

References

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