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Relevance of near-Earth magnetic field modeling in deriving SEP properties using ground-based data

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Ground Level Enhancements (GLEs) are short-term increases observed in cosmic ray intensity records of ground-based particle detectors such as neutron monitors (NMs) or muon detectors; they are related to the arrival of solar relativistic particles in the terrestrial environment. Hence, GLE events are related to the most energetic class of solar energetic particle (SEP) events.

In this work we investigate how the use of different magnetospheric field models can influence the derivation of the relativistic SEP properties when modeling GLE events. As a case study, we examine the event of 2012 May 17 (also known as GLE71), registered by ground-based NMs. We apply the Tsyganenko 89 and the Tsyganenko 96 models in order to calculate the trajectories of the arriving SEPs in the near-Earth environment. We show that the intersection of the SEP trajectories with the atmospheric layer at $\sim$20 km from the Earth's surface (i.e. where the flux of the generated secondary particles is maximum), forms for each ground-based neutron monitor a specified viewing region that is dependent on the magnetospheric field configuration. Then, we apply the Neutron Monitor Based Anisotropic GLE Pure Power Law (NMBANGLE PPOLA) model (Plainaki et al. 2010, Solar Phys, 264, 239), in order to derive the spectral properties of the related SEP event and the spatial distributions of the SEP fluxes impacting the Earth's atmosphere. We examine the dependence of the results on the used magnetic field models and evaluate their range of validity. Finally we discuss information derived by modeling the SEP spectrum in the frame of particle acceleration scenarios.