Cosmic ray cuttoff rigidity estimations based on the World Magnetic Model

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The use of neutron monitor (NM) measurements in space weather monitoring applications requires an accurate estimation of the shielding effect of the geomagnetic field, i.e. the geomagnetic cutoff rigidity. The latter determines the minimum energy required by a charged particle to enable it to penetrate the geomagnetic field and arrive at a certain point on the Earth's surface. The cutoff rigidity offers a possibility to deduce useful information from the intensity of the galactic cosmic rays registered by the neutron monitors, e.g. the energy and spectrum of a Ground Level Enhancement (GLE) event. However, the rigidity estimates have to be re-calculated every few years due to the evolution of the geomagnetic field. Thus, an accurate estimation of the cuttoff rigidity for a given geographical location necessitates a detailed knowledge of the geomagnetic field. Since geomagnetic field models are used for the calculations, the estimated values depend on the quality of these models. This dependence appears to be greater at low and middle latitudes. In this work we utilise Monte-Carlo methods and trajectory-tracing calculations employing the World Magnetic Field Model (WMM), epoch 2015, for calculations of the cutoff rigidities at several NM stations at low and middle latitudes. Results will be compared with similar calculations based on the traditionally-used International Geomagnetic Reference Field (IGRF) model. A thorough analysis will be presented in view of possible space weather monitoring applications.