

The Cosmic Ray Environment Near Earth, 1850-2000

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The intensity of the galactic cosmic radiation (GCR), and the occurrence of large solar energetic particle (SEP) events are studied for the period 1850-2000. The long-term galactic cosmic radiation (GCR) intensity rose steadily from 1850 to a substantial maximum coincident with the Gleissberg minimum of solar activity, circa 1890-1900. It then declined steadily until circa 1950, and remained essentially constant thereafter (with the 11-year modulation superimposed thereon). The frequency of occurrence of large solar energetic particle (SEP) events exhibited an unexpected behaviour- large SEP events being more frequent at times of low long-term solar activity (i.e., the Gleissberg Minimum), and least frequent at times of high solar activity. It is proposed that a long-term secular change in the strength of the solar magnetic fields can explain both long-term correlations. Thus, low solar fields at the time of the Gleissberg minimum imply reduced scattering of the GCR in the heliosphere, leading to less modulation, and higher GCR intensities. The low solar fields result in low Alfven speeds in the corona; high Alfven Mach numbers; leading to high acceleration efficiencies for the production of SEP by a CME. An increasing solar field strength between 1900 and 1950 would lead to stronger modulation of the GCR (reduced intensity), and a reduction in the efficiency of the acceleration of SEP as a consequence of a reduction of the Alfven Mach number. The paper concludes with a prediction of the behaviour of the GCR and SEP events as we approach the next Gleissberg minimum of solar activity.