

Annual integral solar proton fluences since 1984: New reconstruction from GOES data

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The flux of solar energetic particles (SEPs) varies at different time scales, from minutes to the 11-year solar cycle, forming an important highly variable radiation factor near Earth. However, measurements of the SEP flux are subject to large uncertainties as assessed by different methods and from different instruments. Here we report the results of a revision of annual integral SEP fluences derived from in-situ space-borne measurements since 1984 in five energy ranges, viz. above 10, 30, 60, 100 and 200 MeV, using observations performed onboard the GOES Earth-orbiting satellites. We performed a careful inter-calibration of the SEP fluxes to obtain a uniform dataset. This includes careful subtraction of the galactic cosmic ray background and precise calculation of annual SEP fluences. It appears that SEP fluences were significantly weaker, by a factor of 5–8, during the recent solar cycle 24 than during previous cycles 22 and 23, implying that the SEP fluence is affected by the level of solar activity. The occurrence probability density function of SEP annual fluences was evaluated for the five energy ranges. In particular, it was shown that the complementary cumulative distribution function is nearly perfectly fitted by the Weibull distribution allowing for a statistical extrapolation of the annual fluences to a centennial time scale.

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