

The Ground Level Enhancement on January 20, 2005, in the Context of Extreme Solar Cosmic Ray Particle Events and Geomagnetic Super Storms

ERWIN O. FLUECKIGER¹, ROLF BUETIKOFER¹, MICHAEL R. MOSER¹,
LAURENT DESORGHER¹

¹*Physikalisches Institut, Universitaet Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland*

The Ground Level Enhancement (GLE) recorded on January 20, 2005, by the worldwide network of neutron monitors (NM) is ranked among the largest in fifty years, with giant count rate increases at the NM stations McMurdo (almost 3000%) and South Pole (more than 5000%). Earlier super events are e.g. those of February 23, 1956, and September/October 1989. Major criteria for classification are usually the peak flux and the event integrated >10 MeV total proton fluence near Earth. Among the most powerful geomagnetic storms during the solar cycles 19 - 21 were those of November 13, 1960, August 5, 1972, and February 8, 1986. On March 13, 1989, a major storm caused one third of Canada and part of upstate New York to lose electrical power. The largest storm of solar cycle 23 occurred on November 20, 2003, with a Dst index of -472 nT. But all these GLEs and geomagnetic storms are dwarfs compared to the Carrington event of September 1, 1859. Recent analyses of ice core samples indicate that this was the largest solar particle event observed in the past 500 years (McCracken et al., JGR 106(A10), 21'585-21'598, 2001). The associated geomagnetic storm had an estimated Dst of about -1700nT. While in the Carrington event both the solar particle flux and the associated geomagnetic disturbance had exceptional amplitude, extreme GLEs and geomagnetic super storms do not always coincide. As a matter of fact, several of the major solar particle events observed at Earth occurred during large magnetic storms that were triggered by preceding solar activity that did not exceed average intensity. On the basis of the January 20, 2005, GLE the paper reviews selected characteristics of solar extreme events and geomagnetic super storms.