

Electric Power Grid Vulnerability to Geomagnetic Storms

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Abstract

In late October 2003 one of the largest outbreaks of intense solar activity on record was observed. Several Large Coronal Mass Ejections (CME's) and their associated plasma slammed into the earth's magnetosphere at speeds of nearly five million miles an hour. Extremely large geomagnetic storms could have been possible but were largely avoided only through some fortuitous combinations of orientation of embedded plasma field upon its arrival at the Earth. Only minor disruptions were observed for the most part, with the exception of a brief blackout in southern Sweden. Should this be reassurance that our power systems are hardened enough to meet the challenge?

Space Weather and the resulting geomagnetic storms are associated with ejection of charged particles from the Sun, which after colliding with the Earth's magnetosphere will produce significant disturbances in the normally quiescent geomagnetic field at the Earth's surface. These disturbances have caused catastrophic impacts to technology systems in the past (e.g., the power blackout in Quebec in March 1989). More importantly, as detailed examinations have been undertaken concerning the interaction of geomagnetic storm environments with power grids and similar infrastructures, the realization has developed that these infrastructures are becoming more vulnerable to disruption from electromagnetic interactions for a wide variety of reasons. This trend line suggests that even more severe impacts can occur in the future for reoccurrences of large storms. This presentation will explore threat assessment efforts underway within the US in order to provide a broad perspective on the topic.