

23rd SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS (E3)
Policy and economic aspects of space weather (2)

Author: Dr. Kevin Forbes
United States, forbes@cua.edu

Dr. Chris St Cyr
National Aeronautics and Space Administration (NASA), Goddard Space Flight Center, United States,
orville.c.stcyr@nasa.gov

DID GEOMAGNETIC ACTIVITY POSE A CHALLENGE TO ELECTRIC POWER RELIABILITY
DURING SOLAR CYCLE 23?: EVIDENCE FROM THE UNITED KINGDOM, THE NETHERLANDS,
NEW YORK, AND PJM

Abstract

During Solar Cycle 22, a very intense geomagnetic storm on 13 March 1989 led to the collapse of the Hydro-Quebec power system in Canada. Power was gradually restored over a nine hour period. This storm clearly demonstrated that geomagnetic storms have the potential to lead to blackouts. This paper addresses whether geomagnetic activity was a challenge to power system reliability during Solar Cycle 23. Operations by four balancing authorities are considered: National Grid in the United Kingdom, TenneT in the Netherlands, the New York Independent System Operator (NYISO), and PJM, the regional transmission organization that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. For each balancing authority, the relationship between a proxy for geomagnetically induced currents (GICs) and a metric of challenged reliability is examined using the complementary log log econometric method. This is a multivariate method of statistical analysis used by researchers in making inferences with respect to the incidence of rare events. In this study, GICs are proxied using magnetometer data from a geomagnetic observatory which is located within or relatively near to each of the four control areas. For TenneT, the relationship between a GIC proxy and the deployment of emergency power is assessed. The analysis uses data reported at fifteen minute intervals over the period 1 January 2002 through 31 December 2004. For National Grid in the United Kingdom, the relationship between a GIC proxy and the upward deployment of reserve power outside the normal balancing procedures is assessed. The analysis uses data reported at 30 minute intervals over the period 11 March 2003 through 31 March 2005. For NYISO, the relationship between a GIC proxy and the incidence of system alerts and reserve pickups is examined. The analysis makes use of hourly data over the period 1 January 2002 – 31 January 2005. For PJM, the relationship between a GIC proxy and the incidence of “reactive off-cost operations” (out of merit order dispatching due to adverse reactive power conditions) is examined. Each of the four analyses controls for terrestrial factors such as temperature and expected system conditions. The results are expected to be of interest to system operators, regulators, and the general space weather community.