Solar storms can destabilize power grids at midlatitudes

August 31 2012

The Sun is capable of disrupting electrical systems on Earth in a variety of ways, from solar flares and coronal mass ejections to proton storms. Typically, it is only objects far above the Earth's surface, or systems at high altitudes at polar latitudes, that are considered at risk except during the most powerful storms. Notable recent examples include solar activity during March 1989 and October 2003 (the "Halloween Storms"), which knocked out power in Quebec, Canada, and Sweden, respectively. Research by Marshall et al., however, finds that even a moderate event can have destructive effects far from the typical regions of concern.

At 1:20 UT on 6 November 2001, a high-density pocket of solar wind, 18 nanoPascals above the background pressure, sped past the Solar and Heliospheric Observatory (SOHO) satellite, which was orbiting 197 Earth radii above the Earth toward the Sun. In half an hour, this high-pressure wave traveled more than a million kilometers (620,000 miles) to the Earth's magnetopause. The high- pressure pulse induced currents both in the magnetopause and in power lines across New Zealand, causing alarms to be tripped and a transformer to fail catastrophically. Extending from 35 degrees South to 46 degrees South, New Zealand is typically considered outside the region susceptible to such solar activity.

A Northern Hemisphere equivalent would be a zone extending from Maine to North Carolina. The authors find currents of up to 27.4 amperes in transformer earth lines that were supposed to be neutral. For comparison, the Halloween Storms 2 years later caused peak currents of

23.4 amperes and no serious damage, though the authors suggest that this may have been due to damage prevention measures implemented following the 2001 event.

More information: Geomagnetically Induced Currents in the New Zealand Power Network, *Space Weather*, doi: 10.1029/2012SW000806, 2012

Provided by American Geophysical Union