Geomagnetic data reveal unusual nature of recent solar minimum

March 19 2012

Since the mid-1800s, scientists have been systematically measuring changes in the Earth's magnetic field and the occurrence of geomagnetic activity. Such long- term investigation has uncovered a number of cyclical changes, including a signal associated with 27-day solar rotation.

This is most clearly seen during the declining phase and minimum of each 11-year solar cycle, when the Sun's magnetic dipole is sometimes tilted with respect to the Sun's rotational axis. With the Sun's rotation and the emission of solar wind along field lines from either end of the solar magnetic dipole, an outward propagating spiral-like pattern is formed in the solar wind and the interplanetary magnetic field that can drive 27-day, and occasionally 13.5-day, recurrent geomagnetic activity.

Recurrent geomagnetic activity can also be driven by isolated and semipersistent coronal holes, from which concentrated streams of solar wind can be emitted.

During the most recent solar minimum, which took place from 2006 to 2010, however, several researcher groups noticed 6.7-day and 9-day recurrent changes in geomagnetic activity, and similar patterns in the interplanetary magnetic field, and the solar wind. Using modern data covering the previous two solar minima, these higher-frequency occurrences were judged to be unusual.

Love et al. analyzed historical geomagnetic activity records from 1868 to 2011 and find that the 6.7-day and 9-day recurrent changes were actually

unique in the past 140 years.

They suggest that the higher-frequency changes in geomagnetic activity are due to an unusual transient asymmetry in the solar dynamo, the turbulent, rotating plasma deep within the sun which generates the magnetic field.

More information: Geomagnetic detection of the sectorial solar magnetic field and the historical peculiarity of minimum 23-24 *Geophysical Research Letters*, doi:10.1029/2011GL050702 , 2012

Provided by American Geophysical Union