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High-intensity long-duration continuous auroral electrojet (AE) activity (HILDCAA) events and associated space weather impacts

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High-intensity long-duration continuous auroral electrojet (AE) activity (HILDCAA) events[1] are associated with high-speed streams (HSSs) emanated from solar coronal holes. While HILDCAAs represent very intense AE activity (AE peak > 1000 nT) continuing for several days to week (minimum duration > 2 days) when AE does not fall below 200 nT for more than 2 hours at a time, they are not associated with significant ring current development. HILDCAAs are generally recorded during the recovery phase of a geomagnetic storm or during geomagnetic quiet condition (with SYM-H > -50 nT). Statistically, HILDCAAs are recorded more frequently during the solar cycle descending phase compared to the ascending phases and the solar maximum[2].

Sporadic magnetic reconnection between dayside geomagnetic field and the Alfvén wave southward component embedded in HSSs leads to substorm/convection events and energetic (10–100 keV) electron injection into the nightside sector of the magnetosphere during HILDCAAs. Plasma instability caused by the temperature anisotropy of the electrons generates electromagnetic chorus waves. Resonant interactions of the chorus waves with the electrons lead to the acceleration of electrons to relativistic energies[3,4], which can damage satellite electronics.

Figure 1 shows an example of geomagnetic activity during an HILDCAA event, causative solar wind/interplanetary variations, generation of chorus waves and acceleration of magnetospheric relativistic electrons in the geosynchronous orbit of the Earth. The present talk will discuss origin, features, solar cycle variations, and different impacts of HILDCAA events.

References

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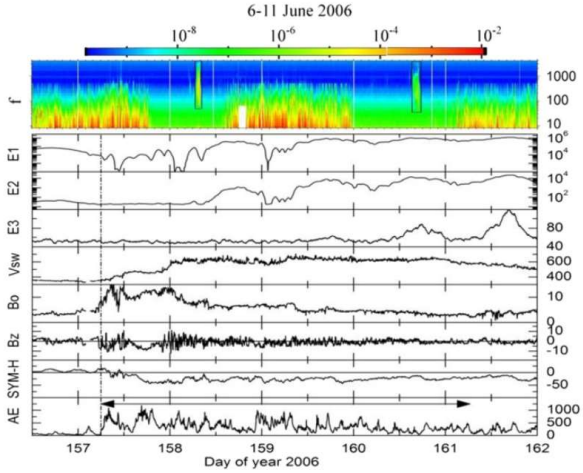

Figure 1. Solar wind/interplanetary dependence and geomagnetic/radiation belt effects during a HILDCAA event on 6–10 June 2006. From top to bottom, the panels show the frequency (Hz)–time (UT) spectrogram of the magnetic field component of the electromagnetic plasma waves (nT^2 Hz^{-1}) measured by the Cluster 1 spacecraft, the variations of $E >$ 0.6 ($E1$), $E >$ 2.0 ($E2$), and $E >$ 4.0 MeV ($E3$) electron fluxes (cm^{-2} s^{-1} sr^{-1}) from GOES-12, and solar wind speed (V_{sw} in km s^{-1}), IMF magnitude (B_0 in nT), and B_z (nT) component in geocentric solar magnetospheric coordinate system, and the SYM-H (nT) and AE (nT) indices, respectively. Perigee passes of Cluster 1 through the duskside magnetosphere are marked by black rectangles in the upper panel. The horizontal arrow in the AE panel indicates the HILDCAA interval. The vertical dash-dot line shows the initiation time of the HILDCAA.