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Morphological features of intense, continuous AE activity events

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The present study uses geomagnetic, solar wind and interplanetary database to investigate, for the first time, the interplanetary, solar cycle and seasonal dependences, and the general characteristics of continuous, intense AE intervals of HILDCAA (High-Intensity, Long-Duration, Continuous AE Activity) events. A multi-solar cycle interval of 1975-2011 is investigated.

HILDCAA occurrence is found to peak in the declining phase of the solar cycle, well after solar maximum and before solar minimum. There are an appreciable number of events in the rising phase also. This dependence is distinctly different from that of intense (Dst$\leq$-100 nT) geomagnetic storms. Intense magnetic storms occur primarily at solar maximum and a few years after solar maximum. Although intense magnetic storms exhibit the well-known semiannual variations with larger occurrences during equinoxes and smaller occurrences during solstices, the present study finds no obvious seasonal dependence of HILDCAAs. During the years of solar minimum and ascending phase, HILDCAA occurrence is significantly higher during the equinoxes than June-solstice. However, the occurrence rate during June-solstice is found to increase during solar maximum and the descending phase. Although most of the events are associated with corotating high speed streams in interplanetary structures, $\sim$10% of the events (when interplanetary data are available) are found to be preceded by interplanetary coronal mass ejections.

The characteristics of HILDCAAs such as integrated, average and peak intensities, duration of the events are analyzed. The average values of the parameters are $\sim$3.30 (10^4 nT-h), 420 nT, 1500 nT and 3.20 days respectively, implying weak-to-moderate level of prolonged auroral activities during the events. These characteristics are highly variable. The variability depends on solar cycles, solar activity conditions and seasons. The study reveals distinguishing characters between the events preceded by geomagnetic storms and those occurring during magnetic quiet conditions (Dst>-50 nT). HILDCAAs occurring during the most recent solar minimum are found to be fewer in number, weaker in strength and shorter in duration compared to those during previous solar minima.