Development of WWW service to search substorms (Substorm Swift Search, S3)

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Substorms are one of the most distinguished phenomena in the geospace. Their occurrence can be identified in a number of different ways, including auroral breakup, energetic particle injection in the inner magnetosphere, magnetic field dipolarization, magnetic reconnection in the magnetotail, and plasmoid development in the distant tail. In terms of ground-base geomagnetic field data, substorm can be identified by high-latitude negative bays and mid-latitude positive bays. There are geomagnetic indices which reflect occurrence of high-latitude negative bays and mid-latitude positive bays; the AE index is for the former and the ASY index is for the latter. These indices are derived from multiple stations distributed in longitude around the globe. Data from 12 stations and 6 stations contribute to the AE index and the ASY index, respectively.

Pi2 pulsations are defined as geomagnetic variations with periods of 40-150 seconds and irregular (damped) waveforms. Previous studies reported that Pi2 pulsations can serve as a diagnostic indicator of substorm onset. Since low-latitude Pi2 pulsations have dominant power near the midnight, multiple ground stations distributing longitudinally are needed for their detection. Recently a large number of geomagnetic observatories have started recording geomagnetic field variations with 1-sec time resolution. This development facilitates the routine derivation of a new index measuring Pi2 power. In this study, using data from the longitudinal network of 8 ground stations, we propose a new substorm index, the ”Wp index” (Wavelet and planetary).

We made stack plots of the above substorm indices (i.e., AE, ASY, and Wp) as well as energetic particle and magnetic field data from geosynchronous satellites (the DRTS and ETS-VIII satellites). Such plots are useful for users to identify substorm onset from different kinds of view points, that is, high-latitude negative bay, mid-latitude positive bay, low-latitude Pi2 pulsation, energetic particle injection, and dipolarization. Plots and digital data are available from ”Substorm Swift Search (S3)” WWW site. The address of this site is http://s-cubed.info.