

Wp index: A new substorm index derived from high-resolution geomagnetic field data at low latitude

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Geomagnetic field data with high time resolution (typically 1 s) have recently become more commonly acquired by ground stations. Such high time resolution data make it possible to identify Pi2 pulsations which have periods of 40-150 s and irregular (damped) waveforms. It is well-known that pulsations of this type are clearly observed at mid- and low-latitude ground stations on the nightside at substorm onset. Therefore, with 1-s data from multiple stations distributed in longitude around the Earth's circumference, substorm onset can be regularly monitored. In the present study we propose a new substorm index, the Wp index (Wave and planetary), which reflects Pi2 wave power at low-latitude, using the geomagnetic field data from 11 ground stations (Tucson, Honolulu, Canberra, Kakioka, Learmonth, Urumqi, Iznik, Fuerstenfeldbruck, Ebro, Tristan da Cunha, and San Juan). We compare the Wp index with the AE and ASY indices as well as the electron flux data and the magnetic field data at geosynchronous altitude for 11 March 2010. It is found that significant enhancements of the Wp index mostly coincide those of the other data. Thus the Wp index can be considered as a good indicator of substorm onset. The Wp index, other geomagnetic indices, and geosynchronous satellite data are plotted in a stack for quick and easy search of substorm onset. The stack plots and digital data of the Wp index are made available from the web site (<http://s-cubed.info>) for public use.