The Space Weather and Solar Cycle Effect on Geomagnetic Activities

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Space weather is the concept of changing environmental conditions in near-Earth space. It is distinct from the concept of weather within a planetary atmosphere, and deals with phenomena involving ambient plasma, magnetic fields, radiation and other matter in space.

Sun is the ultimate energy source for the change of space weather and solar wind is the driver for the dynamic activity in the terrestrial magnetosphere. The magnetic reconnection in the dayside transfers momentum and energy from the solar wind to the magnetotail. The magnetotail is the primary energy storage reservoir for magnetospheric dynamics and the magnetotail current sheet is where the energy release processes begins. The release of the stored energy is accompanied with a reconfiguration of the stretched magnetotail to a more dipolar magnetosphere. Substorms play a key role in the circulation of the energy storage and release process. It is suggested that solar cycle may have an influence on the substorm characteristics.

In order to monitor as many substorms as possible, in this study we utilize the global AL index and Pi 2 pulsations from multiple stations to construct a substorm list for solar cycle #22 (1986 to 1996) to solar cycle #23 (1996 to 2008). Our preliminary list of substorms is complete for cycle #23 and cycle #22 which has more than 40K events in the list. The AL onset list suggests that there are solar cycle effect for substorm occurrence and strength. The intensity change as solar cycle as well. A further examination of the corresponding solar wind condition found that stream interface is an important factor for the controlling of substorm strength and occurrence.