

Relationship between the solar wind structures and high-energy particles associated with magnetic storms and radiation belts

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Toward a reliable space weather forecast, it is necessary to understand the fundamental solar wind structure connecting the Sun and the Earth. There are two kinds of solar wind structures driving a large geomagnetic storm: Coronal mass ejections (CMEs) and corotating interaction regions (CIRs). Basically, high energy particles associated with the ring current and radiation belts show different responses for the two solar wind structures: CME-driven storms tend to have strong evolution of the ring current and disappearing of the slot region with a temporal scale of a few to several hours, while CIR-driven storms tend to have rapid evolution of the outer radiation belt during the recovery phase with a temporal scale of a few days. An interpretation of the basic difference by a concept of the solar wind parameter dependence, dealing the solar wind as a NUMBER, may not be enough. We can take a step forward to the real Sun-Earth connection by understanding the difference as the magnetospheric response to a series of solar wind structures with different inherent natures such as Mach number, plasma beta, and fluctuations etc. We report the result of our analysis especially about the solar wind structures driving great storms and great radiation belt storms during solar cycle 23, including the latest space weather events.