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Study of ring current asymmetry during intense storms

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Recent studies have shown that magnetic storms are relatively weak when the solar wind dawn-dusk electric field (E_y) is slowly changing and accordingly there is a lack of substorm expansion phases over intervals as long as several hours during ring current intensification. This suggests that magnetic storm intensity is controlled not only by the strength, but also by the variability of the interplanetary electric field. Abrupt variations in E_y reflect sudden changes, both southward and northward, of the IMF $B_z$component, which lead to a frequent occurrence of substorm expansion phases. In this study, we report the results of a statistical analysis of geomagnetic events in two categories; those induced by interplanetary magnetic clouds, and those which occurred during intervals of highly variable E_y (such as those found in the sheath region between an interplanetary shock and a magnetic cloud). We use the integrated Epsilon function during the storm main phase as a proxy for the input solar wind energy that is responsible for ring current intensification. Specifically, we compare the ring current asymmetry of the two types of the events. Possible mechanisms of the variation in asymmetry will be discussed.