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Geometric effects of ICMEs on geomagnetic storms

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It has been known that the geomagnetic storm is occurred by the interaction between the Interplanetary Coronal Mass Ejection (ICME) and the Earth's magnetosphere; especially, the southward Bz component of ICME is thought as the main trigger. In this study, we investigate the relationship between Dst index and solar wind conditions; which are the southward Bz, electric field (VBz), and time integral of electric field as well as ICME parameters derived from toroidal fitting model in order to find what is main factor to the geomagnetic storm. We also inspect locations of Earth in ICMEs to understand the geometric effects of the Interplanetary Flux Ropes (IFRs) on the geomagnetic storms. Among 59 CDAW ICME lists, we select 30 IFR events that are available by the toroidal fitting model and classify them into two sub-groups: geomagnetic storms associated with the Magnetic Clouds (MCs) and the compression regions ahead of the MCs (sheath). The main results are as follows: (1) The time integral of electric field has a higher correlation coefficient (cc) with Dst index than the other parameters: cc=0.85 for 25 MC events and cc=0.99 for 5 sheath events. (2) The sheath associated intense storms (Dst $\leq$-100nT) having usually occur at flank regions of ICMEs while the MC associated intense storms occur regardless of the locations of the Earth in ICMEs. The strength of a geomagnetic storm strongly depends on electric field of IFR and durations of the IFR passages through the Earth.