ICME-Driven Geoeffectiveness: Insights from Planar Magnetic Structures
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Abstract: Interplanetary coronal mass ejections (ICME) are large-scale eruptions from the Sun and prominent drivers of space weather disturbances, especially intense/extreme geomagnetic storms. Recent studies by our group showed that ICME sheaths and/or magnetic clouds (MC) could be transformed into a planar magnetic structure (PMS), and we speculate that these structures might be more geo-effective. Thus, we statistically investigated the geo-effectiveness of planar and non-planar ICME sheaths and MC regions. We analyzed 420 ICME events observed from 1998 to 2017, and we found that the number of intense (−100 to −200 nT) and extreme (<−200 nT) geomagnetic storms are large during planar ICMEs (almost double) compared to non-planar ICMEs. In fact, almost all the extreme storm events occur during PMS molded ICME crossover. The observations suggest that planar structures are more geo-effective than non-planar structures. Thus, the current study helps us to understand the energy transfer mechanism from the ICME/solar wind into the magnetosphere and space-weather events.
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