Geophysical Research Abstracts, Vol. 8, 02843, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02843

Statistic study on geoeffectiveness of solar and interplanetary events

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We continue our study of geoeffectiveness (possibility to generate magnetic storms on the Earth) of solar and interplanetary disturbances (see Yermolaev et al., Statistical studies of geomagnetic storm dependencies on solar and interplanetary events: a review, Planet.Space Sci., 2005). In the literature on the solar-terrestrial relations there are different estimations of storm effectiveness of solar and interplanetary events - from 30 up to 100%. Different results arise due to differences in the methods used to analyze the data: (1) the direction in which the events are compared, (2) the pair of compared events, and (3) the methods of the event classifications. We selected papers using (1) the analysis on direct and back tracing of events, and (2) solar (coronal flares and CMEs), interplanetary (magnetic clouds and ejecta) and geomagnetic disturbances (storms on Dst and Kp indices). The classifications of magnetic storms by the Kp and Dst indices, the solar flare classifications by optical and X-ray observations, and the classifications of different geoeffective interplanetary events are compared and discussed. Taking into account this selection, all published results on the geoeffectiveness agree to each other in each subset: “CME to Storm” - 40-50%, “CME to MC, Ejecta” - 60-80%, “MC, Ejecta to Storm” - 50-80%, “Storm to MC, Ejecta” - 30-70%, “MC, Ejecta to CME” - 50-80%, “Storm to CME” - 80-100%, “Flare to Storm” - 30-40% and “Storm to Flare” - 50-80%. Higher values of correlations were obtained by back tracing, that is, by method, in which they were defined as the probability of finding candidates for a source of geomagnetic storms among CMEs and flares, and, strictly speaking, these values are not true estimates of the geoeffectiveness. The latter results are also in contrast with the results of the two-stage tracing of the events: first a storm – an interplanetary disturbance, and then an interplanetary disturbance – a CME/flare. Paper is supported in part by RFBR, grant 04-02-16131.