OCCURRENCE RATE AND CAUSAL RELATIONSHIP OF EXTREME SPACE WEATHER EVENTS

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As extreme space weather phenomena in this study are considered all solar flares above X9, the fastest coronal mass ejections, the strongest geomagnetic storms and the most-intense in proton flux solar energetic particles. These phenomena are mutually interconnected and/or occur in close succession. The extremes of each category in the recorded history of ground-based and satellite observations are identified and their occurrence rates are calculated. A set of criteria is proposed to relate a given geo-effective event with its origin and the accompanying space weather phenomena. The results are presented and discussed.