



## **Geoeffectiveness of the 12 X-class flares in 2002**

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We analyze systematically the chain of events related to the 12 X-ray flares of X class occurring in 2002: source region, CME, ICME, magnetic field at L1, geomagnetic indices, and SEP to determine if we could explain their weak geo-effectiveness by usual criteria. No intense geomagnetic storm is related to any of these flares. Only one of them is associated with a moderate storm. The three others are associated with a weak storm ( $-50 \text{ nT} < \min(\text{Dst}) < -30 \text{ nT}$ ). 75 % of the flares are associated with a halo CME with a good correlation rate for the speed/flux of the flare. The flare sources are mainly close to the limb (70%). We conclude that the association of big flares and strong geomagnetic disturbances may be valid only for extreme or intense geomagnetic storms. Otherwise the magnetic energy of active regions is released in an unexpected way into thermal energy and kinetic energy or in ejections of energetic particles. The most important parameter is the  $B_z$  value and its orientation. It seems that the CMEs launched with high speed (around 2000 km/s) avoid the Earth in our sample. The location of the solar source, the shape of the CME, and the shock front have a direct impact on the geo-effectiveness.