A statistical study of the influence of solar flare characteristics on the presence of IP shocks at 1 AU and corresponding geomagnetic storm intensity

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Solar flares and metric type II radio bursts are one kind of preliminary manifestations of solar disturbances and they are fundamental for predicting the arrival time of interplanetary (IP) shocks at Earth. We statistically studied 347 solar flare-type II radio burst events during 1997.2-2002.8 and found (1) Only 37.5% of the total solar flare-type II radio burst events caused the 1 AU IP shocks near the Earth, the other events without such IP shocks detected account for 62.5%; (2) Solar flare intensity is one of the factors influencing the arrival at Earth of the corresponding IP shocks, and the probability of arrival of shocks increase with the increase of solar flare intensity; (3) Solar flare longitudes also influence the arrival of the corresponding IP shocks. Flares originating far away from central meridian usually correspond to the absence of IP shocks at 1AU, and the most probable location for a flare to generate the 1 AU shock is $W20^{\circ}$; (4) There exists a east-west asymmetry in the distribution of geoeffectiveness of flare-type II burst events along their longitudes. Most severe geomagnetic storms ($Dst_{\min} \leq -100nT$) are usually caused by flare-generated shocks originating from western hemisphere or middle regions in the vicinity of the central meridian, and the most probable location for solar flares to cause more intense geomagnetic storm is $W20^{\circ}$ for strong solar flares (above M5.0 class); (5) The magnetic storm intensity has no clear dependence on the corresponding flare intensity. These results can provide some criteria to estimate whether a shock would arrive at Earth and the corresponding geomagnetic storm intensity.