

M23c Critical Parameters of an Active Region to Produce Eruptive Solar Flares and CMEs

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Solar flares and coronal mass ejections (CMEs) are eruptive phenomena originated in active regions (AR) on the solar surface. However, it is still unclear what determines the capability of an AR to produce eruptive flares (flares with CMEs), and it hinders our ability to predict whether a CME will occur. In this study, we propose a new parameter r_m and test its ability to measure the possibility that a flare will be eruptive and produce a CME. The parameter r_m is defined by the ratio of the magnetic flux (having field-line twist higher than a threshold T_c) to the overlying magnetic flux. The value of r_m for each AR is estimated using nonlinear force-free field (NLFFF) extrapolation. Based on data obtained by the Solar Dynamics Observatory (SDO)/Helioseismic and Magnetic Imager (HMI), we calculated the values of r_m for 29 ARs at 51 moments before they produced the major flare larger than M5.0 class. We find that the foot-point areas for field lines with twist larger than 0.2 can well represent the subsequent flare ribbons, thus we evaluate r_m for $T_c=0.2$ as the critical parameter for producing eruptive flares using nonparametric discriminant analysis (NPDA). The result shows that r_m is moderately able to discriminate ARs which have capability to produce eruptive flares that also produce CMEs.