

Study of the occurrence condition of eruptive flares and CMEs based on non-linear force-free field model

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The solar flares and CMEs sometimes largely disturb the Earth's electromagnetic environment and may impact various social systems. In particular, large magnetic storms ($Dst < -100nT$) are caused by CMEs. Therefore, the prediction of CMEs occurrence is an important issue for space weather forecast. The SOHO observations indicated that, although solar flares often occurred under CMEs, CMEs do not always occurred associated with all solar flares (Yashiro et al, 2006). Solar flares accompanying CMEs are called “eruptive flare”, other solar flares are called “non-eruptive flares”. The occurrence condition of eruptive/non-eruptive has not been yet well-understood.

Recently, Toriumi et al. (2017) pointed out that the ratio of flare ribbons flux to the total flux of active region tends to be larger for the eruptive flare compared to the non-eruptive flares. On the other hand, Inoue et al. (2016) suggested that there is a correlation between the shape of the ribbon and the region of high magnetic twist using the non-linear force free field (NLFFF) model. In this study, we investigated the relationship between the area fraction of high magnetic twist region and the property of whether flare is eruptive or not using the SDO/HMI data and the NLFFF model. The result suggests that the area fraction of highly twisted flux of the active region producing non-eruptive flares tends to be lower than that of the regions producing eruptive flares, although the number of sample is not yet enough to make a clear conclusion.

Keywords: Solar flare, Corona mass ejection (CME), Non-linear force free field, Space weather