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Study on Triggering Process of Solar Flare on the basis of Satellite Observation

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Solar Flares are explosive phenomena driven by magnetic energy stored in the solar corona. Because interplanetary disturbances associated with solar flares sometimes impact terrestrial environments and infrastructure, understanding the flare-triggering process is important not only from a solar physics perspective but also for space weather forecasting. There are numerous observational studies and simulations which attempted to reveal the onset mechanism of solar flares. Because different observations support different models, the underlying mechanism of flare onset remains elusive. Thus the predictability of flare occurrence remains limited.

We have analyzed several flare events obtained by the Solar Optical Telescope (SOT) onboard the Hinode Satellite in order to elucidate flare trigger mechanism [*Bamba et al.* 2013]. We investigated the spatio-temporal correlation between the detailed magnetic field structure and the chromospheric pre-flare emission at the central part of flaring regions for several hours prior to the onset of flares. We observed that the magnetic shear angle in the flaring regions exceeded 70 degrees, as well as that characteristic magnetic disturbances developed at the centers of flaring regions in the pre-flare phase. The observed signatures strongly support the idea of flare trigger mechanism presented by *Kusano et al.* (2012), which proposed that solar flares can be triggered by the interaction between the sheared arcade and one of the two types of small magnetic disturbances. Hence, we could classify the events into two groups depending on the structure of their magnetic polarity inversion lines; to the so-called " Opposite-Polarity (OP) " and " Reversed-Shear (RS) " magnetic field. Furthermore, we studied how small magnetic field can work for triggering flares based on the Hinode observations. The results indicate that the critical amount of magnetic flux for the small magnetic field to trigger flares, depends on the magnetic connectivity in the flaring site, and it varies even within an active region.

However, only four Hinode data sets habe been utilizable for the analyze of this study because of the SOT ' s limited field of view (FOV) (328 " $\times$ 164 " for Narrow-band Filter Imager, 218 " $\times$ 109 " for Broad-band Filter Imager). Therefore, we applied the analysis method of *Bamba et al.* (2013) to the data obtained by the Helioseismic and Magnetic Imager (HMI) and the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO), which has a full-disk FOV (2000 " $\times$ 2000 ") in order to increase the number of event analysis. We chose the flare events observed by SDO until 31 Jan. 2014, larger than M5.0 GOES class. Eleven X-class and twenty M-class events meet this condition, and we classified these events into independent 6 types by using following three conditions: (1) whether the initial flare kernels has obvious and sheared two-ribbon structure, (2) whether the chromospheric brightening was observed at the center of sheared ribbon, (3) the results of measurement of the magnetic shear angle θ and the azimuth of flare trigger field ϕ.

In this presentation, we would like to report the result of comparative study of Hinode and SDO. We would like to also introduce our preliminary result of statistical flare trigger study using SDO/HMI and AIA.

References:
[1] *Study on Triggering Process of Solar Flares Based on Hinode/SOT Observations,*
Y. Bamba, K. Kusano, T. T. Yamamoto, and T. J. Okamoto,
2013 ApJ 778 48 doi:10.1088/0004-637X/778/1/48
[2] *Magnetic Field Structures Triggering Solar Flares and Coronal Mass Ejections,*
K. Kusano, Y. Bamba, T. T. Yamamoto, Y. Iida, S. Toriumi, and A. Asai,
2012 ApJ 760 31 doi:10.1088/0004-637X/760/1/31

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