Flare Productivity in Different Magnetic Types of Active Regions

*Ya-Hui Yang[1], Min-Shiu Hsieh[2], Hsiu-Shan Yu[3], P. F. Chen[4]

1. Institute of Space Science, National Central University, Taiwan, 2. Geophysical Institute, University of Alaska Fairbanks, USA, 3. Center for Astrophysics and Space Sciences, University of California San Diego, USA, 4. School of Astronomy and Space Science, Nanjing University, China

It is believed that intense flares preferentially originate from the large-size active regions (ARs) with strong magnetic fields and complex magnetic configurations. Based on two datasets of daily sunspot and flare information as well as the GOES soft X-ray measurements and HMI vector magnetograms, we investigate the dependence of flare activity on the AR properties and clarifies the influence of AR magnetic parameters on the flare productivity. We find that flare behaviors are quite different in the short- and long-lived complex ARs and the ARs with more complex magnetic configurations are likely to host more impulsive and intense flares. Moreover, our results demonstrate that the total source field strength on the photosphere has a good correlation with the flare activity in complex ARs. Intense flares tend to occur at the regions of strong source field in combination with an intermediate field-weighted shear angle, which implies that the magnetic free energy provided by a complex AR could be high enough to trigger a flare eruption even with a moderate magnetic shear on the photosphere. We thus suggest that the magnetic free energy represented by the source field rather than the photospheric magnetic complexity is a better quantity to characterize the flare productivity of an AR, especially for the occurrence of intense flares.

Keywords: solar flare, active region

