Calibration of statistical solar flare forecast parameters for images from SDO/HMI space instrument

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Forecasting the probability of a solar active region to flare is a challenging and pursued topic in the Space Weather field.

The R value, developed by Schrijver (2007) is one of the most used descriptors of the photospheric magnetic field in active regions for flare forecasting applications. The R value method was calibrated on the magnetograms obtained from the Michelson Doppler Imager (MDI) instrument on board the Solar and Heliospheric Observatory (SOHO) between 1998 and 2006, during solar cycle 23. Since 2010, the Helioseismic and Magnetic Imager (HMI) on board the Solar Dynamics Observatory (SDO) satellite, is operative, collecting solar magnetograms with a spatial resolution 4 times higher than MDI, while the observation program of MDI was terminated on April 2011. We readjust the original R value algorithm to adapt it to the higher spatial resolution of HMI and we compare the statistical analysis of a sample of cycle 24th solar flares with the statistical analysis performed by Schrijver (2007). Furthermore, we propose a new parameter D, aimed to identify and count the number of magnetic polarity-inversion lines within the same active region, to better characterize magnetic active region morphology.

The result of our statistical analysis show that both parameters are good descriptors of the behaviour of an AR and useful tools for flare forecasting, individually but especially if used together.