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Title: "Photospheric Current Spikes as Possible Predictors of Flares"

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Flares involve generation of the largest current densities in the solar atmosphere. This suggests the hypothesis that prior to a large (M,X) flare there are related time dependent changes in the photospheric current distribution, and hence in the resistive heating rate in neutral line regions (NLRs). If this is true, these changes might be useful predictors of flares. Preliminary evidence supporting this hypothesis is presented. Results from a data driven, near photospheric, 3D magnetohydrodynamic type model suggest the model might be useful for predicting M and X flares several hours to several days in advance. The model takes as input the photospheric magnetic field observed by the Helioseismic & Magnetic Imager (HMI) on the Solar Dynamics Observatory (SDO) satellite. The model computes quantities in every active region (AR) pixel for 14 ARs, with spurious Doppler periods due to SDO orbital motion filtered out of the time series of the magnetic field for each pixel. Spikes in the NLR resistive heating rate Q, appearing as increases by orders of magnitude above background values in the time series of Q are found to occur, and appear to be correlated with the occurrence of M or X flares a few hours to a few days later. The subset of spikes analyzed at the pixel level are found to occur on HMI and granulation scales of 1 arcsec and 12 minutes. Spikes are found in NLRs with and without M or X flares, and outside as well as inside NLRs, but the largest spikes are localized in the NLRs of ARs with M or X flares, and associated with horizontal magnetic field strengths $\sim$ several hG, and vertical magnetic field strengths several orders of magnitude smaller. The spikes may be signatures of horizontal current sheets associated with emerging magnetic flux.