Differences Between High-Productive and Low-Productive Active Regions

Declan Brick\textsuperscript{1}, Gang Li\textsuperscript{2}, David Falconer\textsuperscript{2,3}

1. Department of Physics, UAH 2. Department of Space Science, UAH 3. MSFC, NASA, Huntsville, AL

Introduction

- Solar flares are the most energetic events in the solar system and have the potential to damage spacecraft, electric grids, and astronauts.
- MAG4 (Magnetogram Forecast) is a code developed by NASA MFSC & UAH that uses magnetograms of these regions to derive parameters to predict flaring.
- Here we collected a set of 53 HARP tiles-data sets which can contain one or more Active regions (Ars) and use them to determine addition parameters to use in forecasting.

Methods

- We first downloaded HARP patch vector magnetogram data.
- These HARPS were then converted into horizontal and vertical magnetic field components.
- From these components, parameters like alpha, a measure of magnetic twist and calculated by $\alpha=J_z/B_z$, can be computed.
- We divide our sample into high or low productivity based on MAG4’s predictions over a six-day window centered on the time period of the magnetogram.

Key Findings/Results

- We found that high-productive ARs had significant emergence of additional magnetic field 62% of the time whereas low-productive only had emergence 28% of the time.
- When the Kurtosis was calculated for alpha and graphed, we found that it spiked around 75% of the M- and X-class flares (Right Figures).

Summary

- The Kurtosis peaking around flare times indicates that it may be useful as a parameter of flare prediction in future work.
- By using emergence, we possibly can use to improve predictions in future upgrades of MAG4.

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