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Title: “HMI Data Driven Magnetohydrodynamic Model Predicted Active Region Photospheric Heating Rates: Their Scale Invariant, Flare Like Power Law Distributions, and Their Possible Association With Flares”
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A data driven, near photospheric, 3D, non-force free magnetohydrodynamic model predicts time series of the complete current density, and the resistive heating rate $Q$ at the photosphere in neutral line regions (NLRs) of 14 active regions (ARs). The model is driven by time series of the magnetic field $B$ observed by the Helioseismic & Magnetic Imager on the Solar Dynamics Observatory (SDO) satellite. Spurious Doppler periods due to SDO orbital motion are filtered out of the time series for $B$ in every AR pixel. Errors in $B$ due to these periods can be significant. The number of occurrences $N(q)$ of values of $Q \geq q$ for each AR time series is found to be a scale invariant power law distribution, $N(q) \propto Q^{-s}$, above an AR dependent threshold value of $Q$, where $0.3952 \leq s \leq 0.5298$ with mean and standard deviation of 0.4678 and 0.0454, indicating little variation between ARs. Observations show that the number of occurrences $N(E)$ of coronal flares with a total energy released $\geq E$ obeys the same type of distribution, $N(E) \propto E^{-S}$, above an AR dependent threshold value of $E$, with $0.38 \approx S \approx 0.60$, also with little variation among ARs. Within error margins the ranges of $s$ and $S$ are nearly identical. This strong similarity between $N(Q)$ and $N(E)$ suggests a fundamental connection between the process that drives coronal flares and the process that drives photospheric NLR heating rates in ARs. In addition, results suggest it is plausible that spikes in $Q$, several orders of magnitude above background values, are correlated with times of the subsequent occurrence of M or X flares.