Project Details

ROSES ID: NNH10ZDA001N
Selection Year: 2011
Program Element: Solar Dynamics Observatory

Project Title:
Developing Reliable Estimates of Poynting Flux from HMI Observations of Active Region Magnetic Fields

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Summary:
Ultimately, the magnetic energy in the Sun's atmosphere --- the source of dramatic eruptive events such as flares and coronal mass ejections --- is generated below the photosphere in the turbulent, differentially-rotating convective interior. The emergence of new magnetic flux into the solar atmosphere, the twisting and shearing of emerged magnetic flux by turbulent motions, and Alfven and magneto-acoustic waves from intermittent turbulent eddies are all viable mechanisms that can transport magnetic energy into the solar atmosphere. It is crucial that we understand these physical processes and be able to distinguish between them. Thus, we propose to develop and apply techniques to derive quantitative maps of the flux of electromagnetic energy into the solar atmosphere from below the visible surface. These techniques will be based on the recently-developed poloidal-toroidal decomposition (PTD) method of Fisher et al. (2010), and will use observations of the evolving vector magnetic field at the solar photosphere, and observed Doppler flows.

Specifically, the objectives of this proposal are to (1) incorporate Doppler line-of-sight data and sequences of vector magnetograms from HMI into the PTD formalism to derive reliable estimates of the photospheric electric field and the electromagnetic Poynting flux; (2) validate this method with new state-of-the-art MHD simulations of the solar interior and atmosphere where the electric field and Poynting flux are known; (3) create robust and efficient electric field and Poynting flux mapping software to be released to the Heliophysics community and to be incorporated into the HMI Joint Science Operations Center; and (4) apply this method to HMI data for a diverse sample of active regions.

Publication References:

Summary: no summary

Reference: Fisher G. H; Welsch B. T; Abbett W.P.; (2012). Can We Determine Electric Fields of Poynting Fluxes from Vector Magnetograms and Doppler Measurements? Solar Physics, 277, doi: 10.1007/s11207-011-9816-4

Summary: no summary

Reference: Abbett W. P.; Fisher G. H; (2012), Radiative Cooling in MHD Models of the Quite Sun Convection Zone and Corona. Solar Physics, 277, doi: 10.1007/s11207-011-9817-3