Nonlin. Processes Geophys. Discuss.,
doi:10.5194/npg-2015-83-RC2, 2016


Nonlinear Processes in Geophysics
Discussions
Open Access
EGU



# *Interactive comment on* "Multiscale statistical analysis of coronal solar activity" *by* D. Gamborino et al.

**Anonymous Referee #2**

Received and published: 3 February 2016

SUMMARY AND GENERAL EVALUATION

The authors present an interesting spatio-temporal analysis of 4-dim solar data, for a flaring event, the preflare phase, and a Quiet Sun region. They use a Singular Value Decomposition method and investigate the multi-scale behavior of the physical parameter of the temperature T, and attempt to extract information on the heat flow dT/dx in a flare. The description of the method is clear, and the data analysis steps are described in sufficient detail. In the second half of the paper the authors try to extract information on the heat flux before and during a flare, where they arrive at the result that diffusive transport is not relevant in solar flares, which is at odds with other studies. If the authors can reconcile the interpretation of this controversial result in terms of the limitations of the used method, the paper may possibly be suitable for publication.



Full screen / Esc

Printer-friendly version

Discussion paper

DETAILED COMMENTS

In the Discussion and Conclusions the authors arrive at several important and some controversial results:

(1) "... a raw correlation between Fourier time scale and spatial scales during the flare, but not for pre-flare or quiet Sun. This may indicate that the flare-driven heat flows tend to decay into smaller scales, in a cascade-like process." - Perhaps a reference and discussion can be made whether this is relevant to the scenario of "inverse MHD turbulent cascade" (e.g., Abramenko et al. 2003, ARep 47, 151, "Pre-Flare Changes in the Turbulence Regime for the Photospheric Magnetic Field in a Solar Active Region"; Antonucci et al. 1996, ApJ 456, 833 " Interpretation of the observed plasma turbulent velocities as a result of magnetic reconnection in solar flares"; LaRosa,T.N. and Moore,R.L. 1993, ApJ 418, 912-918, "A mechanism for bulk energization in the impulsive phase of solar flares: MHD turbulent cascade".

(2) "... The pre-flare activity seems to produce larger low-amplitude fluctuations, characteristic of intermittency, which might herald the occurrence of the flare." — Discuss in this in the context of the paper by Abramenko et al. (2003), for instance.

(3) "A multi-scale analysis of the heat flux was also performed for the region associated with the flare. The thermal flux profiles along the main direction (x) of the flow were computed original temperature maps and compared with the temperature variation along x, allowing to obtain the advection velocity profile. Diffusive transport is found to be not relevant." — This is contrary to other observational findings that the envelope of the flare area propagates like diffusive transport (Aschwanden 2012, ApJ 757, 94, "The spatio-temporal evolution of solar flares observed with AIA/SDO: Fractal diffusion, sub-diffusion, or logistic growth". The author's result may be biased because they use a 1-dim transport model (in x-direction), with no transport in transverse direction. Furthermore, they assume that there is no energy source inside the region of temperature maps (line 270). It would be more realistic to assume that the energy

transport is isotropic in all directions, because the high-resolution images from AIA show that a flare entails many reconnection sites with magnetic field lines that go in all directions. Perhaps the authors can modify their heat flux model accordingly, or at least discuss the limitations of their model and what bias is expected in the diagnostics of the overall heat flux from a (point-like) flare source region.

---

Interactive comment on Nonlin. Processes Geophys. Discuss., doi:10.5194/npg-2015-83, 2016.