Ann. Geophys. Discuss.,
https://doi.org/10.5194/angeo-2019-33-RC1, 2019

Annales Geophysicae Discussions

Interactive comment on "Photospheric vortex flows close to the polarity inversion line of a fully emerged active region" *by* Jean C. Santos and Cristiano M. Wrasse

Anonymous Referee #1

Received and published: 8 April 2019

Referee Comments:

Using the tracked flow velocity field from the time-sequence magnetograms, the authors found vortex flow patterns surrounding the polarity inversion line and claims the turbulent nature of the plasma by a geometric method. I believe this is an attempt to show the turbulence nature of the flow on the Sun. I have the following comments which may help improve the manuscript.

Abstract: "Using this method. . ." this sentence is not in continuation with the earlier, confusing which method

Section 2: cadence & resolution of the MDI B_LOS needs to be mentioned. It is related

to the discussion of the LCT method employed on them.

P.4, paragraph "To determine the velocity field. . .", FLCT is a method is valid for the intensity based images. However, magnetic fields on the sun evolve according to the magnetic induction equation, so LCT is to be modified accounting the induction equation. You may refer to Schuck (2005) for the differential affine velocity estimator (DAVE) technique. However, I would suggest to check the detection of the same critical points in the flow patters derived from DAVE. I am sure that the flow patterns of vortical nature would exhibit enhanced curvature with DAVE. This needs to be properly discussed. Also please mention the size of the apodising window used.

I have some issue with the cadence of the B_los used. A cadence of 192minutes is too high to track flow velocity and you would loss the vortical patterns. Assuming a 0.5 km/s velocity, in 192 minutes, the motion is around 8 arcsec. Then the critical points found with the velocity field in hand are of major concern. How about using HMI magnetograms at a higher cadence ?

P.7, I would suggest to write a brief description on the box-counting method. How does it relates to the kolmogorov power law. This information is needed from a new reader perspective.

Regarding the critical points detection, I have a concern on the threshold of the magnetic field. Usually, the flow velocity is somewhat noisy in the weak-field regions, ofcourse that is the key issue for the discussion of the turbulent nature of the plasma. Then the identified critical points, Figure 6, in the weak field regions especially in the PIL regions are subjective.Please provide a solid justification.

p.7, "Since the fully developed turbulence consists of a hierarchy. . .", it could be, but in the presence of the magnetic field, it can be quenched, then there is point to think why the vortices are found only at certain points. I mean to ask, what about the power law at the places other than critical points. Generally, turbulence is present every on the sun, then what kind of power is expected for example in some what magnetic field

regions. Is the geometrical method used still applicable there?

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