



Super-diffusion versus competitive advection processes on the solar surface

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From the analysis of the displacement spectrum of magnetic element, it has recently been agreed that a regime of super-diffusivity dominates the solar surface.

Quite habitually this result is discussed in the framework of fully developed turbulence.

However, the debate whether the super-diffusivity is generated by a turbulent dispersion process, by the advection due to the convective pattern, or even by another process is still open, as is the question of the amount of diffusivity at the scales relevant to the local dynamo process.

To understand how such peculiar diffusion in the solar atmosphere takes place, we compared the results from two different data sets (ground-based and space-borne) and confronted those results also to simulation of passive tracers advection.

The displacement spectra of the magnetic elements obtained by the data sets are consistent in retrieving a super-diffusive regime for the solar photosphere, but also the simulation shows a super-diffusive displacement spectrum: its competitive advection process can reproduce the signature of super-diffusion.

Therefore, it is not necessary to hypothesize a totally developed turbulence regime to explain the motion of the magnetic elements on the solar surface.