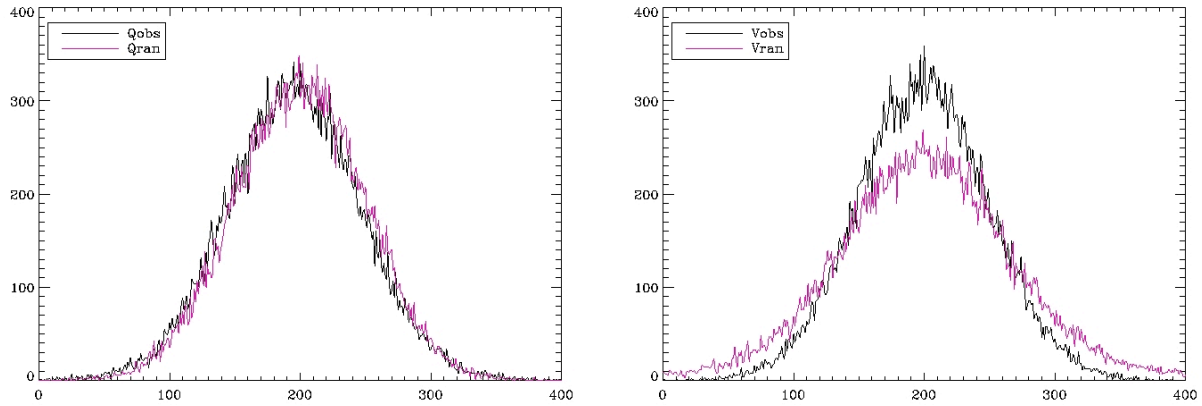
VFISV: Magnetic field spikes in the umbra of sunspots

Nov 16, 2010

Experiment: Setting polarization to noise

In order to determine whether the spikes are a noise artifact or something else, I've set up an experiment in which I substitute Q, U and V for random noise. I took a 200x200 pixel area at disk center, kept Stokes I for each pixel, but turned Q, U and V into pure noise. I choose a normal function to represent the noise and I tried to find a function that more or less represents the values in Q, U and V.



The figure shows the histograms of Q (left) and V (right) for the observed (black) and random synthetic (pink) data. The chosen distribution matches Stokes Q and U, but not V, because the noise (and the signal!!) are different in Stokes V.

The next page shows the results of the inversion. From left to right and top to bottom, magnetic field strength, line of sight velocity, inclination and azimuth. The top figure is for the observed data and the bottom one for the synthetic random polarization.
The spikes in the inclination still appear in the synthetic data (however, as expected, the network signals are not there), and the preference angle is 90 degrees. This proves that the 90-degree inclination is just an artifact of the noise (Q and U dominate over V) and that the spikes are also a consequence of random out-liars.
The histograms in the following page show the quantitative differences between the observed and synthetic inversion results.

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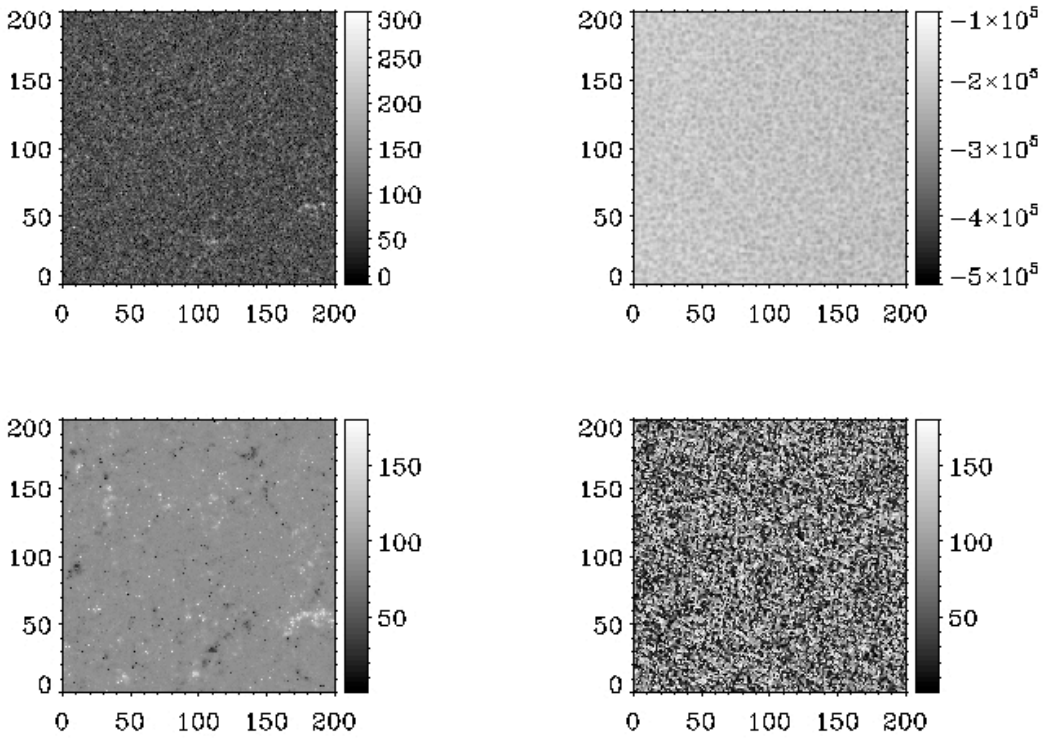
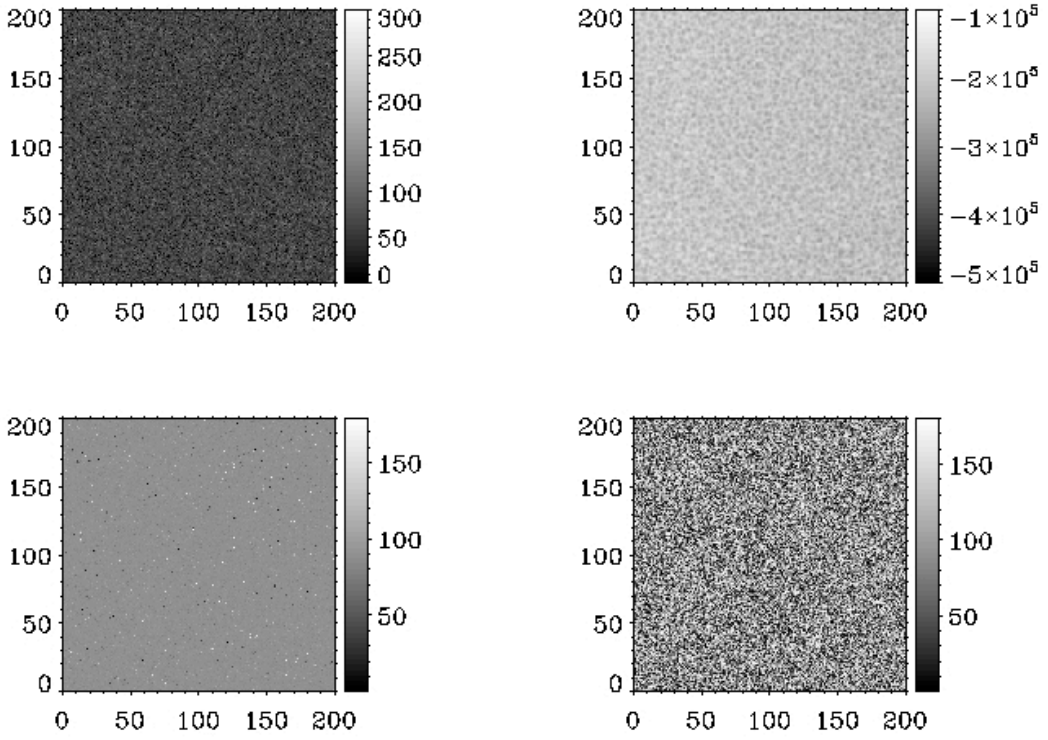


Up: inversion results for observed data. Down: Inversion results for synthetic data



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