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Nonlinear Processes in Geophysics
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Discussions

Interactive comment on "Spatial analysis of oil reservoirs using DFA of geophysical data" *by* R. A. Ribeiro et al.

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Dear F. Schmitt

The reference - Lovejoy and Schertzer, Scaling and multifractal fields in the solid earth and topography, Nonlin. Proc. Geophysics 14, 465 (2007) - is indeed an extensive review of statistical nonlinear methods applied to the geophysics and deserved to be cited.

The other reference - Dashtian et al., Scaling, multifractality and long-range correlations in well log data of large scale porous media, Physica A 390, 2096

(2011) - is more specific about fractal, and multifractal behaviour of well log data which is the specific topic of our manuscript. Because of that we shall also includued this paper in the references.

We agree with the observation that DFA technique is not, in a strict sense, a generalization of Hurst analysis but another method. We will change in the text and call the DFA exponent an index that is similar to Hurst expoent, which is more adequate. Both techniques quantify fluctuations across several scales, but to say DFA is, indeed, a generalization of Hurst exponent is a little bit forced.

The DFA technique is complementary to the Fourier analysis in some sense. For stationary signals there is a relation $\beta = 2\alpha - 1$, for β the exponent of power-law curve of the Fourier power spectrum and α the DFA exponent. Despite β and α being related to each other, the computational estimation of α is more convenient.

We attached the power spectra of three geophysical quantities: gamma ray, sonic and density. The graphic is in log-log scale to facility the reading. We have choose a typical well to perform the analysis. An important issue is that for most signals Fourier spectrum is not a power-law for all frequency range. Figure 5 of the paper Lovejoy and Schertzer illustrate this phenomenon. The figure we added also show the same cut-off for high frequencies. The region we use to make our analysis is above the threshold, $log(frequency) < -0.8$ which corresponds to more than two orders of magnitude.

Thanks for your comment.