Dear Editor

We thank to the two anonymous referees and to F. Schmitt for their reading of the text. We understand that criticism is a key point of the scientific work, their suggestions have improved the manuscript and enhance the results.

We focus this letter on the points we have changed the manuscript. We have already extensively commented in the previous answers and we will not repeat all the arguments here, but perhaps some arguments will appear again. To facilitate the writing, we discriminate the modifications due to the reviewers and the comment from the discussion section. Minor revisions in style and grammar are not reported.

First Reviewer

The central topic of our paper is the search for spatial patterns using DFA of well data. We use spatial correlation analysis, k-means and Mantel-test in our methodology. In a previous paper (Ribeiro, 2010) the authors search for correlation among geophysical data, but not explore spatial analysis, which is the main topic of the present manuscript. In (Ribeiro, 2010) the correlation among geophysical data was not performed with Mantel test, neither it was in other works of the literature, so we also performed this test in our paper.

The results concerning correlation among geophysical data agree in the most with previous works. For instance, sonic and density are correlated quantities. Perhaps, as pointed out by the reviewer, the correlation between porosity and resistivity is a statistical artifact, but we think that more research with different data sets will be necessary to have a clear understanding about this issue.

The paper is about the possibility of using DFA to create spatial patterns. As just one geophysical quantity, the sonic, appears to be a good candidate to generate spatial patterns our conclusion is not a clear yes, neither a no. We use a term that not sounded scientific. We clear the text of the expression "yes without enthusiasm". Indeed, the sentences following this expression describe the results without any personal judgement.

As suggested by the reviewer we changed the place where we defined $\Delta\alpha$ in the manuscript to improve the logic structure of the text.

Second Reviewer

To make the manuscript more convincing we follow the suggestion of the second reviewer and added a new couple of figures showing the spatial distribution of **DFA** exponents. We attached to the manuscript the contour plots of the five studied variables. A visual inspection of these figures shows that sonic and density variables reveal a better spatial structure than other variables, this result is in agreement with our statistic tests.

We review the explanation of the Monte Carlo test presented at the Methodology *subsection 2.3.2*, second paragraph. We hope this change in the text will make the presentation of our randomization test more clear. The new paragraph is the following:

We use a Monte Carlo test, or a randomization test, to check if k-clusters method creates groups that are closer, in a metric sense, than groups generated by an aleatory way. We define an index Ω of neighborhood in the following way. Consider the map of the field with all wells. Over each well, we attach a geometric ball (or a disk) of radius b. The wells that are spatially closer share overlapping balls in opposition to distant wells. This schema of overlapping balls is used to measure if two wells that are in the same k-group are close or not. For all pairs of well logs we perform the computation: if the balls of two well logs overlap and belong to the same group we count $\Omega \rightarrow \Omega + 1$ otherwise we do nothing. The index Ω is normalized by the number of groups and the maximal number of elements in each k-group. After that we shuffle the well logs over the k-groups and compute $\Omega_{shuffled}$ over the shuffled data. The idea of this method is to compare if the k-groups are more distant from each other than groups chosen at random. We estimate a p-value as the probability of Ω being larger than the $\Omega_{shuffled}$ distribution.

We comment the other critics pointed out by the reviewer using topics.

- *section 1, line 18*: We changed the sentence of this line by the following:

  The **DFA** *parameter summarizes fluctuation information of a time series, this parameter is related to the autocorrelation properties and the spectrum of frequency of the data. The* **DFA** *exponent in this sense is an overall measure of its complexity.*

- *subsection 2.2*: The original algorithm to evaluate **DFA** exponent was developed by Peng et all, and it is available in C-language and Matlab. We introduced a citation in the text of the work of Peng.

- *subsection 2.2*: We changed in the manuscript: *for R the linear correlation coefficient R* and added the citation: of Sokal and Rohlf.

- We change in *section 2.3.1*, pag 17: "ordered according to distances τ. $Corr(\tau)$ is estimated as follows [Equation (4)] where the sum in equation is performed over all possible pairs Num."

- *subsection 3.1*: We computed $C(\tau)$ for $0 \leq \tau \leq 80$ by convenience. The correlation function decreases with τ until it reaches a point in which it starts oscillating around zero, a state characterized by absence of correlation. If we take very long τ we will include useless noise in the statistics. We added the following after the use of 80:

We checked that 80 *is a number large enough to* $Corr(\tau)$ *decay and start oscillating around zero.*

- Horizontal and vertical axes refer to x and y distances. We use arbitrary unities of length. For completeness it was introduced a y in the graphic and we clarified that we use arbitrary units in figure legends.

Comment of 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 focused on fractal and multifractal behavior of well log data which is a tool used in our manuscript. Because of that we shall also include 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 changed the text and called the DFA exponent an index that is similar to Hurst exponent, which is more adequate. Both techniques quantify fluctuations across several scales, but to say DFA is, indeed, a generalization of the Hurst exponent is a little bit forced.

Finaly, we performed a grammatical revision of the text, several sentences have been changed to improve the style and the fluency of the manuscript. Again, thank you for reading. And thank you for the comments.