Nonlin. Processes Geophys. Discuss.,
https://doi.org/10.5194/npg-2017-21-RC1, 2017

Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Study on connectivity mechanism and robustness of three-dimensional pore network of sandstone based on complex network theory" *by* Guannan Liu et al.

Anonymous Referee #1

Received and published: 9 August 2017

The paper by Liu et al. aims at characterizing pore networks via structural and dynamical measures derived from complex network theory. It is reported that the degree distribution of these networks resembles the ones generated by the BA model; and that the pore networks are robust against random node removals thanks to to its scale-free nature.

The study of spatial networks derived from 3D images is certainly an interesting subject, but I'm afraid the analysis presented in the manuscript is rather poor and, therefore, I do not recommend publication in NPG. In what follows, I explain the points that support this decision:

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Despite the countless metrics defined in the complex network literature, the structural characterization in the manuscript is limited to the calculation of the average shortest path length and the degree distribution. Important measures such as transitivity and assortativity are not considered in the study. Furthermore, in my opinion, the random removal of nodes does not add much in the analysis – the percolation dynamics of scale-free networks has been already extensively explored and the fact that pore networks are robust against random failures and highly sensitive to targeted attacks does not come as a surprise.

Throughout the manuscript, one notices some sentences that appear to be fundamental for the analysis but are nonetheless vague. For instance, in page 4 between lines 15 and 20, it is stated:

"In order to simplify the analysis, we removed the edges that connect the node, and we simplified the different edges that connect the two identical nodes into one edge, besides, we removed the nodes whose degree are 1 or 2 as they have no effect on the network seepage. We calculated the process of 20 data simplification such as the sides of seepage network d the power exponent γ, the mean of nodal degree $\langle k \rangle$, $P(k) \approx k^{-\gamma}$."

Since the goal of the manuscript is to carefully characterize the structure of pore networks, why is this simplification necessary? Perhaps the reason is evident for specialized audience, but anyway I believe this should be clarified for non-experts in the field.

Another odd statement is found in page 7 between lines 19 and 21:

"At the same time, the power exponent γ is between 3 to 6 whose order is similar to the average path length and the network magnitude, and they haven't change much amount four kinds of porosities."

I believe it does not make much sense to compare the order of the exponent with

average shortest path length. The same γ can yield networks with significantly different scales of L. Comparisons should be done between L and the network size N, and other metrics such as $\langle k \rangle$, assortativity, etc.

Finally, Figure 5 should have its axes displayed in log-log scale and not in linear scale with the log values; that is, show the results with P(k) and k, not in log P(k) and log k. The quality of the figures should be definitely improved too.

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