



Network models of soil porous structure

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Soils sustain life on Earth. In times of increasing anthropogenic demands on soils [1] there is growing need to seek for novel approaches to understand the relationships between the soil porous structure and specific soil functions. Recently [2-4], soil pore structure was described as a complex network of pores using spatially embedded varying fitness network model [2] or heterogeneous preferential attachment scheme [3-4], both approaches revealing the apparent scale-free topology of soils. Here, we show, using a large set of soil images of structures obtained by X-ray computed tomography that both methods predict topological similar networks of soil pore structures. Furthermore, by analyzing the node-node link correlation properties of the obtained networks we suggest an approach to quantify the complexity of soil pore structure.

- [1] R. Lal, Soil science and the carbon civilization, *Soil Sci. Soc. Am. J.*, 71: 1425-1437, 2007.
- [2] S. J. Mooney, D. Korošak, Using Complex Networks to Model Two- and Three-Dimensional Soil Porous Architecture, *Soil Sci. Soc. Am. J.*, 73: 1094-1100, 2009.
- [3] A. Santiago, J. P. Cardenas, J. C. Losada, R. M. Benito, A. M. Tarquis, F. Borondo, Multiscaling of porous soils as heterogeneous complex networks, *Nonlin. Proc. Geophys.*, 15: 893-902, 2008.
- [4] A. Santiago, R. M. Benito, An extended formalism for preferential attachment in heterogeneous complex networks, *Eur. Phys. Lett.*, 82: 58004, 2008.