Geophysical Research Abstracts
Vol. 19, EGU2017-15371, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

A framework to create a new class of pore-network models

Kirill Gerke (1,2), Xiuxiu Miao (3), Timofey Sizonenko (2), and Marina Karsanina (1)

(1) Institute of Geosphere's Dynamics of Russian Academy of Sciences , Russia (cheshik@yahoo.com), (2) Institute of Physics of the Earth of Russian Academy of Sciences, Russia, (3) Key Laboratory of High-efficient Mining and Safety of Metal Mines (Ministry of Education), University of Science and Technology Beijing, China

Modelling flow and transport on the pore-scale and parametrizing larger scale continuum flow models can be effective achieved using pore-network modelling approach. Pore-networks provide very fast computational framework and permit simulations on large volumes of pores for soils and rocks. This is possible due to significant pore space simplifications and unsophisticated relationships between effective properties and geometrical characteristics of the pore elements. To make such relationships work pore-network elements are usually simplified by circular, triangular, square, stars and some other simple shapes. However, such assumptions result in inaccurate prediction of transport properties. We propose a novel pore-network modelling framework without pore shape simplifications. To test this hypothesise we extracted 3292 2D pore element cross-sections from 3D images of sandstone and carbonate obtained using X-ray microtomography. Based on the circularity, convexity and elongation of each pore element we trained neural networks to predict the dimensionless hydraulic conductances. The optimal neural network provides 90% of predictions lying within the 20% error bounds compared against direct numerical simulation results. Our novel approach opens a completely new way to parameterize pore-networks and we outlined future improvements to create a new class of pore-network models without pore shape simplifications. In addition to this new framework and results for hydraulic conductance of pore-network elements we also discuss possible future improvements and different alternatives to create shape-less pore-network models.