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APPLICATION OF LATTICE BOLTZMANN METHOD TO MODEL FLOW THROUGH WATER SATURATED SANDSTONE

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A numeric model of non-reactive flow through naturally stratified sandstone samples is presented. This work is based on laboratory experiments in which it was established that solute migration in saturated stratified porous media was dominated by stratification. The experiment results strongly suggest that the effect of the stratification is dominant for flow parallel to the lamination in these sandstones. For flow perpendicular to stratification, the behavior is the expected for a homogeneous medium. In this work, an artificial porous media is built based on the parameters obtained from the experiment samples (sample size, grain size, and porosity). The Lattice Boltzmann method is used for modeling the flow through the samples. The aim is to use this method to compare the results from the model with the ones obtained from the laboratory experiments on real media. The sandstone modeled, consisted of a repetition of layers of i) medium-grained sand and ii) fine-grained sand. The physical properties of this structure were used as parameters to build the artificial porous media. The results from the LBM flow simulation show that when the flow is parallel to lamination, conditions arise for preferential flow, i.e., fingered flow. This instability is associated with the arrangement of grains of different sizes found in the layers. On the other hand, the model predicts uniform flow when the flow is perpendicular to stratification. It is caused by the fine-grained layers, which diffuse the fluid momentum when it moves through these layers.

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Primary authors: Mr LEÓN-ROBLES, Juvenal (Centro de Investigación Científica y de Educación Superior de Ensenada, México); Prof. CONTRERAS-PÉREZ, Juan (Centro de Investigación Científica y de Educación Superior de Ensenada, México); Prof. HERRERA, Graciela S. (Instituto de Geofísica, Universidad Nacional Autónoma de México, México); MORALES-CASIQUE, Eric (Universidad Nacional Autónoma de México)

Presenter: MORALES-CASIQUE, Eric (Universidad Nacional Autónoma de México)

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