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Influence of Particle Sizes on Solute and Heat Transport Interpretation

Ji-Young Baek[1], Byeong-Hak Park[2], and Kang-Kun Lee[1]
[1]Seoul National University, School of Earth and Environmental Sciences, Seoul, Republic of Korea (kklee@snu.ac.kr)
[2]Disposal Performance Demonstration Research Division, Korea Atomic Energy Research Institute, Daejeon, Republic of Korea

Tracer experiments have been carried out for various scales to enhance the understanding of transport processes in porous media. The comparison between multi-tracers behaviors could provide insights in using tracers for the aquifer characterization. Especially, the comparison of heat and solute transports has been drawing attention in recent studies based on the similarity of governing equations. However, the difference between influences of particle sizes on heat and solute transport processes has yet to be clarified. In this study, to investigate the impacts of mean grain size (d_{50}) difference on solute and heat transports, laboratory heat, and solute tracer experiments were conducted using two grain sizes of sand (d_{50} = 0.50, and 0.76 mm). Obtained experimental data were analyzed by mathematical models and those results were compared at 7 different flow conditions for two different mean grain sizes. Compared to other experimental data conducted with various particle sizes, normalized thermal dispersion coefficients showed a wider range of values to the different particle sizes under the same Pèclet number than normalized solute dispersion coefficients, even though the heat transport occurred in smaller Pèclet numbers. These results could indicate that the influence of particle size difference could be more critical in thermal dispersion coefficients.

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