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Matrix-fracture flow transfer in fractured porous media: experiments and simulations

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The matrix-fracture flow transfer is one of the most important characteristics of flow in fractured porous media. Matrix-fracture flow transfer experiments in fractured porous media were carried out using a self-developed experimental device and simulation. The matrix-fracture flow transfer was analyzed in fractured porous media with regular fractures and irregular fractures at different matrix-fracture pressure differences. The matrix-fracture flow transfer rate accounted for 26%~72% of the matrix inlet flow rate, and the flow transfer rate presented a nonlinear increasing trend as the matrix-fracture pressure difference increased. We have observed the influence of heterogeneous pressure and inconsistent transfer direction on flow transfer in experiments and simulations. The influence of the heterogeneous matrix-fracture pressure difference increased with increasing fracture aperture and fracture/matrix permeability ratio and decreased with increasing trace length and density. The matrix-fracture flow transfer term obtained in the experiment and simulation was analyzed using the shape factor theory and the genialized transfer model we have previously proposed. In FPM with a regular fracture distribution, the fitting effect of the shape factor model and the generalized model was approximately the same. However, in FPM with irregular fracture distribution, the flow transfer rate predicted by the generalized model was more accurate than that predicted by the shape factor model. The flow transfer rate predicted by the traditional shape factor model may have been overestimated because it ignored the effect of the heterogeneous matrix-fracture pressure difference. The findings of this study can help for better understanding of matrix-fracture flow transfer to predict groundwater flow field in naturally fractured porous media.

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References

Time Block Preference

Time Block A (09:00-12:00 CET)

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