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Application of a Multiphase Flow Code for Investigation of Influence of Capillary Pressure Parameters on Two-Phase Flow

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Abstract: We have developed a multiphase flow code that has been applied to study the behavior of non-aqueous phase liquids (NAPL) in the subsurface. We describe model formulation, discretization, and use the model for numerical investigation of sensitivity of the NAPL plume with respect to capillary parameters of the soil. In this paper the soil is assumed to be spatially homogeneous. A 2-D reference problem has been chosen and has been recomputed repeatedly with modified parameters of the Brooks–Corey capillary pressure model. In this paper we present selected figures showing the resulting plumes as well as quantitative information regarding position of the center of mass of the plume and variances (spreads) of the plume in both axes. These data allow us to evaluate influence of the capillary pressure parameters on the plume morphology in a way that has already been used for characterization of the plume distribution in laboratory experiments. Results confirm the hypothesis that capillary pressure parameters are the key quantities that determine the fate of organic contaminants in the subsurface, and emphasize the significance of the residual NAPL saturation for correct modeling of the NAPL contamination.

Keywords: two-phase flow; non-aqueous phase liquids (NAPL); control volume finite elements; capillary pressure parameters; Brooks–Corey model; plume sensitivity;

AMS Subject Classification: 65M60; 76S05; 76T99;

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