IDEALIZED MODELING OF SUBSURFACE FLOW BARRIER SENSITIVITIES

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We present a series of simple three-dimensional numerical flow models of to examine how different barrier types impact the local subsurface flow regime and head distribution. Pumping is simulated near barriers including a linear boundary (similar to image well superposition), conductive faults structure, and laterally opposing facies (i.e. sharp permeability change). For each of these scenarios, vertical barriers (90°) were compared to dipping barrier orientations (45°). Each simulation was run for a duration of 1000 h with a fully penetrating well pumping at 6.3E-03 m^3/s (100 USGPM) under confined aquifer conditions. A finite element method based multiphysics software (COMSOL) was utilized for model mesh generation and flow simulation. Transient average well drawdowns were evaluated for each run. The linear barrier models produced the most substantial average well drawdown, which is attributed to the barrier's impermeability. Opposing facies simulations produced more average drawdown at the well than their conductive fault model counterparts. The impacts of barrier dip angle in late test time were only discernible in the conductive fault model runs. Furthermore, we include preliminary examples of a simple field study analogue where both opposing facies and a conductive fault are present. Additional perturbation analyses that vary both barrier dip and well proximity are likely to provide further insights to the flow regime sensitivity.

Keywords:

numerical flow modeling, fault hydrogeology, flow barriers

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