HLWYM HEmails

From: Hakan Basagaoglu
Sent: Sunday, March 30, 2008 1:40 PM
To: Scott L Painter; Chandrika Manepally
Cc: Stuart Stothoff; chandrika.manepally@swri.org; Jude Mcmurry
Subject: RE: active fracture parameter flow vs transport

Two additional supportive information indicating that fracture-matrix interfacial area could be different for the advective flow (and transport) vs diffusive transport

1) Zhou et al. (2007, JCH, p 20):

" ... large fractures that are globally connected and flow conductingm whereas fractures with small apertures may not contribute significantly to the global flow in case of significant heterogeneoty in fracture apertures. Unlike global flow, glbal transport occures within both large globally connected fractures and small-scale fractures, leading to a large range of fractures contributing to global transport..."

This suggest that global advective flow (and hence advective transport) will occur mostly in large fractures, however, the diffusive transport could occur both in large and small-size fractures (water will be relatively slowly moving and/or immobile in small-sized fractures). Therefore, the matrix-interfacial area for the diffusive transport should be less than or equal to the matrix-fracture for the advective flow.

2) Seol et al. (2006, VZJ, p. 10).

"...The calibrated gamma values vary with flow rates and are NOT consistent with the values obtained from flow tests..."
Given that gamma values are related to the fracture-matrix interfacial area and and the number of active fractures in the system, this calibration process suggests that the matrix interfacial area for flow and transport could be different.

This is consistent with my earlier argument. Simply, thin film flow on fractures surface does not necessarily promote the advective transport across the interface (low matrix Ksat, etc), but always provides difusive pathways that may promote diffusive transport.

DOE defined their effective De in terms of matrix porosity and matrix permeability. If matrix permeability is high, then we should expect both advective and diffusive transport across the interface. But, if the matrix permability is low, but the porosity is high (clay in the extreme end), then we expect less significant/negligible advective transport but sigtnificant diffusive transport. Therefore, if fracture surface is wet but it has low Ksat, then the interfacial area is important only for the diffusive transport, but not for the advective transport. So, the interfacial area for the advective and diffusive transport should be different. The difference could be more significant if you could consider the explanations in Zhou et al. (2007)-above.

So, I certainly believe that the gamma values for the flow and transport can be different. But, recall that DOE explained this difference in terms of sensitivity analyses in their Particle Tracking AMR. However, in my opinion, their journal articles also consistent with their assumption.

Hakan

-----Original Message-----
From: hbasagaoglu [mailto:hbasagaoglu@cnwra.swri.edu]
Sent: Friday, March 28, 2008 6:33 PM
To: 'Scott L Painter'; 'Chandrika Manepally'

Cc: 'Stuart Stothoff'; 'chandrika.manepally@swri.org'; Jude McMurry
Subject: active fracture parameter flow vs transport

I should confess that resorting to "zero capillary gradient across the interface" was misleading and confusing in my argument for the point I wanted to make.

Having said this, however, I still believe that the matrix-fracture interfacial area for the advective transport (interflow btw fracture and matrix) should be less than or equal to the the fracture-matrix interfacial are for the diffusive transport . Because, wet fracture-matrix interfacial area (e.g. film flow on fracture walls) may not necessarily promote advective (interflow) transport (across the interface), but it does promote diffusive transport across the interface. For example, if the matrix permeability is very very low near fracture-matrix interface, there wont be (or very negligible) advective transport of RNs from fracture to matrix (or vice versa) even for non-negative capillary gradient at the fracture-matrix interface. On the other hand, water films on the fracture walls will promote the diffusive transport of RN across the interface. Therefore, interfacial area for the advective trasnport will be <= interfacial area for the diffusive transport.

Hakan

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