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Hydrology and Earth System Sciences Discussions

Interactive comment on "Evidence of non-Darcy flow and non-Fickian transport in fractured media at laboratory scale" *by* C. Cherubini et al.

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It is not clear if and how the 3D aperture distribution was obtained. please elaborate 'The characteristics of each fracture have been determined only from its trace on block surface.'

222,17 0.8m must be 0.08m The number has been corrected

230,16 equation no. 10 must be 12 and subsequent numbers are all shifted The equation number has been corrected

233,14 please show "a" and "b' in the figure a and b have been shown in the figure

234,16 define Q Q has been defined

237,24 Bodin et al. 2007 not in the reference list Bodin et al has been added in the reference list

237,25 the cause may be because there are two paths for tracer? The presence of 'a late peak' has been explained as probably caused by the presence of a second 'delayed' flowpath

238,10 please explain how the normalized plot is obtained In order to simplify the calculation of the analytical solutions a unit length for the one-dimensional domain has been assumed. It is therefore necessary to normalize the parameters v and D so they both have units of (T-1). To obtain the normalized values of v and D, it is simply necessary to divide them by L and L2 respectively

That the flow was non-Darcy is not surprising given the gradient and the permeability of the fractures. The hydraulic gradient imposed is useful to reach transitional flow regime in the media. 'Considering the height of the block equal to 0.08 m the viscous term is larger than the inertial one as long as 77e-6 m2s-1. This specific discharge is of the same order of magnitude as the one found by Qian et al (2011) in a filled single fracture (0.250 m height).' It's clear that in natural condition low hydraulic gradients are detectable and inertial effects are negligible. However anthropogenic stresses generally give rise to high hydraulic gradients and consequently inertial forces cannot be neglected. 'Generally in highly fractured aquifers under natural conditions low hydraulic gradients are detectable and inertial characteristics of the flow field can be negligible. Anthropogenic stresses in the aquifer such as pumping and recharge scenarios give rise to high hydraulic gradients and consequently the impact of the inertial effect cannot be neglected. Pumping tests with multiple pressure steps should be used for a more accurate identification of the range of validity of the Darcian – type relationship and for the quantification of linear and nonlinear flow relations.' The effects of non Darcian flow have been interpreted in terms of effects on solute transport as regards advection, dispersion and limited mass transfer phenomena. 'the presence of the transitional flow regime leads to a delay on solute transport with respect to the

values that can be obtained under the assumption of a linear flow field' 'While the presence of a transitional flow regime affects the velocity field, it seems not to exert influence on the behavior of dispersion.' 'Moreover the presence of transitional flow regime contributes to enhance the non – equilibrium effects.'

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/10/C633/2013/hessd-10-C633-2013-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 221, 2013.