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A simplified approach for evaluating transversal dispersion coefficient

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Pore-scale transversal dispersion has been identified as a key factor in the dilution of solutes and mixing of reactants in porous media (Kitanidis (1994), Oya and Valocchi (1998), Fiori and Dagan (2000)). In steady state potential flow fields, local transversal dispersion is the main process exchanging solute mass between fast and slow stream tubes. Whereas the spatial variability of advective velocities leads to highly irregular concentration fronts, transversal dispersion causes a smoothing effect. At the large time limit, transversal dispersion eliminates the concentration variance, and the description of solute transport by macroscopic uniform parameters becomes accurate even for initially small plumes in heterogeneous fields (Kapoor and Gelhar (1994)). In laboratory studies, the experimental identification of transversal dispersion is not a very developed subject; in this work we propose a simplified method for identifying transversal dispersion coefficient in laboratory experiments, based on the analytical solution of an impulsive injection of a non reactive solute in a soil column (cylindrical geometry) packed with a homogeneous porous medium. This technique is a fashionable way in order to save a great amount of time and in case the experimenter has at command a limited budget. A first-order approximation analytical solution based on Taylor series expansion for the estimating coefficient is supplied. The transversal dispersion coefficient is evaluated with a simple formula containing information on the boundary conditions, the domain geometry and on two points concentration measurements. The solute transport is supposed two-dimensional, whereas the hydraulic flow is unidirectional with a uniform velocity. The identification method is based on the measurement of concentration of one pair of points and the stability of the method, with respect to concentration measurement errors, is analyzed to assess the reliability of the transversal dispersion estimate, under a Bayesian approach. Furthermore, we

evaluate the modelling error, in comparison to classical parameter estimation problem based on many measurement points and we infer some information about the benchmarking of these two methods.