XVIII International Conference on Water Resources
CMWR 2010
J. Carrera (Ed)
CIMNE, Barcelona 2010

NUMERICAL UPSCALED MODEL OF TRANSPORT WITH NON-SEPARATED SCALES

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Summary. We show numerical results for a new model describing the multiscale flow of a single-phase incompressible fluid and transport of a dissolved chemical by advection and diffusion through a heterogeneous porous medium without the usual assumptions of scale separation. The model was developed theoretically by Peszyńska and Showalter (2007) and originally motivated by experimental work by Zinn et al. (2004) which provides a unique testbed for multiscale modeling in the presence of not well separated scales. The new model includes as special cases the classical homogenized model as well as the double porosity models, but it is characterized by presence of additional memory terms that describe the effects of local advective transport as well as diffusion. We discuss numerical discretizations and present numerical results to show the quantitative significance of each memory term in different regimes of flow and transport.