

Derivation of Conditions Describing Transport Across Zones of Reduced Dynamics Within Multiphase Systems

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Equations for describing flow and transport in multiphase systems can be derived within the context of averaging theory. In some subsurface systems, the balance equations must be three dimensional in one portion of a domain of interest but need be only one or two dimensional in other regions (e.g., across clay lenses or within fractures). Conditions linking the dynamic processes among the different regions are typically obtained heuristically. Here a general framework is presented within which the needed conditions may be derived systematically. Particular conditions for mass, momentum, chemical species, and heat transfer are illustrated between main porous media domains and both a permeable fracture and a semipermeable layer.