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A COMBINED DETERMINISTIC/STOCHASTIC APPROACH TO MULTI-SCALE, NONSTATIONARY ALLUVIAL AQUIFER CHARACTERIZATION

Modeling groundwater flow and contaminant transport in highly heterogeneous alluvial aquifers requires combining conceptual geological tools with numerical modeling techniques. Our approach incorporates detailed stratigraphic evaluation with transition probability geostatistics to develop characterizations of stream-dominated alluvial fan aquifers. An advantage of this method is that it allows modeling of heterogeneity at several scales. Our approach uses sequence stratigraphic concepts, developed for the alluvial fan setting, to (1) delineate large-scale stratigraphic units in the alluvial aquifer, (2) predict overall facies patterns in the aquifer, and (3) guide development of appropriate Markov chain models used in transition probability geostatistics within the stratigraphic framework. Application of stratigraphic models developed through this approach in groundwater flow and contaminant transport simulation allows us to reasonably match groundwater ages from environmental tracer data (e.g., CFCs), assess aquifer test results in heterogeneous media, and assess the influence of various portions of the stratigraphic system on groundwater flow and contaminant transport. To illustrate this approach, we present applications from the Kings River alluvial fan, located southeast of Fresno, California, and at the Lawrence Livermore National Laboratory site (LLNL), located in Livermore, California.