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Improving Water Management of Complex Fractured Aquifer Watersheds Using Low Cost Field Data

Fractured aquifer watersheds serve as primary water resources throughout many areas of the United States. Fluid movement is controlled by a complex network of fractured rock which impedes accurate simulation of flow and transport. Fueled by cyclic fluctuations of drought and increased water demands due to population increase, it is important to develop cost effective, practical techniques to guide sustainable fractured aquifer management. Developing appropriate management guidelines requires understanding of aquifer response to hydrologic stress, specific to each watershed. Direct characterization of fracture flow systems includes collecting subsurface data at a fine spatial resolution, throughout the region of interest. However, high-resolution data collection at the watershed scale is cost prohibitive for local communities, and not a viable option. Lower cost alternatives must be implemented to guide credible water management. This project evaluates the hypothesis that low cost field data can delineate the scale at which fracture architecture can be represented as a continuum (representative elementary volume), eliminating the need for detailed fracture measurements to simulate fluid movement at the watershed scale. Once the REV can be determined inexpensively, each community can guide credible water management decisions using simple equivalent continuum simulators. Our effort combines laboratory experiments, geophysical imaging, geochemical and geostatistical analyses.