



Controlling Scaling Metrics towards Improved Characterization of Well-Head Protection Regions

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We address the value of hydrogeological information on risk as a function of several characteristic length scales that define groundwater flow and transport in the presence of a pumping well. Modeling aquifer heterogeneity through a random hydraulic conductivity spatial distribution renders uncertain transport predictions and shape and extent of the well capture zone. Improvement in the delineation of the well region of influence and reduction of the uncertainty associated with transport predictions is typically performed by means of hydrogeological sampling campaigns. Here, we focus on the assessment of the impact of hydrogeological data acquisition on the reduction of uncertainty linked to the environmental scenario analyzed. We investigate the significance of the amount of available hydrogeological measurements to yield predictions at an acceptable level of uncertainty of (a) contaminant capture by the well and (b) adverse health effects due to exposure of population. We do so by elucidating the role of the main (dimensionless) length scales that characterize and control the well capture zone and its delineation.