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Experimental Design Considerations for Estimating Flow Parameters with GPR and Hydrological Measurements

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Abstract: Using a method recently developed in our group for estimating flow parameter distributions in the vadose zone with transient ground-penetrating radar (GPR) data (such as travel times or inferred values of water saturation) and hydrological data, we investigate various issues of experimental design for parameter estimation. Specifically, an extension of the pilot point method was recently implemented in the iTOUGH2 software (Finsterle, 1999) so that GPR measurements collected during a transient flow event could be used to estimate distributions of flow parameters (Kowalsky et al., 2003). Using this approach, we examine the impact that ponding conditions, temporal sampling strategies, increasing degrees of soil heterogeneity, and varying soil characteristics have on parameter estimation uncertainty.