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Reducing hydrograph uncertainty through subsurface characterization

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Abstract Subsurface heterogeneity in saturated hydraulic conductivity is one of the largest sources of uncertainty in hydrology and hydrogeology. However, recent work has demonstrated that uncertainty in hydraulic conductivity can also impart significant uncertainty in runoff processes. Here, the role of site characterization in reducing hydrograph uncertainty and bias is demonstrated numerically. A fully integrated hydrologic model is used in a hypothetical experiment where a control hillslope is generated using correlated, Gaussian random fields. Direct measurements of hydraulic conductivity at varying density are obtained from this control simulation and assimilated into stochastic transient simulations. The hydrographs, resulting from integrated flow simulations for each realization, are shown to much more accurately match the control. Data assimilation resolves large-scale features in surface ponding and saturation. This implies that substantial reduction in hydrograph uncertainty may be reached through site characterization.

Key words conditioning; groundwater surface water interactions; hillslope; runoff generation