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The Agricultural Ecosystems Services (AgES) watershed model is used to estimate the spatial complexity of soil hydraulic properties in a field-scale agricultural watershed, Colorado, USA

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Soil hydraulic properties that control water storage flow rates can vary markedly in space, and surface layers may vary temporally due to management events, reconsolidation and biological activity. Field measurements are expensive to collect and generally reveal complex variability that is difficult to fully characterize. Yet, these soil properties are represented using model parameters that may strongly affect simulated flows and the distribution of soil water in space and time. Thus model calibration using available measurements of soil moisture and surface runoff is essential. Here, we address the level of calibration detail needed to estimate available data by using five levels of spatial complexity in the calibrated soil parameters. Results are also explored to address issues of spatial scaling. Furthermore, a new model component of temporal changes in soil porosity and saturated hydraulic conductivity is tested to simulate effects of tillage and soil consolidation related to rainfall. Interactions between spatial and temporal parameters and processes will be discussed in terms of their influences on simulated soil moisture patterns and surface runoff. Non-uniqueness of the estimated parameter sets is recognized, but further work is needed to better quantify the information content of data needed to infer unique space-time patterns of the estimated soil hydraulic properties.

Keywords: Soil hydraulic properties, spatial variability, agricultural watershed, temporal dynamics

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