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Development of a simulation of the surficial groundwater system for the contiguous United States

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Water resource and environmental managers across the United States face a variety of questions involving groundwater availability and/or groundwater transport pathways. Emerging management questions require prediction of groundwater response to changing climate regimes (e.g., how drought-induced water-table recession may degrade near-stream vegetation and result in increased wildfire risks), while existing questions can require identification of current groundwater contributions to surface water (e.g., groundwater linkages between landscape contaminant inputs and receiving streams may help explain in-stream phenomena such as fish intersex). At present, no simulation tools with coverage of the entire contiguous United States (CONUS) exist to help characterize groundwater contributions to receiving streams and predict potential changes in base-flow regimes under changing climate conditions. We will describe the Phase 1 development of a simulation of the water table and shallow groundwater system for the CONUS. We are beginning by using only CONUS-extent datasets such as the National Recharge Map and the Map Database for Surficial Materials to develop groundwater flow (MODFLOW) and transport (MODPATH) models that are calibrated against groundwater level and stream elevation data from the National Water Information System and the National Hydrography Dataset, respectively, in addition to environmental tracer information. Phase 1 includes the development of a transmissivity map for the surficial groundwater system and examines the impact of model-grid resolution on the simulated steady-state discharge network (and associated recharge areas) and base-flow travel time distributions for different scales. Subsequent phases of this work will simulate water table changes at a monthly time step and serve as a critical complement to surface-water-focused efforts by the United States Geological Survey to provide CONUS-scale hydrologic modeling and prediction tools.