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INTEGRATED HYDROLOGICAL MODELING OF THE GREATER SAN JOAQUIN RIVER BASIN OF CALIFORNIA USING COUPLED GROUNDWATER-LAND-SURFACE ATMOSPHERIC MODELS.

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Summary. By modifying the amounts of sensible and latent heat available to drive atmospheric boundary layer dynamics, soil moisture variability can substantially modify winds and wind shear in the lower atmosphere. Soil moisture in turn depends on groundwater flow as well as atmospheric forcing. Simulations using coupled models, including a variably-saturated groundwater flow model (ParFlow) and a mesoscale atmospheric model (WRF), allow examination of the effects of soil moisture heterogeneity on atmospheric boundary layer processes. This parallel, integrated model can simulate spatial variations in land surface forcing driven by three-dimensional (3D) atmospheric and subsurface components. The purpose of the study focuses on investigation of the interaction between the surface and groundwater hydrology under current and future climate conditions in the region.

Test cases are presented with both a fully-coupled model (which includes 3D groundwater flow and surface water routing) and the uncoupled atmospheric model. The effects of the different soil moisture initializations and lateral subsurface and surface water flow are seen in the differences in atmospheric evolution, boundary layer and wind and wind shear.

Finally, we present work that leads toward an intercomparison study assessing the impact of heterogeneous and time-dependent soil moisture forcing on an integrated land surface, surface water flow, and three dimensional, variably saturated subsurface flow model over the greater San Joaquin River Basin (Central Valley and upper watershed areas), California. The overall

domain encompasses the entire watershed for the San Joaquin River, including a large portion of the Central Valley proper and upper watersheds extending into the neighboring Sierra Nevada and Coastal Ranges. The domain area is 270 km x 220 km and is discretized with a lateral spatial resolution of 1km x 1km. The vertical extent of the domain depth ranges from a low point at approximately 500m below sea level in the valley up to the top of the Sierra Nevada Range (at 3,800m above sea level). A fixed depth of 500-m below the land surface was used to simulate the groundwater processes with a vertical resolution of 1m and total number of 29.7 M nodes.

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