Applying inverse modeling techniques to regional ground water models of the Lower Arkansas River Valley

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Abstract. Regional-scale ground water flow and mass transport models have been developed and initially calibrated for the Lower Arkansas River Valley (LARV) to assist in determining the areal extent and severity of waterlogging and salinization problems, as well as in exploring the potential benefits from improved water management and infrastructure strategies. Together, the modeled regions constitute a total area of 105,600 ha (261,000 acres), containing roughly half of the irrigated lands between Pueblo, Colorado and the Colorado-Kansas border. Due to the large areal footprint of the modeled regions and the nature of irrigated alluvial deposits, extensive variability exists in the required model input datasets. Increased computing power and software functionality has led to the refinement of the ground water models developed for the LARV. The most notable refinements include: 1) adoption of the new Unsaturated Zone Flow (UZF1) package developed for MODFLOW-2005, replacing the recharge (RCH) and evapotranspiration (ET) packages, 2) spatially-varying estimates of precipitation and potential ET in place of uniform estimates for each region, 3) increased land and crop classification categories to more accurately account for actual ET and, 4) and improved accuracy in the timing of seepage losses from earthen canals. Work is currently underway to use the inverse modeling program UCODE_2005 to manipulate selected model parameters using ordinary kriging to calibrate the refined models. Local sensitivity analysis metrics calculated by UCODE_2005 will guide refinement of the inverse modeling procedure. Whereas the original models developed for the LARV relied solely upon ground water head observations to achieve calibration, flow measurements in the stream-canal network of the Arkansas River will be used in addition to head observations to calibrate subsurface return flows to surface water features. Parameters slated for estimation initially include hydraulic conductivity, specific yield, specific storage, and conductance (controlling seepage) along earthen canals. Future addition of a solute transport model will add to the list of parameters to be estimated. The calibrated models will serve as the new baseline from which the effectiveness of alternative water management and infrastructure strategies will be evaluated.

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