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ABSTRACT

Data Intensive Simulation and Analysis of Groundwater Flow and Transport in the Los Alamos aquifer

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Characterization of the groundwater flow and transport in regional aquifer systems is a challenging task. In most practical cases, there is not sufficient hydrogeologic information that can be applied to evaluate aquifer properties. In addition, the development, execution and analyses of large-scale numerical models are computational demanding requiring advanced high-performance codes and state-of-the-art computational resources. We have developed a complex 3D regional groundwater flow model of the regional aquifer beneath the Los Alamos National Laboratory (LANL) site to provide a better understanding of hydrogeologic properties, recharge sources, groundwater travel times, migration pathways for potential contaminants, and potential contaminant concentrations at water supply wells. The 3D computational grid is generated using sophisticated grid generating software, LaGriT (http://lagrit.lanl.gov). LaGriT allows the use of unstructured meshing strategies, which capture the details of complex groundwater flow of the LANL site, including wellbore geometries and hydrostratigraphy. The numerical simulation is performed using the FEHM (Finite Element Heat and Mass transfer) (http://fehm.lanl.gov) and AMANZI (http://ascemdoe.org) codes. Long-term groundwater level monitoring at LANL started in the mid-1940s; the monitoring data is currently collected at more than 70 regional monitoring wells providing an extensive water-level observation data set. The water-level data represent over 62 years of recorded drawdowns and recovery caused by the spatially and temporally variable pumping at six municipal water-supply wells. The water-level data is applied in the 3D flow model to inversely estimate the aquifer parameters. The model calibration, uncertainty quantification, and sensitivity analyses are

performed using the code MADS (Model Analyses and Decision Support; http://ees.lanl.gov/staff/monty/codes/mads). The research utilizes high performance computational resources (multiprocessor clusters) at LANL. In this study, we present the challenges of model development, lessons learned, and insights provided by the model into the LANL aquifer.