THE ROLE OF PARAMETER ESTIMATION AND UNCERTAINTY ANALYSIS IN USING MODELS TO DEVELOP STRATEGIES FOR SUSTAINABLE USE OF GROUNDWATER RESOURCES

Velimir Vesselinov, Elizabeth Keating, Charlie Nylander
Los Alamos National Laboratory, Los Alamos, NM

Velimir V Vesselinov; Hydrology, Geochemistry, and Geology Group
Earth and Environmental Sciences Division, Los Alamos National Laboratory
EES-6, MS T003, Los Alamos NM 87545
Tel: 505 665 1458, monty@mpython.lanl.gov

ABSTRACT

Groundwaters are an important source for drinking water supply and their sustainable use is of high importance for our society. Mathematical models are commonly applied to better understand the mechanisms of recharge and discharge of groundwater resources. There is frequently pressure to develop complex models that take into account the many significant number of processes controlling aquifer behavior and are capable to reproduce complex hydrologic datasets. As a result these models typically include many model parameters, some of which may be quite uncertain and even impossible to measure independently. Consequently, model predictions of "sustainable use" may be quite uncertain. Even worse, the relation between parameter uncertainty and prediction uncertainty is difficult to quantify and is frequently ignored. There is a tendency for this problem to worsen with increasing model complexity. By applying principles of inverse analysis, it is possible to minimize the degree of model complexity that is necessary to explain important hydrologic datasets, a process which in general will also reduce the degree of uncertainty associated with model predictions. Furthermore, these analyses highlight those types of data collection that will most efficiently reduce predictive uncertainty in the future. We are applying these techniques to predictions of groundwater recharge and discharge in a semi-arid basin in northern New Mexico. Our results highlight those aspects of hydrostratigraphy that are most important to characterize and locations where additional head data would best reduce predictive uncertainty.