Reducing the Hydrologic and Geochemical Uncertainty for Modeling Uranium Migration at the Hanford 300 Area by Assimilating Multi-scale and Multi-type Data

Hanford IFRC (Principal Investigator: John Zachara)

X. Chen* (PI), G. Hammond, C. Murray, J. Zachara—PNNL

In modeling the uranium migration within the Integrated Field Research Challenge (IFRC) site at the Hanford 300 Area, uncertainties arise from both hydrologic and geochemical sources. The hydrologic uncertainty includes the transient flow boundary conditions induced by dynamic variations in Columbia River stage and the underlying heterogeneous hydraulic conductivity field, while the geochemical uncertainty is a result of limited knowledge of the geochemical reaction processes and parameters at the field scale, as well as heterogeneity in uranium source terms. In this work, multiple types of data are sequentially assimilated across scales to reduce the hydrologic uncertainty, including the results from constant-injection tests, borehole flowmeter profiling, and conservative tracer tests. The hydrologic data assimilation is followed by geochemical data assimilation, which is conditioned on point measurements of sorbed uranium in the water table smear zone and uranium breakthrough curves from a desorption test that took place at high spring water table. Ensemble-based data assimilation techniques are used in our study, and their computational demand is managed by using the multi-realization capability within the parallel PFLOTRAN simulator.

*Xingyuan.chen@pnnl.gov