Models – Repositories of Knowledge
(Proceedings ModelCARE2011 held at Leipzig, Germany, in September 2011) (IAHS Publ. 355, 2012), 141-148.

Using streamlines for highly-resolved, reactive transport for CO_2 leakage contamination in groundwater

ADAM L. ATCHLEY[1,3], REED M. MAXWELL[1,3], ALEXIS NAVARRE-SITCHLER[2,3], ERICA R. SIIRLA[1,3] & JOHN E McCRAY[2]

1 Department of Geology & Geological Engineering, 2 Environmental Science & Engineering Division, 3 Hydrological Science & Engineering, Colorado School of Mines, Golden, Colorado 80401, USA
aatchley@mines.edu

Abstract We present a Lagrangian streamline approach where a large, heterogeneous 3D flow field is reduced to a number of 1D transport simulations. The streamline approach allows the mapping of these 1D reactive transport simulations back onto a 3D flow field, thus accounting for spatial heterogeneity within the aquifer and complex aqueous geochemical processes. A CO_2 leakage scenario from a hypothetical CCS site is used where a resulting plume of CO_2 lowers the groundwater pH and mobilizes metals from an existing mineral host-rock distribution. The plume migration and related metal dissolution and precipitation within the aquifer were simulated using this streamline-geochemical modelling approach under varying hydrological heterogeneity variances (σ^2_{lnK}). Results showed that heterogeneity significantly influences well contamination and geochemical processes.

Key words reactive transport; uncertainty analysis; carbon capture and storage