



## **An adaptive hybrid EnKF-OI scheme for efficient state-parameter estimation of reactive contaminant transport models**

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Reactive contaminant transport models are used by hydrologists to simulate and study the migration and fate of industrial waste in subsurface aquifers. Accurate transport modeling of such waste requires clear understanding of the system's parameters, such as sorption and biodegradation. In this study, we present an efficient sequential data assimilation scheme that computes accurate estimates of aquifer contamination and spatially variable sorption coefficients. This assimilation scheme is based on a hybrid formulation of the ensemble Kalman filter (EnKF) and optimal interpolation (OI) in which solute concentration measurements are assimilated via a recursive dual estimation of sorption coefficients and contaminant state variables.

This hybrid EnKF-OI scheme is used to mitigate background covariance limitations due to ensemble under-sampling and neglected model errors. Numerical experiments are conducted with a two-dimensional synthetic aquifer in which cobalt-60, a radioactive contaminant, is leached in a saturated heterogeneous clayey sandstone zone. Assimilation experiments are investigated under different settings and sources of model and observational errors. Our results suggest that the proposed scheme allows a reduction of around 80% of the ensemble size as compared to the standard EnKF scheme.