HYDROSCAPE: A new versatile software program for predicting contaminant transport in groundwater

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Understanding how contaminants are transported in the subsurface is a major problem in hydrogeology. To help resolve the uncertainties associated with groundwater transport, complex numerical models are often used to predict how a contaminant plume evolves through time. However, numerical simulations can be costly and time consuming. Analytical solutions to the advection-dispersion equation (ADE), a partial differential equation that governs solute movement in groundwater, are invaluable for rapid and inexpensive assessments of contaminant scenarios and for verifying numerical models. These solutions often require simplified representations of the aquifer (homogeneous) and source region (constant concentration throughout time) which restrict their applicability to real systems. Although useful, many of these solutions are also not explicitly coded into user-friendly programs which would promote their broader use by professionals.

HYDROSCAPE is a new, easy-to-use software program that produces high quality outputs, including contour maps of the plume, breakthrough curves at user-defined points, concentration profiles along arbitrary transects, and videos of plume evolution. HYDROSCAPE contains a large library of analytical solutions to the ADE, including multi-dimensional solutions, discrete and continuous mass inputs, finite aquifers, and a variety of chemical reactions, to allow hydrogeologists to easily choose, compute and compare various groundwater contaminant scenarios. HYDROSCAPE also includes a parameter estimator and sensitivity analysis routine for inverse modelling.

HYDROSCAPE also includes a number of "advanced features", which relax the simplifications of most analytical solutions. These features include spatial concentration variations within the source region, user-defined arbitrary source functions and geometries, and allowing simple, horizontal, planar geology. Although some restrictions still exist, by relaxing the source region and geology simplifications, HYDROSCAPE can be applied quickly and easily to a wide variety of reasonably complex contaminant transport scenarios.

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