Long-Time Simulation of Nuclear Waste Transport

Scientific Achievement

We developed a new Eulerian-Lagrangian method that can be more accurate and efficient than competing methods in certain long-time simulations involving the underground leakage of radionuclide wastes.

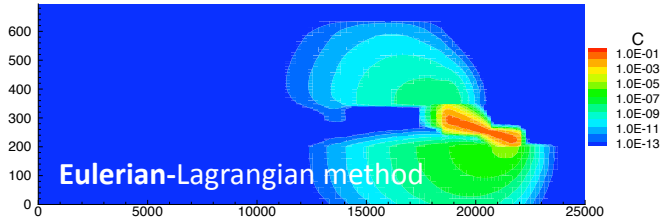
Significance and Impact

Enables accurate assessment of risk to public health through the understanding and prediction of the fate of radionuclides in the subsurface environment.

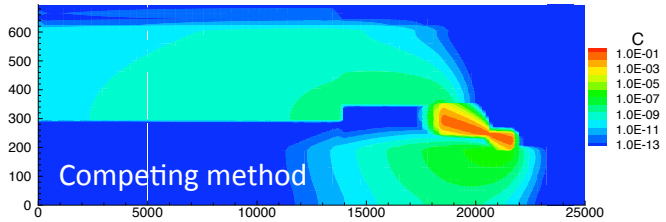
Research Details

– Both mass and volume are preserved, so
  - small concentrations are not lost in the computation
  - and reaction dynamics can be computed accurately.

– The simulation can use much longer time steps, resulting in
  - less *numerical diffusion* (i.e., unphysical spreading of a contaminant plume, such as leakage from a repository shown in the figures at 250,000 years of simulation)
  - and much less computational time to complete the one million year simulation.



Accurate simulation



Excessive numerical diffusion

T. Arbogast and W. Wang, *Stability, Monotonicity, Maximum and Minimum Principles, and Implementation of the Volume Corrected Characteristic Method,* SIAM Journal on Scientific Computing 33, 2011, pp. 1549-1573.

U.S. DEPARTMENT OF ENERGY | Office of Science
TEXAS
Sandia National Laboratories
CFSES