Anthony D LaFleur* (alafleur@unr.nevada.edu). A fast characteristic finite difference method for fractional advection-diffusion equations with non-linear reaction.

Contaminant transport in porous media can be modeled with fractional differential equations. This approach results in early arrival of contaminants and heavy-tail distributions observed in field experiments. The fractional advection-diffusion equation discretized by the implicit finite difference scheme and with the shifted Grunwald approximation is unconditionally stable. We add an additional non-linear, Lipschitz continuous term to account for reactions and we solve the advection-diffusion equation utilizing fast Toeplitz matrix-vector multiplication. We then extend the method to the two-dimensional case. Numerical results are provided to compare performance of the methods proposed. (Received February 23, 2015)