# Modelling Reactive Pollutant Transport in Sensitive Ecologies: The case of two species in Groundwater.

**Hans Tah Mbah**

*Institute for Groundwater Studies, University of the Free State, Bloemfontein, 9301, South Africa*

*mbah.ht@ufs.ac.za*

Fractured geological formations amplify the risk of groundwater contamination, due to accelerated transport and mixing of reactive pollutant fluxes from diverse sources (landfills, industrial and leachate from mine tailings). The mixing of pollutants, within and across intersecting fractures is a complex reactive transport process that requires innovative approaches to accurately predict local and regional scale contaminant behavior. In this study, we extend the traditional advection-dispersion model to account for geochemical reactions within the heterogeneously fractured media. By coupling the homogenous (pre-mixing) with a heterogenous (post-mixing) transport scenarios, we introduce a new model to describe the dynamic behavior between two pollutant species. The numerical solutions obtained are based on the Crank-Nicolson discretization scheme, with fully established numerical stability conditions. The new model illustrates how chemical reactions, including adsorption and precipitation, can significantly attenuate contaminant plume spread in fractured media. The model's ability to predict the fate of each species, highlights its potential as a tool for monitoring and sustainable management of groundwater quality, particularly in areas with high concentration of industrial and mining activities. By providing insight into the reactive dynamics in fractured acquirers, the model brings a valuable addition to remediation frameworks as a robust tool for predicting contaminant spread in fractured media.