GLY 4822, Assignment 8: Abbreviated Version

1. Starting from *Mass In – Mass Out = Change in Stored Mass per Unit Time*, derive the 1-D ADE.

2. Derive an explicit finite difference expression for the 1-D ADE.

3. Use the measured flow, the cross-sectional area of the column, and an estimated porosity to compute the estimated mean pore water velocity.

4. You can use the rule-of-thumb $a = 0.1 * L_{max}$, where α is the dispersivity and L_{max} is the length of the full column to estimate the dispersivity, which in simplistic terms, is a predictor or the effect of the porous medium on the spreading of the chemical. Then use the approximate relation $D = \alpha v$ to estimate the dispersion coefficient.

5. Refer to the on-line video (https://drive.google.com/file/d/0B4cL0GnLSiwBUEVRUTlsVmJYRVU/view?usp=sharing) and process the data file BTC394.PRN (available at https://drive.google.com/open?id=148smoM_kqOB4q2MhxMLPDFsIJk4_xiI8) for the column salt breakthrough to obtain time in seconds with $t = 0$ at the start.

6. Analyze the curve as follows:

   - Use an Excel spreadsheet solution of the explicit finite difference expression and approximately fit the simulation to the data by varying the dispersion coefficient and the velocity.
   - It will be convenient to change the initial condition to the starting 'concentration' (actually volts reported by the data logger) and the left-hand side boundary condition to something like 0.65 – which looks like about where the curve would have leveled off if we had let it run long enough.

7. Compare and contrast your pre- and post-experiment estimates of the dispersion coefficient, dispersivity, porosity, and velocity. Propose a new estimated porosity and dispersivity based on the experimental results.