Hydrobiological Modelling

Assignment 3

A 20m long pipe with cross sectional area 1m² containing water has a dye injected midway along its length. If 10g of dye are released per second, modify the diffuse.f90 program to plot the dye concentration to the right of the injection point for 4 metres at 0.1m intervals for 10 second, 20 seconds and 50 seconds after initiation of injection, assuming D = 0.1. Your code must use an implicit method of solution.

You should read in your notes the method of handling the Neumann condition for the explicit method (using the imaginary node at x=-delta x).

For the implicit method this will enable you to set up an equation at node =0, which must be added at the top of the matrix which is sent to tridi for solution. Note that this will require a little adjustment to dimensions of the matrix components and the loops in tridi.

Download the Matlab code from my web page.

Compare your results with the particle tracking model part1.m. Experiment with the number of particles used in the particle tracking model.

Report on the following:
1. The boundary conditions used in diffuse.f90 - describe in detail how you developed them and what assumptions have been made. Show the code changes made. (5 Marks)
2. Test your code against a known solution - e.g.a figure in your notes - report on your comparison. (2 Marks)
3. Explain how the Matlab code works. Include a flow chart of the Matlab code. (4 Marks)
4. Run the Matlab code using different numbers of particles. Discuss the accuracy of the model. Compare the results with your finite difference code. (3 Marks)
5. Modify the Matlab code to produce a scatter plot of the particle positions. (3 Marks)

3 Marks will be given for quality of report presentation.

Brian Williams