Lab 2: MATLAB Programming
Assigned on 9/22/2015 and Due on 10/1/2015

Question 1: Essay writing (10 points)

Watch the video available at the link below for speeding up MATLAB applications. Write a review that is no longer than two single-spaced, typed pages with normal font and margins. The review should identify what you have learned from watching the video. You may also list the techniques that you have known and those you learned for the first time from the video.

http://www.mathworks.com/videos/speeding-up-matlab-applications-81729.html?form_seq=conf1134&elqsid=1441902641887&potential_use=Education&country_code=US

If the link does not work, search for the video entitled "Speeding Up MATLAB Applications"

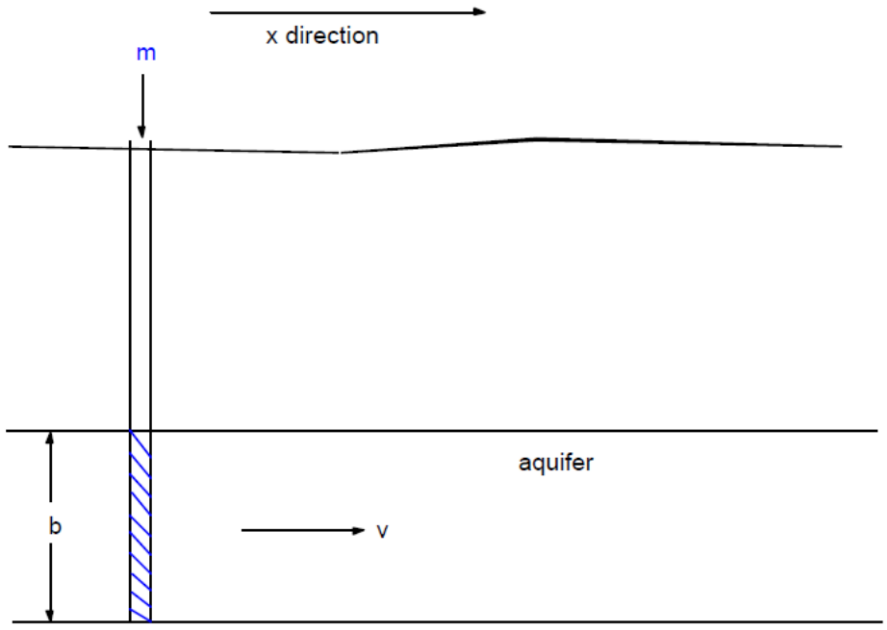
Question 2: Groundwater transport modeling (30 points + 10 bonus points)

Consider a problem involving transport of a non-reactive contaminant with advection and dispersion in a homogeneous aquifer with average pore velocity *v*. A mass *m* of contaminant is assumed to be injected instantaneously into an extensive aquifer of thickness *b*. The contaminant transport is controlled by the flow velocity *v* and dispersion (determined by the dispersion coefficients, D_x and D_y, of the contaminant) through the governing equation

$$\frac{\partial c}{\partial t} = D_x \frac{\partial^2 c}{\partial x^2} + D_y \frac{\partial^2 c}{\partial y^2} - v\frac{\partial c}{\partial x}$$

where *c* is concentration. For infinite domain and zero initial concentration, the analytical solution to the equation for this case is

$$c(x, y, t) = \frac{m/b}{4\pi t\sqrt{D_x D_y}} \exp\left(-\frac{(x - vt)^2}{4D_x t} - \frac{y^2}{4D_y t} \right)$$

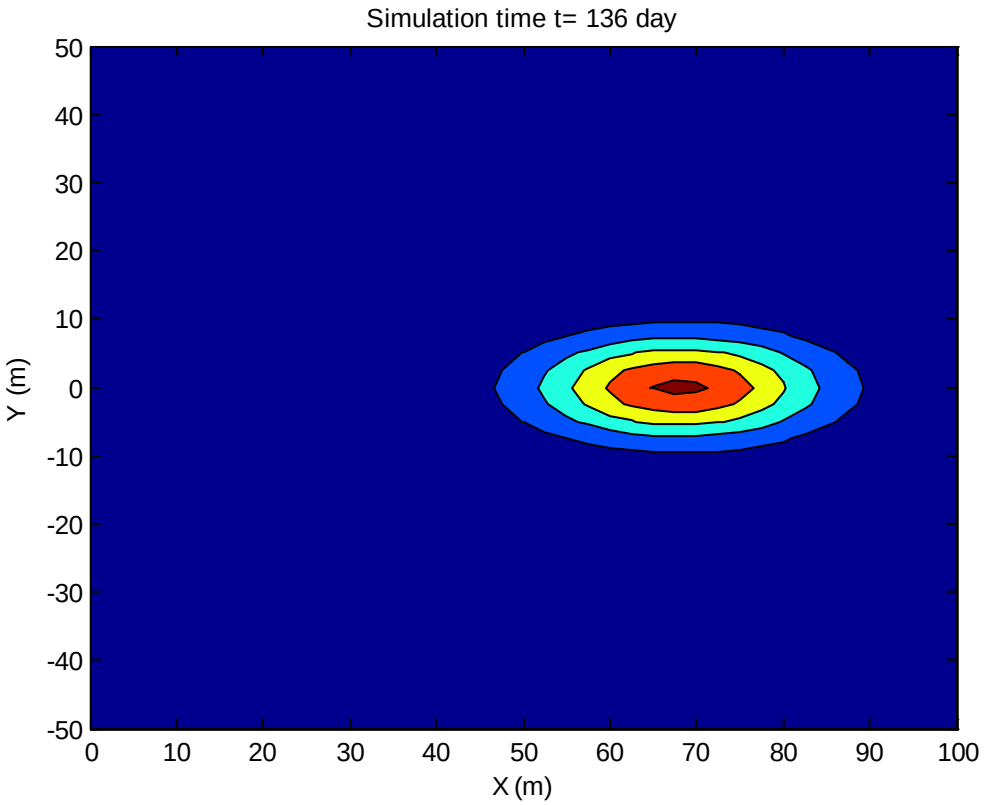


Write an m-file function, G_puff, to compute the concentration with different model parameters: m, D_x, D_y, v, and b. Use the following values for the dimension of the problem:
xmax=100, xmin=0m, dx=2.5m
ymax=50m, ymin=-50m, dy=2.5m
tmax=100/v, tmin=tmax/50, dt=tmax/50

Run the problem using the following parameter values:
m=1.0 kg, D_x=0.5 m^2/day, D_y=0.1 m^2/day, v=0.5 m/day, b=1.0 m

Use *contourf* to plot a contour like the one below.
Hint: Use meshgrid to avoid the *for* loop.

Bonus question: making a movie
If you want to generate the movie, you need to generate contours at a series of times and each "frame" is saved using *getframe*. After executing G_puff the command *movie*(M) can be used to display the sequence of frames. The command *set* will be useful for generating the movie.


Simulation time t= 136 day
50
40
30
20
10
0
-10
-20
-30
-40
-50
Y (m)
0
10
20
30
40
50
60
70
80
90
100
X (m)