Fall 2007
EPS 236: Geological fluid mechanics

Homework number 9

Due Wednesday, November 7

Please do not procrastinate too long in starting question 19.

19. In class we will derive an expression for the spreading rate of a viscous fluid (Reynolds numbers much less than 1) over a flat surface. We will find that for a constant volume of fluid, the radius R increases as time$^{1/8}$.

Perform an experiment to verify the $t^{1/8}$ spreading rate. To do this, you will need to measure the radius of a spreading blob of very viscous fluid (e.g., honey, syrup, polybutene oil – I can provide samples of any of these if you need some) as a function of time. By plotting your data on a log-log scale you should be able to determine the power law relationship (if there is one). You should try to let your experiment run for at least one day.

If your experimental data do not agree with the theory, describe several possible reasons for the disagreement.

20. For the flow described in the preceding problem, the expression derived in class was for an axisymmetric geometry (i.e., the fluid spread in a radial direction).

Derive a similar expression for a two-dimensional flow in the same limit (low Re, flow due only to buoyancy forces, constant volume of fluid).