CVEN 627 "Engineering Surface Water Hydrology"

H O M E W O R K 2

Assigned 2/6/06
Due 2/13/06

1. Dingman, Problem 6-3, p. 271

2. Dingman, Problem 6-4, p. 271. This problem highlights the Campbell equations, which are covered in the Dingman text. Write VB code including these equations to work this problem. You may use the *modSoil_Properties.bas* module as a guide.

3. Repeat Problem 6-4 using: (a) the Brooks-Corey equations (already contained in the *modSoil_Properties.bas* module), and (b) the Van Genuchten equations (which you should code in VB). Compare the results obtained by the 3 sets of equations.

   Van Genuchten:
   (λ = particle size distribution index)

$$\frac{\theta-\theta_r}{\phi-\theta_r}=\left[\frac{1}{1+\left(\frac{\psi}{\psi_{bub}}\right)^{\lambda+1}}\right]^m$$

$$\frac{K(\theta)}{K_{sat}}=\left(\frac{\theta-\theta_r}{\phi-\theta_r}\right)^{1/2}\left\{1-\left[1-\left(\frac{\theta-\theta_r}{\phi-\theta_r}\right)^{1/m}\right]^m\right\}^2$$

$$where \quad m=\frac{\lambda}{\lambda+1}$$

4. Given is an Excel file containing an explicit FD solution to Richards equation (in a VB macro) and a data setup on the worksheets to present results. For soils of typical characteristics in the USDA categories Clay, *Loamy Sand*, and *Silt*, use the coded solution to simulate soil water flows of your own design (i.e., you are free to make up whatever boundary conditions you want). Change the Δt and Δz values, and diagnose how the ability of the solution to perform well is affected by these parameters. Suggested ranges are Δt = [10 s, 2 hr] and Δz = [0.1 cm, 50 cm]. Draw conclusions about the role of time and space discretization, rate of change of boundary conditions, and inter-cell gradients in the solution's performance. Write up your conclusions.