

Homework 3

Due Friday, April 25.

Show all work.

Name

You may work with others if you like, but please list their names if you do.

- 1) If a soil has $\theta = f_a$, which is greater: the permeability of the air phase, or the permeability of the water phase? Explain your reasoning.

- 2) Suppose that infiltration proceeds in accordance with Green and Ampt's (1911) model. Let porosity = 0.45, ponding depth = 0 cm, $K_{sat} = 1.3$ cm/hr, antecedent volume wetness = 0.22, and suction at the wetting front = 43 cm. Plot cumulative infiltration over a 1 hour period, starting when the wetting front is 5 cm below the soil surface. Show your work (I recommend using a spreadsheet). What was the minimum rainfall rate needed to sustain this infiltration rate? What was the cumulative depth of water infiltrated?

For those who like more of a challenge, what value do you get for Philip's sorptivity, using the "data" from the Green and Ampt prediction?

- 3) Explain the influence of hysteresis on evaporation.

- 4) Given Wein's law, what temperature should an object be in order to emit microwaves? Given your result, how can a microwave oven heat food?

- 5) A fire is started on the surface of a soil having thermal diffusivity $D_h = 5.5 \times 10^{-3}$ cm²/s. How long will it take the heat pulse to reach an earthworm 40 cm below the soil surface?

- 6) For the same soil, at what depth in the soil profile would you find the lowest temperatures around July 20? Assume you're in the Northern hemisphere, and July 20 is the hottest day of the year.