Unit 12 Physical Hydrometeorology

1. Graduate students: A 4 hour storm has a constant rain rate of 2 cm/h. The rain falls on a silt loam soil that has an effective saturation of 30%. Calculate the infiltration rate, f, and cumulative infiltration, F after 1 hour. Determine at which time, t, and infiltration rate the cumulative infiltration reaches 6 cm. The appropriate Green-Ampt parameters for a silt loam soil are θ_e = 0.486, ψ = 16.68 cm, K = 0.65 cm/h and s_e=0.3.

2. Graduate students: Determine the vertical infiltration of water into a homogeneous sandy soil profile using the Philip model. Assume a constant soil water content at the surface at saturation. Also assume that the ponding depth exceeds the water penetration depth, i.e. free water is available in excess at the surface. Note that this assumption is needed for the water content at the surface to remain constant throughout the infiltration period. The duration is 1 to 24 h. The infiltration sorptivity S=1cm/$h^{0.5}$, and A=7.6cm/h. The saturated hydraulic conductivity k=21 cm/h.

3. Undergraduate students: Define hydraulic conductivity. Identify the range of possible values for different mineral soils including the units. Report what processes and conditions influence hydraulic conductivity. Explain how “isotropy” or “anisotropy” in the soil matrix will affect hydraulic conductivity. Differentiate between the infiltration rates of saturated soils and non-saturated soils.

4. Undergraduate students: Explain what an infiltration rate of 15 mm/h means. Sketch what would happen when the precipitation rate is 18mm/h. Discuss the potential fates of water in this case.