

Problem 4-21

Consider a 1 m long horizontal column with homogenous loamy sand soil. Use HYDRUS-1D (Simunek et al., 2008) to plot the wetting front position as a function of different fixed (ranging from 0-10 cm) pressure heads at one end of the column at an elapsed time of 5 hours. Note that each run of HYDRUS-1D will have a constant pressure head at one end of the column. Assume that the initial pressure head throughout the soil is -500 cm. Repeat calculations with loamy soil with initial pressure head of -1000 cm.

Make the calculations using HYDRUS-1D with the following conditions:

- One-dimensional horizontal soil profile 1 m length.
- Duration of simulation: 5 hours
- Soil material: Loamy sand or loamy
- Discretization: 101 nodes equally distributed with depth (i.e. 1 cm per element)
- Initial condition: Pressure head is -500 cm or -1000 cm.
- "Lower" boundary condition: Constant pressure head of -500 cm or -1000 cm.
- "Upper" boundary condition: Constant pressure head that vary between 0 and 10 cm in increments of 2 cm.

Answer:

HYDRUS-1D may be downloaded free of charge at http://www.pc-progress.cz/Pg_Hydrus_1D.htm. Make up constant boundary conditions between 0 and 10 cm in HYDRUS-1D, and then from the results of the water content distribution determine where the wetting front is approximately located. The model outputs in the following figure were generated using six different simulations for each soil. The van Genuchten-Mualem single-porosity hydraulic model with no hysteresis was assumed. (See attached HYDRUS-1D modules 4_21_LS_A-F.h1d and 4_21_L_A-F.h1d.)

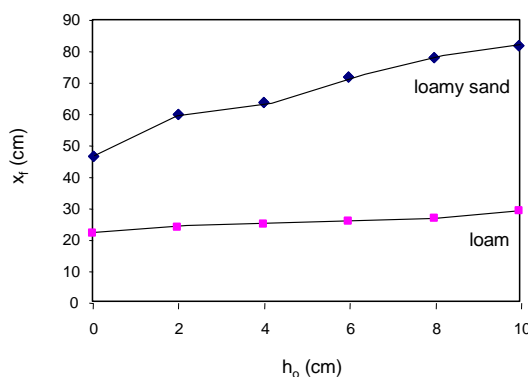


Fig. 4-17: Wetting front as a function of boundary pressure head in two soils