Groundwater recharge at the Nučice catchment

Task: Study groundwater recharge at the Nučice catchment. Use measured volumetric water content to better predict effective soil hydraulic parameters. Compare the modeled water content with the measured data to do so. Change parameters so the modeled and observed data fit as good as possible. Calculate recharge to groundwater level for each month of the modeled season.

Procedure

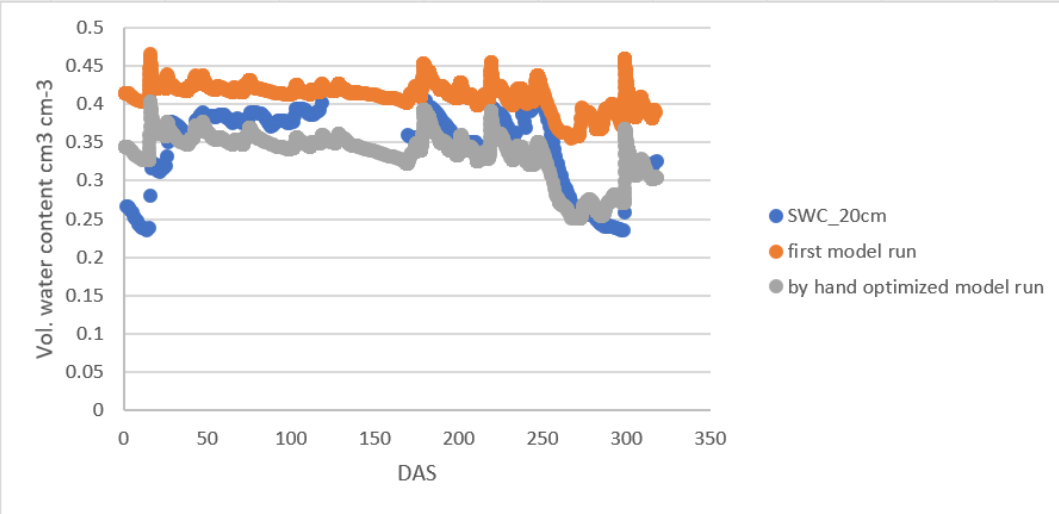
1 – Have a look at the data in the file nucice20132014.xls. Make graphs of rainfall, evapotranspiration (ET) and ground water level. Partition ET in evaporation and transpiration. Use days after sowing (DAS) in the graphs.

2 – Prepare the H1D model. Use meteorological data as the upper boundary condition (partition the ET to obtain evaporation) and groundwater level as the lower boundary condition. Include root water uptake in the model. RUN THE MODEL. Put the modeled volumetric water content into graph with the measured data.

3 – Change soil hydraulic characteristics “by hand” and try to model the measured data.

4 –Show how much water cumulatively entered and left the soil column through the boundaries in each month

HAND IN: Excel sheet with graphs of volumetric water content with measured data, first model run, and “by hand” optimized modeled data (as in the graph below) and table and bar plot from the procedure point 4.



Month	Top [L]	Bot [L]
10		
11		
12		
1		
2		
3		
4		
5		
6		
7		

FILL and make a barplot

Detail procedure

Ad1

Column explanation in nucice2014.xls:

DAS – Days after sowing
P_cm_day – Daily precipitation in mm
Et_cm_day – evapotranspiration for reference crop FAO link
CC_proc – canopy cover in percentage
gwl_mm_below_ground – ground water level bellow surface in mm
swc_20cm – measure volumetric water content in 20 cm bellow soil surface. (next sheet)

Catchment area is 48,5 ha.

The GWL readings is related to the soil surface not the bottom of the computation domain.

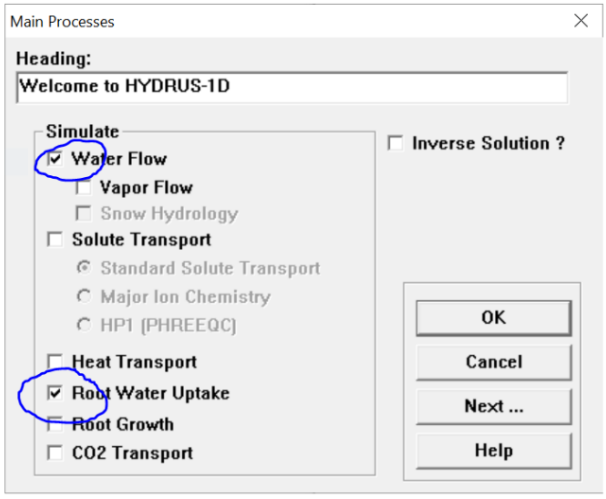
Evaporation = (1-CC/100) * ET

Transpiration = (CC/100) * ET

Detail procedure

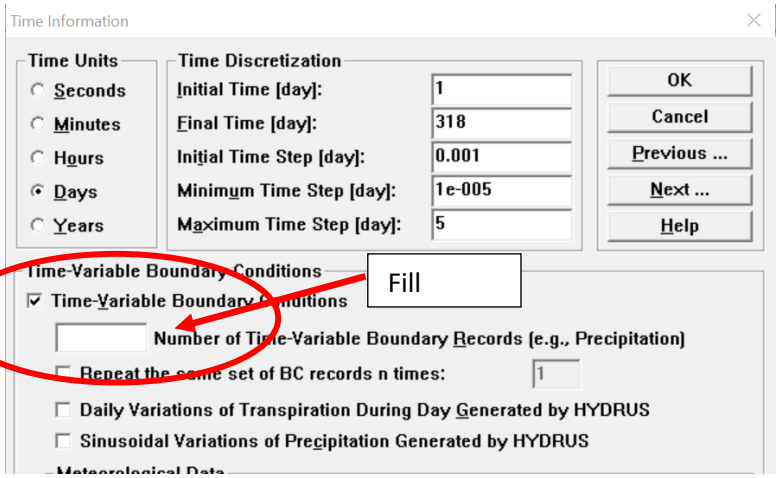
Ad2

Main processes:

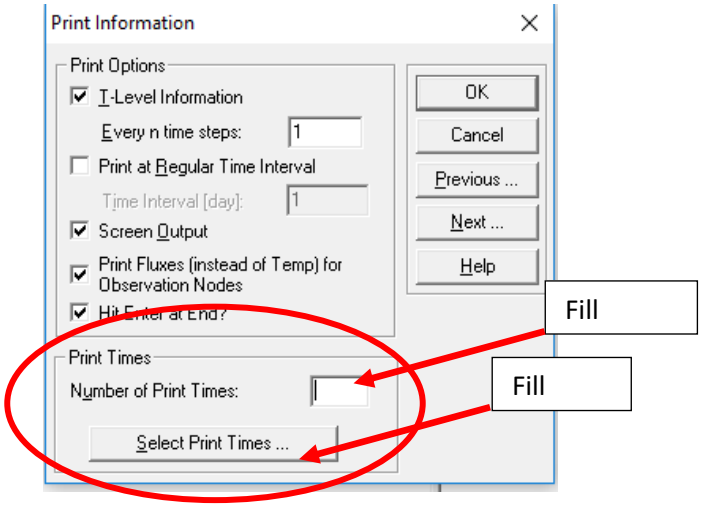


Geometry information: Soil profile of 65 cm.

Time information: Set the variable boundary condition. The number of Time-Variable Boundary condition is number of records of your meteorological data.



Print information: Print several times. You can use the default times.



Water Flow Parameters:

theta_r = 0.043 [cm³/cm³], theta_s = 0.509 [cm³/cm³], alfa = 0.02485 [1/cm], n = 1.189[-], Ks = 127 [cm/den]

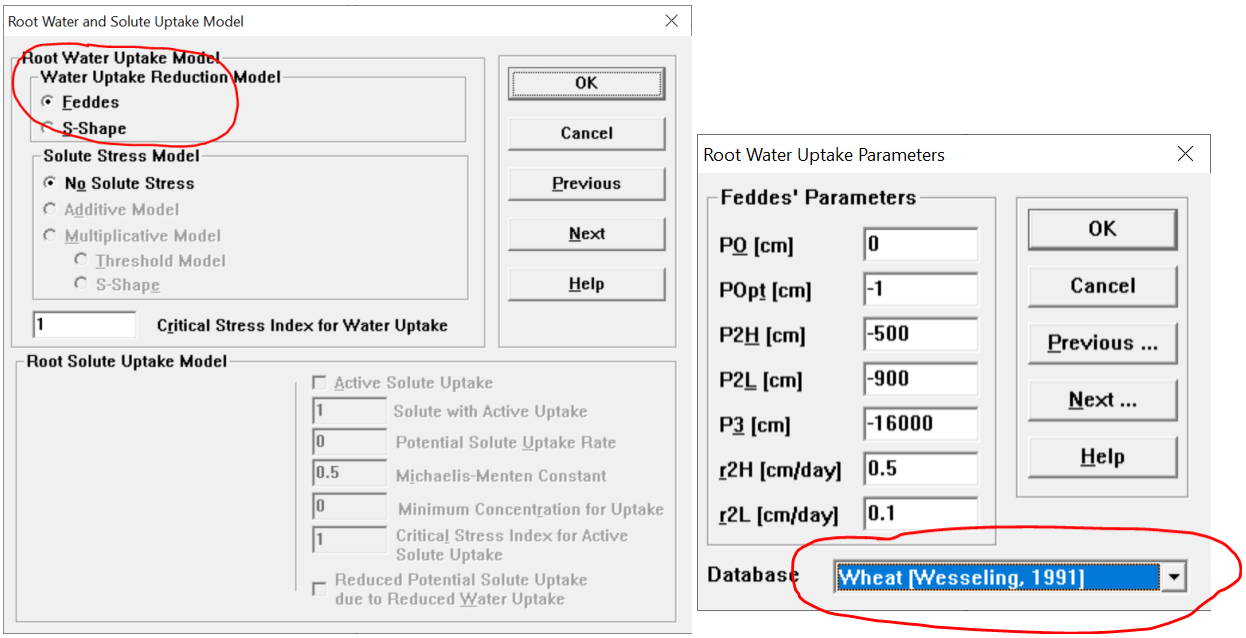
Water Flow Boundary Conditions:

Upper BC: Atmospheric BC with surface runoff

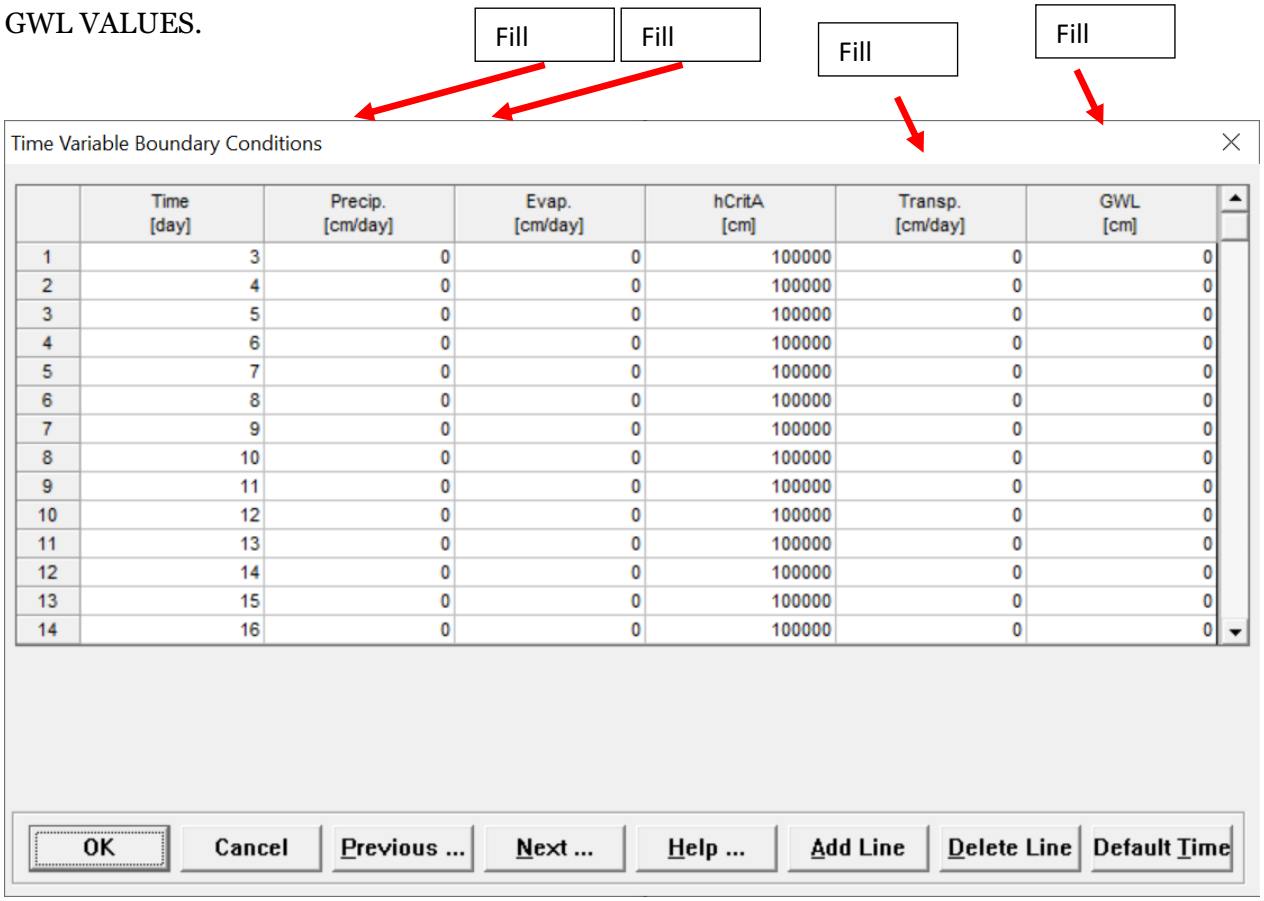
Lower BC: Variable pressure head

Root water and Solute uptake model

Use uptake reduction model of Feddes and parameters for Wheat in the Database

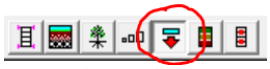


Time variable Boundary Condition: Copy + paste from the excel. GWL IS RELATED TO SOIL SURFACE NOT THE LOWER BOUNDARY CONDITION IN THE EXCEL. RECALCULATE THE GWL VALUES.



	Time [day]	Precip. [cm/day]	Evap. [cm/day]	hCritA [cm]	Transp. [cm/day]	GWL [cm]
1	3	0	0	100000	0	0
2	4	0	0	100000	0	0
3	5	0	0	100000	0	0
4	6	0	0	100000	0	0
5	7	0	0	100000	0	0
6	8	0	0	100000	0	0
7	9	0	0	100000	0	0
8	10	0	0	100000	0	0
9	11	0	0	100000	0	0
10	12	0	0	100000	0	0
11	13	0	0	100000	0	0
12	14	0	0	100000	0	0
13	15	0	0	100000	0	0
14	16	0	0	100000	0	0

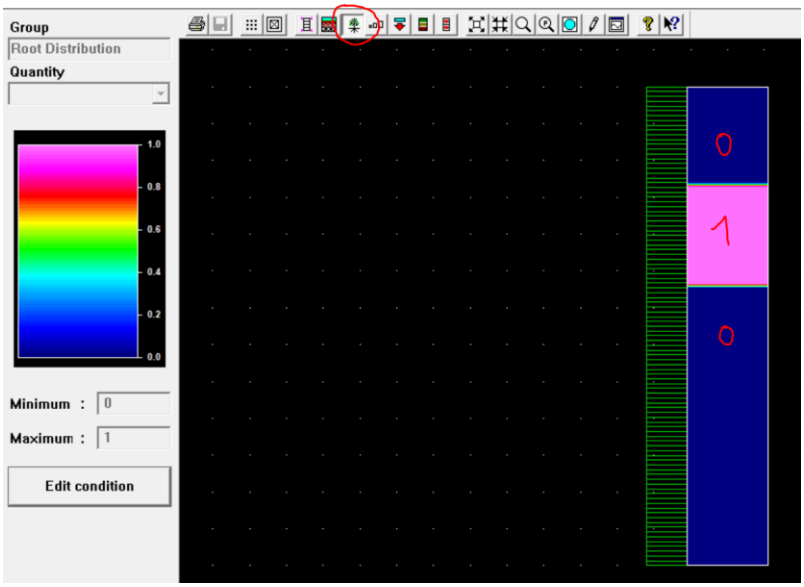
Soil Profile - Graphical Editor



Initial condition: Soil profile is in equilibrium with the first ground water record (hint: h(z) has a slope 1, see the homework).

Observation points: Put is one observation point to the depth of the -20 cm where the water content probe is, so you can compare the model results with the measured dat.

Root distribution:



NOW YOU CAN RUN THE MODEL. Have a look at the results when the calculation is successful.

Modeled data can be found in the directory: [directory with the project]/[project directory]/Obs_Node.out

Detail procedure

Ad3

Change the soil hydraulic parameters and try to visually fit the model results with the measured data (measured data are in the sheet 2 in the nucice20132014.xls).

Modeled data are in the output: *observation points -> vertical variable: water content*

Copy the modeled water content into the excel sheet when you are satisfied with your results for comparison with the first run and observed data.

Modeled data can be found in the directory: [directory with the project]/[project directory]/Obs_Node.out

Ad4

Modeled variables at boundaries can be found in the file: [directory with the project]/[project directory]/A_level.out

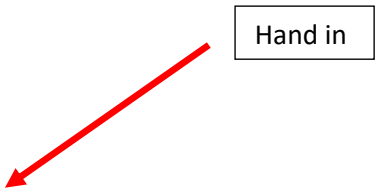
In the file, you need to have a look at the columns:

sum(vTop): cumulative flow through the top boundary condition

sum(vBot): cumulative flow through the bottom boundary condition

Get the monthly inflows/outflows from the data and fill with them the table similar to a table below. Include only months in which you have data for all days in the month.

Month	Top [L]	Bot [L]
10		
11		
12		
1		
2		
3		
4		
5		
6		
7		



Make bar plot from the data in the table.