Course: GW Flow and Contaminant Transport Modeling

Homework #4: Simulation of contaminant transport

The HW is based on the geometry of HW3 (15 boreholes drilled on an area of 400 x 300 m, fine sand layer and an underlying gravelly sand layer with ground level and the thicknesses of the given worksheet. horizontal hydraulic gradient is 0,002 m/m in any direction upon your wish, GW level is 2.5 m below the surface in the middle of the model, all not mentioned data can be freely chosen by the student but should be coherent to the soil type).

Additionally please apply 50 mm/yr recharge from precipitation for the whole model domain. There is a tank leakage of 0.15 m3/d in the sandy layer from the beginning, and 250 mm/yr recharge under a non-isolated industrial waste disposal site of an area of 30 · 40 m size from the beginning of the 5th year. All the four well are active with the following production rates (W1: 50, W2: 120, W3: 75, W4: 50 m3/d average production rates)

There are two investigated contaminants: Benzene and Toluene. The transport properties of the two components are as follows: K_d = 1.2 m^3/g and 1.5 cm^3/g, Half-life: 3000 d and 3500 d, long. dispersivity in sand 3m, in gravelly sand 2m, transversal dispersivities: 0,3 and 0,2m in layer 1 and 2. Molecular diffusion coefficient 10^{-10} m^2/s for both components.

Tasks:

1. to modify the GW flow model of HW3 by adding recharges, new well, etc. and prepare it to be able to simulate transport procedures
2. to build a transport model of the site for 15x2 years period with the given contamination sources (exact location is freely chosen) The concentration of tank leakage is 45 000 µg/L (benzene) and 35 000 µg/L (toluene), the areal industrial pollution strengths is 1 770 000 µg/L (benzene) and 530 000 µg/L (toluene) which is equal to water solubility of the components
3. to install monitoring wells to the model into both layers
4. to determine the concentration distribution and to make concentration animation for both layers
5. to determine concentration-time curves for the pumping test period in representative locations of the model
6. to establish a slurry wall of U or L shape to slow down the contaminant migration on reasonable sites regarding the freely chosen location of wells and contaminant sources
7. to determine the concentration distribution and to make concentration animation for both layers in this new situation
8. to determine concentration-time curves for the pumping test period in representative locations of the model in this new situation

Deliverables:

In printed form a short report of the problem with

- the details of the chosen data
- graphic presentation of concentration fields, concentration vs time curves (each monitoring well, comparative graphs of wells screened to the same layer)
- the description and evaluation of results

Digitally (only at the end of semester)

- report in document form
- full dataset of the model
- plots in graphical form

Borehole data:

X	y	z	Thickness1	Thickness2
[m]	[m]	[m asl.]	[m]	[m]
-6,4	309,5	98,7	18,1	16,7
412,5	310,2	98,6	17,5	13,5
406,4	107,8	99,9	17,2	12,7
411,8	-6,2	99,3	19,1	17,1
-29,2	-25,6	98,9	19,7	16,6
103,5	190,2	98,8	22,4	18,6
209,4	235,1	100,4	21,3	16,4
322,0	114,5	98,2	21,5	16,2
182,6	103,1	100,9	23,0	17,3
48,5	251,9	98,6	20,4	17,1
345,4	268,6	98,3	20,8	16,0
360,2	50,1	100,3	21,0	18,0
130,3	30,7	99,4	20,6	16,5
52,6	76,3	99,2	19,9	17,1
200,7	157,4	100,5	24,7	19,5