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02/28/2022

HW6 Figures

Challenge 1: For the initial boundary head values and recharge and ET rates

- **plot the flow across the left and right boundaries**

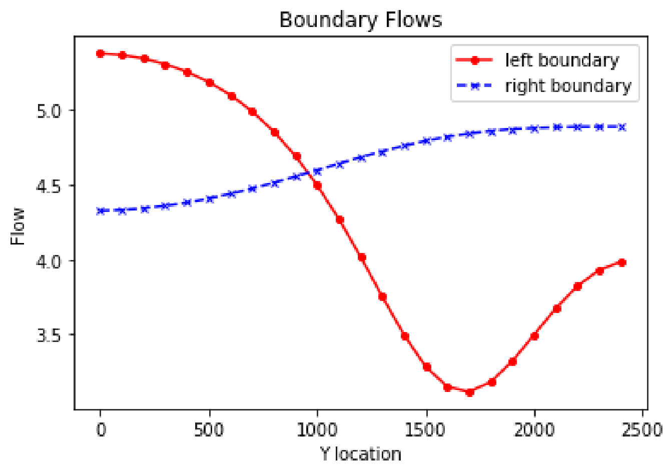

Figure 1: Flow across the left and right boundaries of the homogeneous domain. Flow across the left boundary drops considerably near the y-location of the recharge zone. With this decrease on the left boundary there is an accompanying slight increase along the right boundary.

- **Plot the equipotentials and flow vectors in plan view and outline (hand draw) the area that would be affected by recharge (i.e. if it were contaminated)**

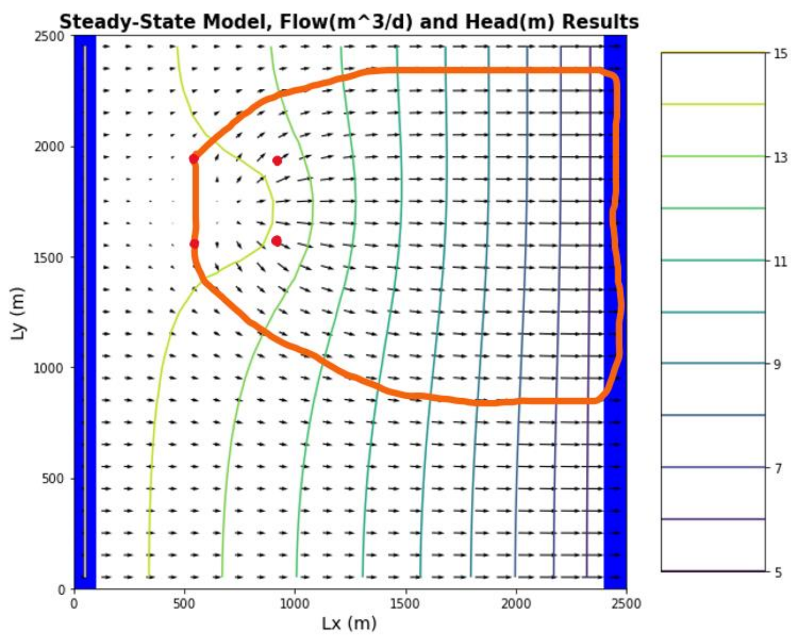

Figure 2: Equipotential lines and flow vectors for the initial model parameters. Recharge area is marked by red dots. Potential contamination zone is marked by orange circled area.

- **Plot ET, Recharge, and Water Table depth**

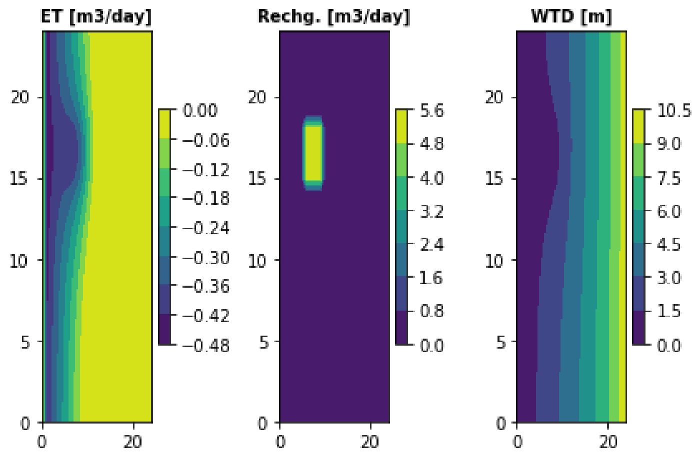

Figure 3: Plot shows evapotranspiration rate, recharge rate, and depth to the water table for the homogeneous domain. Evapotranspiration is very low in most of the domain, but is prominent near the recharge zone. Area of high recharge is noted by the yellow region in the middle chart. Depth to the water table is lowest at the left side of the domain and around the recharge zone, and increases toward the right side of the domain.

Challenge 2: Calculate the water balance for the model

$F_{in} = total\ flow\ into\ the\ system$

$F_{out} = total\ flow\ out\ of\ the\ system$

$f_L = total\ flux\ through\ the\ left\ side\ of\ the\ domain$

$f_R = total\ flux\ through\ the\ right\ side\ of\ the\ domain$

$R = total\ recharge\ into\ the\ system$

$ET_t = total\ ET\ affecting\ the\ system$

$$F_{in} = f_L + R$$

$$F_{out} = f_R - ET_t$$

$$F_{in} = F_{out}$$

$$F_{in} = (106.444\ m^3/day) + (80.000\ m^3/day)$$

$$F_{out} = (116.093\ m^3/day) - (-70.352\ m^3/day)$$

$$F_{in} = F_{out}$$

$$186.444\ m^3/day = 186.444\ m^3/day$$

Challenge 3: Change the extinction depth in your model

- **Extinction Depth = 10 m**

$$F_{in} = (147.906\ m^3/day) + (80.000\ m^3/day)$$

$$F_{out} = (73.793\ m^3/day) - (-154.113\ m^3/day)$$

$$F_{in} = F_{out}$$

$$227.906\ m^3/day = 227.906\ m^3/day$$

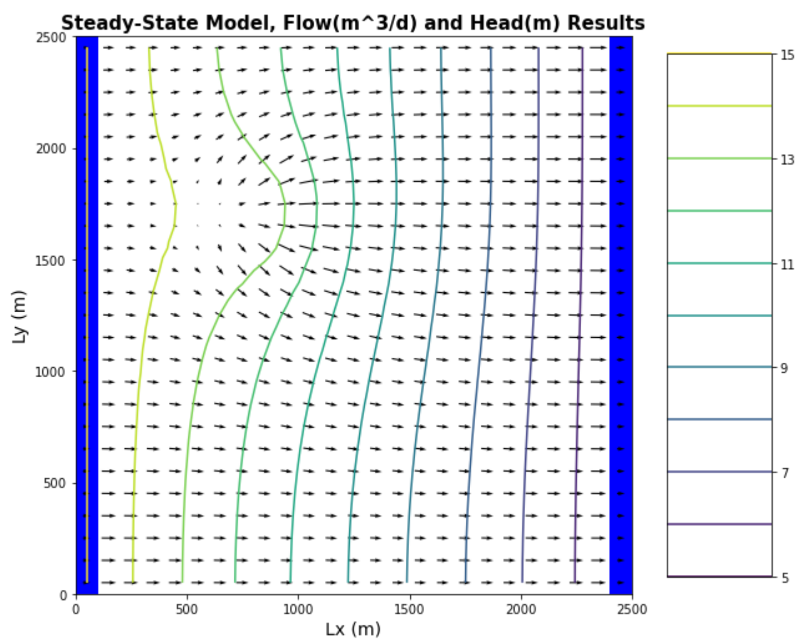

Figure 4: Equipotential lines and flow vectors for the homogeneous domain where the ET extinction depth has been increased from 3 m to 10 m.

Challenge 4: Now start the well pumping, extracting 20 m3/day

- **Plot the equipotentials and flow vectors in plan view and outline (hand draw) the area that would be affected by recharge (i.e. if it were contaminated)**

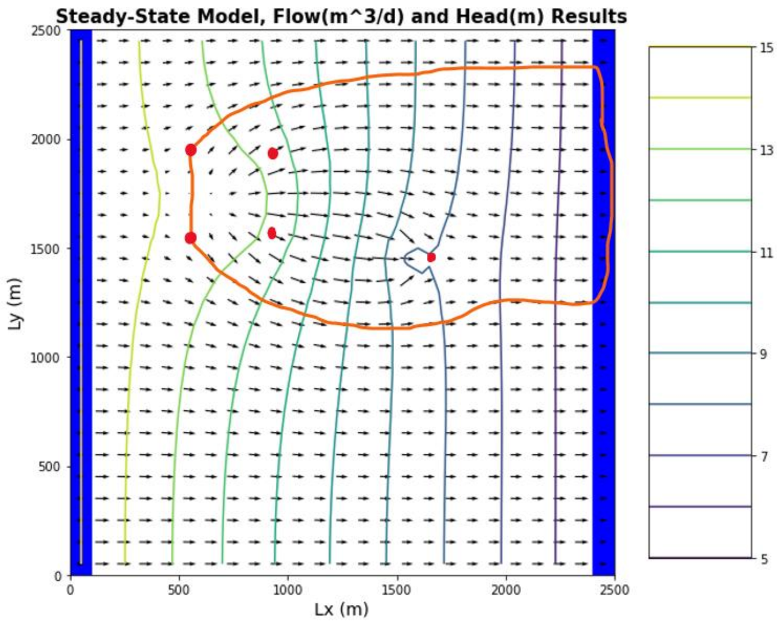

Figure 5: Equipotential lines and flow vectors for the homogeneous domain where the ET extinction depth is 10 m and a pumping well is active in the homogeneous domain. The pumping well is located at [0,10,15] and is pumping at a rate of 20 m^3/day. The recharge zone of the aquifer is marked by a square of red points and the well is marked by another red point to the right of this zone. The potential contamination area from the recharge is outlined in orange.

- **Plot ET, Recharge and Water Table depth**

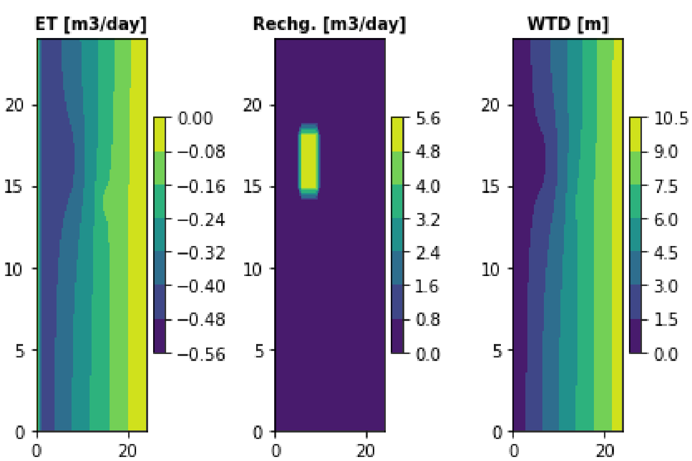

Figure 6: Plot shows ET, recharge, and depth to the water table for a homogeneous domain with an active pumping well. The recharge zone present in the domain can be noted on all three charts in the top left corner of each plot. The pumping well can be seen on both the ET and WTD plots as there are slight bumps in the opposite direction to those caused by ET on each plot.

Challenge 5: Write a mass balance for the well

$$F_{in} = total\ flow\ into\ the\ system$$

$F_{out} = total\ flow\ out\ of\ the\ system$

$f_L = total\ flux\ through\ the\ left\ side\ of\ the\ domain$

$f_R = total\ flux\ through\ the\ right\ side\ of\ the\ domain$

$R = total\ recharge\ into\ the\ system$

$ET_t = total\ ET\ affecting\ the\ system$

$W = total\ water\ removed\ by\ well\ from\ the\ system$

$$F_{in} = f_L + R$$

$$F_{out} = f_R - ET_t - W$$

$$F_{in} = F_{out}$$

$$F_{in} = (153.165\ m^3/day) + (80.000\ m^3/day)$$

$$F_{out} = (64.532\ m^3/day) - (-148.633\ m^3/day) - (-20\ \ m^3/day)$$

$$F_{in} = F_{out}$$

$$233.165\ m^3/day = 233.165\ m^3/day$$