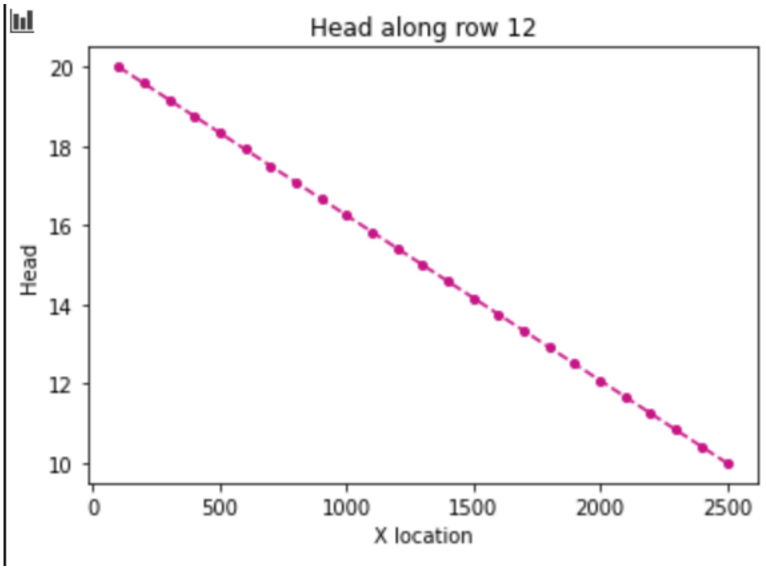
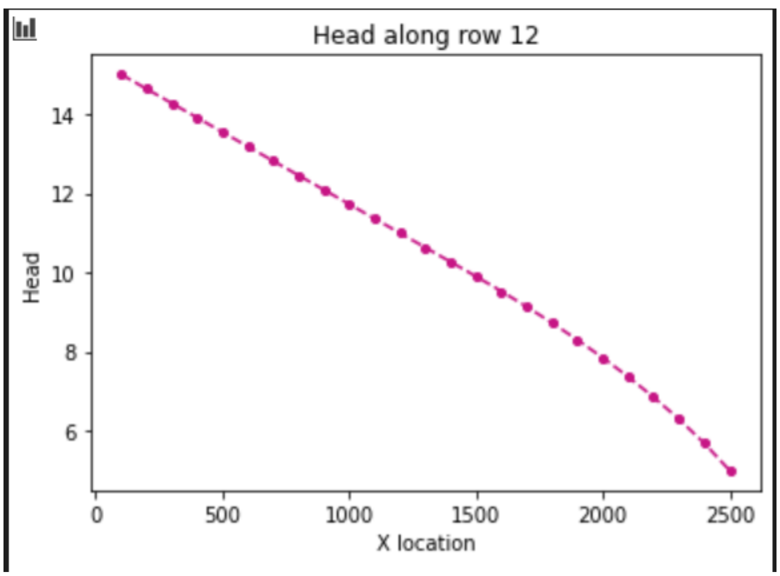
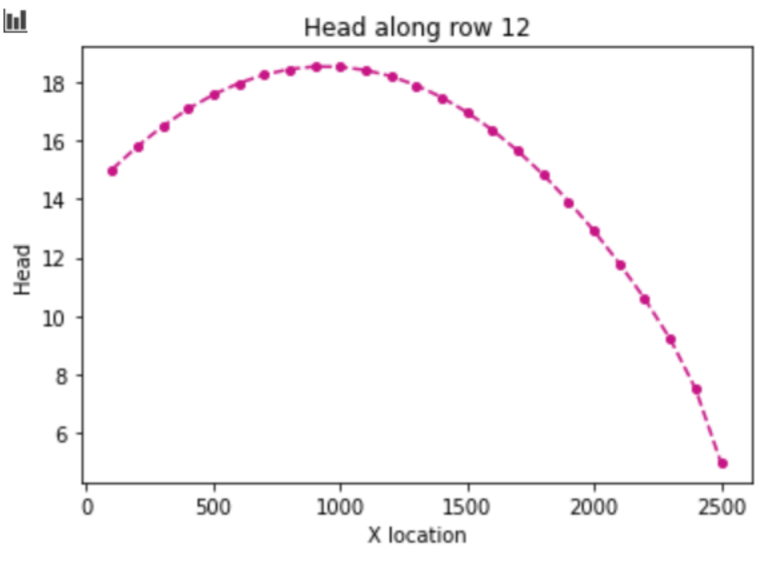
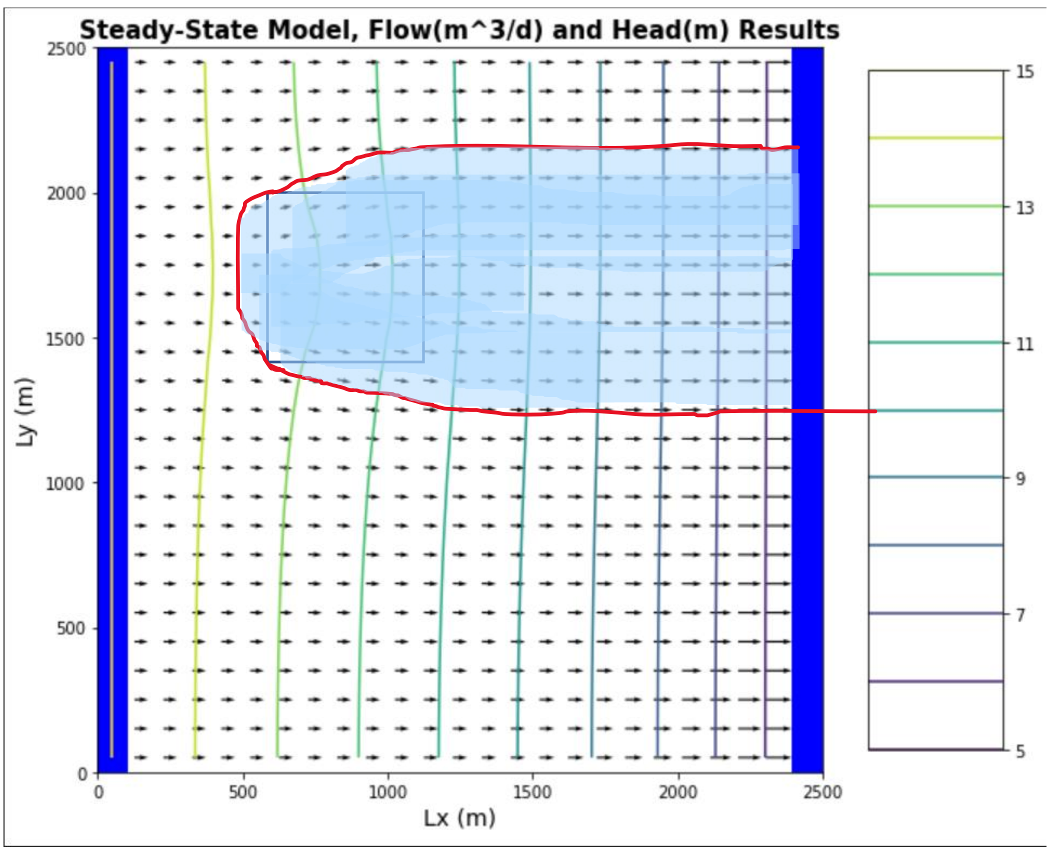
Danielle Rehwoldt

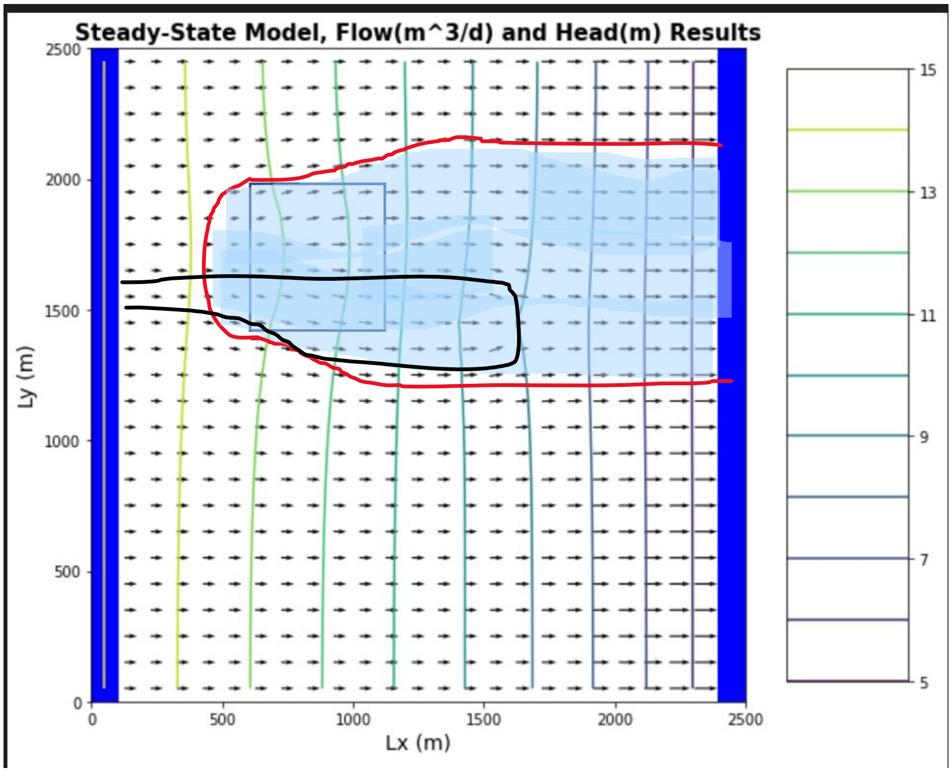
HW5






Head along row 12
Head
X location
18
16
14
12
10
8
6
0
500
1000
1500
2000
2500


Steady-State Model, Flow(m^3/d) and Head(m) Results
Ly (m)
Lx (m)
0
500
1000
1500
2000
2500
15
13
11
9
7
5



Questions:

For the initial boundary head values and pumping and recharge rates, compare the head versus x distance - along a transect from the middle of one constant head boundary to the other - to the results for the BoxModel. Now reduce the boundary heads to 15 and 5. Compare this result and explain any observed differences. The overall gradient is the same, as is the K of the medium ... is the flow the same for both boundary conditions? Why or why not?

No. The flow decreases with the unsaturated condition (becomes more horizontal and linear) because as we still have a steady-state model, we know that it is harder for the water to move through the initial unsaturated medium. We don't know what the saturated thickness is until we know the head distribution and vice versa. All we know is that it is going to curve concave down as the lower portion of the head gradient gets steeper/flow increases with the introduction of the saturated aquifer.

Now add recharge at a constant rate of 1e-4 m/day over the entire top boundary. Explain the head transect and boundary flows. Is flow in this system 2D or 3D? Is it represented as 2D or 3D? Explain what you mean by your answers.

The head transect is curved as a mound as the boundary flows are going laterally along the curved water table. The surface is 2D and recharge is taking place in the surface. The surfaces to begin with were no-flow boundaries. The flow is 2D. The is represented in 1D because modflow decreases the dimensions once to understand it easier. Modflow has the transmissivity decrease towards the end of the curve.

Now model a system with zero recharge except for a farm located in [6:10, 6:10] - in python terms. Recharge beneath the farm is 1e-4 m/day due to excess irrigation. First, calculate the annual excess irrigation, in meters, that has been applied to the farm. Second, assuming that the crop is cotton, it is located in southern Arizona, and cotton is grown all year (for simplicity), calculate the total irrigation rate on the farm that would be associated with this amount of excess irrigation. Finally, identify the area within the domain that might be subject to contamination if the recharge water was somehow tainted.

Not sure how to calculate the excess/total irrigation. Consumptive use of cotton in Arizona: 41.2'' per season.

Inches to meters: 1.04648 m

Recharge is 1e-4 m/day

Light blue highlighted capture zone may be subject to contamination.

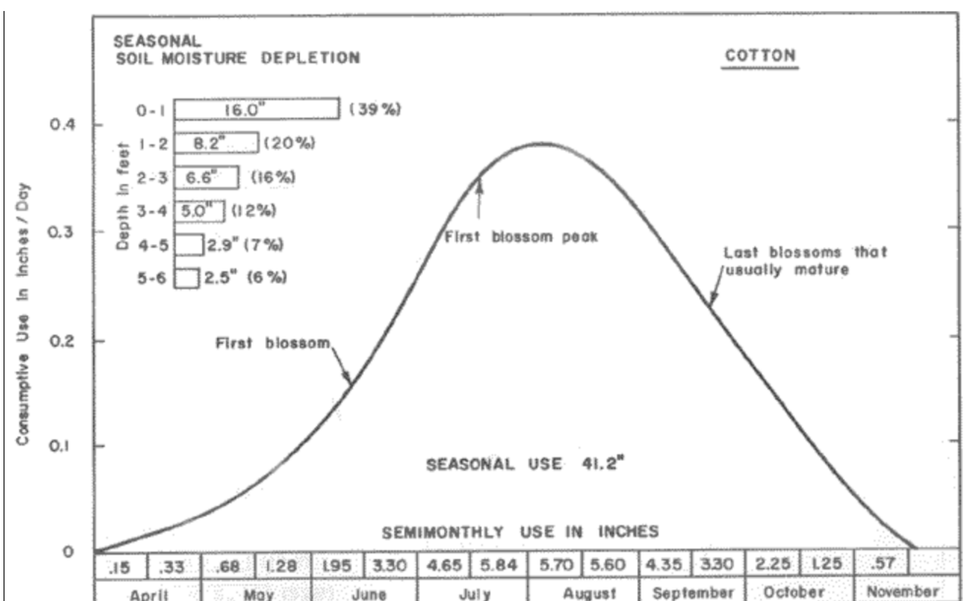


Figure 2.—Mean consumptive use for cotton at Mesa and Tempe, Ariz., 1954-62.

Lastly, start the well pumping at a rate of 8 m3/day. Using one color, identify the capture zone of the well. Using a second color, show the area that might be contaminated by the irrigated farm fields. Comment on the impact of the well on the pattern of potential contamination.

The capture zone is the highlighted light blue area. The well pulls the contamination in another localized area (black outlined area) within the capture zone with another area of increased gradient. So along with the black outlined area, the capture zone area pulls contamination in as well.