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HWRS 482

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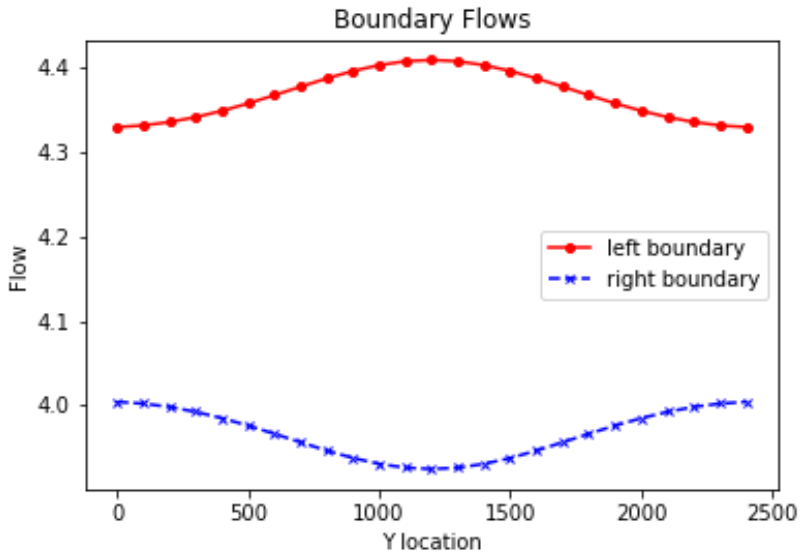
HW4 Discussion

1.The well is located at [0,10,15] in the starter code and it is withdrawing water at a rate of -8 m3/day (note, the rate is negative to indicate water being removed from the domain). You need to move the well to the center of the domain [0,12,12] and change the rate to -10 m3/day.

Followed the directions and moved the well, set the moved well as my base for the entire assignment.

2.For the initial well location, plot the total flow into the left (constant head = 20) and out of the right (constant head = 10) boundaries. (The code, as provided, makes this plot for you.)



Explain why the values are not constant along the boundary (relate to the definition of a Type I boundary).

The flows are not constant along the boundary because some of the water is being lost. The well is taking up water in the center of our domain and there is less water leaving the right boundary.

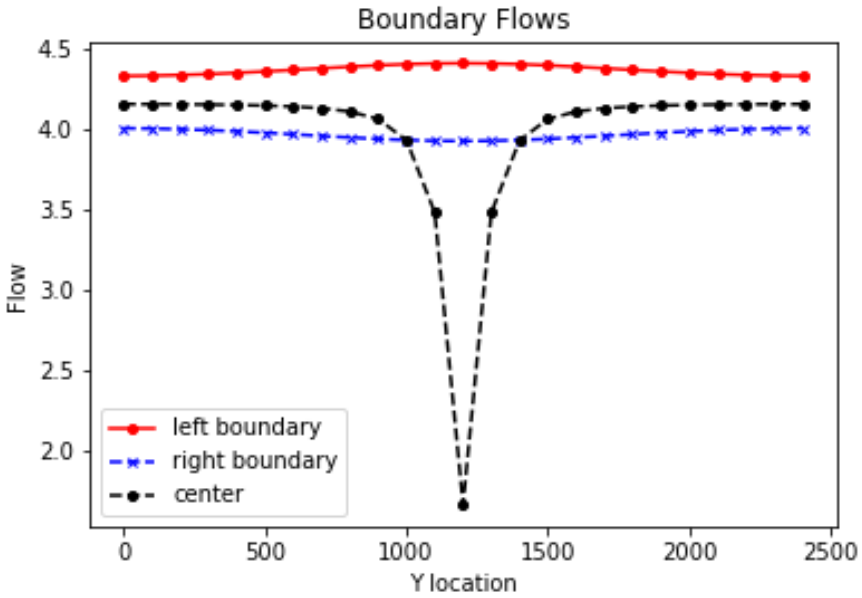
Explain the shapes of the flow distributions and why they are not the same for the left (inflow) and right (outflow) boundaries.

The shapes of the flow correspond with the well which is taking up more water in the center. There is less water flowing through the center of each boundary.

You are still modeling stead state conditions? So, what is supplying water to the well?

Steady state means what goes in is coming out. I am assuming what supplies water to a well is some water source. It could be a river. Or it could be a spring.

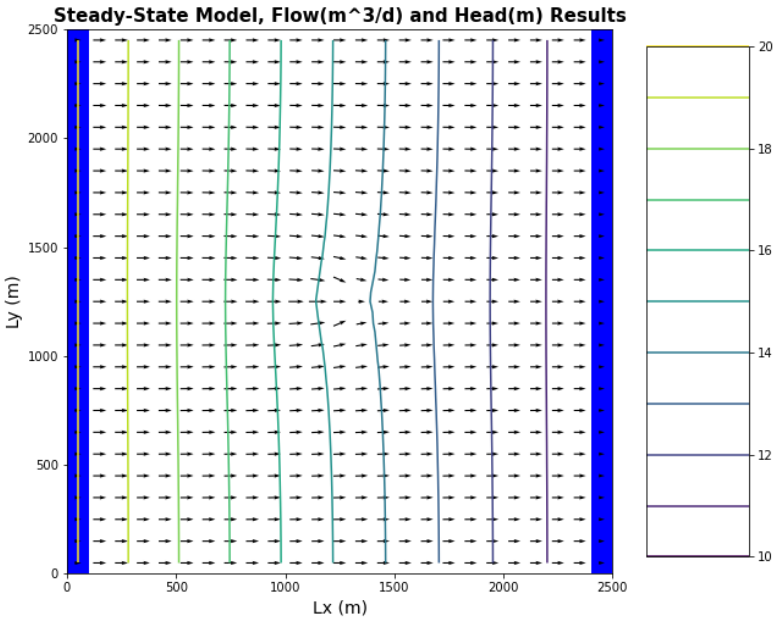
3.Plot series of the flow left-to-right along a vertical line that passes through the center of the well [:,12]



How do you interpret the flow along this transect? (Hint, also look at the flow along a transect just upgradient from the well [:,11]).

The flow is very small at the center of the transect and the flow is symmetrical on either side of the center. This is telling me that there is nearly zero flow in this area.

4. Then, look at the plot of equipotential (i.e. the constant head lines, this is the last plot in the example) and flow vectors.



Describe how water flows through the domain. To aid in your description, draw a line through all of the flow vectors that terminate in the well. This approximates the capture zone of the well. Use this to refine your description of the flow system, being as specific as possible about where water that ends up being extracted by the well originates on the inflow boundary.

The water in the above diagram is moving through the domain similarly along all cells until it gets near the well. The flows along the center of the domain (going left to right) are moving toward the well. The flows on the outer edges tend to be linear and aren't affected as much by the well. The water that is taken up by the well seems to originate from the center of the left boundary.

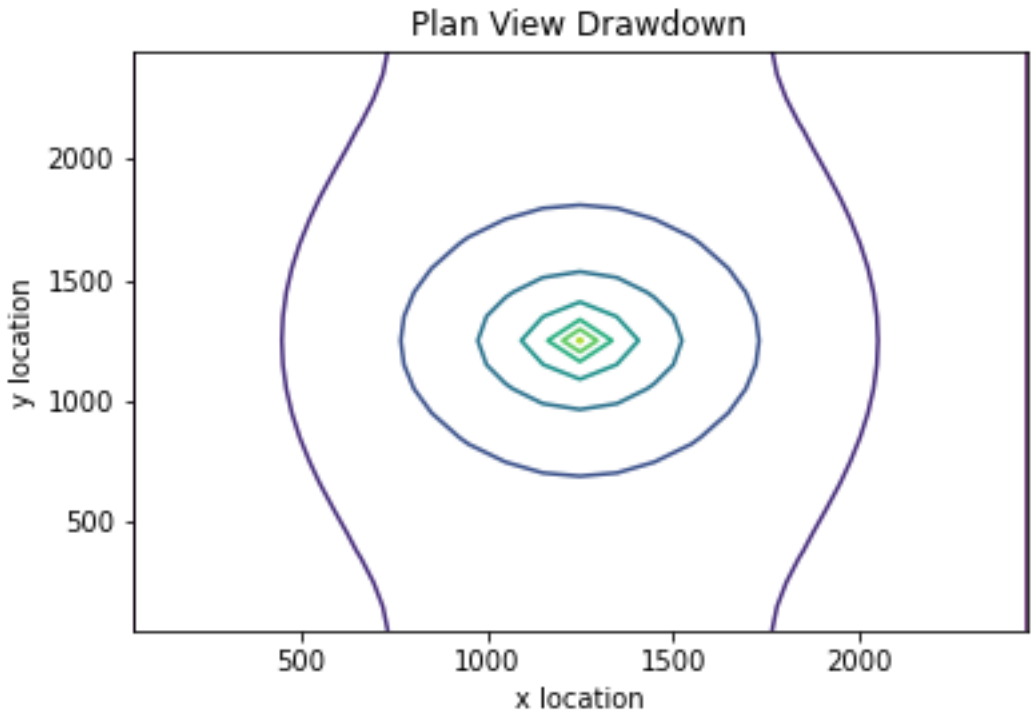
5. Then, look at the plan view drawdown plot.

Why aren't the drawdown contours circles? Either explain why this is correct or fix the plot.

I am having a little trouble understanding the question. The graph for this question is the one below. This graph does have circle contours, but it does have the two at the ends that aren't circles as well as the center contours which are diamond like. The reason the contours at the end aren't circles are probably due to the flow paths going past the well and the center contours are more rigid due to the drawdown changes around that area.

Why are the drawdown contours not equally spaced?

My guess to why the contours aren't evenly spaced is because the spacing between the contours because the drawdown gradient is not constant. There is more drawdown where the contours are closer.



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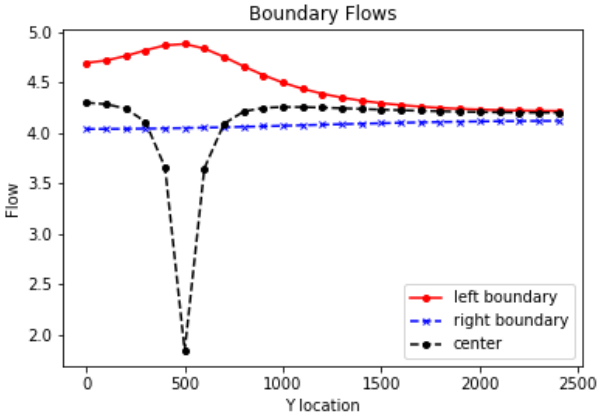
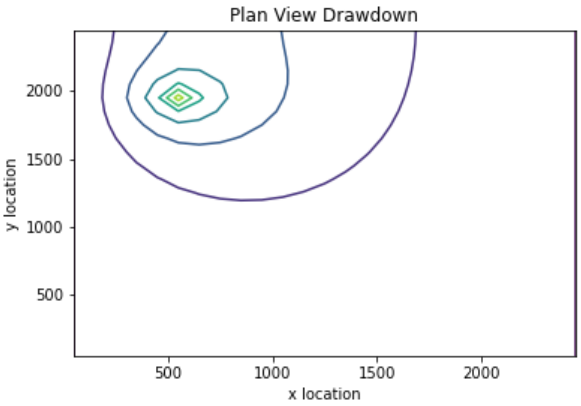
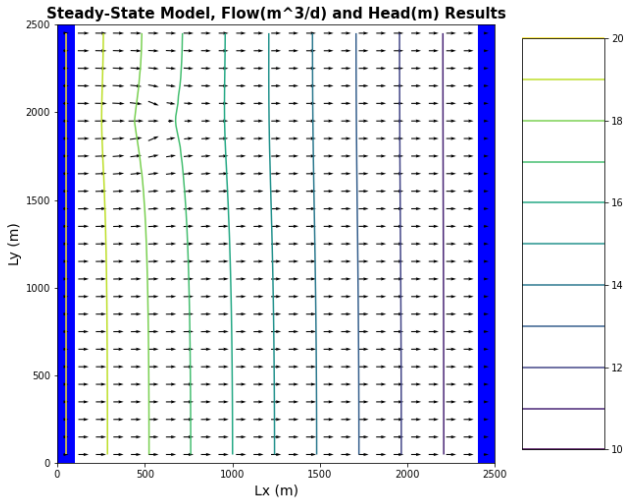
6. Move the well to [0,5,5]. Use all plots necessary to describe fully how water is flowing through the domain with the well in this location.





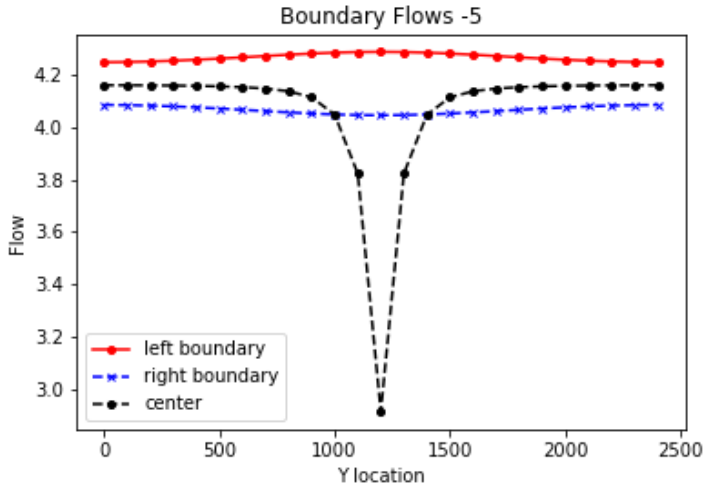


When the well was moved the flow entering the left boundary was the highest and we can see that the flow was higher near the well. the flow leaving the right boundary was uniform. A transect going through the well shows a lower flow at the 500 y location where the well is located. We can see our drawdown contours in the figure on the right, and the contours are centered near the well, drawdown is happening at the top left corner of our domain. In the center figure we can see the flow is being diverted towards the well and the head equipotential lines are morphed towards the well's pumping.

BONUS :

Before running the model, predict what you would happen to the inflow/outflow boundary fluxes if you reduced the pumping rate to -5 with the well located at [0,12,12]. Were you correct? If not, how were you wrong?

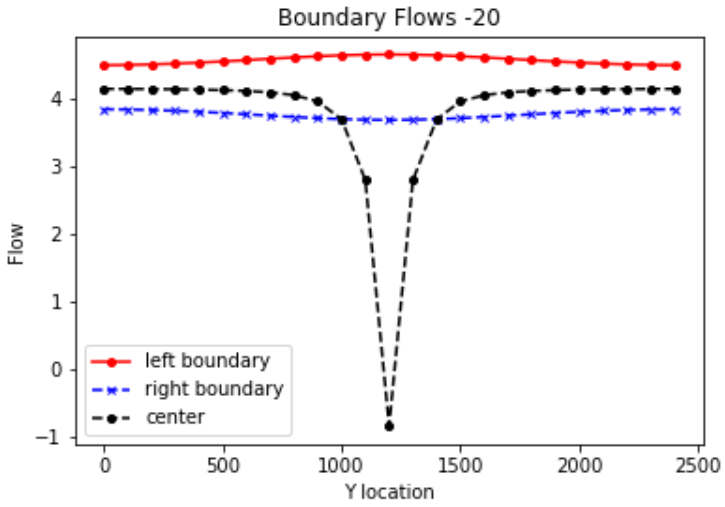
I think the flow would look like the one with a pumping rate of -10. The “humps” on each boundary flow plot would just be less pronounced. A little flatter looking but there would still be a significant difference in flow just like the one for -10.



Yes, I was correct, however the plots were adjusted according to the data, and you don’t see a difference in the “humps” from this one and the one for -10.

Now predict what would happen if you increased the pumping rate to -20. Still correct? Now try -25. Uh oh, what happened??

If we increased the pumping rate to -20 then it would be like the plots for -10. The humps (boundary flow plot) in graph this time would be pronounced. There will be more flow near the center for inflow boundary and less flow for the outflow boundary.



Yes, I was correct, however the plots were adjusted according to the data and you don’t see a difference in the “humps” from this one and the one for -10. The values for flow have changed as well, and there is a negative value for flow in the center now.

Glossary Questions

What are equipotentials? How do we create them from MODFLOW Models?

Equipotentials are lines that tell you the value of something on a map and this value is the same along this line. We create them in MODFLOW using the head values. We would need to create our own grid using the data in MODFLOW.

What are flowlines? (BONUS thought experiment: How can you impose a no flow boundary based on symmetry? Give it a shot to explain WHY this works in a couple of sentences.)

Flow lines are the flow patterns of the water in the system. It shows you in what direction the flow is going. I am guessing that if the system is symmetrical the flow eventually reaches an equilibrium and calms down (in a confined system), where there is no flow.

What are flow nets? And how does a flow net vary from a map of equipotentials with flow lines drawn on it?

Flow nets are diagrams or maps that show you the elevation of ground water. Or the depth of the water table below the earth's surface. A flow net with flow lines in it differs only from the arrows signifying the direction of flow.

Define the concept of 'capture' in a way that a non-expert might understand? (e.g. think about our homework problem, if the right boundary represented a stream, what would the impact of the well be on the stream?)

Capture is when a pump or something else takes water away from a source. It takes water away that contributes to the flow of that water source. If the right boundary represented a stream then the well would capture water if the river eventually started feeding the well rather than the aquifer itself.