The Challenges

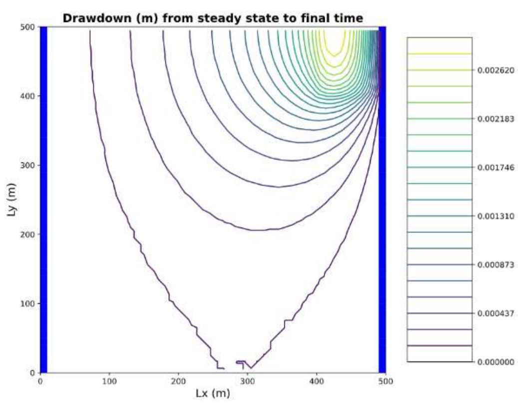
a) The gradient is not uniform for the initial steady state conditions - discuss the influences of recharge and the unconfined condition on this nonlinearity.
    a. Without any input or output from the system, we'd expect the gradient to be linear. To accommodate the input/output of the system, the amount of storage has to change. In an unconfined system, that means that the elevation of the water table has to change. Since the ends of the model are held in place by the constant head boundaries, this effect is going to curve the gradient more, farther away from those boundaries.

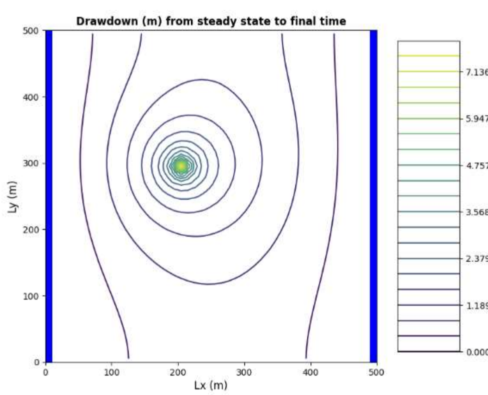
b) Determine if the system has reached steady state - consider a point at the well and another at the center of the domain.
    a. The system does not appear to have reached steady state. My intuition with the graphs is that the head where the pumping is occurring creates a transient state and that it reverses when the pumping ceases. It doesn't have time to reach a steady state before pumping is resumed.

c) Find the zone of influence of the well defined in two ways:

- Based on the drawdown from the initial steady state to the end of simulation time (end of final no-pumping stress period).

The well's zone of influence appears to influence pretty much the entire system save the bottom right, and far left side of this model.

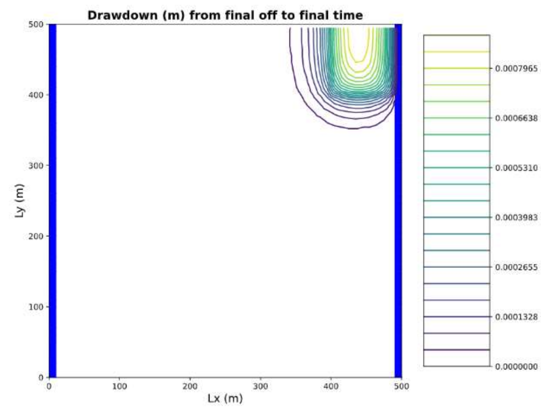


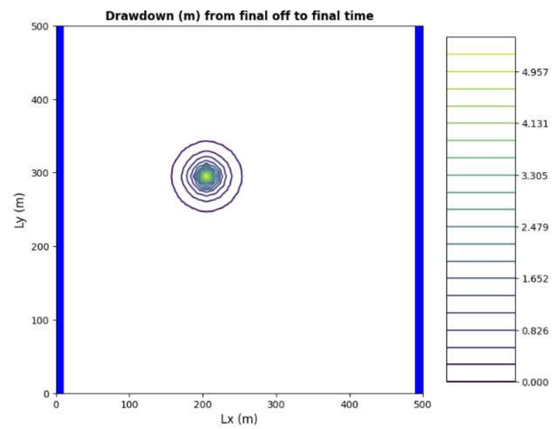


C continued

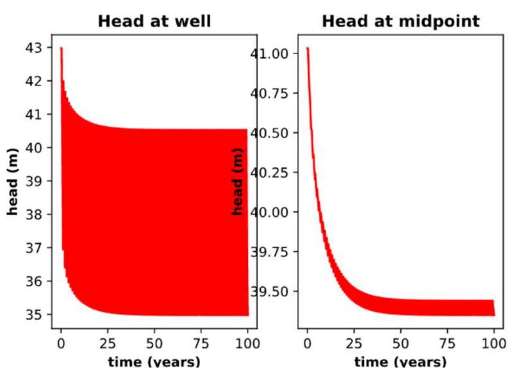
- Based on the drawdown from the end of the last pump-on stress period to the end of simulation time.

When we look at the influence of the well from the finall off-time to the final time, the zone of influence seems to only be around the well (the area adjacent to the well in the chart on the right).





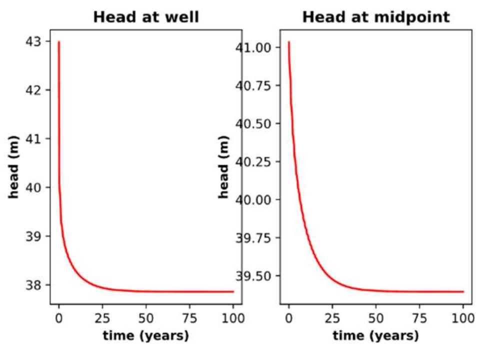
d) How long does it take a point at the center of the domain to reach steady state. At that point, explain how you could divide the domain into a steady and transient part and solve each separately.



Just eyeballing it, it looks like this system reaches (more or less) a steady state after around 50 years of pumping. At least if we ignore the massive oscillation occurring every year.

e) Find a constant pumping rate (same throughout the year) that matches the head time series at the middle of the domain.

Because 500 cubic meters of water were only being pumped during one quarter of the year, my initial thought was to have a constant pumping rate of one quarter the initial pumping rate. It turns out that recharge completely cancelled any effect on head that that had on the system. Half of the initial pumping rate seems to come close to matching the average values for head. I am not sure why it seems to work out this way.



f) Find a constant pumping rate (same throughout the year) that matches the head time series at the well, leaving only a regular, repeating seasonal residual. Are the two pumping rates the same?
I think this is the same as part e)

g) Discuss the sources of water captured by this well. If you're up for a challenge, calculate them for the final pump-on period.
The two sources of water captured by the well that I can think of are the water from the left boundary and the recharge occurring within the capture-zone.

h) Discuss how you would define the capture zone of the well. How is it different than our definitions of capture zone so far in the course?
The difference between this capture zone and the ones from previous models is that this one changes in it's extent through time both in the period before it reaches a steady state and in the period of time when the pumping has been turned off. I'd expect the capture zone to expand and contract every year even after it can be simplified as a steady state system.