**The Challenge**

1. Compare your results for the case with no ET to the modified ET case and explain how your results differ. To do this I'm expecting you will create some plots as well as looking at the water balance.

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| --- | --- |
| No ET | With ET |
|  |  |
| * With no ET there is a higher difference between our flux. This is because evaporation does not remove any extra flux from the system. | * There is a lower difference between our flux seen with our scenario with ET. With ET, additional water is removed so there is less flux leaving the system * There is also higher flow in our case with ET because our system is drier, therefore more water flows in from our boundary condition. |
|  |  |
| * Our drawdown is less pronounced. | * + We see additional drawdown occuring because there is less water, but the pumping rate is the same |

1. Modify the model so that the ET only occurs in a square area around the well that is 200m by 200m. Discuss how this changes your results using plots and water balance calculations.

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| --- | --- |
| No ET | With ET in a box |
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| NA | * With ET we can see that flow is more pronounced before the region of ET. * With a box ET I would expect there to be a lower difference between our left and right flux compared to our scenario with no ET, however the difference would be greater than the scenario where there is ET everywhere. |

1. Modify the recharge in the model so that it is also transient. Its up to you how you want to modify it. Provide and explanation for the scenario you ran and explain how it impacts your results.

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| --- | --- |
| No ET No Recharge | Transient Recharge |
|  |  |
| NA | * With recharge I would expect to see a lower flux on the left and a higher flux on the right because we are introducing water to our system. * I see the opposite in this result and I don’t know why |

**Glossary questions:**

1. What are initial conditions? Describe various approaches to determining initial conditions for a groundwater model.
   * Initial conditions are the starting conditions we begin our model simulations at. Examples would be- initial moisture content of the soil, initial GW levels, initial pressure head of the system.
   * To determine initial conditions we could change some boundary conditions to see whether that changed our models outputs.
2. What does it mean for a groundwater model to be ‘spun up’? How can we go about achieving this and how would we know if we are done? What can happen if you run transient models on a groundwater model that is not spun up?
   * We run our model for a chosen time period until equilibrium (either dynamic or steady state) is reached. This is our “spin-up” period. If we run a transient model without making sure our model has been spun-up, we will get outputs that are responding to variations in our model, and not the true results we are looking for.
3. Groundwater is generally the slowest moving component of the hydrologic cycle. Describe (1) the speeds at which groundwater flows compared to surface water (2) the time scales over which water tables and groundwater heads respond to changes in pumping vs recharge in both confined and unconfined systems? What are the implications of these timescales for how we model groundwater systems?
   * GW – 1 foot/day (this is considered fast)
   * SW – 1 foot/second
   * In unconfined systems our GW table drops faster compared to confined system. We therefore need to make sure we appropriately specify our timesteps and our stress periods.