

## HW7 Glossary Questions

1. What does it mean to be simulating saturated flow vs variably saturated flow? What are the advantages and disadvantages of each? Why is it much harder to solve for unsaturated flow? Integrate the concept of a linear versus a nonlinear model into your answer.

Solving for saturated flow means that the flux plane of every grid cell within a model is completely wetted and their corresponding head values do not reflect an actual height of water at each point in the model. This is easier for a modeling system to solve because it maintains a linear relationship between each cell. However, variably saturated flow implies that the wetted flux plane can change as a function of the cell's head value which implies that the cross-sectional area—a variable responsible for determining the head gradient—is dependent on the state of the system and this is the source of nonlinearity in variably saturated flow. It is much harder for the modeling system to solve these nonlinear flows.

2. What is meant by an internal source/sink for ground water flow and how is it different than a boundary condition? Give an example.

An internal source/sink for groundwater flow is a point within the domain that contributes a positive (source) or negative (sink) flux value to the system. In our models, we have used recharge as sources and pumping wells and evapotranspiration as sinks. These are different than boundary conditions because boundary conditions must always be satisfied within the model whereas sources/sinks can terminate if the model conditions are not sufficient such as in the case of evapotranspiration's extinction depth.

3. What is meant by 'forecast uncertainty' in the context of a groundwater model? What are the sources of this uncertainty? What is required for a prediction to be as robust as possible?

The forecast uncertainty of a groundwater model relates to the confidence level that the model can faithfully and accurately represent what will happen in the future and it is derived from the model builder's assumptions of which initial conditions and parameters are relevant and the model. Physical models are tested according to their ability to match historical data even though many conditions and parameter states can recreate past observation; as a result, the weight of the model builder's biases are amplified throughout the model and ultimately leads to a physical representation that contains inherent uncertainty about which parameters were neglected that might contribute significantly to future outcomes or which data were omitted that are necessary to create accurate predictions.