Exam IHE Transient Groundwater

Tuesday, Feb 4, 2020.

# Question 1

1. Explain what is meant by air-entry pressure, and how you interpret it in terms of groundwater?
2. What happens to the water level in a piezometer installed in a confined aquifer if suddenly a load equivalent to a pressure increase is placed on ground surface?
3. What happens to the water level in a piezometer if the barometer pressure suddenly change by an amount ?
4. Explain what causes the difference between the answers to questions 2. And 3.
5. If a pressure transducer is fixed in a piezometer, below the water level at a given elevation, then what changes would it register in the two situations described in questions 2 and 3? (A pressure transducer measures and registers the absolute pressure, i.e. water + air).

# Question 2

Let the time-dependent change of head in a strip of land with width *𝐿* [m] between two ditches be caused by a sudden change of water level equal to *𝐴* [m] at the left ditch and equal to *𝐵* [m] at the right ditch. We know that this can be computed using the formula that is valid for a half-infinite aquifer (that is an aquifer for which *x*>0) bounded by surface water at *x*=0, if we apply superposition. The formula for the half-infinite aquifer is

In preparation of the superposition, a superposition scheme is drawn (see figure below), which shows the strip of land in dark yellow and the first few of the infinite series of mirror ditches. The arrows indicate the direction and size of the change of head at each ditch.



1. Is this scheme correct? Explain why or why not that is the case.

The first term of formula describing the drainage of a strip of land of with , the head at is uniform and equal to *A* [m] above the ditches on either side, is given by

with

1. What does this equation tell you? What's happening here? What name would you give to *T* ? Also explain why.
2. What is the halftime of this drainage process? Explain, and show it mathematically.
3. How would you compare the rate of drainage of a desert that is 500 km wide between surface -water boundaries and an arable field of 100 m wide between ditches, if both have the same aquifer properties?

# Question 3

The simplified Theis solution for the drawdown due to a pumping well in a (un)confined aquifer reads

A pumping test was carried out with an extraction of . The drawdown was measured in 3 observation wells.

The figure shows the measured drawdown in the observation wells as a function of on logarithmic scale.

Answer the following questions

1. What is the transmissivity? Explain and compute it.
2. What is the storage coefficient? Explain and compute it.
3. If you had only the drawdown in the well itself instead of in observation wells? What could you and what could you not determine, and why?
4. What is the radius of influence? Explain and show it mathematically.

