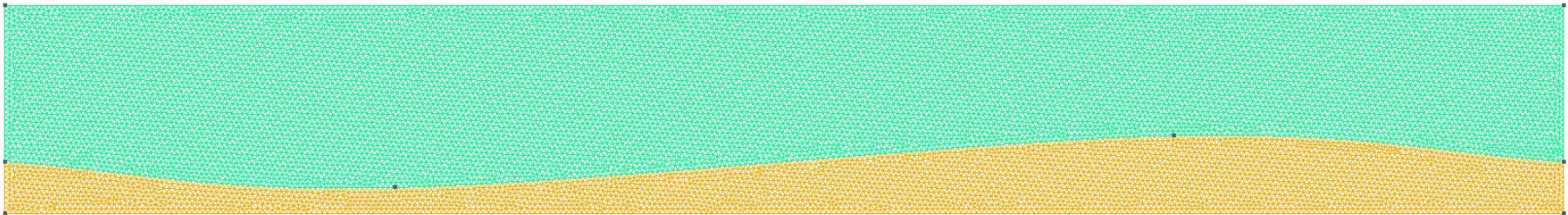# Quantification of the magnitude of the errors of transmissivity estimates from the analysis of pumping test synthetic data performed in aquifers with complex geometry

Undergraduate Thesis - Phillipe Lima

Project

What is?

Quantify the magnitude of the errors of transmissivity estimates due to vertical flow component caused by irregular aquifer geometry

Why?

Studies analysing the pumping tests results account for heterogeneity of T or K and do not mention the irregularities of the b. (this is responsible for a minor part of the heterogeneity character)

How?

Create a numerical model of a aquifer with complex geometry. Do a monte carlo simulation to get the geometries that lead to higher errors of T estimates.

Results

v1 (basis of the next models):

steady state
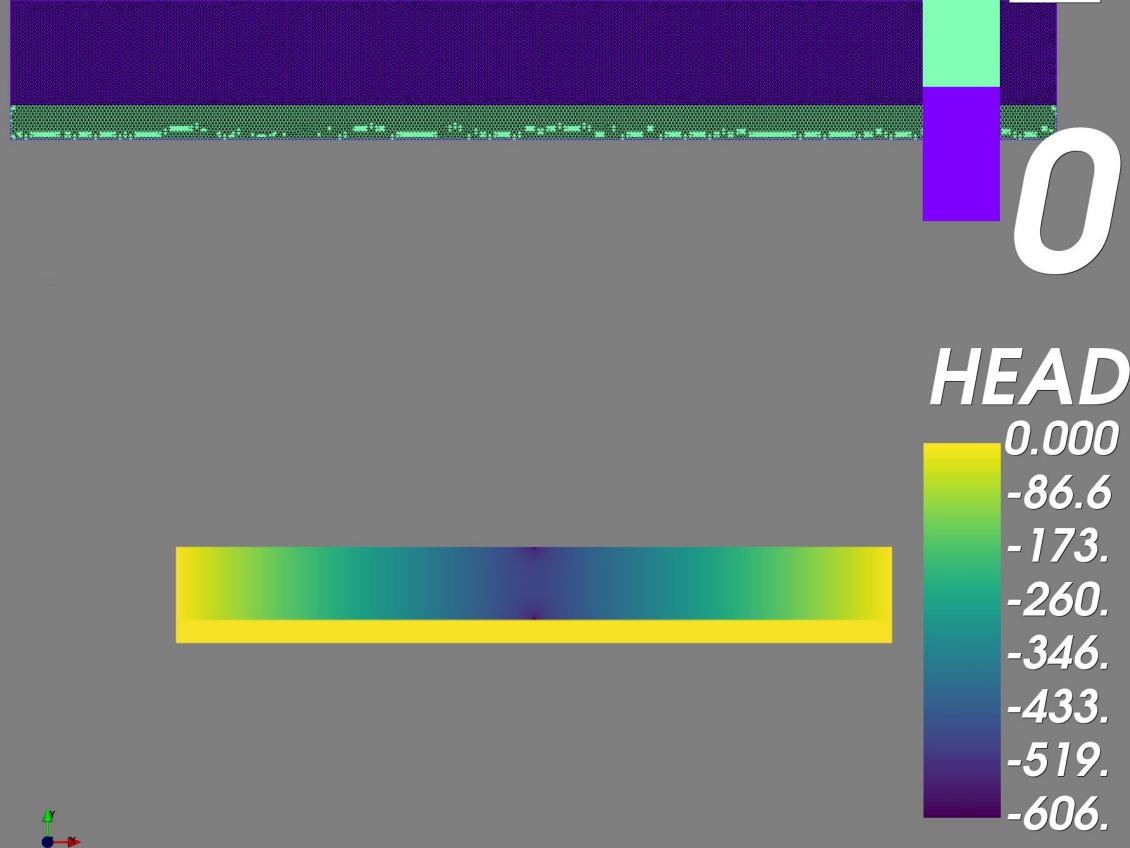
domain mesh = 3000x400

IC (domain) = 0.0 head

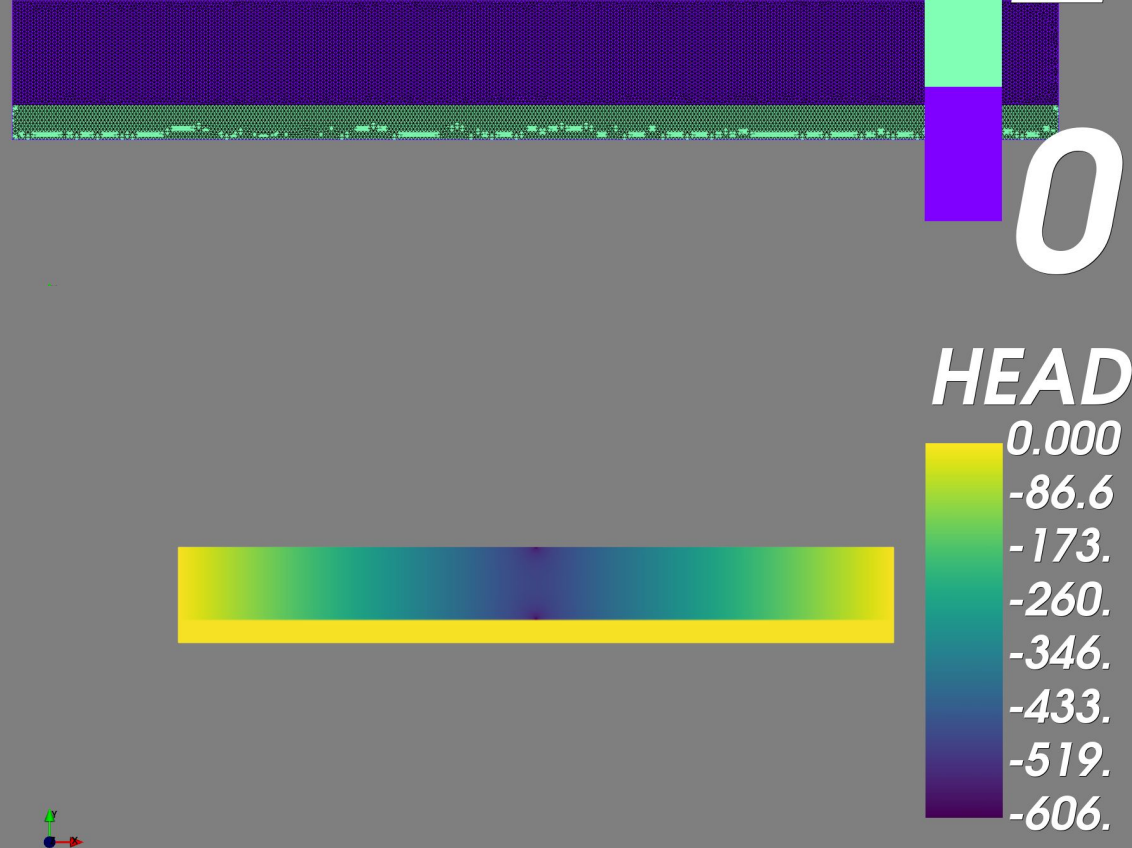BC (l, r, b) = 0.0 head

K aquifer = 1e-4 m/s

K bedrock = 0 m/s

storage = 1e-3

rate = -1e-2 m3/s

Material ID

2

0

HEAD

0.000
-86.6
-173.
-260.
-346.
-433.
-519.
-606.

Questions

(1) The pwell and owell (polylines) appears as the points that form it in the model.
(2) DIS_TYPE of the Source Term block only works for "CONSTANT" and do not works for "CONSTANT_NEUMANN"
(3) I created a xy instead of xz model. Is this make difference? (gravitation)

Results

v2:

transient state
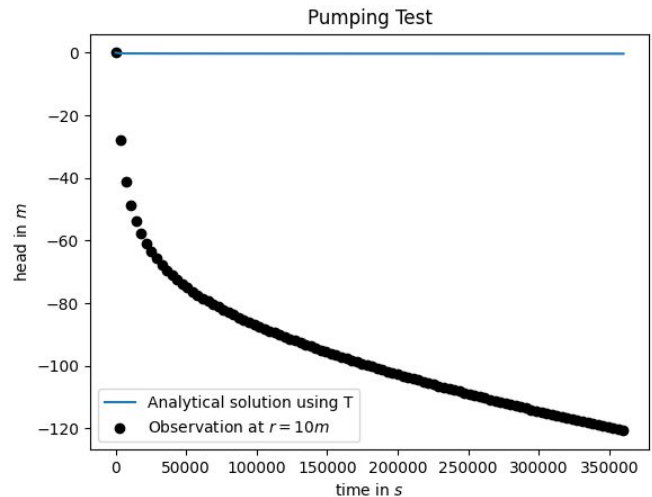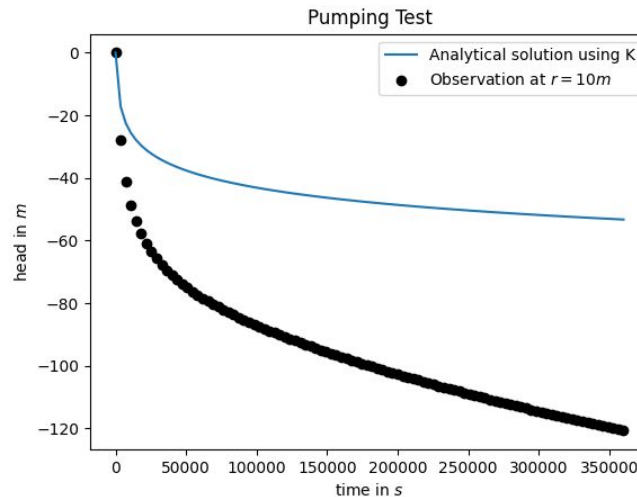
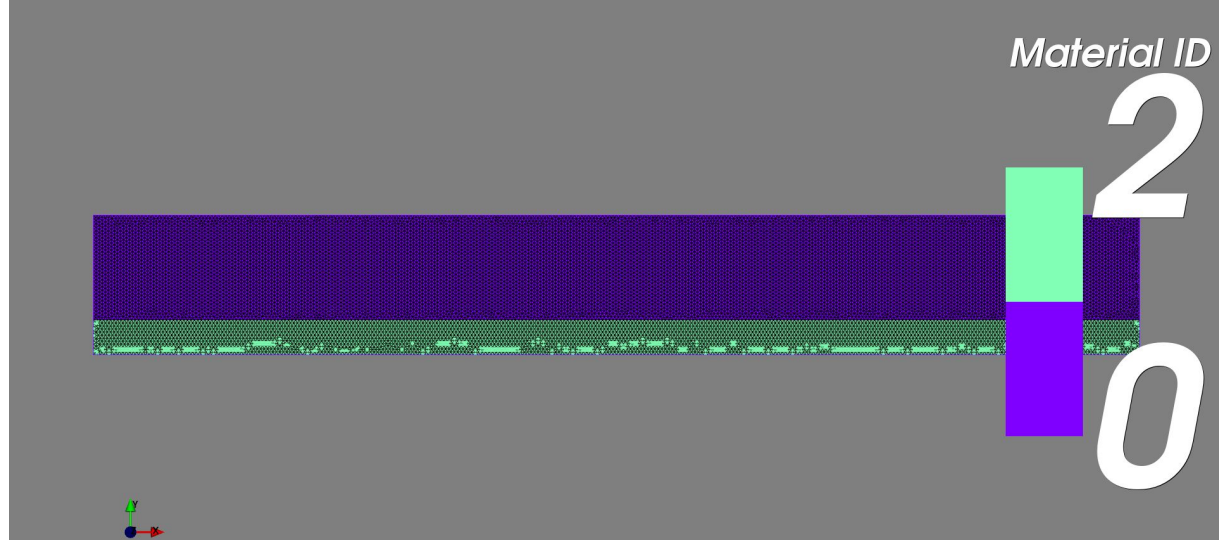domain mesh = 3000x400

IC (domain) = 0.0 head

BC (l, r, b) = 0.0 head

K aquifer = 1e-4 m/s

K bedrock = 0 m/s

storage = 1e-3

rate = -1e-2 m3/s

Results

v2:

transient state

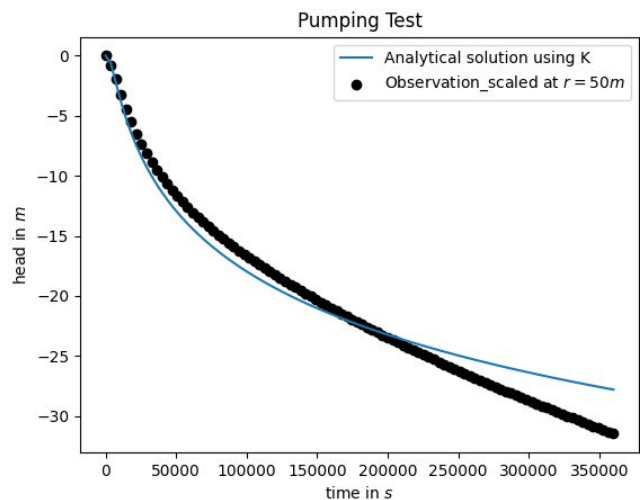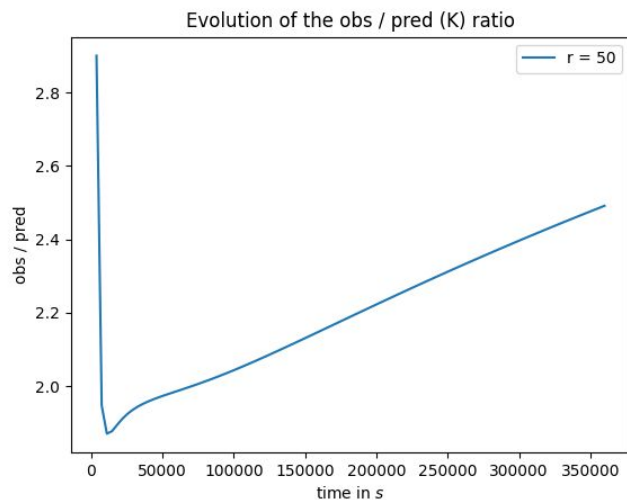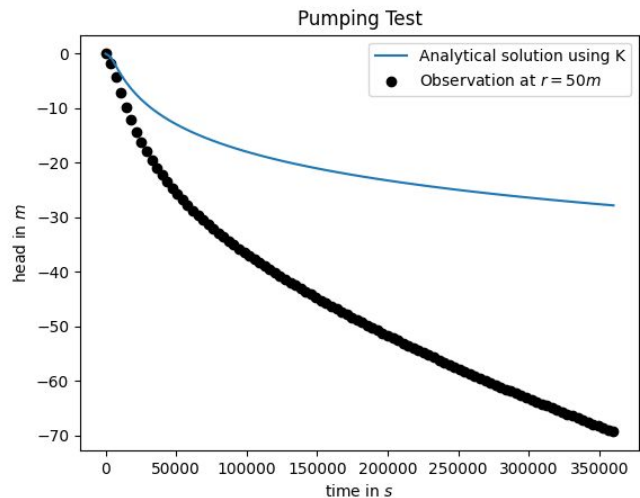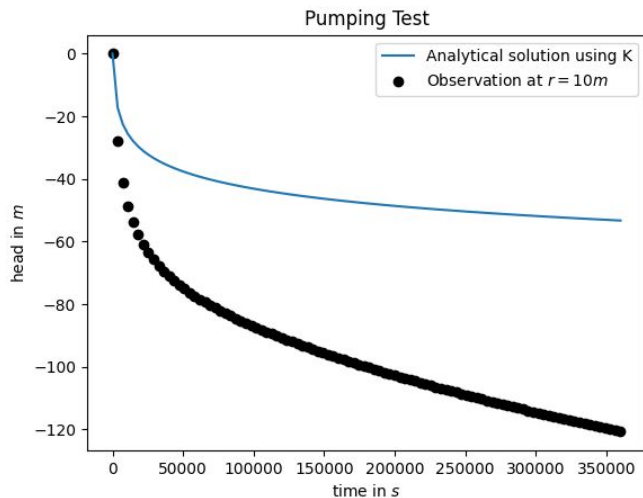domain mesh = 3000x400

K aquifer = 1e-4 m/s

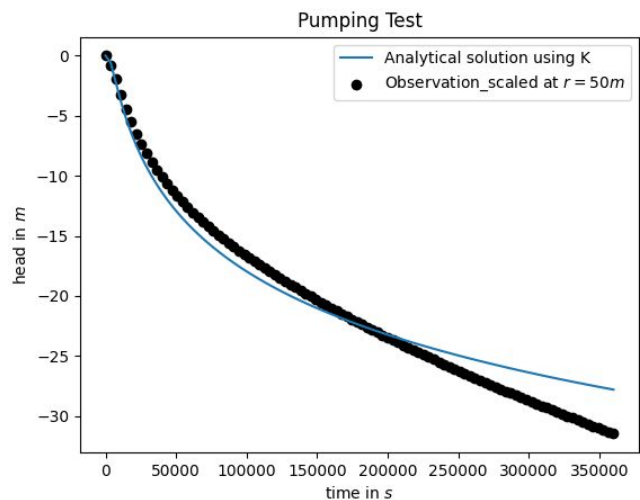K bedrock = 0 m/s
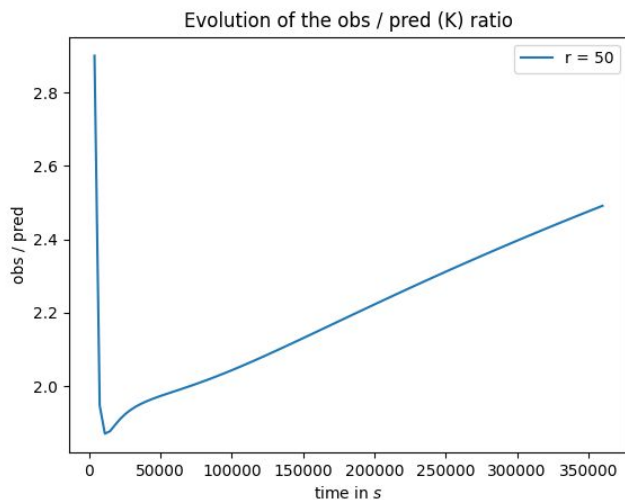
storage = 1e-3

rate = -1e-2 m3/s

mean(obs/pred(K) = 2.201
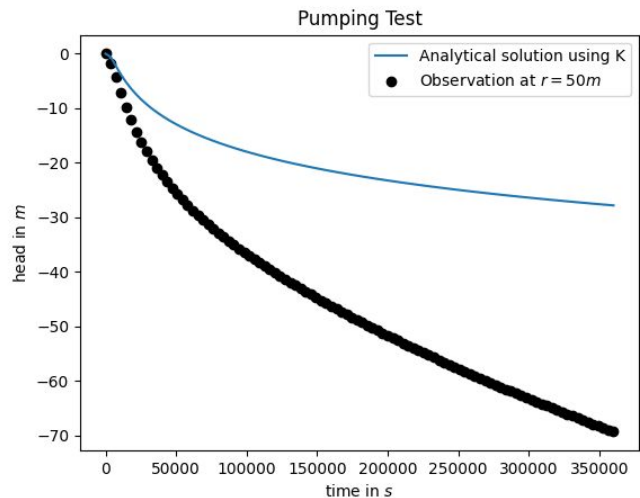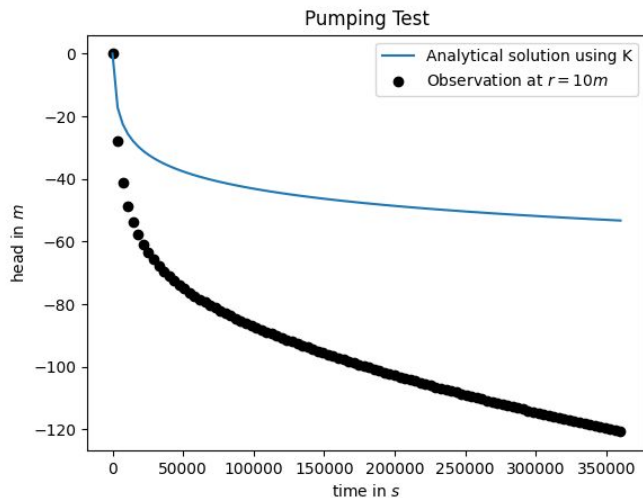
ln(Ttr) = -9.21034

ln(Twtp) = -9.58408

Questions

(1) How fix the difference between analytical and obs head? or how to handle it?

(2) confined vs unconfined? My proposal is about an unconfined aquifer but I have problem to execute this approach. I will go ahead with confined scenario.

Next steps

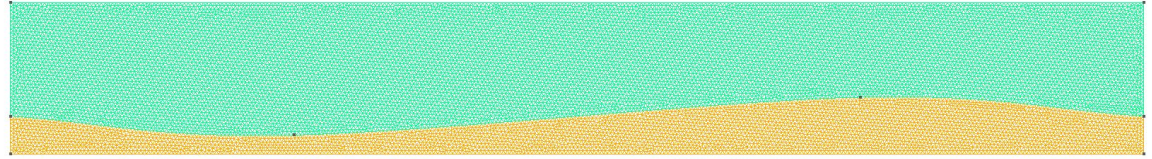v3:

domain mesh = 3000x400
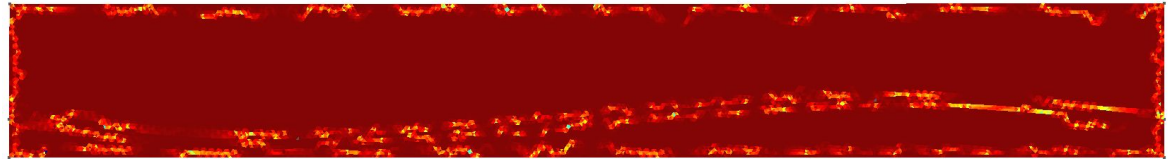
K aquifer = 1e-4 m/s

K bedrock = 0 m/s

storage = 1e-3

2 unfixed nodes

v4:

monte carlo simulation
varying the unfixed nodes

Mesh quality

Gamma = inscribed_radius /
circumscribed_radius

Gamma

| 0.685 | 0.716 | 0.748 | 0.779 | 0.811 | 0.842 | 0.874 | 0.905 | 0.937 | 0.968 | 1 |

Proposal Evaluator's Recommendations

Title

Methods - Make it more clear

Steps and feasibility of the project - Make it more specific and clear