

Practical exercises:

Exercise

Use the pumping example from last week (week 5). Add a point vector layer with at least 3 observation points with a growing distance to the pumping location. Add columns in the attribute table for each day of the pumping test. Then use the function `v.what.rast` (Menu: Vector – update attributes) to extract the groundwater levels at the observation points for each day of the pumping test. Then export the attribute table of your vector layer and visualize the decrease in groundwater level at the observation points, e.g., using Excel.

Theoretical exercises:

Exercise

Which part of modeling diffusion-advective transport might be cumbersome and why?

Exercise

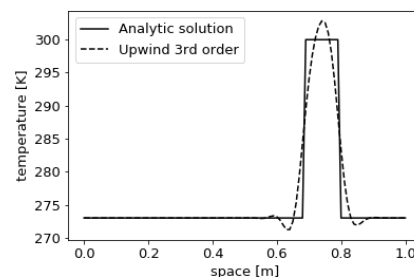
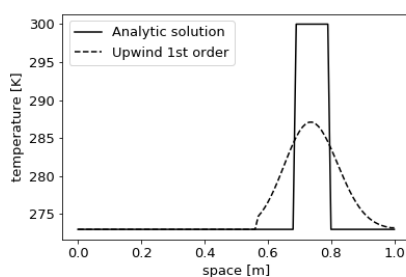
Explain why modeling advection requires special attention and explain at least two issues that might occur if advection is not modeled adequately.

Exercise

What can be done with respect to the input signal to reduce numerical diffusion and increase accuracy during a simulation of an advective transport.

Exercise

Compare the numerical solution of the 1d advective transport problem using the upwind scheme of 1st and 3rd order. Which method would you prefer and why?



Exercise

Explain the difference between a Eulerian grid and Lagrangian markers.

Exercise

Describe the idea of using Lagrangian markers to simulate advective transport processes. Name at least one drawback and one benefit of using Lagrangian markers compared to a solution based on a Eulerian grid.

Exercise

Explain why a smaller time step might increase numerical diffusion during a solution of the diffusion-advection equation.

Exercise

Explain why fractures are often represented through an object of reduced geometrical dimension.

Exercise

Discuss at least two conditions under which fractures should be handled explicitly in a hydraulic groundwater model.

Exercise

Explain the concept of effective porous media. Under which conditions is this concept a reasonable approximation of nature and how can an effective porous media approach be improved to account for fracture flow?

Exercise

Explain the difference between a Dual Domain model and a discrete fracture network.

Exercise

Explain the difference between a discrete fracture network and an embedded discrete fracture model.

Exercise

Name conditions under which discrete fracture network models neglecting matrix flow might be an adequate representation of nature.

Exercise

Sort (a) an effective porous media model, (b) a dual domain model and (c) a discrete fracture model by their computational costs. Explain your sorting.