

### Practical exercises:

#### **Exercise**

A company secretly disposed a toxic solute in the groundwater by diluting 0.1 kg of the solute with 1 m<sup>3</sup> of fresh water for 30 days with a pumping rate of 10 liters per second. Subsequently, they pumped fresh water with a similar pumping rate for the following 10 days into the aquifer to cover their crime. However, the illegal disposal got noticed after another 30 days and it is now your task to propose a possible setup for a pump and treat installation. The groundwater flow is aligned in NE-SW direction with a hydraulic gradient of 1% in east-west and 2% in north-south direction. The hydraulic conductivity of the soil is estimated to be around 0.00005 m/s with a diffusivity of 10<sup>-7</sup> m<sup>2</sup>/s. Porosity is around 12% and dispersion length is around 0.01 m. From laboratory tests it is known that the solute experiences a retardation factor of 1.6. The aquifer thickness is around 35 m with 8 m depth to groundwater.

- a) Design a conceptual model providing an estimate about the geometry, boundary conditions, and the different temporal stages of the simulation. Identify all values for the respective parameters and convert into suitable units where necessary.
- b) Conduct a numerical groundwater flow and solute transport model for the described scenario. Note the unsteady flow conditions due to the changing pumping conditions.

### Theoretical exercises:

#### **Exercise**

Name at least three aspects related to the quality of a numerical groundwater model and discuss their influence on the quality of the model.

#### **Exercise**

Name at least three properties of a numerical simulation that can be checked comparably easy and explain how one can conduct such a check.

#### **Exercise**

How do you check if your model is consistent with respect to temporal and spatial resolution?

#### **Exercise**

Name two phenomena that might indicate unstable or inaccurate numerical results.

#### **Exercise**

Explain two different scenarios under which a non-homogeneous distribution of the Peclet number is observed.

#### **Exercise**

Explain why conceptual misinterpretations of a situation are difficult to detect based on a numerical simulation result.