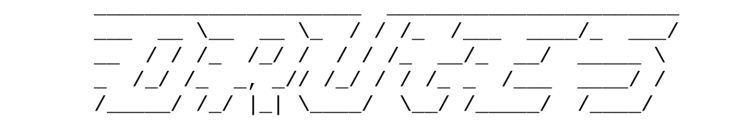


# Projects 2018
# Applied Hydropedology

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For the following projects, you require a working installation of DRUtES and meshing software GMSH. GMSH is a software package, which is a part of all leading Debian and Red Hat based Linux distributions. It also available for Mac OS X and even for Microsoft Windows.

We recommend you to watch following GMSH tutorial to become familiar with the software.

In the end, each group should make a scientific poster (A0), which will be presented during the last exercise. EGU student Poster winners

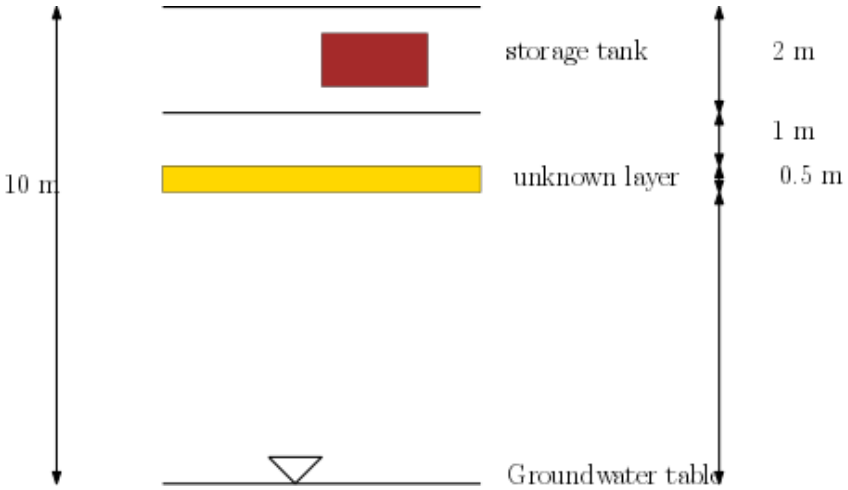
## 1 Project 1: Pesticide spill

### 1.1 Scenario

An underground storage tank of dimensions $2 \times 1.5 \times 1$ m$^3$ containing pesticides suddenly cracked and started leaking. The accident took place in the mid of September. The leakage was taken under control and stopped within the first 30 minutes. Unfortunately, the total volume of 200 l of pesticides leaked into the soil before it was stopped. The solubility of the pesticide is 400 ppm. The half-life of the pesticide is 50 years. Old soil records indicate layering. The top layer is sandy loam and below is clay loam. However, different measurements indicated different layers in 3 m depth. The storage tank was located in Příbram region, Central Bohemia, check CHMI temperature measurements for temperature records, and CHMI rainfall measurements for rainfall records. Use (Linacre, 1977) to obtain average potential evaporation data.

### 1.2 Tasks

1. Generate a mesh that adequately represents the problem.
2. Find adequate parameters for your soil.
3. Conduct coupled simulations (ADE: contaminant transport + Richard's equation) with a range of different parameterizations for the unknown layer.
4. What is your domain setup? Include boundary and initial conditions.
5. The authorities are very much interested in following questions:
    - When does the pesticide reach the groundwater table?




- The pesticide won't be detected when the concentration is below 10 $\mu$g/l. When will that happen?
- Since there are uncertainties in the initial condition setup (especially the initial condition for the Richards equation), try to obtain a so-called "super-conservative" solution (as pessimistic as possible). This precautionary approach is often used within the European Union.

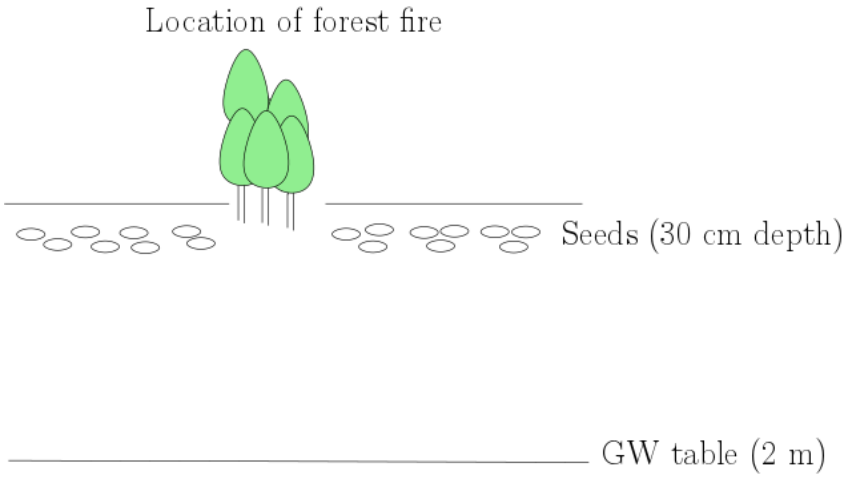
6. Write down all assumptions.
7. Create a scientific poster (A0) to present your findings.

# 2 Project 2: Forrest fire

## 2.1 Scenario

Farmers just finished sowing new seeds on their fields (end of March) when a forest fire between two different agricultural fields broke out. The fields are separated from the forest by an unpaved road 3 m in width. The fire was brought under control quite quickly, but still caused the temperature to rise up to 500 °C for 30 minutes. The fire was extinguished by water, as a result the top soil layer in the forest became fully saturated. The farmers are worried that the seeds were damaged. The insurance will cover the losses of the seeds when it can be shown that the temperature rose to 50 °C. The accident took place in Haná region, South Moravia. The initial conditions for the water content can be guessed from the rainfall data CHMI rainfall measurements and from the temperature data CHMI temperature measurements. Use (Linacre, 1977) to obtain average potential evaporation data.

The field to the right is a sandy loam, whereas the field to the left is a clay loam.

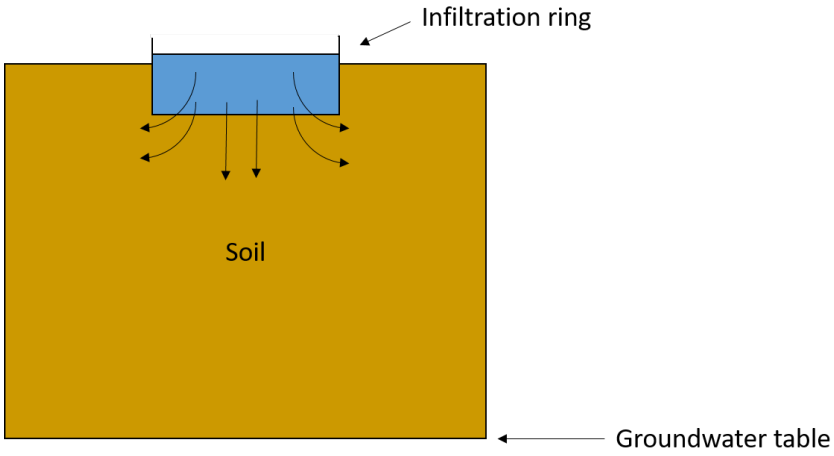



## 2.2 Tasks

1. Generate a mesh that adequately represents the problem.
2. Find adequate parametrization for the agricultural fields.
3. Conduct a sensitivity study with different initial conditions. Is there a difference when the soil is wet or dry?
4. Conduct coupled simulations (Heat + Richard's equation).
5. What is your domain setup? Include boundary and initial conditions.
6. Since there are uncertainties in the initial condition setup (especially the initial condition for the Richards equation), try to obtain a so-called "super-conservative" solution (as pessimistic as possible).
7. Write down all assumptions.
8. Create a scientific poster (A0) to present your findings. For inspiration look

# 3 Project 3: Mesh optimization

Single ring infiltration is a common method to determine saturated hydraulic conductivity. For this, a ring is placed into the surface of the soil and water is added with a constant height of water. The ring is usually quite narrow. Modelers wonder how to discretize the mesh to adequately represent the infiltration process and run the simulation within a reasonable time. This in situ experiment took place in the late August in Vimperk region – South Bohemia (Šumava mountains), obtain the initial conditions estimate from the CHMI rainfall measurements and CHMI temperature measurements. The potential evaporation can be estimated from (Linacre, 1977)




## 3.1 Tasks

1. Find the optimal mesh that optimizes simulation time and accuracy.
2. What is your domain setup? Include boundary and initial conditions.
3. Write down all assumptions.
4. Create a scientific poster (A0) to present your findings.