Versuchseinrichtung zur Grundwasser- und Altlastensanierung · *VEGAS*
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Problem Description
Msc. Thesis

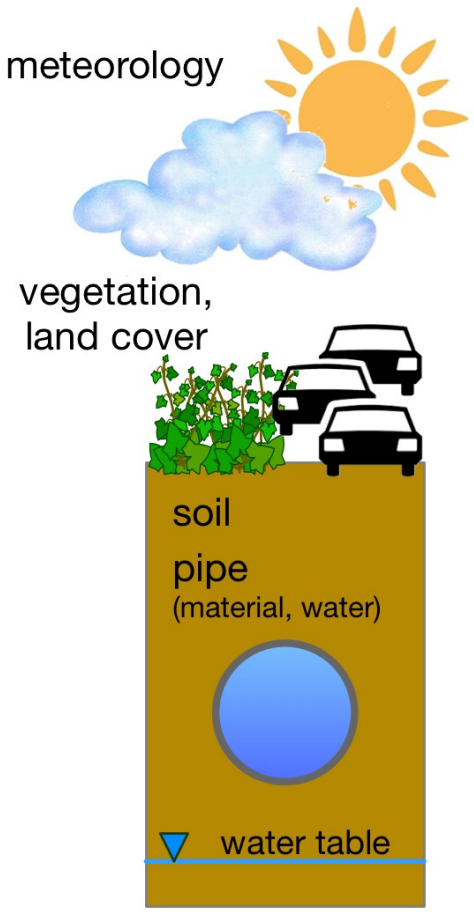
/cph 16-May-2019
Announcement_Master_Thesis.docx

Shallow subsurface heat transport under transient boundary conditions for technological applications

Motivation

The highest share of energy demand for private consumers is heating. Therefore, carbon neutral heating solutions are a key technology in transitioning to a carbon neutral society. A major problem in heating buildings with regenerative energy sources like solar energy is the mismatch between demand of heat and supply of heat: During the summer, heat demand is low but solar heat supply is high; during the winter, heat demand is high but solar heat supply is low. Seasonal heat storage systems would alleviate this problem and thereby lead to increased solar fractions in the heat sector. Shallow subsurface seasonal heat storage systems are one approach to seasonal storage. For their design, heat transport in the unsaturated zone under transient boundary conditions need to be considered.

The same factors also determine the design of sustainable drinking water distribution networks.



Tasks

1. Set-up a suitable numerical model for coupled heat, water, and air flow in the variably saturated zone.
2. Evaluate the sensitivities of a seasonal heat store design under transient boundary conditions: Quantify the heat fluxes from ground surface into liquid-filled pipes, using the model from (1), under time-variant meteorological-, vegetation-, pavement-, soil-, hydraulic-, and pipe-material- parameters (Figure 1).
3. Optimize the performance of the storage system given the parameter sensitivities obtained from (2).

Requirements & Support

Basic programming knowledge, some experience with Linux/Unix systems, and solid math knowledge are advantageous, but not required. We will support you with setting up the model in Dumux and help with programming in Python.

Supervision

Samuel Scherrer, M.Sc.

PD Dr.-Ing. Claus Haslauer

Formulation of Problem/Examiners

Samuel Scherrer, M.Sc.

PD Dr.-Ing. Claus Haslauer

PD Dr.-Ing. Sergey Olyadishkin

Dr.-Ing. Esad Osmancevic

We‘d be happy to hear from you and happily discuss details of the project with you.

Starting Date: As soon as possible / to be discussed