

**Course on**

# Geothermics Modelling

using **COMSOL Multiphysics**

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**for natural scientists and engineers**

**Course:**

*July 19<sup>th</sup> – 23<sup>rd</sup> 2010*

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see website:

<http://www.geo.fu-berlin.de/geol/news/index.html>

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Course Overview

## Core Topics

- **Introduction to COMSOL**
- **Introduction to groundwater flow modelling**
- **Fundamentals of heat transport in porous media**
- **Steady flow and transport (heat storage)**
- **Steady flow and transient transport (doublet)**
- **Coupled flow and heat transport**

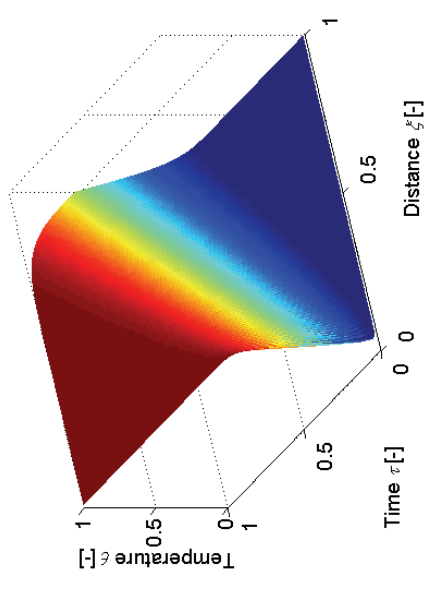
## Additional & Optional Topics

- **Mass transport**
- **Introduction to free fluid flow modelling**
- **Coupled porous media and free fluid flow**

Software: **COMSOL Multiphysics**

## Aim

First practice in simulation of deep and shallow heat storage and extraction; especially of steady and transient heat and temperature distributions under the influence of advection, thermal diffusion, heating and cooling



*Example:* Temperature distribution in time and space due to advection and diffusion

## Teaching & Training

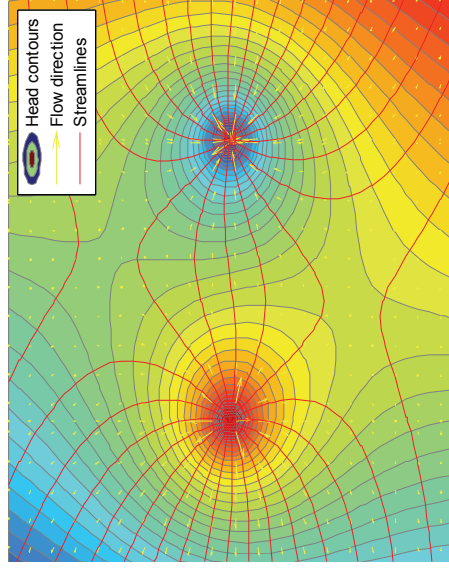
- Preprocessing
- Processing
- Graphical postprocessing/ visualization incl.
  - Isotherm plots
  - Temperature profiles
  - Breakthrough curves
  - Animations
- Numerical postprocessing

## Software

COMSOL Multiphysics is **the software** for general multiphysics applications, as they arise in many fields of technology development.

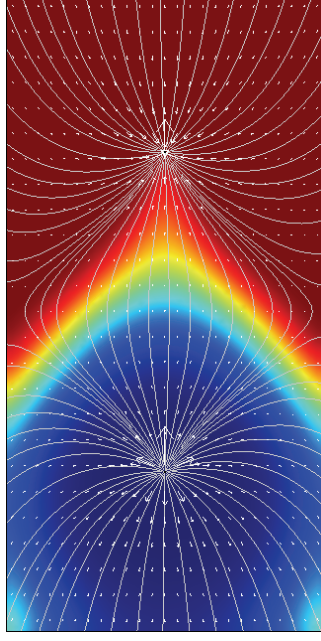
Flow, heat and mass transport, electromagnetism and other physical and chemical processes can be linked together in a single model in order to examine mutual influences.

Here we focus on the interaction between flow and heat transport in porous media. For that purpose we take advantage of the COMSOL Earth Science Module (ESM). In case of interest we also outline the connection with MATLAB®.



*Example:* Doublette flow in a regional flow field

COMSOL Multiphysics is based on **Finite Elements** and can be applied for steady and transient simulations in 1D, 2D and 3D dimensional space.



*Example:* Heat transport in a doublette, simulated with COMSOL Multiphysics

## Venue

The course will take place at the Geo-Campus of Freie Universität Berlin in Berlin Lankwitz.

Participants should have a basic knowledge of groundwater flow modelling.

Fee: 200 €; for students the course is free of charge.

Course is held as 1-week hands-on block course in a PC-pool.

The course will be held in German or English.

Beforehand application is obligatory.

For details on the software see:

<http://www.comsol.com>

<http://www.comsol.de>

see also:

<http://www.springerlink.com/content/q66i396255572439/>

<http://www.mathworks.com/matlabcentral/fileexchange/15646>

In case of interest please fill in the following form and send to:

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I want to participate in the COMSOL Geothermics Modelling Course:

Name: \_\_\_\_\_

Affiliation: \_\_\_\_\_

Address: \_\_\_\_\_

Tel.: \_\_\_\_\_

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E-Mail: \_\_\_\_\_