



D6.5 / D18

**Workshop 3 – Lausanne,
February, 6th to 8th 2018 -**

Report

Enigma ITN

Workshop 3: Predictive modeling and upscaling of flow and reactive transport in heterogeneous aquifers

The Enigma ITN workshop 3 took place in Lausanne, Switzerland from Tuesday 6th to Thursday 8th in February 2018.

Main organisers of the workshop: CSIC (CSIC Research Centre Barcelona), UT (University of Tübingen) & UNIL (University of Lausanne)

Participants to the workshop:

All 15 ESRs participated to workshop 3 in Lausanne:

1	ESR1	Kevin de Vriedt
2	ESR2	Guilherme Nogueira
3	ESR3	Alvaro Pardo Alvarez
4	ESR4	Justine Molron
5	ESR5	Lara Blazevic
6	ESR6	Behzad Pouladi
7	ESR7	Joel Tirado Conde
8	ESR8	Anne Karin Cooke
9	ESR9	Alejandro Fernandez Visenti
10	ESR10	Peleg Haruzi
11	ESR11	Richard Hoffmann
12	ESR12	Satoshi Izumoto
13	ESR13	Veronika Rieckh
14	ESR14	Andrea Palacios
15	ESR15	Jorge Lopez Alvis

In addition, the workshop was followed by six PhD students external to ENIGMA: Carlotta Brunetti (University of Lausanne); Przemyslaw Juda (University of Neuchâtel); Mayumi Claire Hamada (University of Lausanne); Charlotte Le Traon (University of Rennes 1); Diane Doolaege (University of Rennes I and Itasca) and Alejandro Romero Ruiz (University of Lausanne).

Objectives

The workshop program introduces the mathematical and physical basis of flow and reactive transport in porous media, and the numerical methods for predictive modelling. It discusses scale effects for approaches based on the advection-dispersion equation and upscaling methods to get alternative effective equations (i.e., CTRW or MRMT for non-Fickian transport). Special emphasis is laid on mixing and mixing-controlled reactions in heterogeneous media as well as on field methods for the identification and characterization of non-ideal behaviour. Hands on practices on simple problems will illustrate predictive modelling honouring extensive data sets and acknowledges uncertainty.

Support

A book chapter was provided before the start of the workshop to ensure that basic concepts were known prior to the workshop. Also, links to various online courses to learn the basics of Matlab programming for those that were unfamiliar with Matlab.

The logistics and communication were done through the website of the organizer:
<https://wp.unil.ch/linde-hydrogeophysics/about/>.

Program & Locations

Content

Predictive modeling and upscaling of flow and reactive transport in heterogeneous aquifers

February 6-8, 2121 (Lectures) 2138 (Exercises) Géopolis, University of Lausanne

Instructors: Jesus Carrera (CSIC), Olaf Cirpka (UT), Marco Dentz (CSIC)

February 6 (Jesus Carrera):

Lecture, 9h00-10:30. Principles of GW flow; Hydraulic conductivity; Storage coefficient; Flow equation; Dimensionless form of the flow equation.

Coffee Break, 10:30-11:00

Lecture, 11h00-12:00. Introduction to numerical methods and groundwater modeling.

Exercises 12:00-13:00. Excel exercises on 1-D flow

Lunch 13:00-14:00

Lecture, 14:00-15:30 Principles of solute transport; Diffusion; Dispersion; the ADE equation; Mixing and reactions.

Coffee Break, 15:30-16:00

Lecture, 16h00-17:00. Introduction to numerical methods for solving transport.

Exercises 17:00-18:00. Excel exercises on 1-D transport.



Photo: Lecture room at UNIL

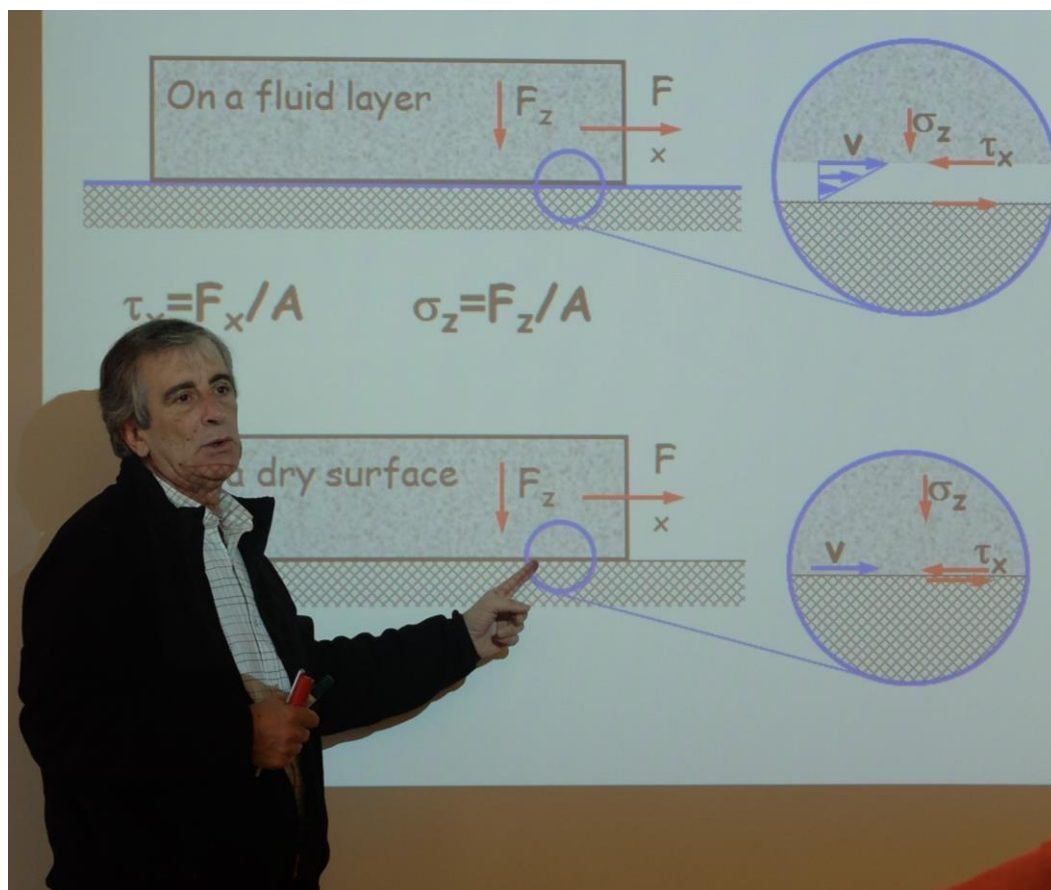


Photo: Lecture by Jesus Carrera.

February 7 (Olaf Cirpka):

Lecture, 9h00-10:30. Principles of bioreactive transport 1: Reaction kinetics and system behavior in 1-D bioreactive transport

Coffee Break, 10:30-11:00

Lecture, 11h00-13:00. Principles of bioreactive transport 2: Mixing-controlled bioreactive transport in homogeneous and heterogeneous domains 2-D domains

Lunch 13:00-14:00

Exercises, 14:00-15:30 Matlab exercises on 1-D bioreactive transport

Coffee Break, 15:30-16:00

Exercises, 16:00-18:00 Matlab exercises on 2-D bioreactive transport

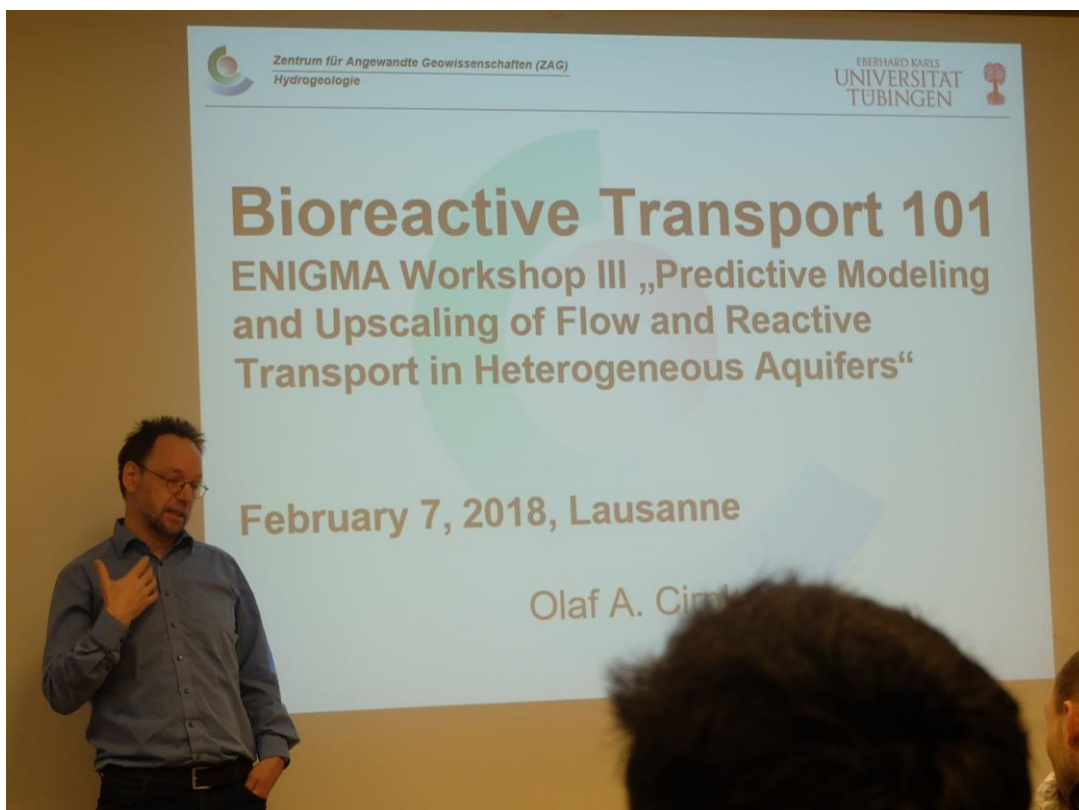


Photo: Lecture by Olaf Cirpka.



Photo: Computer exercise.

February 8 (Marco Dentz):

Lecture, 9h00-10:30h. Transport in heterogeneous media, overview, questions and challenges

Coffee Break, 10:30-11:00

Lecture, 11h-13h. Stochastic transport modeling, random walks, central limit theorem, dispersion, macrodispersion

Lunch 13:00-14:00

Lecture 14:00-16:00. Non-Fickian transport models, continuous time random walks, generalized central limit theorem, multirate mass transfer

Coffee Break, 15:30-16:00

Exercices 16:00-18:00. Numerical implementation of a simple random walk and determination of mean velocity and dispersion. Generalization to dispersion in a stratified medium. Numerical implementation of a continuous time random walk and calculation of solute breakthrough curves.

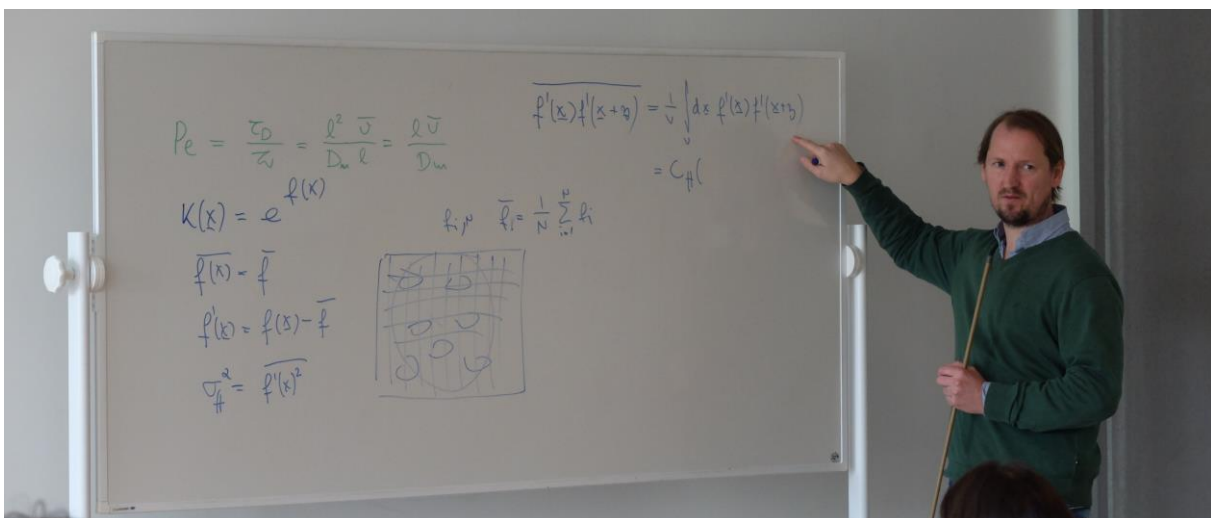


Photo: Lecture by Marco Dentz.

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3rd Workshop Report



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