Welcome to

Hydraulic groundwater modeling

- Week 1

Goals of this course

- Obtaining the basic skills to apply numerical models
- Learning how to interpret results of numerical simulations
- Being able to judge about the reliability and quality of a simulation
- Getting used to the specific “modeling” vocabulary

This course will not …

- cover details of mathematical and numerical analysis
- train you on specialized software
- teach you programming skills

Why using GrassGIS ?

- It is GIS Software (so you should feel familiar)
  - GrassGIS is the „big-brother“ from QGIS
- It is free (& open-source)
  - You can download it on your private PC
  - You can run it from home & at any time
- It is fairly simple
  - Based on known GIS principles (rastermaps)
- It does what we need fairly well
  - More specialized / more advanced software exists (will be introduced)
- It is very popular
  - Lots of help online

Course content

- A short repetition on the mathematical & physical basics of groundwater flow
- Introduction to the theory behind numerical modeling
- Hands-on experience
- Provide an outlook on what is possible

Course structure

- Week 1: Introduction to (numerical) modeling
- Week 2: Governing equations for groundwater flow
- Week 3: From the field application to simulation
- Week 4: Spatial discretization techniques
- Week 5: Temporal discretization and stability concerns
- Week 6: Features of realistic groundwater models

Course structure

- Week 7: Geostatics and spatial heterogeneity
- Week 8: An in-depth look of groundwater modeling in GrassGis
- Week 9: Available and common tools used for groundwater modeling
- Week 10: The hardware-site of numerical modeling
- Week 11: The workflow using numerical models
- Week 12: Recap and Questions

Exercises of this course

- Week 1: Get settled and familiar with GrassGis
- Week 2: Combining mathematics and software
- Week 3: First simulations
- Week 4: Influence of spatial discretization
- Week 5: Modeling transient problems
- Week 6: Anisotropy and groundwater recharge

Exercises of this course

- Week 7: Geostatistics with GrassGis
- Week 8: Transport modeling
- Week 9: Analysis of transport modeling (moment analysis)
- Week 10: Studying and visualizing flow paths and tracks
- Week 11: Complex examples – part 1
- Week 12: Complex examples – part 2

Reading list:

- Anderson, Woessner, Hunt: Applied Groundwater Modeling (Elsevier)
- Diersch: FeFlow (Springer)
- Press et al.: Numerical Recipes
- Essing: Groundwater Modeling (lecture notes, U Utrecht, 2000)
- Roth: Soil Physics (lecture notes, U Heidelberg, 2007)