s1995204

EASC10077- Hydrogeology 2: Simulation of Groundwater Flow and Transport:

Tutor (not including marking): Assist in Hydrogeological conceptual modelling. Tutor use of open source finite element code.

Tuesday 3:30 - 5:00 X 10 plus prep time.

Maximum submission date: 31 August 2023 (at the earliest)

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* Good knowledge in Hydrogeology, Groundwater Hydrology, Fluid dynamics, Geophysics applied to hydrogeology (resistivity, seismic refraction), Reservoir Engineering. This includes knowledge about concepts linked to hydrological groundwater systems and the petro-physical properties of reservoirs, acquired from both theoretical courses and practicals/field work in France and Iceland.
* Good notions of the workflow of numerical modelling, acquired during courses on applied groundwater modeling, from the development of a conceptual model (analysis of the groundwater system by combining geological and geophysical data, identification of potential contaminant sources and transfer mechanisms…), to the implementation of numerical calculations (i.e. definition of initial/boundary conditions, discretization of a medium...). The realization of conceptual model of a groundwater system in Iceland was part of a project aiming to identify the catchment area/flow of a river within lava bodies.
* One-semester class in continuum mechanics and heat transfer: good understanding of the mathematics behind 1D/3D flow equations (conservation laws, Darcy’s law, convective/advective flow, laminar/turbulent flow, transient/steady state flow...).
* Software :
  + introductory course to FEFLOW, MODFLOW and iTOUGH2
  + modelling of heat and mass flow transfers using the FEM software DEFMODE (mesh generation using GMSH) as part of my Master’s project
  + extensive use of the finite-difference hydrodynamic software MARTHE developped by the BRGM (French Geosurvey), to calculate fluid flows and mass and energy transfers in a three-dimensional porous geothermal reservoir as part of an internship in 2015 and a short-term contract as reservoir engineer in 2019.
  + experience of coding with MATLAB and the creationg of bash script (Linux)
* Intend to take class in numerical modeling as part of the phD. It would be a great benefit to be able to develop skills in this topic and be able to explain it and share with students about the simulation of groundwater flow.

Courses and assignments:

- Hydrogeology (Lasalle Beauvais, France). Course content : water cycle, calculations of hydrological balance, type of aquifers (according to the reservoir geology and structure + concepts of confined/unconfined aquifer and their hydrodynamic properties...), soil and aquifer properties (i.e. permeability, porosity, hydraulic conductivity, transmissivity, storage coefficient, specific yield...), hydraulic head/gradients, Darcy's law, piezometric maps, flow network, tracer tests...

- Groundwater hydrology (University of Iceland). Course content and assignments: determination of aquifer properties from aquifer tests (single well and interference tests, Time- and Distance-Drawdown analysis, Theis and Jacob's solutions...), estimates of water budget and groundwater recharge from baseflow (stream hydrographs, Meyboom method, recession curve displacement method, notions of losing/gaining streams and rainfall runoff relationship...), mechanisms of solute transport in groundwater, analysis of the quality of groundwater and the sources of pollution, saltwater encroachement (saline intrusions), and introduction to analytical/numerical modeling (finite difference/element methods, conservation of mass and energy, Poissons/Laplace equations...)

- Near-surface geophysics (Lasalle Beauvais, France). Courses in electromagnetic and mechanical waves, signal acquisition and processing, including gravimetry, magnetics and sesmic refraction.

- Geophysical exploration (University of Iceland). Courses in geophysical data analysis and processing, including seismic refraction, seismic refraction, gravity, TEM & MT resistivity and magnetics.

Practicals and field work:

- study the structure of the chalk aquifer in Picardie, north of France: 1-day refraction seismic data acquisition followed by data processing using the Pickwin and Plotrefa software.

- 5-day geophysical surveys in South Iceland aiming to gain insight on the subsurface structure of a valley, using MT-soundings, magnetics, seismic refraction, micro-gravity surveys, and resistivity data acquisition (Schlumberger DC resistivity method), followed by a 1-month group project (signal processing and interpretation).

- 1-day field work in Iceland (mapping and measurements of fractures in a lava field) aiming to understand stream water flows in lava bodies: determination of the orientation and size of the fractures along with the hydraulic conductivity of the lava, realization of a conceptual model and calculation of the water budget to identify the sources of water in the system.

Professional experience:

- 4-month internship (2015) as hydrogeologist and 3-month contract (2019) as geothermal reservoir engineer at the BRGM (French Geosurvey): formatting of injection/pumping test data; 3D thermohydrodynamic flow modeling between geothermal wells in the Dogger aquifer (Paris Basin) using Marthe (BRGM software)

EASC8001: Earth Dynamics

* Good knowledge of the surface/mechanical processes, tectonic and deep magmatic processes associated to the Earth geodynamics, acquired from both theoretical classes and field works in France, Italy and Iceland. I obtained a double Master degree in geology from Lasalle University in France and the University of Iceland that brought me complementary and deep understanding of those processes in different environments and geological context, both from a geological and geophysical point of view.
* A total of about 10 weeks of field work in sedimentary areas (Britain; Normandy; Cevennes, the Alps in France and in Sicily) and 2 weeks in volcanic areas (Massif Central in France and South Iceland) for geological/structural mapping and geophysical surveys (seismic, gravity, resistivity).
* Practical knowledges in sedimentary and magmatic petrography/petrology, minerology, crystallography, geochemistry (about 20 hours of practical for observing/recognizing hundreds of sedimentary, metamorphic and magmatic rocks and minerals from the micro scale, using optical microscopes, to the macro scale) and structural geology, tectonics, seismology, facies sedimentology, volcanology, phase equilibrium.
* Applied geosciences courses (i.e. Mines & quarries, hydrology, petroleum geology). I attended introductory courses about the economic use of the rocks/minerals and specialized in petroleum geology (gained extensive knowledges in structural/reservoir geology and the analysis of past deposit environments) and geothermal energy.

Application as field demonstrator:

I wish to share my motivation on the field and my passion for geology through these field trips, with a great enthusiasm whatever the weather is! As a new phD student, I am extensively curious about discovering the geology of the East coast of Scotland, and I wish to spread this curiosity among students. I hope my knowledges about sedimentology, structural geology, volcanology and petrology from a naturalist approach will help students understanding the processes of earth dynamics thanks to a good observation of present outcrops. As a vice-president of the student association in Lasalle Beauvais in France, I have gained experience in managing projects and organizing trips for groups of students and I am aware of the needs for safety in such field trips. I would therefore be more than happy to have the chance to participate to this class as a field demonstrator.