

Introduction into Basic Hydrogeology, University of Münster, Chair of  
Landschaftsökologie  
Lecturer: Dr. F. Einsiedl, Assoc. Prof., DTU Copenhagen

## ***TIMETABLE***

Monday to Thursday: 9 a.m. to ca. 5 p.m. (s.t.)

## ***Location***

Institute of Landschaftsökologie, room: will be announced immediately (contact person: Karin Meinikmann, [karin.meinikmann@uni-muenster.de](mailto:karin.meinikmann@uni-muenster.de))

## ***Aim/objectives***

This course (crash course or “Blockkurs”) aims to get a holistic understanding in hydrogeology and to learn to apply this knowledge to hydrogeological problems. The course will focus on different aspects in hydrogeology ranging from the hydrologic water cycle and basics on groundwater flow parameters such as heterogeneity and porosity to hydraulic field experiments, groundwater chemistry, environmental isotopes, tracer tests and groundwater protection.

## ***Learning objectives***

A student who has met the course will be able to:

- describe important elements in hydrogeology
- describe the governing processes of the hydrologic cycle
- understand hydrogeological problems in the field
- describe, characterize, and determine geological, physical and hydraulic properties of different types of aquifers including some aspects for the unsaturated zone.
- interpret pump tests in hydrogeology.
- use artificial tracers for catchment hydrology
- apply chemical and isotopic knowledge to hydrogeology
- understand and explain biological processes in groundwater

## ***Course outline***

The core of the course consists of teaching in hydrogeology followed by a series of exercises, which should expose the students to the most important techniques and methods in hydrogeology. The tutorials and assignments are supported by focussed reading, discussion, and lectures.

## ***Course Content***

Topics will include selections from the following: hydrologic water cycle, physical properties and parameters of the groundwater flow, hydraulic properties of an aquifer applying hydraulic experiments, groundwater chemistry, environmental isotopes, tracers in hydrogeology and groundwater protection

block	Person Responsible	Topic	Tutorial
1	FE	Students meet and coordinator will explain how course will work. <u>Reading:</u> Importance of hydrogeology, the Hydrologic water cycle, physical properties and basics I: Definition and explanation of keywords: e.g. confined and unconfined aquifers, leaky aquifer, porosity, permeability, heterogeneity, Darcy's law, flow velocity, hydraulic permeability and conductivity	Exercise I
2	FE	Physical properties and basics II (Groundwater flow in both saturated and unsaturated, steady-state, non-steady state, compressibility, specific storage, Laplace's equation, diffusion equation, transport)	Exercise II
3	FE	Types of aquifers (porous, fractured, karstic: geology, properties, features) Hydraulic properties, hydraulic conductivity of porous, fractured and karstic systems)	Exercise III
4	FE	Hydraulic testing (pump test)	Exercise IV
5	FE	Water chemistry and water parameters (conductivity, pH, temperature, redox)	Exercise v
6	FE	Contaminant hydrology (Contaminants in groundwater, sources, modern view to heterogeneity)	Exercise VI
7	FE	Environmental isotopes I ( <i>basics</i> ) (What is an isotope, stable and radioactive isotopes, isotope fractionation, application in hydrogeology and biogeochemistry)	Exercise VII
8	FE	Environmental isotopes II ( <i>basics</i> ) Stable isotopes of S, N, C and H <sub>2</sub> O, microbial degradation of contaminants,	Exercise VIII
9	FE	Tracers in Hydrogeology (tracer transport, tracers in gW, properties of tracers, application of fluorescence dyes in hydrogeology)	Exercise IX
10	FE	Groundwater protection strategies	Exercise X
11	FE	Summery and recapitulation	Exercise XI