

7. Water retention curve

Part 3. Water movement in soil

8. Water flow in capillary tubes

9. Water flow in saturated soil

10. Water flow in unsaturated soil

Part 4. Chemical transport in soil

11. Conservation and flux equations

12. Convection-dispersion equation

Measuring and modeling in practice

During lab and field work, intact soil samples are taken from fields with different land use and soil physical and hydraulic properties are measured. At the field, water content and matric potential is measured. Data are used to assess the effect of land use on 1) soil health using soil physical quality indicators and 2) on the water regime with the Hydrus model.

Initial competences

The student should have good knowledge of mathematics and physics, and some basic understanding of earth sciences and soil science or pedology.

Final competences

- 1 Apply standard lab and field methods to determine hydrophysical properties of soil.
- 2 Use soil-moisture sensors and tensiometers to measure soil-moisture status.
- 3 Explain the principles behind lab and field methods, and instrumentation for monitoring soil-moisture status.
- 4 Analyse simple to more complex water transport processes in soil.
- 5 Evaluate physical quality of soils.
- 6 Apply parameter estimation methods to determine soil hydraulic properties.
- 7 Apply numerical models to predict changes in water content and matric potential with time.
- 8 Explain hydrophysical and soil mechanical properties of soil.
- 9 Explain the principles behind water and chemical transport in soil.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar, practical

Extra information on the teaching methods

Lecture: online lectures (short video's) in preparation of on campus seminars and practical.

Practical: (1) Fieldwork: soil sampling and measurement of 1. soil structural quality with visual evaluation methods, 2. soil-moisture status with sensors and tensiometers, 3. hydraulic conductivity and infiltration rate, **(2) Laboratory work:** measuring bulk density and porosity, water content (gravimetrically), water retention curve, hydraulic conductivity curve.

Seminar: active hands-on teaching on case studies with quizzes to link theory to practice, on estimation of parameters of water retention model, on simulating water flow with Hydrus model to evaluate effect of land use and soil structural degradation, using data collected during practical.

Learning materials and price

A syllabus is available. Additional documentation (slide shows, background information, exercises, video) can be found on Ufora platform.

Cost: 5.0 EUR

References

Jury, W.A. & Horton, R. 2004. Soil Physics. John Wiley & Sons.

Hillel, D. 1998. Environmental Soil Physics : Fundamentals, Applications, and Environmental Considerations. Academic Press.

Radcliffe, D.E. & Simunek, J. 2010. Soil Physics with HYDRUS: Modeling and Applications.

CRC Press, Taylor & Francis Group

Course content-related study coaching

Instructors (professor/assistants) are available for questions and further explanations on appointment.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Participation, assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

Written assessment with open-ended questions (periodic evaluation): short answer and essay questions on theory + exercises. This evaluates the teaching methods lecture and seminar.

Participation (permanent evaluation): assessment of participation in and quizzes related to seminars and practicals. This evaluates the teaching methods seminar and practical.

Assignment (permanent evaluation): assessment of the quizzes related to seminars and practicals. This evaluates the teaching methods seminar and practical.

Calculation of the examination mark

Written assessment with open-ended questions: 65%

Participation + Assignment: 35%

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner. This means that if, in that case, a grade of 10 or more out of 20 is obtained, the grade may be brought down to 7/20.