BRES2103 Soil physics

[30h+22.5h exercises] 4 credits

This course is taught in the 1st semester

Teacher(s): Charles Bielders, Marnik Vanclooster
Language: French
Level: Second cycle

Aims

By the end of the course and practicals, the students will be in a position to :
- master the concepts related to water retention and water flow in soils, and be able to apply these concepts for calculating water retention and water flow under steady flow conditions
- describe the functioning of measurement tools for soil state variables (water content, water potential, temperature, #)
- be able to characterize the moisture status of the soil (water content and potential), its water retention curve and saturated hydraulic conductivity through the choice of appropriate measurement volume, measurement method and number of measurements
- be able to explain the processes that govern heat and gas transfer in soils
- be able to explain the different factors that govern the soil mechanical resistance and describe the various techniques available to characterize it
- be able to write up a team report concerning the practicals and to analyse the results critically

Main themes

- Review of the characteristics of porous media
- Water retention in soils : water content, potential, water retention curve
- Techniques for characterizing water content and potential
- Steady water flow in soils, hydraulic conductivity curve
- Techniques for characterising the hydraulic conductivity curve
- Unsteady water flow in soils- Transfer of heat and gases in soils : processes
- Mechanical properties of soils, compaction, and measurement techniques

Content and teaching methods

First, the main physical characteristics of soils are reviewed in order to understand the geometry of porous media and its influence on the hydrodynamic, thermal, gas transfer and mechanical properties. The principles of water retention in soils and steady state water flow are then described in detail : hydration and capillarity, components of water potential, water retention curve, Darcy's Law, saturated and unsaturated hydraulic conductivity. Unsteady flow is introduced. These notions are applied to static equilibria, the calculation of steady state water fluxes (evaporation, infiltration), and water balance calculations. These applications make use of an especially developed educational software. The main techniques for characterizing water content and potential as well as the water retention and hydraulic conductivity curves at different scales are reviewed. Finally, the principles of gas and heat transfer as well as soil mechanics are introduced. The main principles of water retention and flow are illustrated through a series of practicals : soil sampling, representative volume, bulk density, porosity, water content, matric potential, water retention curve, static equilibria, saturated hydraulic conductivity, etc. A report concerning these practicals is due.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Evaluation Evaluation is based on the practical reports, open-book exercise resolution and oral questioning.
Support handbook, powerpoint sheets, educational software D. Hillel

Programmes in which this activity is taught

BIR2	Bio-ingénieur

Other credits in programs

BIR22/4E	Deuxième année du programme conduisant au grade de bio-ingénieur : Sciences et technologie de l'environnement (Technologies environnementales: eau, sol, air)	(4 credits)	Mandatory
BIR22/7A	Deuxième année du programme conduisant au grade de bio-ingénieur : Sciences agronomiques (Ressources en eau et en sol)	(4 credits)	Mandatory
BIR22/7E	Deuxième année du programme conduisant au grade de bio-ingénieur : Sciences et technologie de l'environnement (Ressources en eau et en sol)	(4 credits)	Mandatory