

International PhD Course in
MERGING MEASUREMENTS AND MODELING IN SOIL PHYSICS
May 2 – 7, 2005
Danish Institute of Agricultural Sciences

Guest lectures

Professor Ty Ferre, University of Arizona
Professor Markus Tuller, University of Idaho

Course content

This course will present accepted and emerging concepts of key processes of water flow in unsaturated porous media. These concepts will be presented together with standard and novel methods to make the measurements necessary to describe these processes. The focus of the course is the need for a unified treatment of measurement and modeling in quantitative soil physics. Specifically, we will discuss how advancements in our understanding of soil physics should guide the design of measurement and monitoring efforts. Similarly, we will discuss how the interpretation of measurements made with emerging indirect methods should be made in the context of the soil physical model of interest.

Tentative course schedule

Day 1

- a.m. - Soil Physics Basics
- p.m. – Traditional Soil Physics Modeling

Day 2

- a.m. – Traditional Soil Physics Measurement Methods
- p.m. – Traditional Soil Physics Measurement Methods

Day 3

- a.m. – New Concepts in Soil Physics
- p.m. – New Concepts in Soil Physics Modeling

Day 4

- a.m. – New Approaches to Soil Physics Measurement
- p.m. – New Approaches to Soil Physics Measurement

Day 5

- a.m. – New Approaches to Soil Physics Measurement
- p.m. – New Approaches to Soil Physics Measurement

Day 6

- a.m. – Merging Measurement and Modeling
- p.m. – Merging Measurement and Modeling

Material to be covered in the sessions includes:

Soil Physics Basics

- Energy distributions during hydrostatic, steady state, and transient flow through homogeneous and heterogeneous media;
- Relationships between soil physical and soil hydraulic properties;
- Macroscopic soil hydraulic property models.

Traditional Soil Physics Modeling

- Simplified representations of infiltration and drainage;
- A spreadsheet-based analysis of steady-state unsaturated flow;
- Numerical solutions of Richards' equation.

Traditional Soil Physics Measurement Methods

- Laboratory and field methods to measure water pressure;
- Laboratory and field methods to measure water content;
- Laboratory and field methods to measure hydraulic conductivity;
- Laboratory and field methods to measure and infer soil hydraulic model parameters.

New Concepts in Soil Physics

New Approaches to Soil Physics Measurement (I)

- Time domain reflectometry and related water content measurement methods;
- Passive and active heat transport monitoring to infer water flux.

New Approaches to Soil Physics Measurement (II)

- Gravity for storage change;
- Electrical resistance tomography for water content and solute concentration change;
- Electromagnetic induction for water content change and solute concentration change;
- Ground penetrating radar for water content change.

Merging Measurement and Modeling

- Time domain reflectometry as a case study for correcting local effects of instrument sensitivity for inferring soil hydraulic model parameters;
- Gravity as a case study for the direct integration of geophysical measurements in hydrologic investigations.

Course outline

The course will last six days. Each day will begin with a lecture session. The second half of the day will involve hands-on modeling and measurement activities.

Background of participants

The Ph.D. students should have a background in

- agronomy, hydrology, or hydrogeology
- numerical modeling

Time and place

May 2-7, 2005

Research Center Foulum, Denmark

Organizers

Finn Plauborg, Danish Institute of Agricultural Sciences, Finn.Plauborg@agrsci.dk

Ole H. Jacobsen, Danish Institute of Agricultural Sciences, Ole.H.Jacobsen@agrsci.dk

Per Møldrup, Aalborg University, pm@bio.aau.dk

Work load and credit points

Approximately 125 hours in total including the lectures and exercises during the course and preparatory reading before and during the course. The work load corresponds to 5 ECTS.

Study material

Notes and copies of references papers will be provided during the course. Software and key papers can be made available ahead of time upon request.

Admission

Applicants are requested to submit the registration form no later than March 29, 2005. Information on admission to the course will be forwarded shortly after.

The total number of participants is limited to 20. PhD students are given first priority but depending on the number of registrants we also welcome post-graduate participants. The course is free for PhD students enrolled at universities. Post-graduate participants will be charged a course fee of DKK 4.000.

Accommodation and travel

For PhD students FIVA will arrange for accommodation in residence facilities near the research center free of charge and in addition the international students will receive support to daily allowances. International students from Europe and North America are requested to cover travel expenses from own funding. For international students from other countries a few stipends are available from DWF Research (<http://www.danishwaterforum.dk>) for travel expenses.

International students are requested to submit with the application form (1) a brief description of research interests and background, (2) a CV, and (3) a letter of recommendation from the thesis advisor.

Post-graduate participants are requested for pay for lodging.

Further information

Please contact the course organizer or FIVA.