Name of course: Modelling production and environmental impacts of cropping and grassland systems using APSIM

ECTS credits: 5 ECTS

Course parameters:
Language: English
Level of course: PhD course
Time of year: September 22-26, 2025

No. of contact hours/hours in total incl. preparation, assignment(s) or the like: For the ETCs course: 40h of lectures distributed in 5 lecture days; 20h for working in homework/simulation exercises and self-study during the course, 55 h familiarizing with relevant literature, report writing and preparation of a presentation of simulation study on one of the topics covered during the course, 10 h presentations and discussions with course participants, plus oral examination. The total workload is 125h.

Course fee: The course fee is 600 Euros. This covers e.g. course material, meals during the course, including dinner.

Objectives of the course:
The course aims to give insight into the basic function of process-based ecosystem models applied to cropping and grassland systems (commonly known as crop models). The course will have special focus on biophysical modelling using the Agricultural Production Systems Model (APSIM).

Learning outcomes and competences:
At the end of the course, the student **should be able to**:
- set up an APSIM simulation for different environments (soil types, climates) and different cropping systems and management options, using appropriate input parameters and initial conditions.
- process model outputs and test these based on experimental data using simple statistics.
- have a general understanding of different modelling approaches and limitations and benefits.

Compulsory programme:
active participation, assignments, oral presentation, and report

Course contents:

This course provides a general introduction to crop models: the basic principles and approaches behind modelling plant growth, soil hydrology, soil biogeochemistry and near-ground atmospheric interactions. The course further offers an introduction to the biophysical Agricultural Production Systems Model (APSIM). This is done through a series of short lectures by the instructors, which explain the science behind the various sub-models in APSIM, namely water flow, solute transport (focusing on nitrogen), soil organic matter turnover, transfer of water and energy in the soil-plant-atmosphere continuum, and crop (production) model. Each of these will be followed by hands-on exercises where the participants learn how to use APSIM for a simple, pre-defined system, about the required data inputs, and model parameter initialization. The course will focus on Northern European production systems that include wheat, maize, pulses, and cover crop rotations, and address aspects such as plant growth and development, crop yield response to management practices (e.g. planting date, cultivar, N rate), crop rotations, soil water processes (e.g. drainage, evaporation), soil carbon, nitrogen and surface organic matter dynamics (e.g. N mineralization and residue decomposition). Furthermore, the course will address data analysis, and how to extract and analyse model output data for both model calibration, testing and scenario analysis. For this, various statistical approaches will be discussed. An overview of different models regarding complexity, data requirement, accuracy, and transferability will also be presented and discussed.

Prerequisites:

The PhD student must master data analysis, and preferably have some knowledge in programming. The course will use the APSIM model (http://www.apsim.info). It will be assumed that the PhD students have the software installed on their computers.

Name of lecturer[s]:

• Iris Vogeler, Senior Researcher. Department of Agroecology, Aarhus University.
Responsible for overview on modelling and overall course coordination.
• Jorge F. Miranda Vélez, PostDoc. Department of Agroecology, Aarhus University, Responsible for water dynamics in soils.
• Virginia Anne Nichols, Tenure Track Prof. Department of Agroecology, Aarhus University. Responsible for simulation of arable crops.
• Maarit Mäenpää, Academic employee. Department of Agroecology, Aarhus University. Responsible for data analysis and statistics.

Type of course/teaching methods:
Lectures alternated with supervised exercises and self-study including the elaboration of a report on the self-chosen project. The course responsible will offer feedback to a draft of the reports, provided the draft is delivered before a deadline established at the beginning of the course by the course responsible.

Course homepage:
None

Course assessment:
Classwork - satisfactory participation in the course; Group work oral presentation and examination. Full attendance to the lectures is a necessary condition to participation in the oral examination.

Provider:
Department of Agroecology

Special comments on this course:

Time: September 22-26, 2025

Place: AU Viborg – Department of Agroecology, Aarhus University, Blichers Allé 20, Postboks 50, DK-8830 Tjele

Course fee: 4500 DKK or 600 Euros.

Registration:
The deadline for registration is 10 August. Admission information will be sent out no later than 18 August 2025.

If you have any questions, please contact Iris Vogeler, e-mail: iris.vogeler@agro.au.dk

PLEASE NOTE

Deadline for registration is 10. August 2025
If you have any questions, please contact Iris Vogeler, e-mail: iris.vogeler@agro.au.dk