

# Modelling production and environmental impacts of cropping and grassland systems using APSIM (2024)

**Name of course:** Modelling production and environmental impacts of cropping and grassland systems using APSIM (2024)

**ECTS credits:** 5 or 7.5 ECTS (European Credit Transfer System)

## Course parameters

**Language:** English

**Level of course:** PhD (Masters and young researchers with strong interest are also welcomed)

**No. of contact hours/hours in total incl. preparation, assignment(s) or the like:**

For the 5 ECTS 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.

For the additional 2.5 ECTS: 40 h APSIM model on own project with consultations with the instructor(s) and oral examination; 25 h for writing a report. The additional workload is 65h.

**Capacity limits:** 20

## 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).

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.

### **Learning outcomes and competencies:**

At the end of the course, the participants will 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.

### **Name of lecturers:**

- Iris Vogeler, Senior Researcher. Department of Agroecology, Aarhus University. Responsible for overview on modelling and overall course coordination.
- Val Snow, Principal Scientist, AgResearch, New Zealand. Responsible for theory and modelling approaches in nitrogen cycling and movement & soil organic matter dynamics.
- Davide Cammarano (Italy), Professor. Department of Agroecology, Aarhus University. Responsible for introduction into environmental modelling approaches.
- Jorge F. Miranda Vélez, PostDoc. Department of Agroecology, Aarhus University, Responsible for water dynamics in soils.
- Uttam Kumar, Postdoc. 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, group work, assignments, and self-study.

**Course assessment:** Classwork - satisfactory participation in the course; Group work oral presentation and examination. Prior to the course, each participant should

prepare one slide PPT to introduce their research. For the additional 2.5 ETCS a report on a self-chosen project.

**Prerequisites:** 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 and have verified that it has successfully installed by running at least one of the example simulations.

**Provider:** Department of Agroecology, Aarhus University, Blichers Allé 20, Postboks 50, DK-8830 Tjele

**Special comments on this course:** The course fee is 600 Euros.

**Time:** September 23 -27, 2024

**Place:** AU Viborg – Department of Agroecology

**Registration:** The deadline for registration is June 30, 2024. Admission information will be sent out no later than July 31, 2024.

**For registration:** If you have any questions, please contact Iris Vogeler, e-mail: [iris.vogeler@agro.au.dk](mailto:iris.vogeler@agro.au.dk)