Food and Agriculture Organization of the United Nations

Pre-training session

Online

(22nd November 2023)

Overview

- **Three sessions** (pre-training, in person-training and follow-up)

Date	Content
22nd November	**Pre-training online** • Resources for this workshop • **Crop Module 1**-Introduction to Crop Models
5-8th December-**Tandojam** 11-14th December-**Lahore**	**In-person workshop** • Mix of presentations and hands-on training
January 23rd	**Follow-up workshop** • Answering questions • More hands-on exercises

Overall outcome of the training

Outcomes

- Improved understanding of climate science, climate models, and applications
- Application of crop productivity models and limitations
- Learn how to run the AquaCrop model (simplified and advanced mode)
- Learn how to interpret the results of the AquaCrop model and how to use AquaCropPlotter
- Learn how to use and apply AquaCrop in real case studies

Speakers

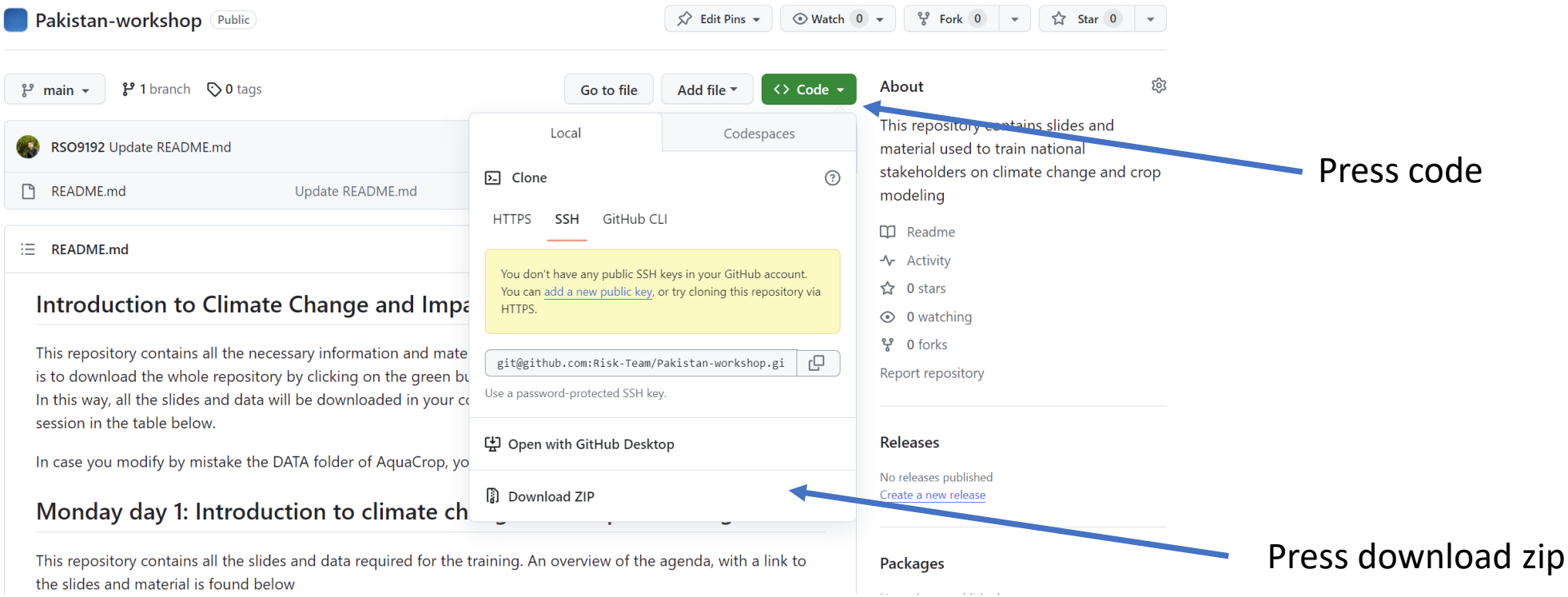
- **Riccardo Soldan** holds a Ph.D. in Interdisciplinary Bioscience from the University of Oxford and a Master's in Crop Science. Riccardo has several years of experience in the field of ecosystem modelling. While at FAO Riccardo has developed the Climate and Agriculture Risk and Visualization framework (CAVA) and led the development of AquaCropPlotter, an application used to process and visualize the results of AquaCrop.
- **Jorge Alvar-Beltrán** holds a Ph.D in Environmental Sciences from the University of Florence, with an emphasis on climate-resilient crops in hot-spot regions of climate change, Burkina Faso. Prior to joining FAO in 2020, he worked for the World Meteorological Organization (WMO) to strengthen the capacities of Met Services to deliver weather-informed agricultural advisories to the last-mile.

Resources

- The link to all material and slides presented in this workshop can be found at **https://github.com/Risk-Team/Pakistan-workshop**
- Link to AquaCrop **(https://www.fao.org/aquacrop/en/)**
- Link to AquaCropPlotter **(https://foodandagricultureorganization.shinyapps.io/AquaCropPlotter/)**

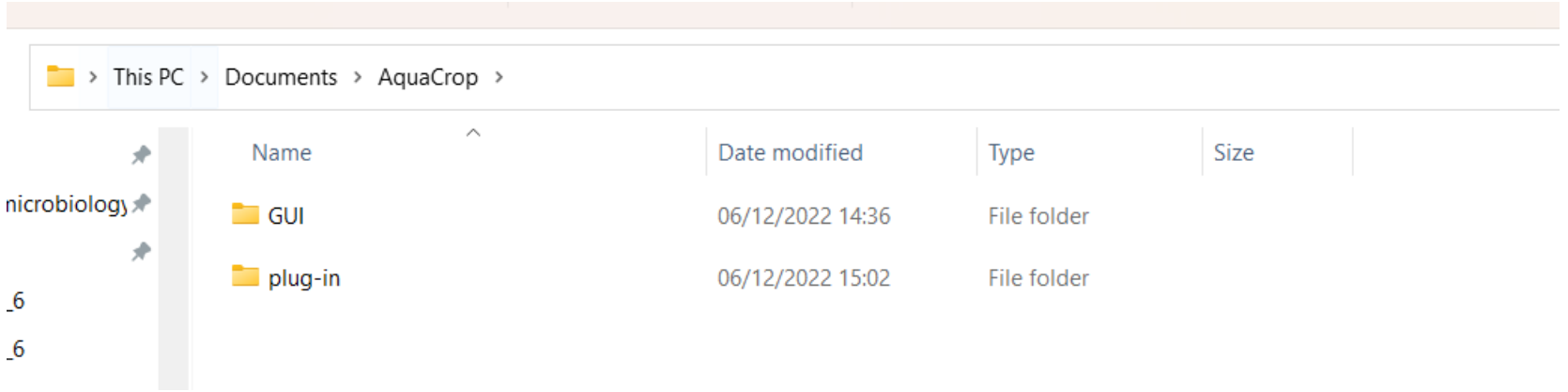
Instruction-data and material

- The link to all material and slides presented in this workshop can be found at https://github.com/Risk-Team/Pakistan-workshop
- Once you are on the correct page, you can download the whole repository to your local computer (**Desktop**)



Instruction-software

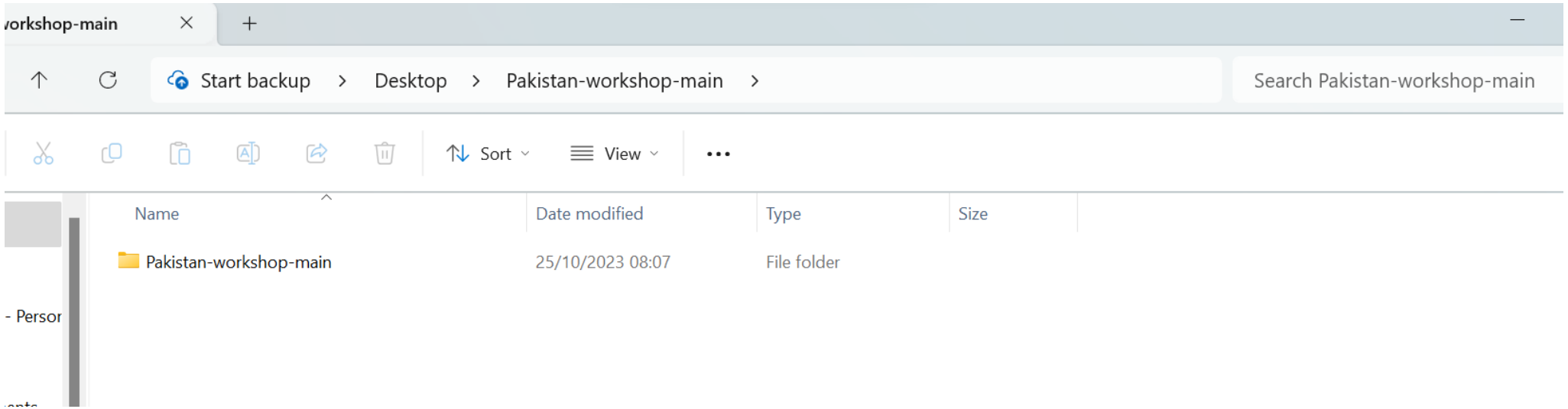
- Install AquaCrop in the documents folder



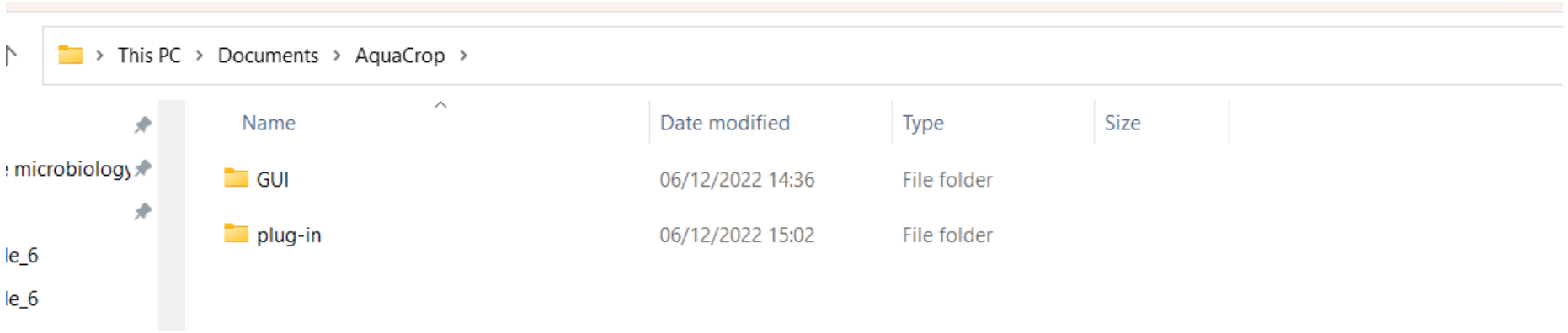
- Paste this file into the plug-in, folder SIMUL

Instruction-Software

- Where your data folder should be



- Where your AquaCrop installations should be



Food and Agriculture Organization of the United Nations

Introduction to Crop Models

Online

(22nd November 2023)

Food and Agriculture Organization of the United Nations

Table of content

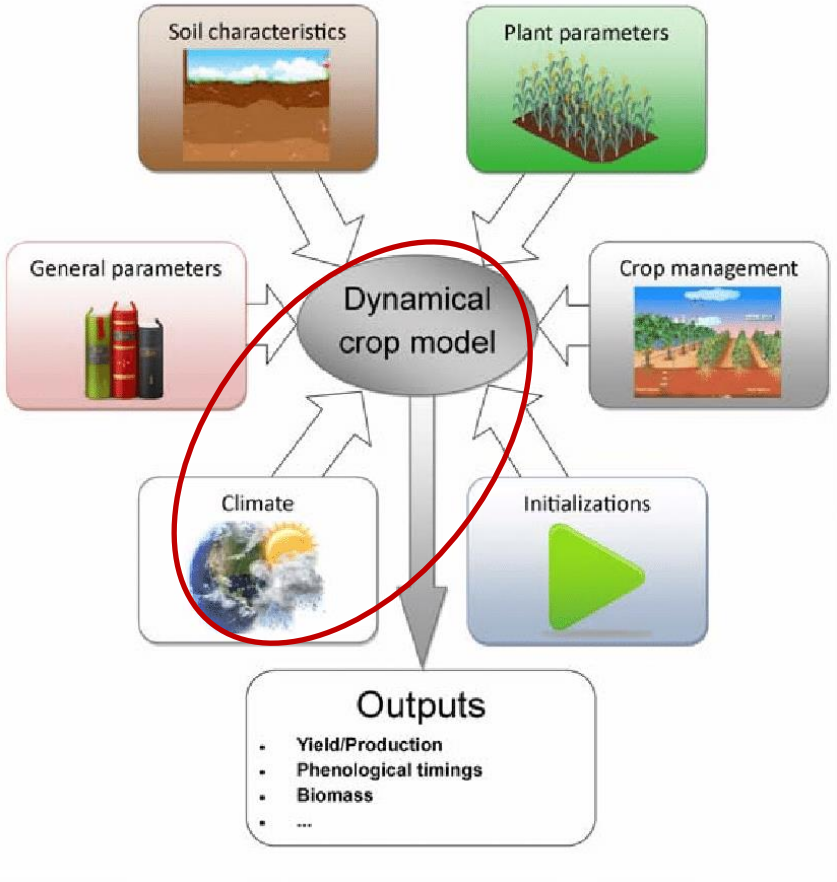
- Practical applications of crop models
- AquaCrop compared to other models
- How do crop models work?
- AquaCrop: user interface

Crop models: what are they useful for?

Crop models are sets of mathematical equations that represent processes within a predefined plant system as well as the interactions between crops and its environment.

Crops models can contribute to agriculture in many ways:

- understanding crop responses to environmental changes;
- comparing attainable and actual yields;
- identifying constraints to crop producton and water productivity;
- developing irrigation schedules for maximizing production;
- studying the effect of climate change;
- supporting decision-making on water allocations and water related policies;



Costa *et al.*, 2015

Some of the most widely used crop models

Model name	Main features/advantages	Link
AquaCrop	Crop-water productivity	link
AEZ	Maximum potential yield	link
APSIM	Crops and agricultural inputs	link
EPIC	Focuses on soil erosion	link
DSSAT	Crop growth and development	link
CropSyst	Effect of management on productivity	link

Useful overview of crop models

AquaCrop compared to other crop models

- AquaCrop produces much finer outputs (for site-specific locations) than other models and, as a result, its spatial applications are narrower.
- AquaCrop does not consider the leaf area index (LAI) as done by many other crop simulation models (i.e., GAEZ, DSSAT and CropSyst)
- Uses a relatively low number of parameters and mostly-intuitive input variables that can be determined by simple methods.
- AquaCrop simulates one crop at the time and cannot run multiple crops for comparative economic assessments (GAEZ).
- AquaCrop considers abiotic/biotic stresses (temperature & weeds), while other models do not (WOFOST)
- AquaCrop does not take into account other reducing factors such as pests and diseases

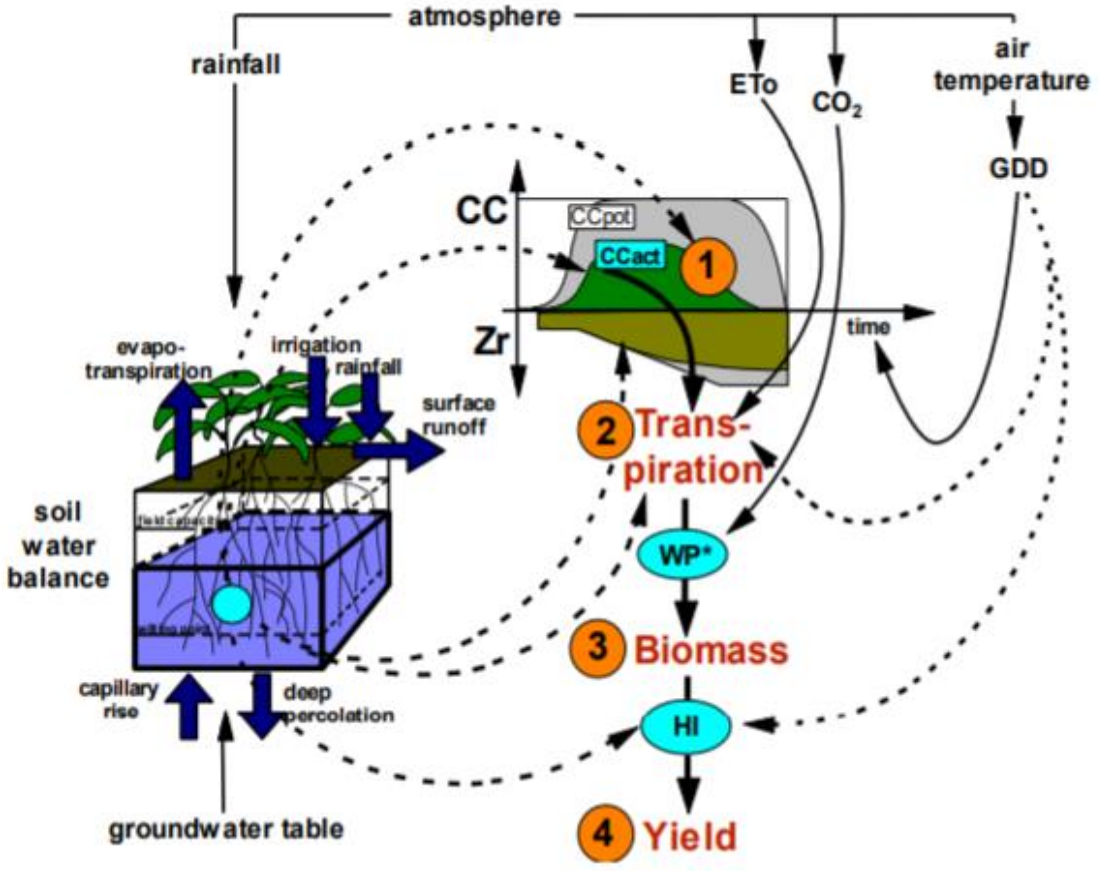
Limitations of crop models

Every model has its strengths and weaknesses and, therefore, the selection process is a critical step determined by the robustness of the model, as well as on the applications, context and objective of the impact assessment.

A potential threat in crop modelling is that users are not always familiar with the intended use and limitations of each tool and, consequently, are not necessarily aware of the uncertainties associated with their outputs

- A major limitation of crop growth models is the lack of spatial information of the actual conditions of each field or region.
- Many crop-growth models require a significant amount of input data, sometimes difficult to retrieve.
- Many crop-water productivity models lack comprehensive fertilizer management and pests and diseases modules.

AquaCrop: introduction



AquaCrop simulates crop yield in different steps:

1) crop development
2) crop transpiration
3) biomass production
4) yield formation

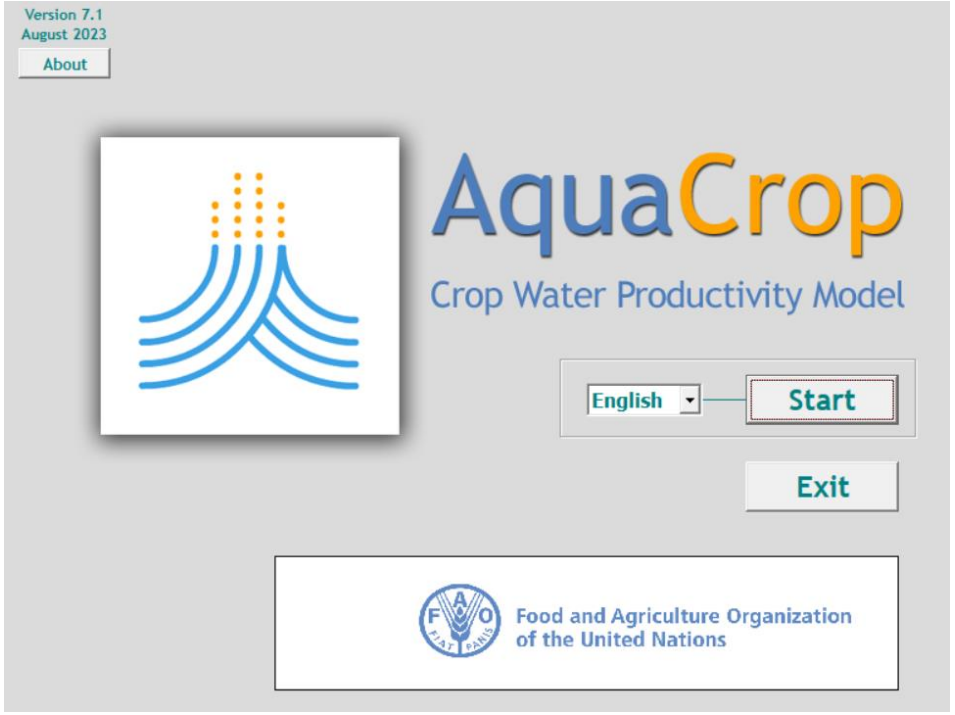
Evapotranspiration: location, air temperature, humidity and solar radiation…

Penman Monteith equation:

$$\lambda ET = \frac{\Delta(R_n - G) + \rho_a c_p \frac{(e_s - e_a)}{r_a}}{\Delta + \gamma\left(1 + \frac{r_s}{r_a}\right)}$$

AquaCrop interface

Graphical User interface



Plug-in or standalone

LIST	File folder
OUTP	File folder
PARAM	File folder
SIMUL	File folder
aquacrop	Application
AUTHORS.md	MD File
LICENSE	File

Outcomes of today's session

- Format of this workshop (training material, software, etc)
- Introduction to crop models and AquaCrop interface
- The rest will be covered during the in-person training

Thank you!

Contact details:
jorge.alvarbeltran@fao.org
riccardo.soldan@fao.org