



**Food and Agriculture
Organization of the
United Nations**



Crop Module 2

Creating Climate files

Jorge Alvar-Beltrán
(2023)



Objective and data used in this session

Objective: how to create climate files on AquaCrop

We will create our own climatic files (using daily values) for Badin from 01-01-2010 until 31-12-2099.

- **GCM:** one model (bias-corrected using W5E5 dataset) under RCP 4.5.
- **Climatic variables:** maximum temperature (Tmax), minimum temperature (Tmin), and precipitation (pr).

All the climate data for Badin is available in Crop_Module_2 [\(link\)](#)



Preparing the CSV climatic files

Step 1: select column A

AutoSave Off | Badin_RCP45.xlsx | No Label

File Home Insert Page Layout Formulas **Data** Review View Automate Help WPS PDF

Get & Transform Data: Get Data (From Text/CSV, From Web, From Table/Range, Recent Sources, Existing Connections), Refresh All, Queries & Connections (Properties, Edit Links)

Data Types: Stocks, Currencies

Sort & Filter: Sort (A-Z, Z-A), Filter, Clear, Reapply, Advanced

A1 : Year,Month,Day,Precip.,Tmax,Tmin

	A	B	C	D	E	F	G	H	I	J
1	Year,Month,Day,Precip.,Tmax,Tmin									
2	2010,1,2,0.0,27.0,11.6									
3	2010,1,1,0.0,26.4,11.0									
4	2010,1,3,0.0,27.0,12.0									
5	2010,1,4,0.0,27.0,11.6									
6	2010,1,5,0.0,27.9,12.0									
7	2010,1,6,0.0,28.6,12.0									
8	2010,1,7,0.0,28.1,12.0									
9	2010,1,8,0.0,27.0,11.3									
10	2010,1,9,0.0,26.1,10.7									
11	2010,1,10,0.1,25.4,10.9									
12	2010,1,11,0.0,25.4,11.1									
13	2010,1,12,0.0,25.1,11.1									
14	2010,1,13,0.0,24.6,10.0									
15	2010,1,14,0.0,24.7,9.5									
16	2010,1,15,0.0,24.7,9.3									
17	2010,1,16,0.0,24.8,9.3									
18	2010,1,17,0.0,25.1,9.5									

Steps 3-4: click the **Data tab** in the upper toolbar and, afterwards, click in **Text to Columns**

Steps 4-5: click on **Delimited** and then **Next**

AutoSave Off | Badin_RCP45.xlsx | No Label

File Home Insert Page Layout Formulas **Data** Review View Automate Help WPS PDF

Get & Transform Data: Get Data (From Text/CSV, From Web, From Table/Range, Recent Sources, Existing Connections), Refresh All, Queries & Connections (Properties, Edit Links)

Data Types: Stocks, Currencies

Sort & Filter: Sort (A-Z, Z-A), Filter, Clear, Reapply, Advanced

A1 : Year,Month,Day,Precip.,Tmax,Tmin

Convert Text to Columns Wizard - Step 1 of 3

The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the data type that best describes your data.

Original data type:
Choose the type that best describes your data:
☒ **Delimited** - Characters such as commas or tabs separate each field.
☐ Fixed width - Fields are aligned in columns with spaces between each field.

Preview of selected data:

1	Year,Month,Day,Precip.,Tmax,Tmin
2	2010,1,2,0.0,27.0,11.6
3	2010,1,1,0.0,26.4,11.0
4	2010,1,3,0.0,27.0,12.0
5	2010,1,4,0.0,27.0,11.6
6	2010,1,5,0.0,27.9,12.0

Buttons: Cancel, < Back, **Next >**, Finish

Preparing the CSV climatic files

Steps 1-2: use the **comma** delimiter and click **next**

Step 3: click on **Finish**

Convert Text to Columns Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

- ☐ Tab
- ☐ Semicolon
- ☒ **Comma** 1
- ☐ Space
- ☐ Other:

☐ Treat consecutive delimiters as one

Text qualifier: " " v

Data preview

Year	Month	Day	Precip.	Tmax	Tmin
2010	1	2	0.0	27.0	11.6
2010	1	1	0.0	26.4	11.0
2010	1	3	0.0	27.0	12.0
2010	1	4	0.0	27.0	11.6
2010	1	5	0.0	27.9	12.0

Cancel < Back **Next >** 2 Finish

Convert Text to Columns Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

Column data format

- ☒ General
- ☐ Text
- ☐ Date: DMY v
- ☐ Do not import column (skip)

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Destination: \$A\$1 v

Data preview

Year	Month	Day	Precip.	Tmax	Tmin
2010	1	2	0.0	27.0	11.6
2010	1	1	0.0	26.4	11.0
2010	1	3	0.0	27.0	12.0
2010	1	4	0.0	27.0	11.6
2010	1	5	0.0	27.9	12.0

Cancel < Back Next > **Finish** 3



Preparing the CSV climatic files

	A	B	C	D	E	F	G	H	I
1	Year	Month	Day	Precip.	Tmax	Tmin			
2	2010	1	2	0.0	27.0	11.6			
3	2010	1	1	0.0	26.4	11.0			
4	2010	1	3	0.0	27.0	12.0			
5	2010	1	4	0.0	27.0	11.6			
6	2010	1	5	0.0	27.9	12.0			
7	2010	1	6	0.0	28.6	12.0			
8	2010	1	7	0.0	28.1	12.0			
9	2010	1	8	0.0	27.0	11.3			
10	2010	1	9	0.0	26.1	10.7			
11	2010	1	10	0.1	25.4	10.9			
12	2010	1	11	0.0	25.4	11.1			
13	2010	1	12	0.0	25.1	11.1			
14	2010	1	13	0.0	24.6	10.0			
15	2010	1	14	0.0	24.7	9.5			
16	2010	1	15	0.0	24.7	9.3			
17	2010	1	16	0.0	24.8	9.3			
18	2010	1	17	0.0	25.1	9.5			
19	2010	1	18	0.0	25.3	10.8			
20	2010	1	19	0.0	24.2	10.3			
21	2010	1	20	0.0	23.7	9.1			
22	2010	1	21	0.0	24.1	8.6			
23	2010	1	22	0.0	25.2	9.5			
24	2010	1	23	0.0	26.1	10.5			
25	2010	1	24	0.0	25.6	9.9			
26	2010	1	25	0.0	25.5	9.8			

Step 1: delete the first row (year) and the **date columns (A,B,C)** (AquaCrop cannot read text)

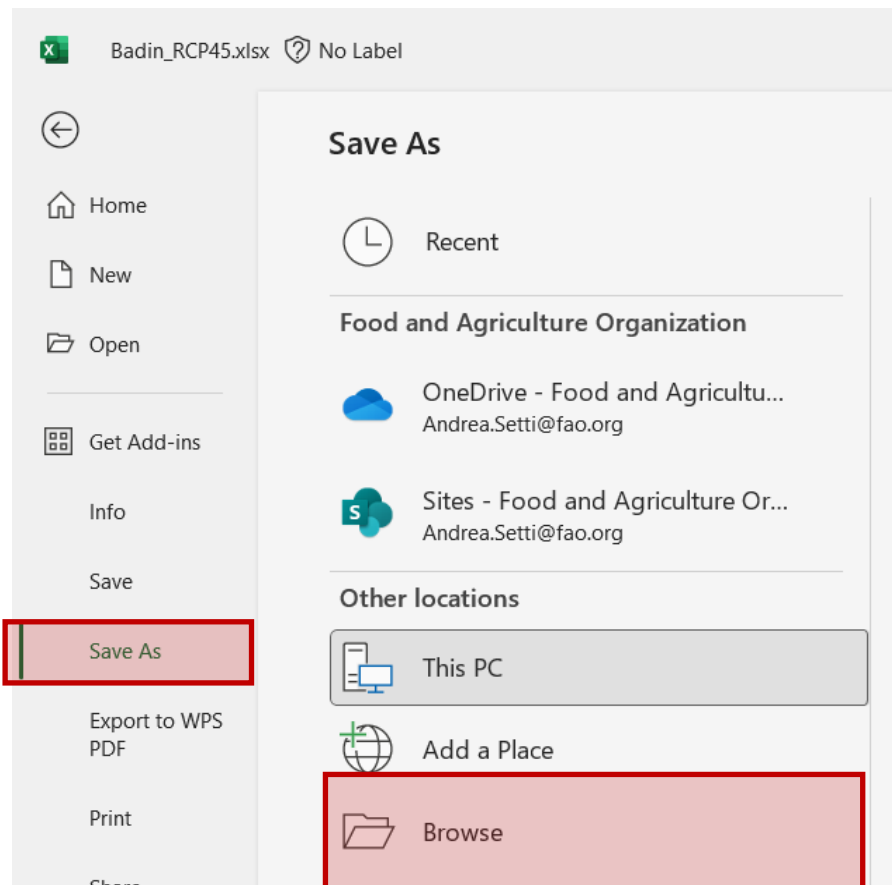
Remember that the columns respectively correspond to:

- A) Precip: precipitation (mm/day)
- B) Tmax: maximum temperatures (°C)
- C) Tmin: minimum temperatures (°C)

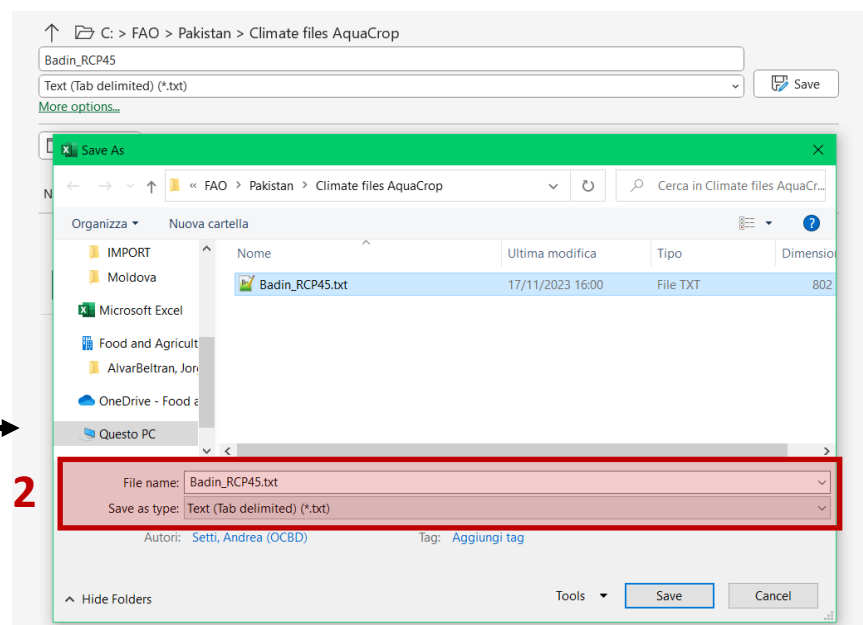


Saving the climatic files in the right format

Steps 1-2: save the CSV file as type **“Text (Tab delimited)”**



Step 3: save the file in the AquaCrop folder
“IMPORT”



GUI_AC71 > AquaCropV71No13102023 >

Nombre

- DATA
- IMPORT
- OBS
- OUTP
- SIMUL
- _DEISREG.ISR
- _ISREG32.DLL
- AquaCrop
- AquaCrop
- DelsL1.isu



Create/import climatic files

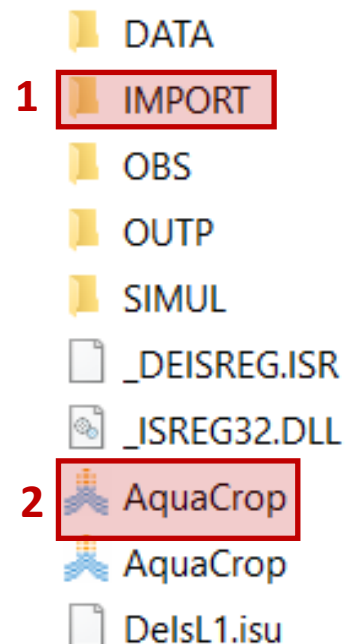
Prec	Tmax	Tmin
0.0	27.0	11.6
0.0	26.4	11.0
0.0	27.0	12.0
0.0	27.0	11.6
0.0	27.9	12.0
0.0	28.6	12.0
0.0	28.1	12.0
0.0	27.0	11.3
0.0	26.1	10.7
0.1	25.4	10.9
0.0	25.4	11.1
0.0	25.1	11.1
0.0	24.6	10.0
0.0	24.7	9.5
0.0	24.7	9.3
0.0	24.8	9.3
0.0	25.1	9.5
0.0	25.3	10.8
0.0	24.2	10.3
0.0	23.7	9.1
0.0	24.1	8.6
0.0	25.2	9.5
0.0	26.1	10.5
0.0	25.6	9.9
0.0	25.5	9.8
0.5	25.9	10.6
0.0	25.0	11.1

- Daily values are introduced in AquaCrop as txt. format
- The more climatic variables you have, the better the results - as ETo estimations will be closer to the reality (observed values)...
- ...and remember: AquaCrop calculates biomass production from crop transpiration.
- AquaCrop does not read blank cells nor text
- AquaCrop has default CO₂ files from 1900 until 2100
- If weather data necessary to compute ETo is missing, procedures to estimate missing climatic data are used – based on the methodologies outlined in the Irrigation and Drainage Paper No 56 ([FAO, 1998](#)).

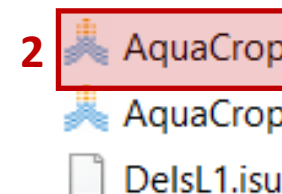


Open txt. file on AquaCrop

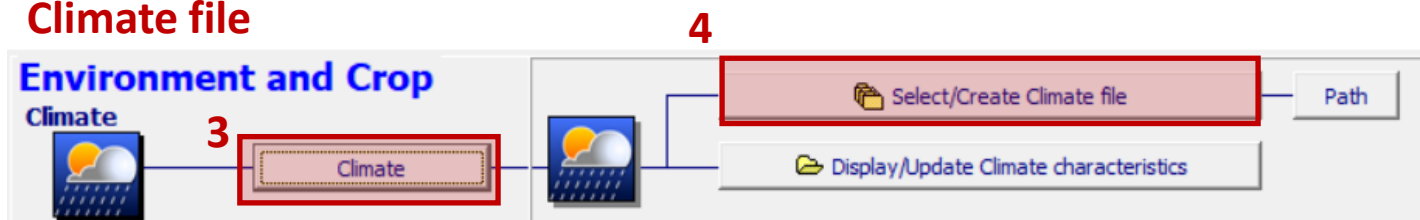
Step 1: copy paste the txt file into AquaCrop folder **IMPORT**



Step 2: open **AquaCrop** and click on **Start**

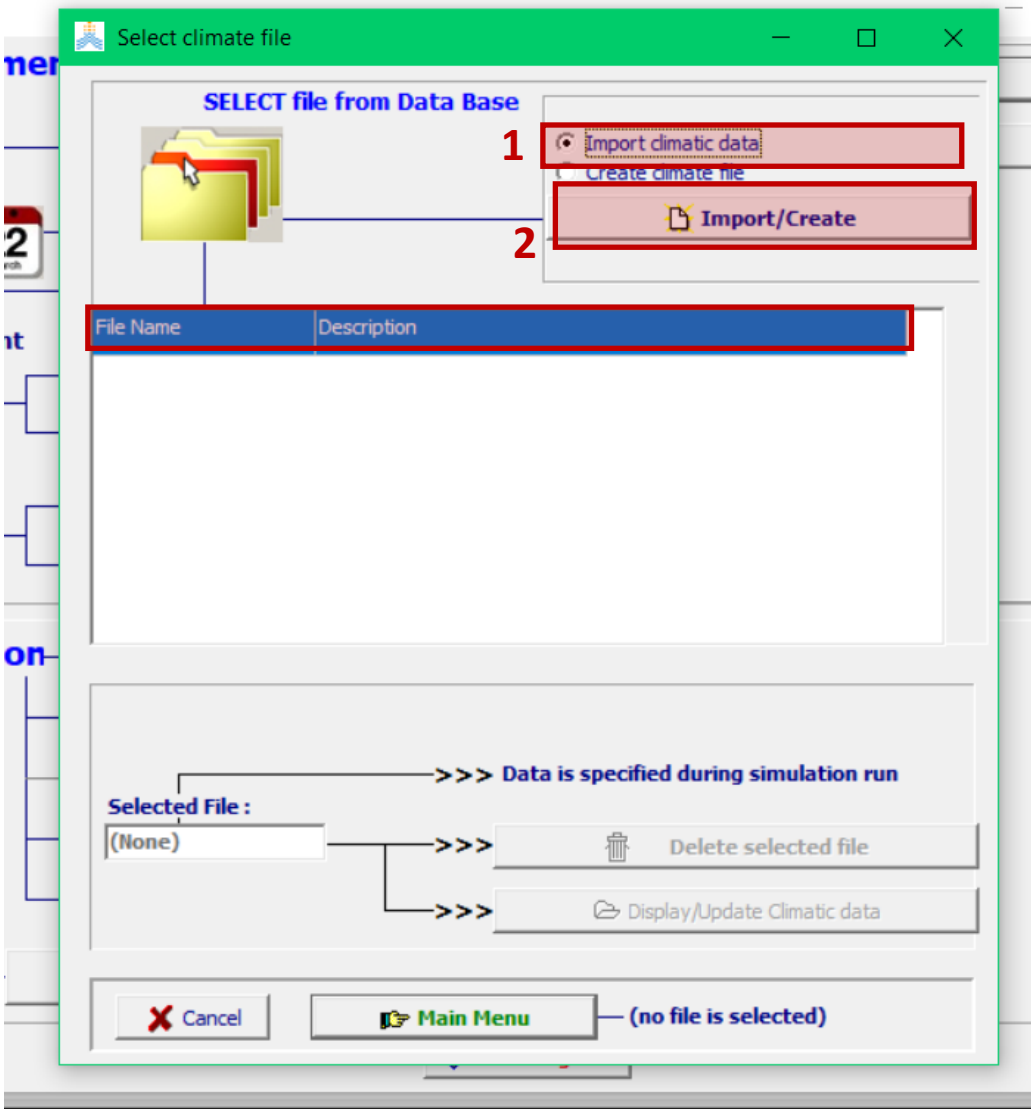


Step 3: open the **climate** module and click on **Select/Create**
Climate file

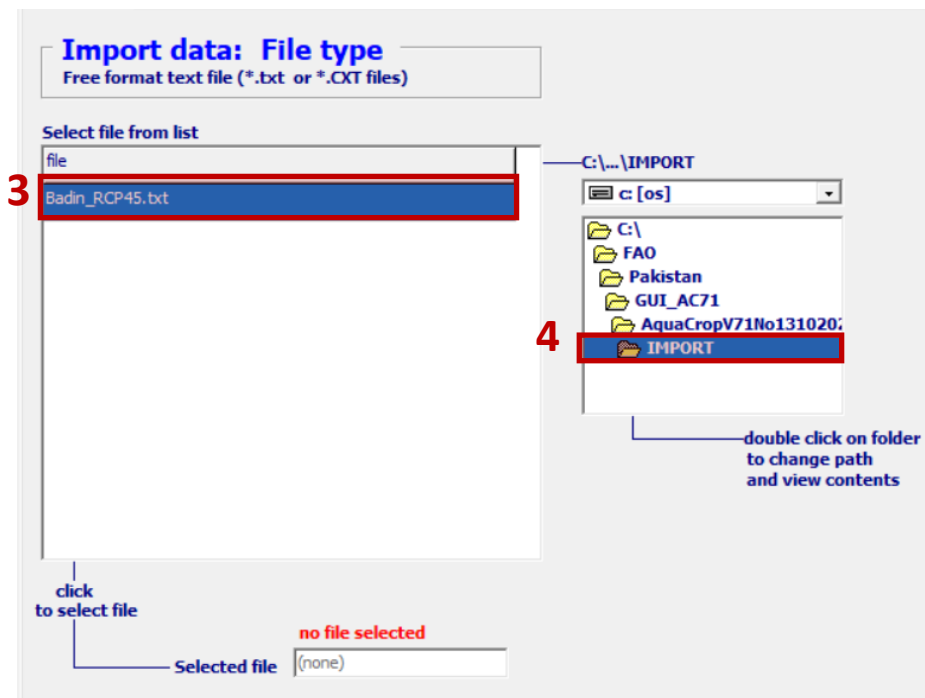


Create a climatic file

Steps 1-2: click on **Import/Create** climatic file

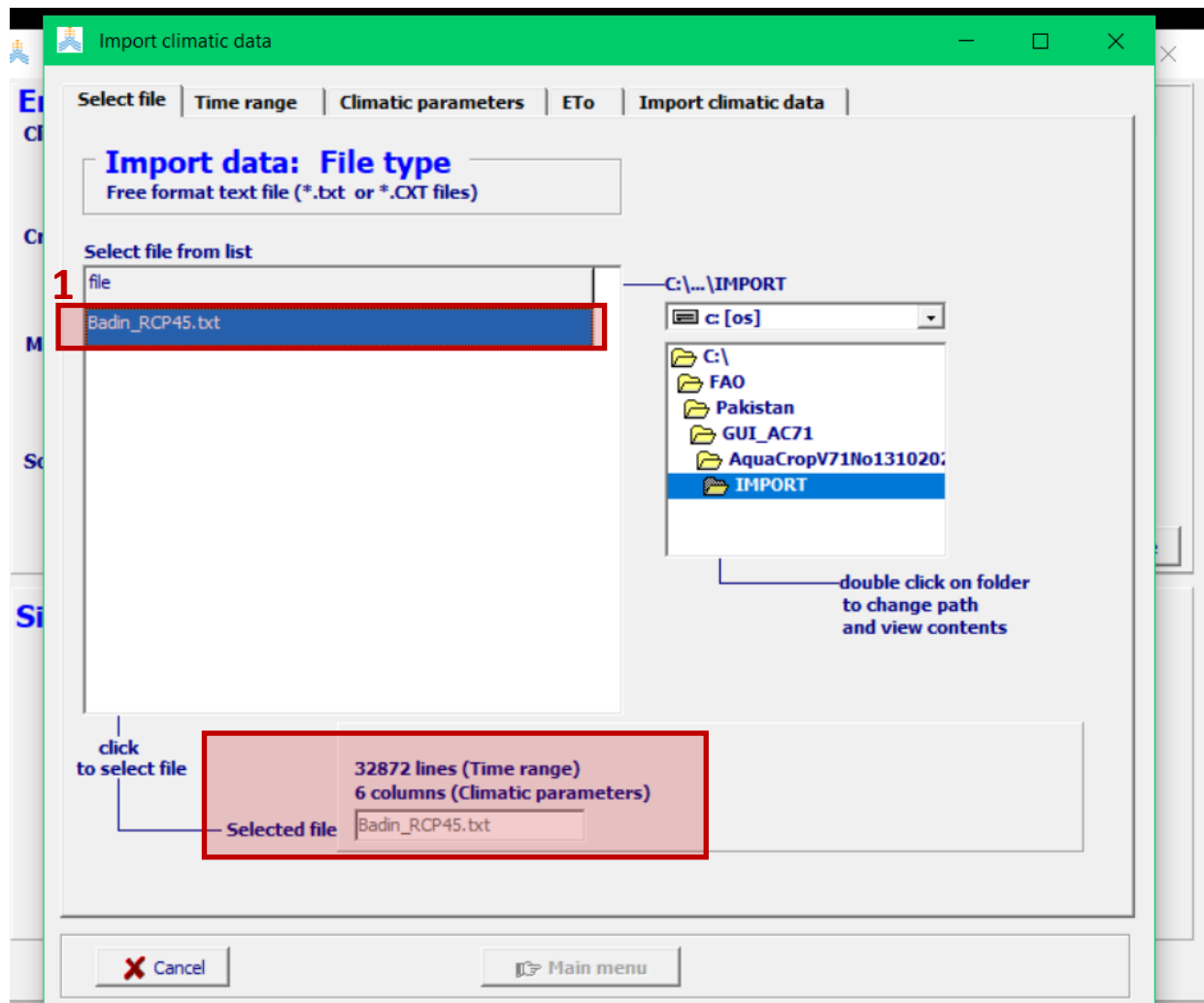


Steps 3-4: select **Badin_RCP45** and click on **Import/Create**





Create a climatic file



Step 1: double click on the file named **Badin_RCP45**

Double check that no errors appear in red (e.g., AquaCrop cannot read text, rows missing, blank cells etc.)



Create a climatic file

Import climatic data

Select file **1** Time range Climatic parameters ETo Import climatic data

Type and time range of climatic data

Type **2** ☒ Daily
☐ 10-daily
☐ Monthly

Time range

☐ not linked to a specific year

First Day 1 Last Day 31
First Month January Last Month December
First Year 2005 Last Year 2005

3 >>> number of daily records (=365) in specified time range **4**

Adjust time range
number of days in specified time range (365)
does not correspond with number of lines (32872) in file

Cancel Main menu

Steps 1-2: click on **Time range** and specify the frequency of climate observations/projections. In our case, **Daily**.

Steps 3-4: select the starting **(01/01/2010)** and end period **(31/12/2099)** of daily climatic information

AquaCrop can support daily, 10-day, and monthly climatic data

Create a climatic file

Import climatic data

Select file | Time range | Climatic parameters | ETo | Import climatic data

Climatic parameters

Not relevant parameters : 1, 2, 3

Column...	1	2	3
<< click in cell to select parameter >>			
Symbol.....			
Unit.....			
Code.....			

Missing data.....

Undefined Value: -999.000

Missing..... none none none

Data range.....

Column Max...	46.8	47.8	34.3
Column Min....	0.0	21.3	6.9

Program limits (Data Range)

Upper limit...			
Lower limit...			

>> Update Data Range

Cancel Main menu

Remember that the new columns correspond to:

- A) pr: precipitation (mm/day)
- B) Tmax: maximum temperatures (°C)
- C) Tmin: minimum temperatures (°C)

Create a climatic file (rain & Tmax)

Steps 1-3: click on the first column (**blank cell**), then select the **rain tab** and **rain (mm)**.

Import climatic data

Select file | Time range | Climatic parameters | ETo | Import climatic data

Climatic parameters

Not relevant parameters : 1, 2, 3

Column... 1 2 3

<< click in cell to select parameter >>

Symbol.....

Unit.....

Code.....

Missing data.....

Undefined Value -999.00

Missing..... none none none

Data range.....

Column Max... 46.8 47.8 34.3

Column Min... 0.0 21.3 6.9

Program limits (Data F

Upper limit...

Lower limit...

>> Update Data Ran

List of climatic parameters

Temperature | Humidity | Wind | Sunshine/Radiation | ETo | **Rain** | None

rainfall

Code	Symbol	Unit	Description
601	Rain	mm	Rainfall
602	Rain	inch	Rainfall

click to select code

Close

Cancel Main menu

Step 4-6: click on the second column (**blank cell**), then select the **temperature tab** and **Tmax (°C)**.

Import climatic data

Select file | Time range | Climatic parameters | ETo | Import climatic data

Climatic parameters

Not relevant parameters : 2, 3

Column... 1 2 3

<< click in cell to select parameter >>

Symbol.....

Unit.....

Code.....

Missing data.....

Undefined Value -999.00

Missing..... none none none

Data range.....

Column Max... 46.8 47.8 34.3

Column Min... 0.0 21.3 6.9

Program limits (Data F

Upper limit... 300.0

Lower limit... 0.0

>> Update Data Ran

List of climatic parameters

Temperature | Humidity | Wind | Sunshine/Radiation | ETo | Rain | None

air temperature

Code	Symbol	Unit	Description
101	Tmax	°C	maximum air temperature
102	Tmean	°C	mean air temperature
103	Tmin	°C	minimum air temperature
111	Tmax	°F	maximum air temperature
112	Tmean	°F	mean air temperature
113	Tmin	°F	minimum air temperature

click to select code

Close

Cancel Main menu



Create a climatic file (Tmin & RH)

Steps 1-3: click on the third column (**blank cell**), then select the **temperature tab** and **Tmin (°C)**.

Import climatic data

Select file | Time range | **Climatic parameters** | ETo | Import climatic data

Climatic parameters

Column... 1 2 **3**

<< click in cell to select parameter >>

Symbol... Rain Tmax Tmin

Unit... mm °C °C

Code... 601 101 103

Missing data.....

Undefined Value -999.00

Missing... none none **none**

Data range.....

Column Max... 46.8 47.8 34.3

Column Min... 0.0 21.3 6.9

check range

Program limits (Data F

Upper limit... 300.0 45.0 45.0

Lower limit... 0.0 -15.0 -15.0

Update Data Range

List of climatic parameters

Temperature | Humidity | Wind | Sunshine/Radiation | ETo | Rain | None

air temperature

Code	Symbol	Unit	Description
101	Tmax	°C	maximum air temperature
102	Tmean	°C	mean air temperature
103	Tmin	°C	minimum air temperature
111	Tmax	°F	maximum air temperature
112	Tmean	°F	mean air temperature
113	Tmin	°F	minimum air temperature

click to select code

Close

Cancel Main menu

Update data ranges exceeding limits

Now you can visualize all the imported parameters as well as the data ranges for each of these variables!

Import climatic data

Select file | Time range | Climatic parameters | ETo | Import climatic data

Climatic parameters

Column... 1 2 3

<< click in cell to select parameter >>

Symbol.....	Rain	Tmax	Tmin
Unit.....	mm	°C	°C
Code.....	601	101	103

Missing data.....

Undefined Value -999.000

Missing..... none none none

Data range.....

Column Max...	46.8	47.8	34.3
Column Min...	0.0	21.3	6.9

check range

Program limits (Data Range)

Upper limit...	300.0	45.0	45.0
Lower limit...	0.0	-15.0	-15.0

>> Update Data Range

Cancel Main menu

Steps 1-2: change the upper limit of **Tmax** to **48°C** Finally, click on **Save and Close**

Limits of climatic data

Station: Badin_RCP45

Limits

adjust limit with

Rainfall

Lower limit 0 mm/day 300 mm/day

Temperature

Maximum, mean and minimum air temperature
Dewpoint temperature, wet and dry bulb temperature

Lower limit -15 degrees Celsius 48 degrees Celsius

Relative humidity

Maximum, mean and minimum relative humidity

Lower limit 15 percent 100 percent

Vapour pressure

Actual vapour pressure

Lower limit 0.0286 kPa 11.1628 kPa

Wind speed

Lower limit 0 m/sec 8 m/sec

Hours of bright sunshine

Lower limit 0 hours/day 11.3 hours/day 14.0 hours/day

Radiation

Solar or shortwave radiation, Net radiation

Lower limit 0 MJ/m2.day 19.8 MJ/m2.day 31.7 MJ/m2.day

accepted deviation ... 5 %

Angstrom equation
a = 0.25
b = 0.50
Rs = a + b (n/N=1) Ra
correction for altitude (222 m)

Latitude station 22° 22 North

ETo (reference ET)

Lower limit 0 mm/day 10 mm/day

2 Save and Close

Introduce coordinates

All the imported parameters have been successfully uploaded!

Import climatic data

Select file | Time range | Climatic parameters | ETo | Import climatic data

Climatic parameters

Column... 1 2 3

<< click in cell to select parameter >>

Symbol.....	Rain	Tmax	Tmin
Unit.....	mm	°C	°C
Code.....	601	101	103

Missing data.....

Undefined Value -999.000

Missing..... none none none

Data range.....

Column Max...	46.8	47.8	34.3
Column Min...	0.0	21.3	6.9

Program limits (Data Range)

Upper limit...	300.0	48.0	48.0
Lower limit...	0.0	-15.0	-15.0

>> Update Data Range

Cancel Main menu

Step 1: since we are preparing the climatic file for **Badin**, change the **altitude** to **9 masl** and the **latitude** to **24.63 decimal degrees**.

Import climatic data

Select file | Time range | Climatic parameters | **ETo** | Import climatic data

Coordinates of Meteorological station

Station Badin_RCP45

Altitude 9 meter above sea level (m.a.s.l.)

Latitude 24.63 decimal degrees North

specified in ☐ Degrees and Minutes ☒ Decimal degrees

ETo calculation (FAO Penman-Monteith method)

considered

- Air temperature..... Maximum (Tmax) and minimum (Tmin) air temperature (available)
- Air humidity..... Actual vapour pressure (estimée de Tmin) **estimated**
- Radiation..... Net radiation (solar radiation estimated from (Tmax - Tmin) difference) **estimated**
- Wind speed..... Wind speed (estimated from specified average value) **estimated**

Coefficients check coefficients for required estimates

ETo calculator

ETo

ETo Reference evapotranspiration
(evaporating power of the atmosphere)

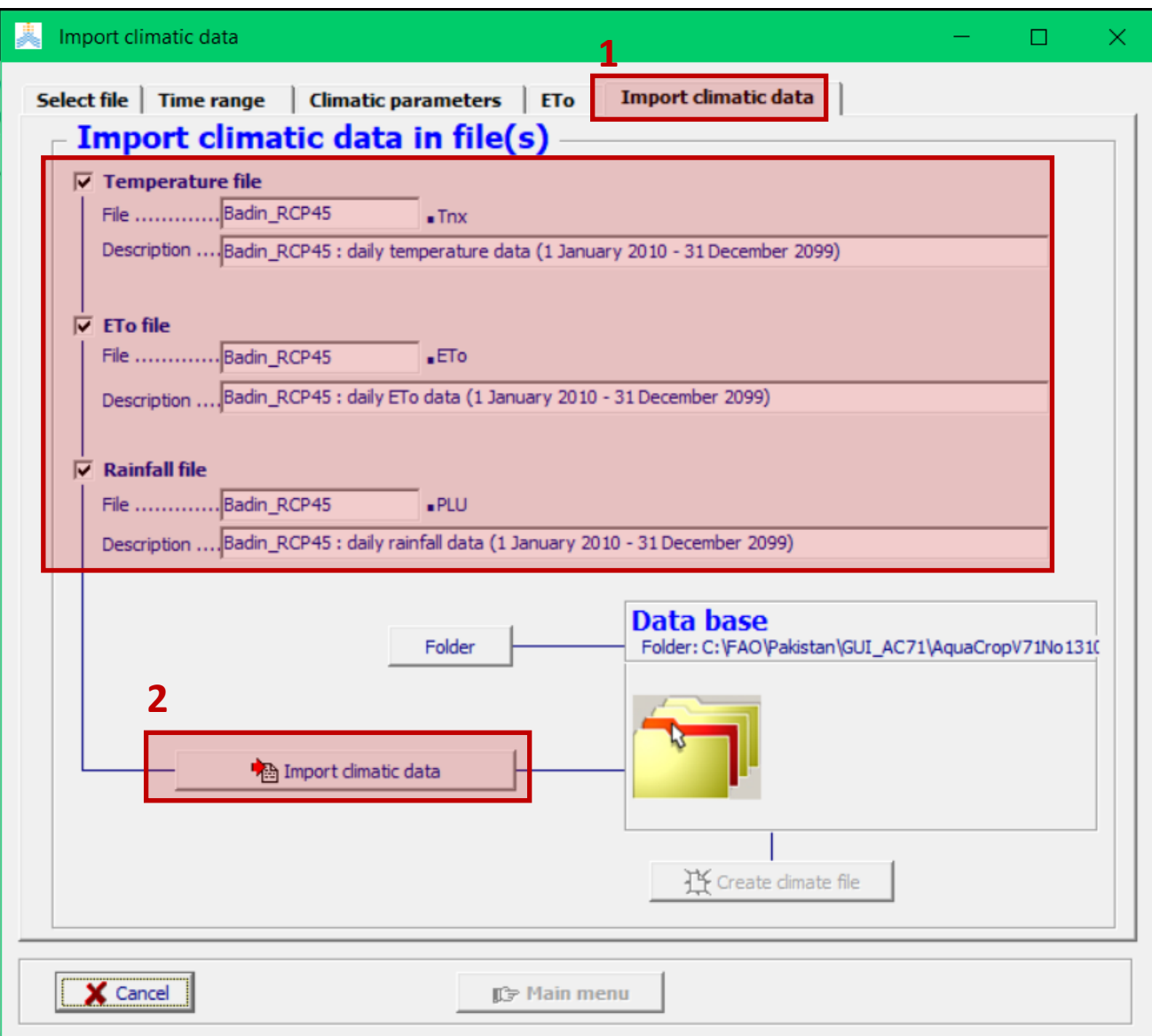
calculated with estimates for:

- air humidity
- wind speed
- net radiation

Cancel Main menu

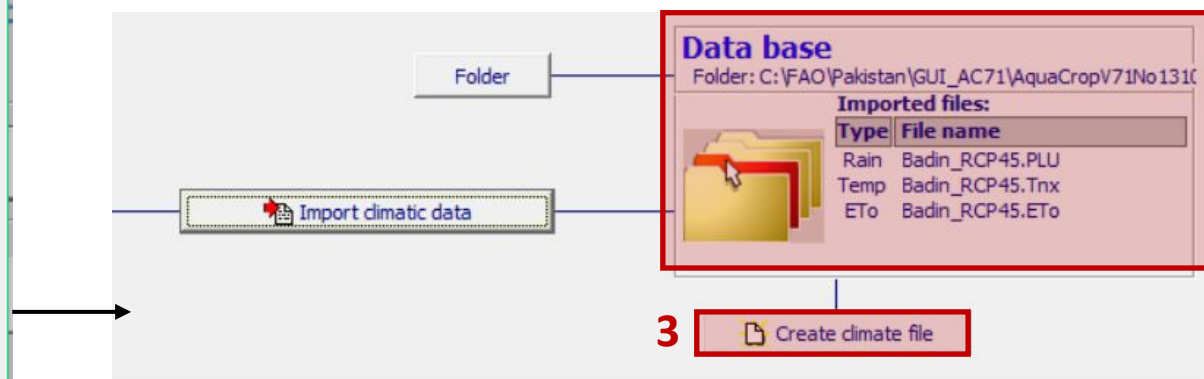


Import climatic data into AquaCrop



Step 1: click on **Import climatic data** and double check that the temperature, ETo and rainfall files are selected/ticked

Steps 2-3: click on **import climatic data** and then on **create climate file**.



Select the rain file

Step 1: Name the climatic file as **Badin_rcp45**

Steps 2-3: Click on **Rain** and **Select File from Rain Database**

1 **File Name**
Badin_rcp45

Description

Selected Rain, ETo, Temperature and CO2 file


	File Name	Description
2 <input checked="" type="radio"/> Rain	(None)	Specify Rain data when Running AquaCrop
<input type="radio"/> ETo	(None)	Specify ETo data when Running AquaCrop
<input type="radio"/> Temp	(None)	Default temperature data: Tmin = 12.0 and Tmax = 28.0 °C
<input type="radio"/> CO2	MaunaLoa.CO2	Default atmospheric CO2 concentration from 1902 to 2099

Data Base

3

Step 4: Select the correct rain file named:
Cahul_MOHC-HadGEM2-ES_rcp26: daily rainfall

SELECT file from Data Base


(double) Click a File in the list to select

File Name	Description
Badin_RCP45.PLU	Badin_RCP45 : daily rainfall data (1 January 2010 - 31 December 2010)

4

Selected File :
(None)

>>> Data is specified during simulation run

>>>

>>>

(no file is selected)

Select the ETo and Temp files

Steps 1-3. Click on **ETo**, select file from **ETo Database** and **accept selection**

Remember that the file is named: Badin_RCP45: daily ETo data

1 In the 'Create climate file' window, the 'ETo' radio button is selected.

2 In the 'Select ETo file' window, the file 'Badin_RCP45.ETo' is selected from the list.

3 The 'Accept selection' button is clicked.

Steps 4-6. Click on **Temp**, select file from **Temp Database** and **accept selection**

Remember that the file is named: Badin_RCP45: daily temperature data

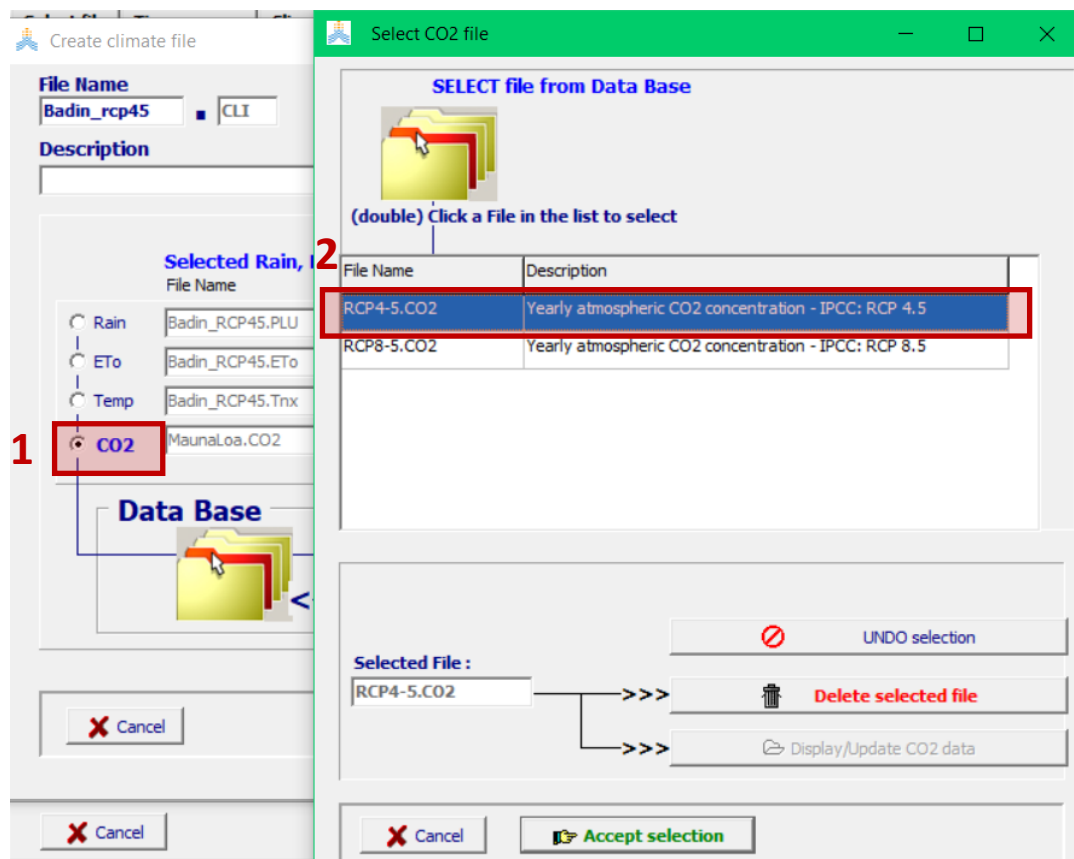
4 In the 'Create climate file' window, the 'Temp' radio button is selected.

5 In the 'Select temperature file' window, the file 'Badin_RCP45.Tnx' is selected from the list.

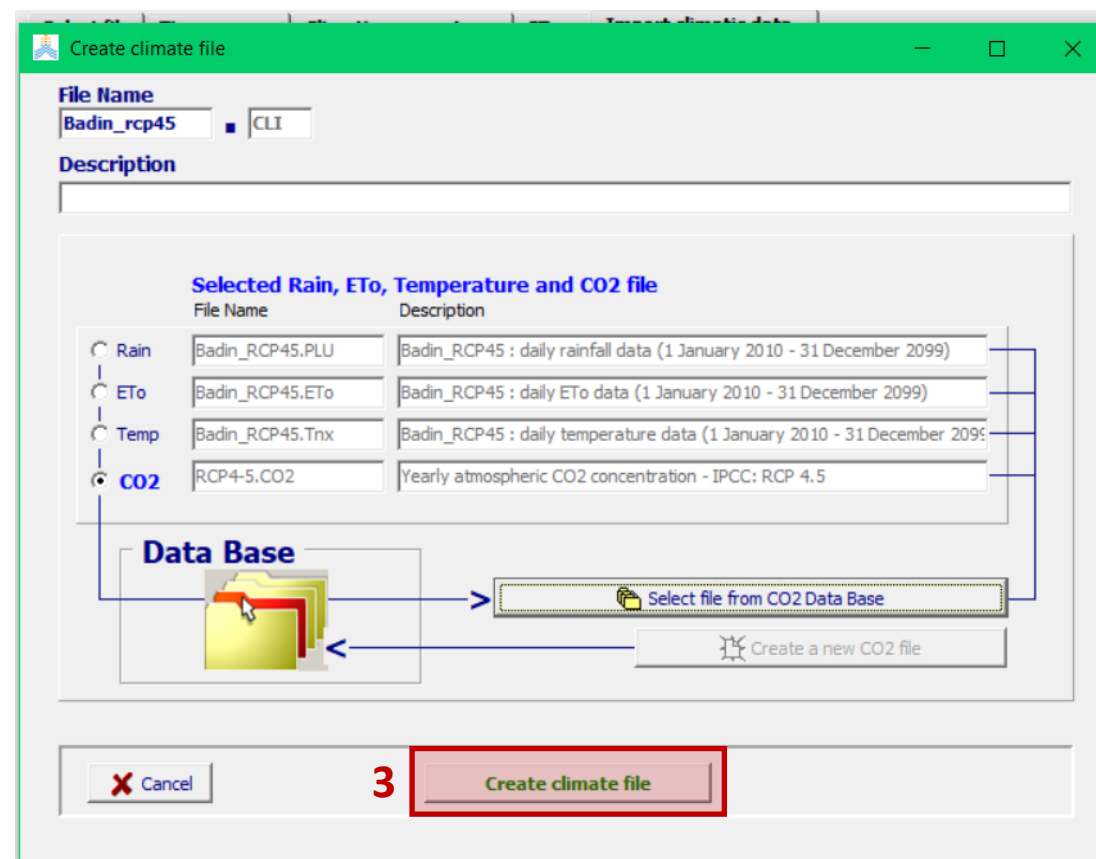
6 The 'Accept selection' button is clicked.

Select the CO₂ file and create climate file

Steps 1-2. Click on **CO₂** and select **RCP 4.5-CO₂** from database

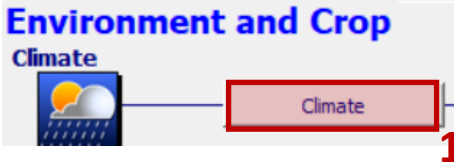


Step 3. Click on **Create climate file**



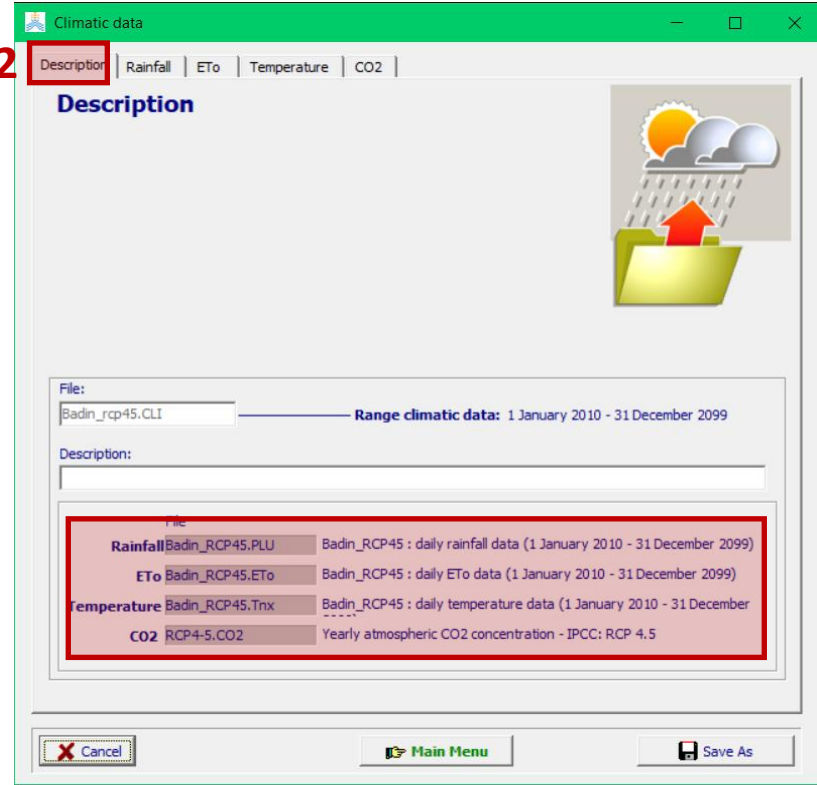


Visualize the climatic results for Badin

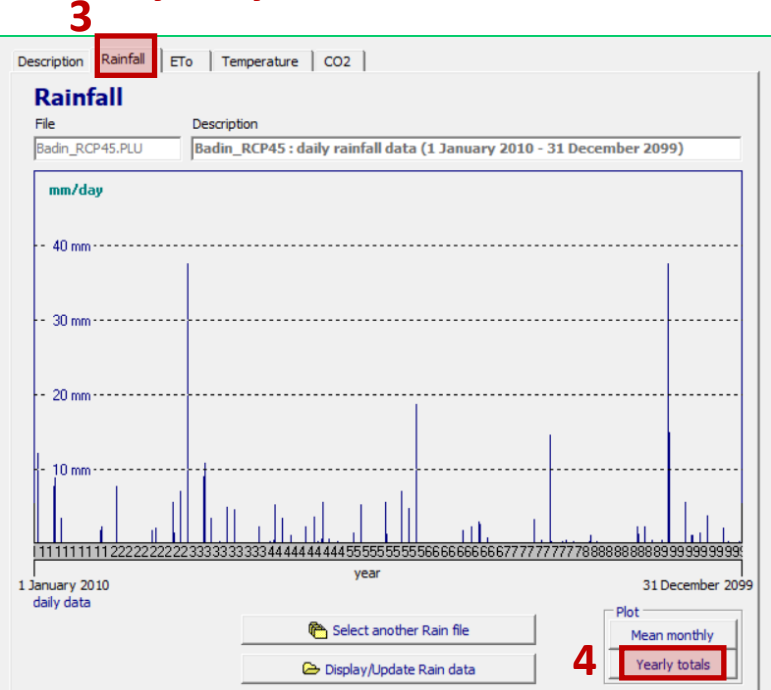


Step 1: Click on the **climate module** and **select Badin_rcp45**

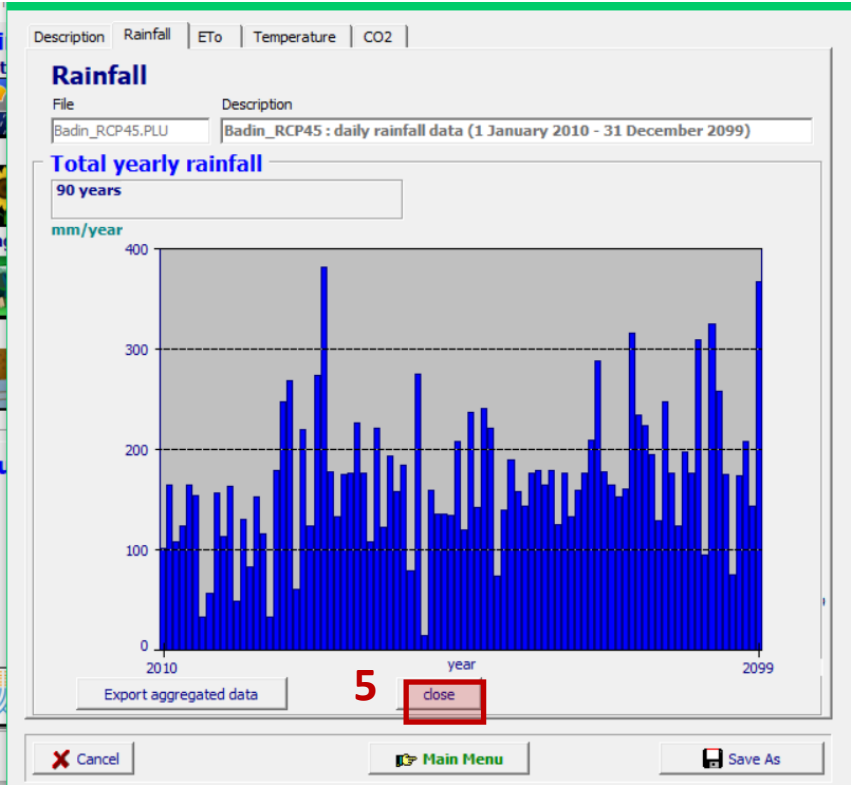
Step 2: In **description**, verify that the climate files are the right ones



Steps 3-4: Click on the **rainfall tab** and on **yearly totals**



Step 5: Visualize the rainfall data and then click on **close**

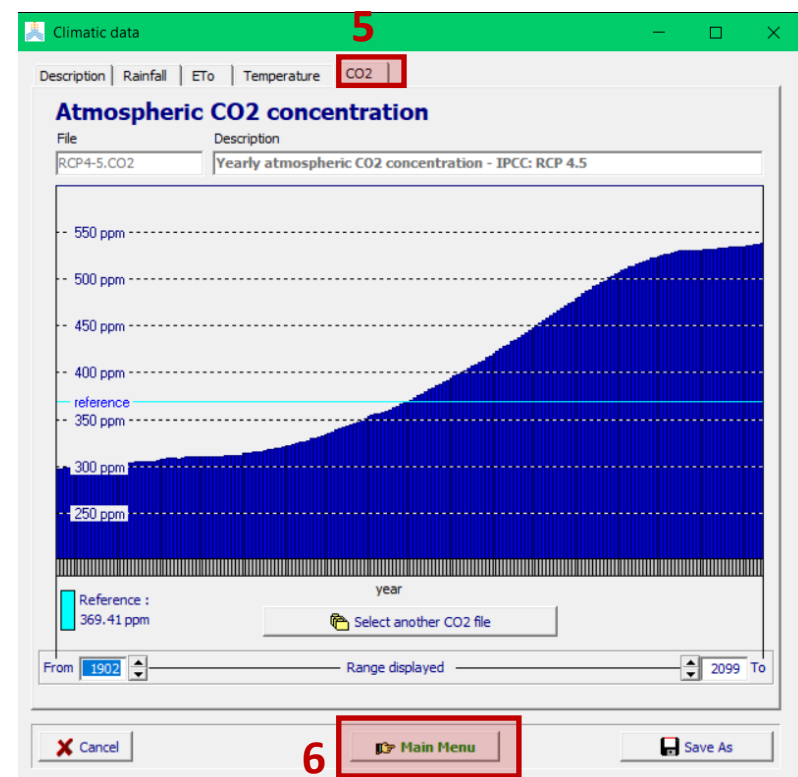
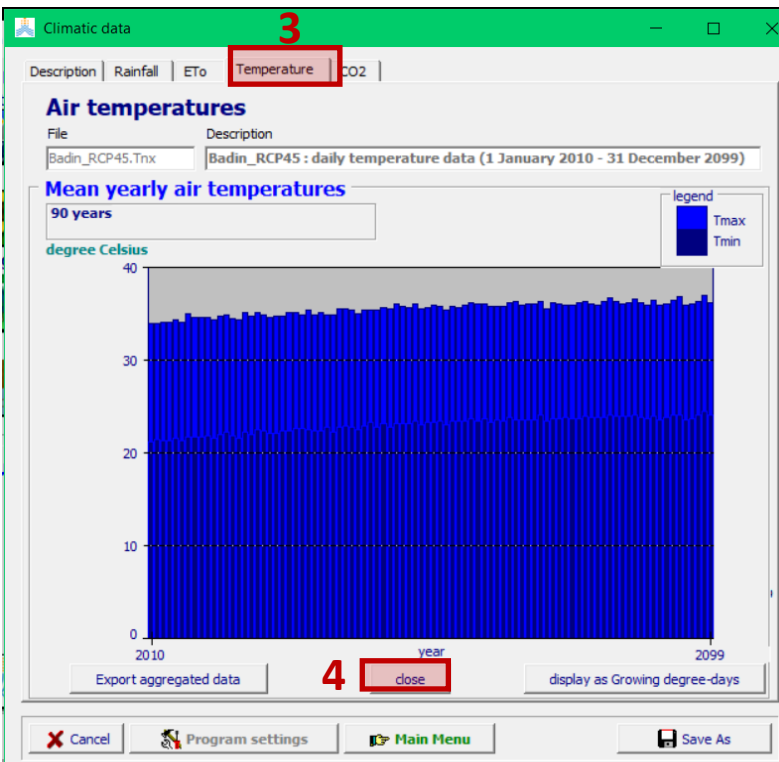
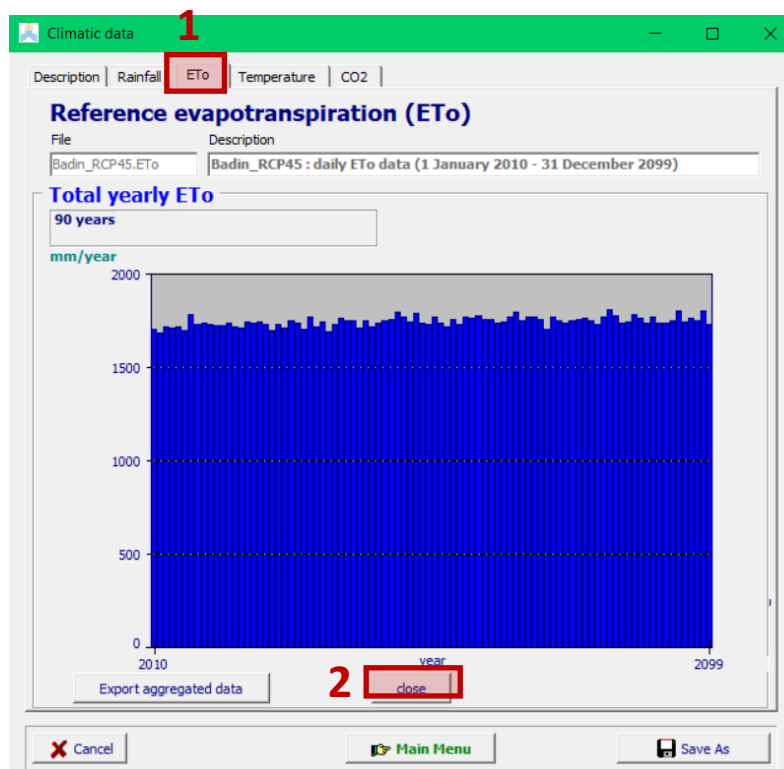


Visualize the climatic results for Badin

Steps 1-2: Click on the **ETo** tab and visualize the ETo data → then **close**

Steps 3-4: Click on the **Temperature** tab and visualize the temperature data → then **close**

Steps 5-6: Click on the **CO₂** tab and visualize the CO₂ data for RCP 2.6 → then click on **Main Menu**





Take away messages

- Creating climatic files in AquaCrop it is a long, but straightforward process.
- If the user wants to produce daily simulations, daily weather values are required; and so forth for 10-day values and monthly
- To compute ETo, the user needs at least three input climatic parameters (precipitation, Tmax and Tmin).
- The maximum number of climatic parameters is 6.
- AquaCrop automatically computes missing parameters (e.g., wind speed or relative humidity) necessary for running the Penman Monteith equation.
- It is important to use the right naming when saving the climatic files.
- AquaCrop automatically produces visuals for precipitation, ETo, temperature and CO₂.