

SWAT WEATHER DATABASE TOOL

A SUPPORT SYSTEM FOR THE LONG-TERM ANALYSIS OF
CLIMATE SCENARIOS WITH SWAT

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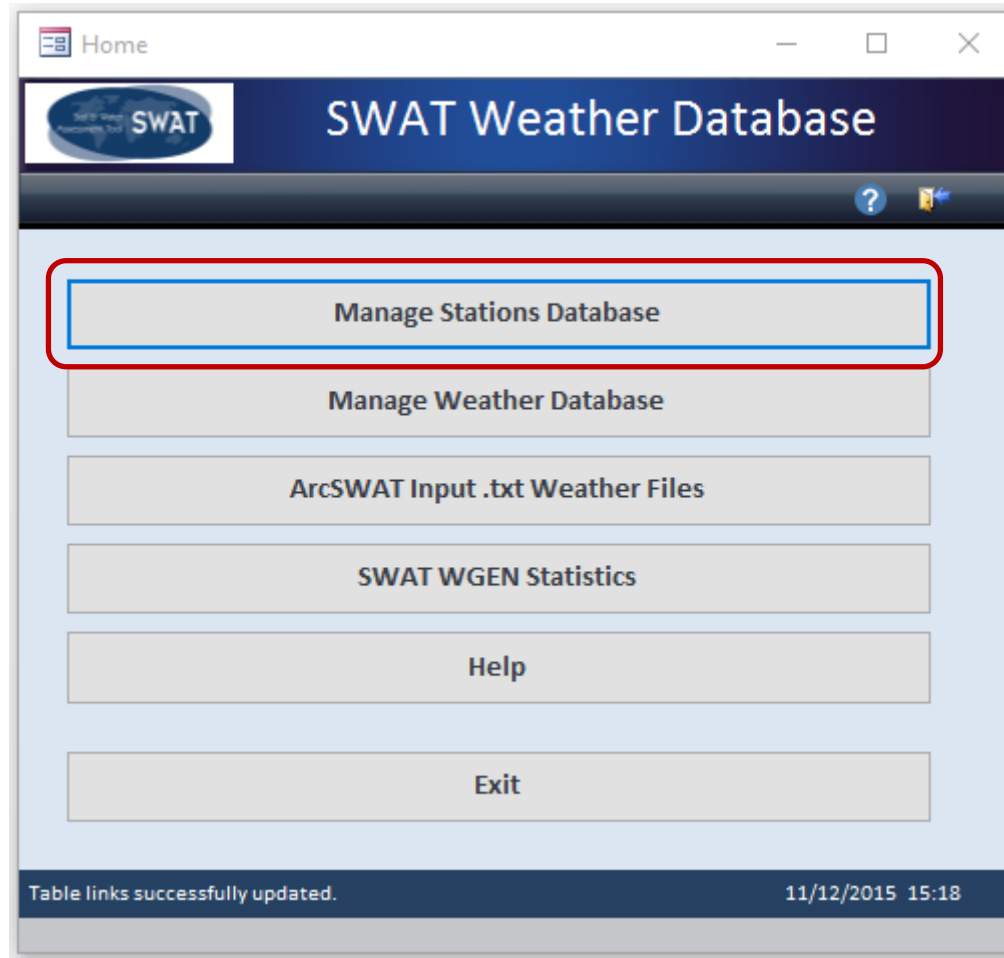
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INTRODUCTION

- Motivation & Background
 - Need to process weather data coming from different datasets, for different stations and for large simulation periods
 - Need to efficiently calculate WGEN statistics
- The SWAT Weather Database Tool:
 - Designed to be an efficient, user friendly tool to manage weather data
 - Capable of:
 - Storing and processing weather data
 - Easily creating the input .txt weather files
 - Efficiently calculating the WGEN statistics of several stations in one-step run
 - Suitable for beginners (new project set-up) and advanced (large weather datasets) SWAT users
 - Requirements:
 - A Windows operating system;
 - A recent copy of Microsoft Access and Microsoft Excel, and;
 - A .pdf reader (e.g. Adobe Acrobat Reader).



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Manage Weather Stations

Station Code	Station Name	Latitude	Longitude	Elevation	Station Description	Other Information
1	329959	32.940000	-95.938000	141		
2	329956	32.940000	-95.625000	153		

FIELD NAME	DATA TYPE	MAX CHARACTER FIELD LENGTH	REQUIRED	DUPLICATES ALLOWED
Station Code	Text	255	Yes	No
Station Name	Text	255	Yes	Yes
Latitude	Double	28	Yes	Yes
Longitude	Double	28	Yes	Yes
Elevation	Double	28	Yes	Yes
Station Description	Text	255	No	Yes
Other Information	Text	255	No	Yes

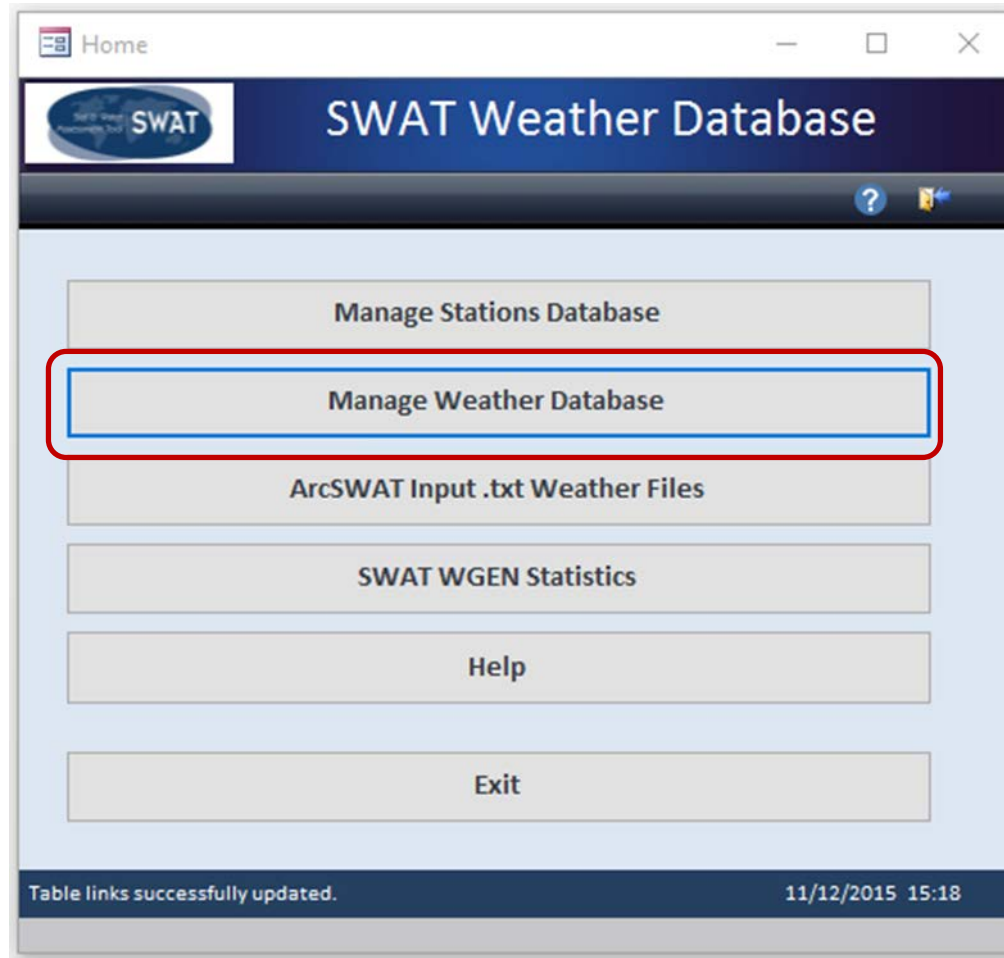
Record: 1 of 2 | No Filter | Search

Hello! Please select what operation would you like to perform with the stored station database.

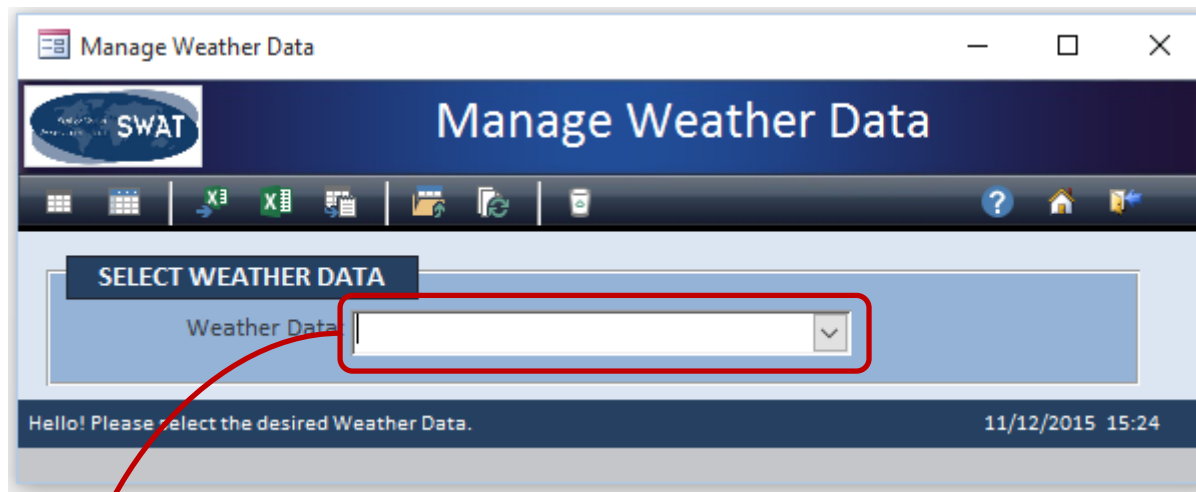
11/13/2015 13:01



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- **Weather Variables:**

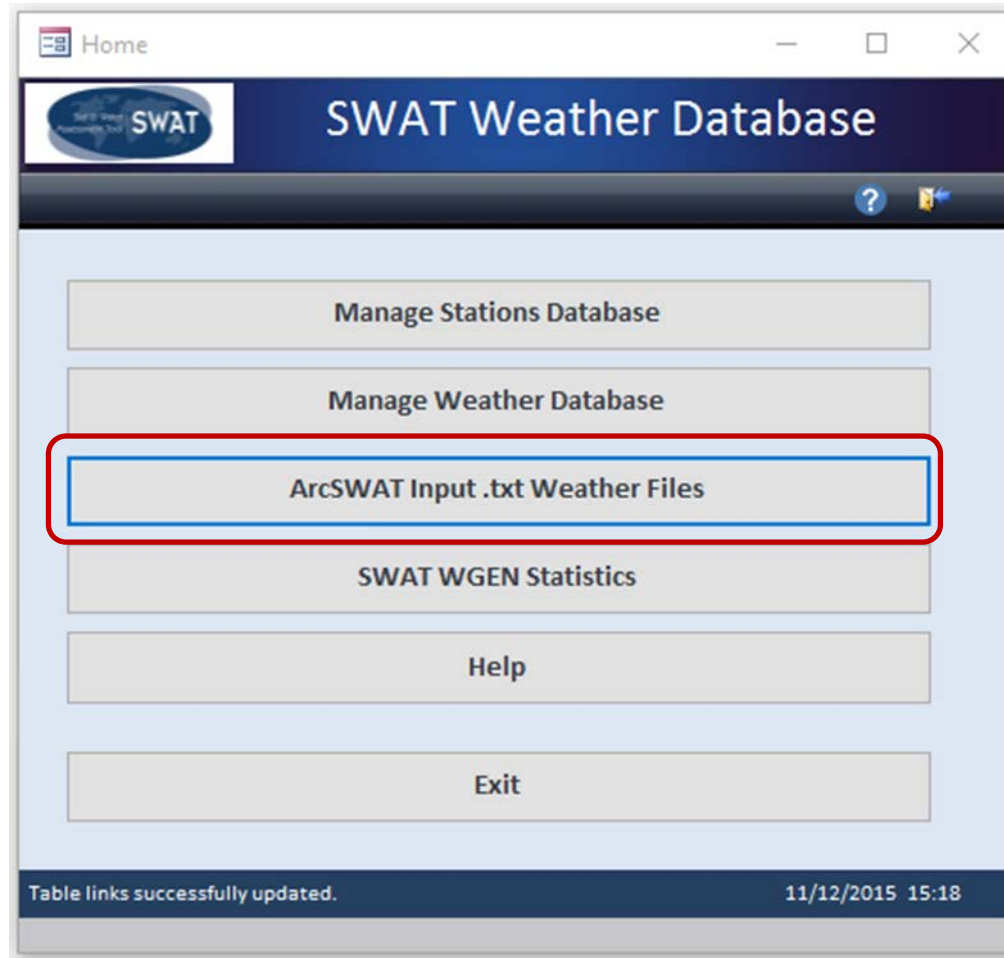
- Relative Humidity (HMD)
- Precipitation (PCP)
- Solar Radiation (SLR)
- Max & Min Temperature (TMP)
- Wind Speed (WND)

	A	B	C	D	E	F	G	H	I
1	Date	Station	PCP						
2	01/01/1979	2	1.36						
3	01/02/1979	2	0.08						
4	01/03/1979	2	0.00						
5	01/04/1979	2	2.47						
6	01/05/1979	2	13.80						
7	01/06/1979	2	18.08						
8	01/07/1979	2	1.46						
9	01/08/1979	2	0.18						
10	01/09/1979	2	0.00						

Date format → MDY
Station → Station Code
Missing data → -99



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SWAT WEATHER DATABASE TOOL

Write Weather Data to ArcSWAT Input Files

SWAT

Write Data to ArcSWAT Input Files

SELECT WEATHER DATA

SWAT Version: [Dropdown]

Weather Data: [Dropdown]

Generate ArcSWAT .txt Files

Hello! Please select the desired SWAT Version and Weather Data to be written. 11/12/2015 15:27

- **SWAT Version:**

- 2009
- 2012

- **Weather Variables:**

- Relative Humidity (HMD)
- Precipitation (PCP)
- Solar Radiation (SLR)
- Max & Min Temperature (TMP)
- Wind Speed (WND)



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WGEN Statistics

WGEN Statistics from Weather Data

CALCULATE WGEN STATISTICS

WGEN File Name:

Output File Type:

Calculate WGEN Data

Hello! Please inform the desired WGEN file name and extension to be saved. 11/12/2015 15:32

- User can specify the name of the WGEN output file

- Output file type:
 - .xls
 - .xlsx
 - .csv
 - .txt



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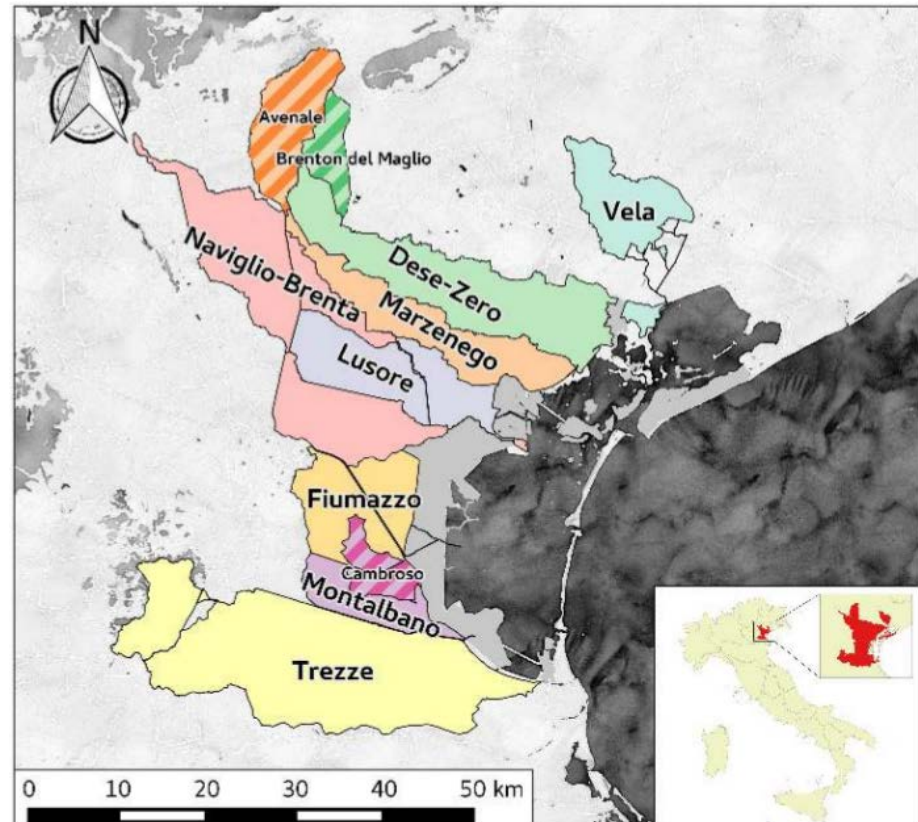
- Some last remarks on the calculation of WGEN statistics:
 - RAIN_YRS (number of years of maximum monthly half-hour rainfall) is currently not calculated by the application. A default value of RAIN_YRS = 10 is assumed for all weather stations.
 - RAINHHMX (maximum half-hour rainfall in entire period of record for month) is estimated as being the average of 1/3 of the maximum recorded daily rainfall for that month.
 - DEWPT (Average daily dew point temperature for each month) is actually the relative humidity (fraction). See the SWAT Input/Output Documentation for further details.

In case any of the above remarks constrains the computation of a particular WGEN statistics, users may always post-update these values before uploading the results to a SWAT project.



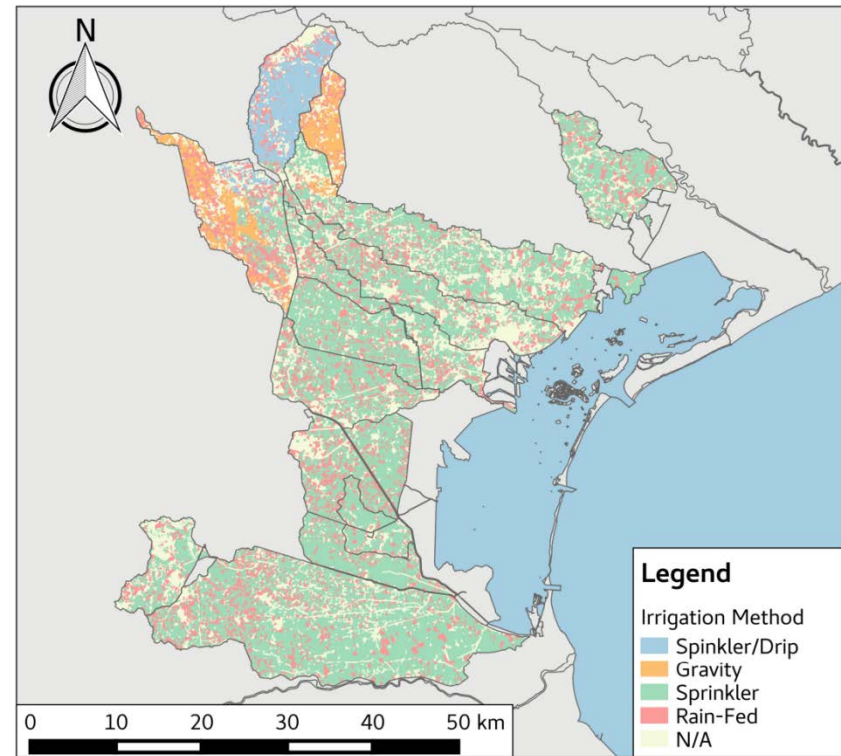
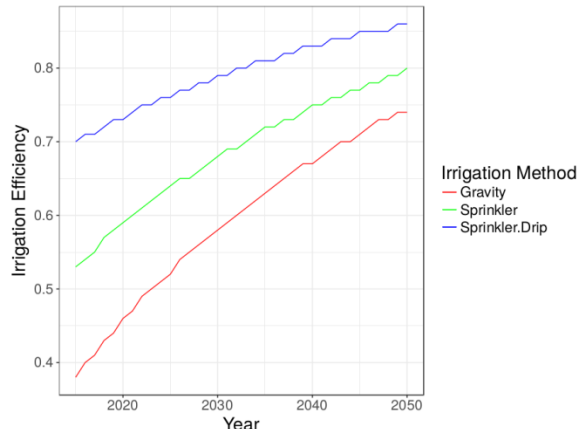
EXAMPLE CASE STUDY

- The problem
 - The complex relationship between a generally increasing demand/competition for freshwater resources in the agricultural sector and the possible negative effects of climate change on the supply of this resource
- The objective of the study
 - To explore how climate change may impact the agricultural sector of the Venice Lagoon Watershed, in north-eastern Italy, in terms of availability of freshwater resources for irrigation
- The case study
 - Area:
 - Lagoon: $\approx 500 \text{ km}^2$;
 - VLW: $\approx 2,000 \text{ km}^2$
 - Characterised by:
 - Complex drainage network system;
 - Complex irrigation schedule;
 - Mainly agricultural areas (maize, soybean);



EXAMPLE CASE STUDY

- The methodology
 - Evaluation of two distinct irrigation scenarios:
 - Baseline** (irrigation efficiencies are kept constant), and;
 - Evolutionary** (irrigation efficiencies improve consistently over time).



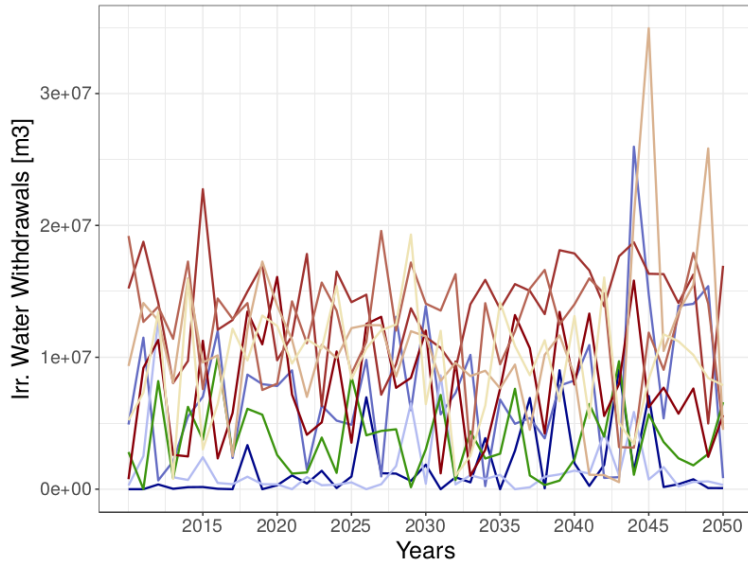
List of considered GCMs and related data.

Project	RCM	GCM	Experiment	Spatial Resolution	Frequency
COSMO-CLM ¹	COSMO-CLM	CMCC-CM	rcp45	0.0715°	daily
EURO-CORDEX EUR-11 ²	SMHI-RCA4 v1	CNRM-CERFACS-CNRM-CM5	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	SMHI-RCA4 v1	ICHEC-EC-EARTH	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	SMHI-RCA4 v1	IPSL-IPSL-CM5A-MR	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	SMHI-RCA4 v1	MOHC-HadGEM2-ES	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	SMHI-RCA4 v1	MPI-M-MPI-ESM-LR	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	CCLM4-8-17 v1	CNRM-CERFACS-CNRM-CM5	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	CCLM4-8-17 v1	MOHC-HadGEM2-ES	rcp45	0.11°	daily
EURO-CORDEX EUR-11 ²	CCLM4-8-17 v1	MPI-M-MPI-ESM-LR	rcp45	0.11°	daily

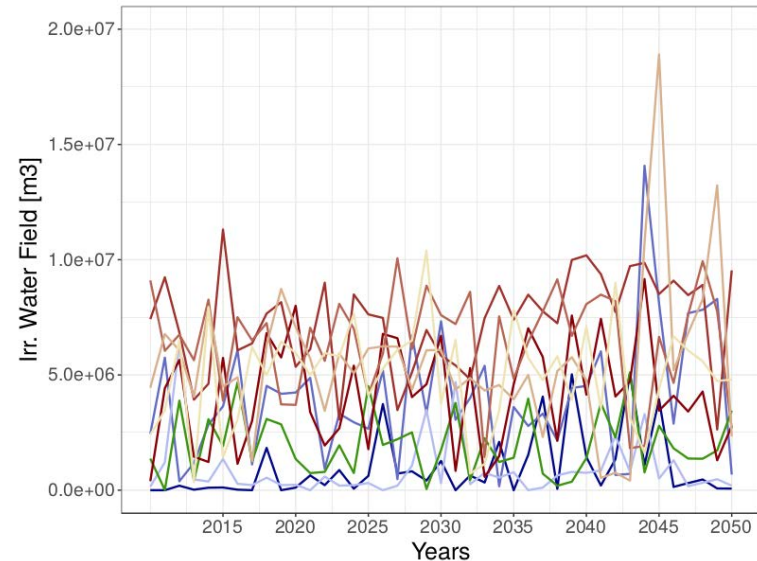
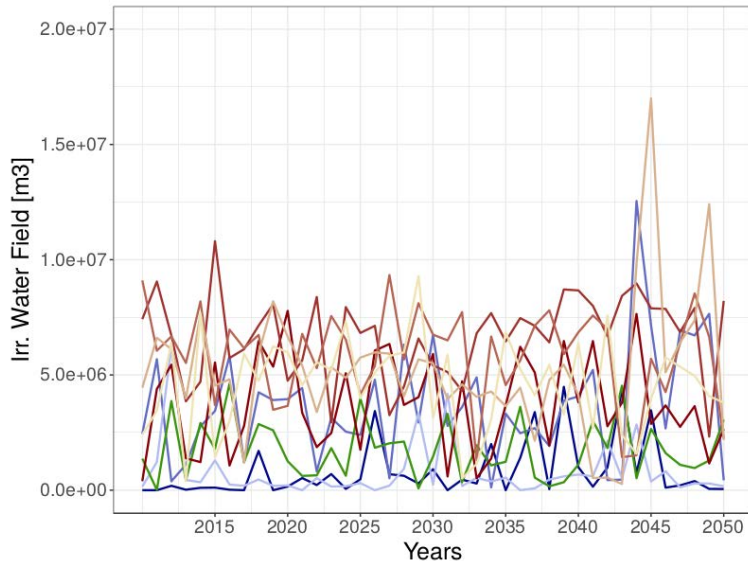
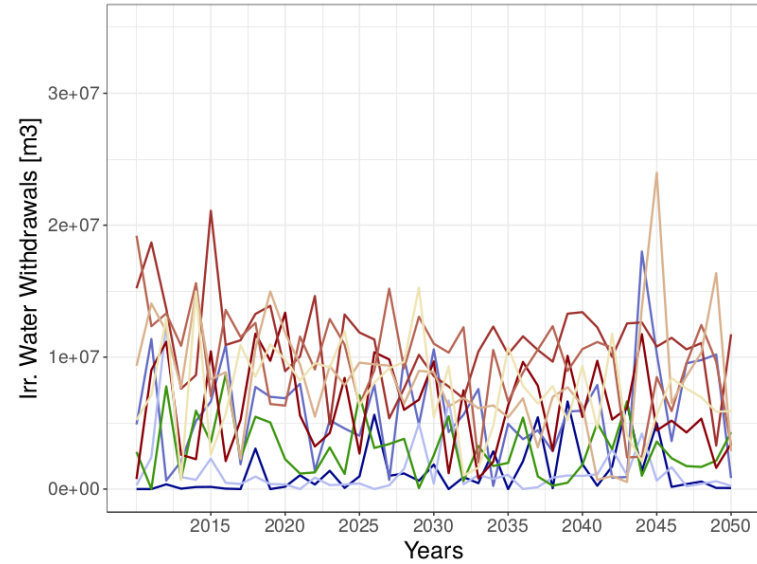


EXAMPLE CASE STUDY

Baseline Scenario



Evolutionary Scenario



* Results for crop type CORN.

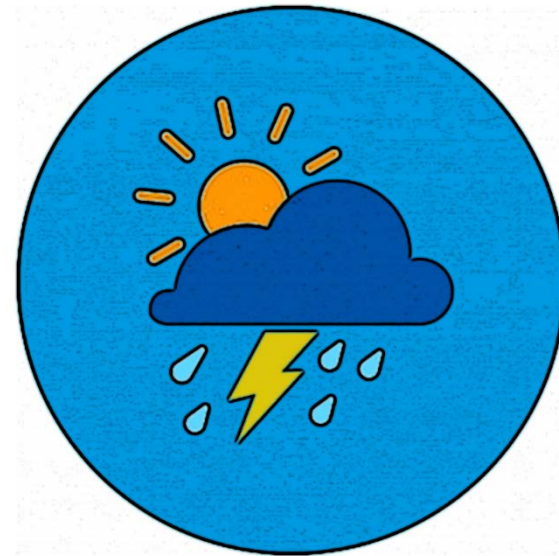


WAY FORWARD

- Improve the stability of the software
- Improve the compatibility with the latest MS Access when calculation the WGEN statistics
- Addition of plots, tables, and similar support graphical interfaces to assist the analysis of the weather data
- Implementation of a multi-scenario/multi-model support (import data from NetCDF files & connection with R)



Thank You!



2017 International SWAT Conference in Warsaw, Poland