

Innovative solutions to climate change adaptation and governance in the water management of the Region of Crete





Management Plan for the River Basin Districts of Crete, Greece

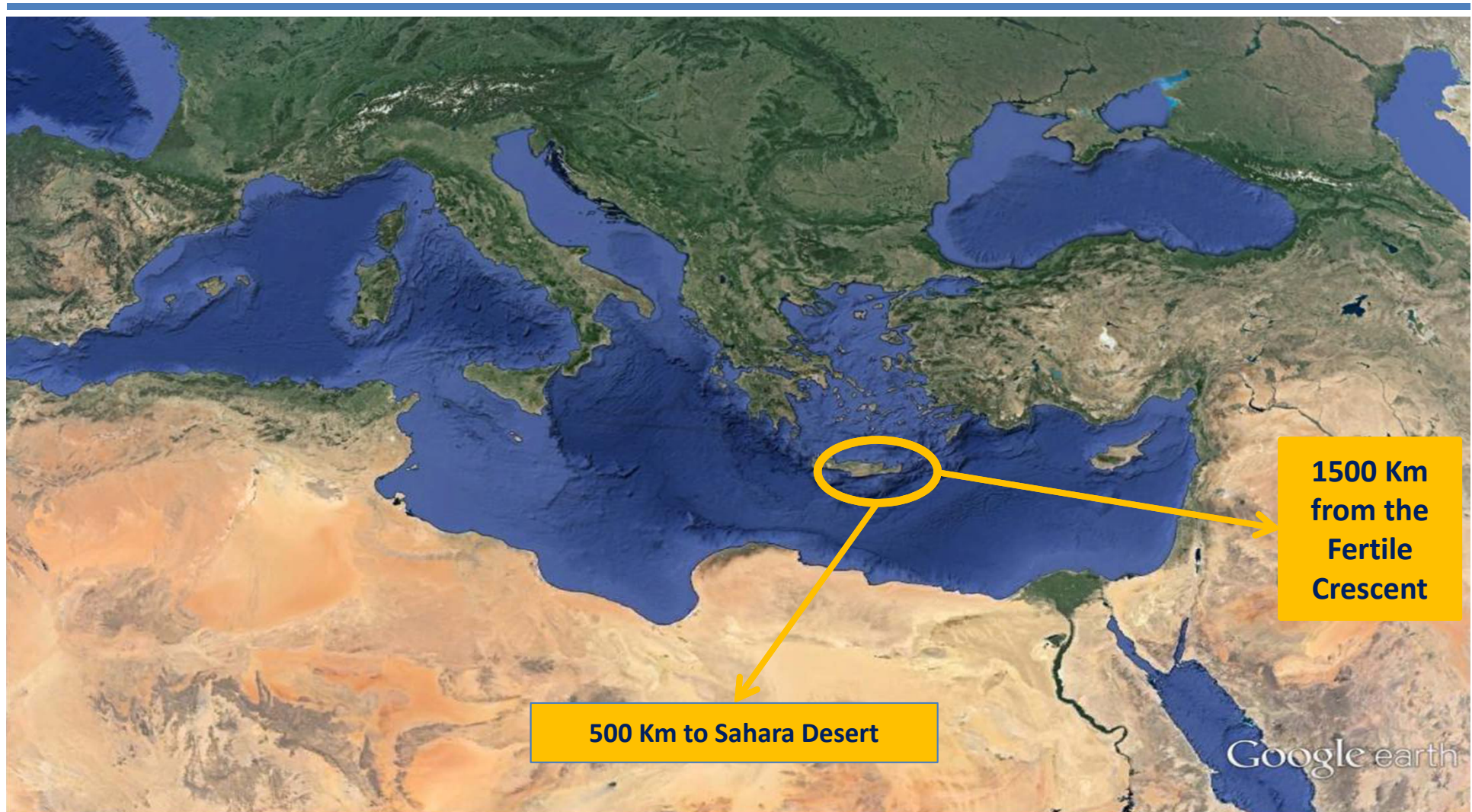


In the upcoming revision (2015-2021), the following should be addressed:

- Include a study of **drought** and assess the impact of **climate change** on water resources.
- Include an overall assessment and prioritization of the **Program of Measures**.
- The participation of stakeholders during the previous public consultation of the Management Plan should be analyzed and **innovative governance approaches** should be implemented.



Crete and climate change





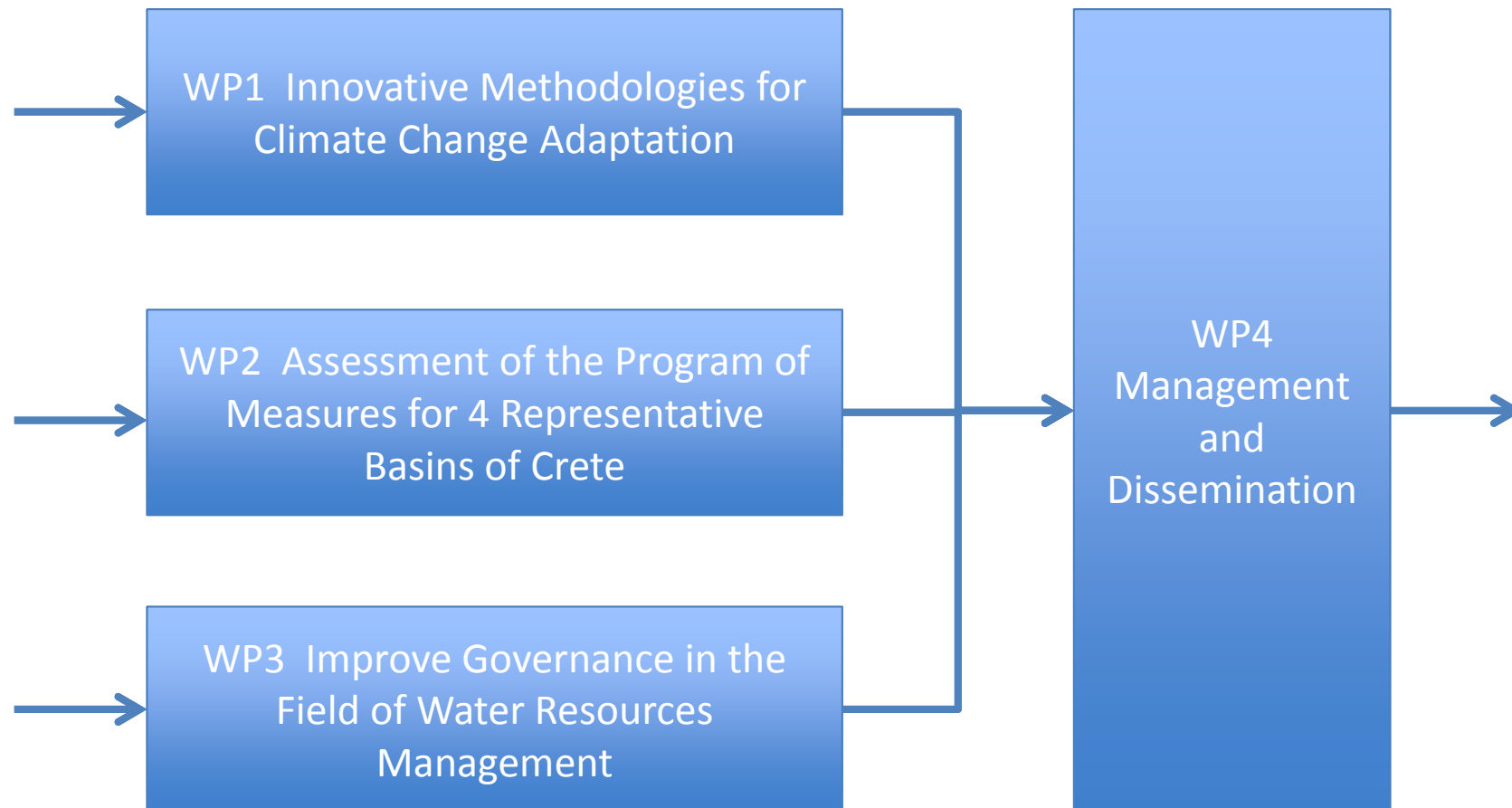
AquaMan Objective

The general goal is the development of innovative methodologies for integrated water resources management of Crete that will take into account:

- adaptation measures to climate change ,
- the rational evaluation and prioritization of the Program of Measures and
- innovative governance approaches to water management

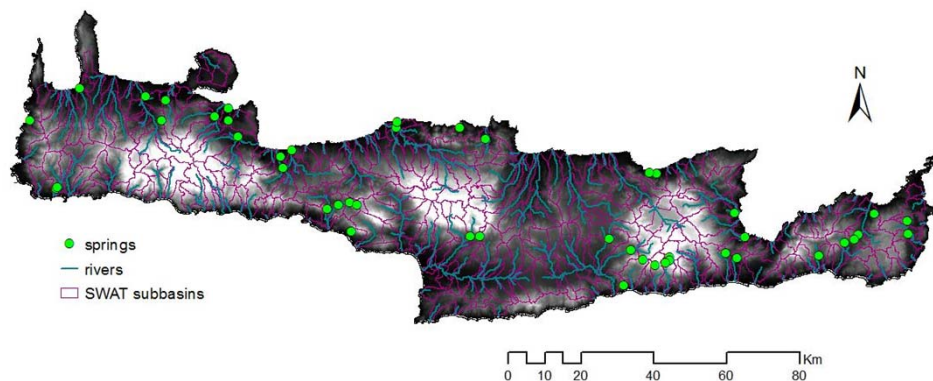


AquaMan Work Packages



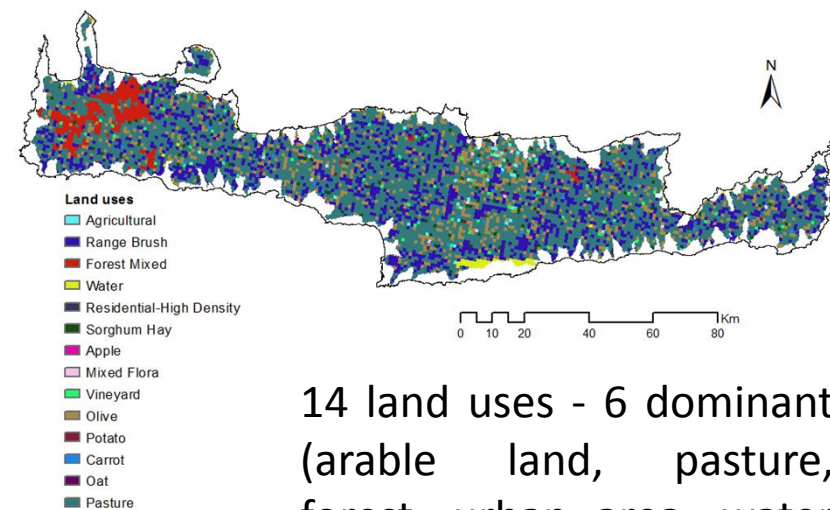


Crete-SWAT Model

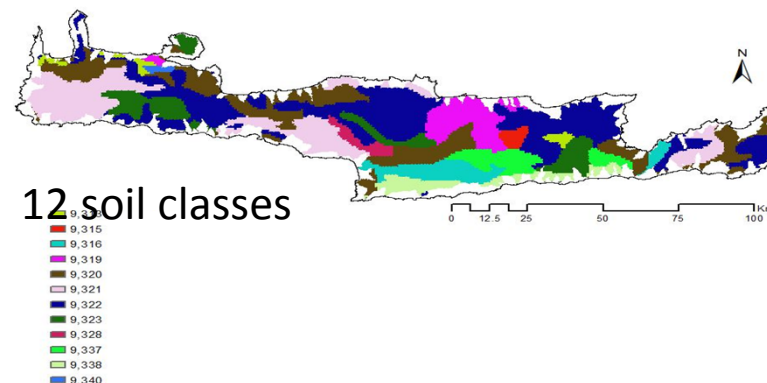


Model overview

- 352 sub-basins and streams
- 47 springs
- 12 soil classes
- 14 land uses
- Topographic data from DEM
- 502 HRUs



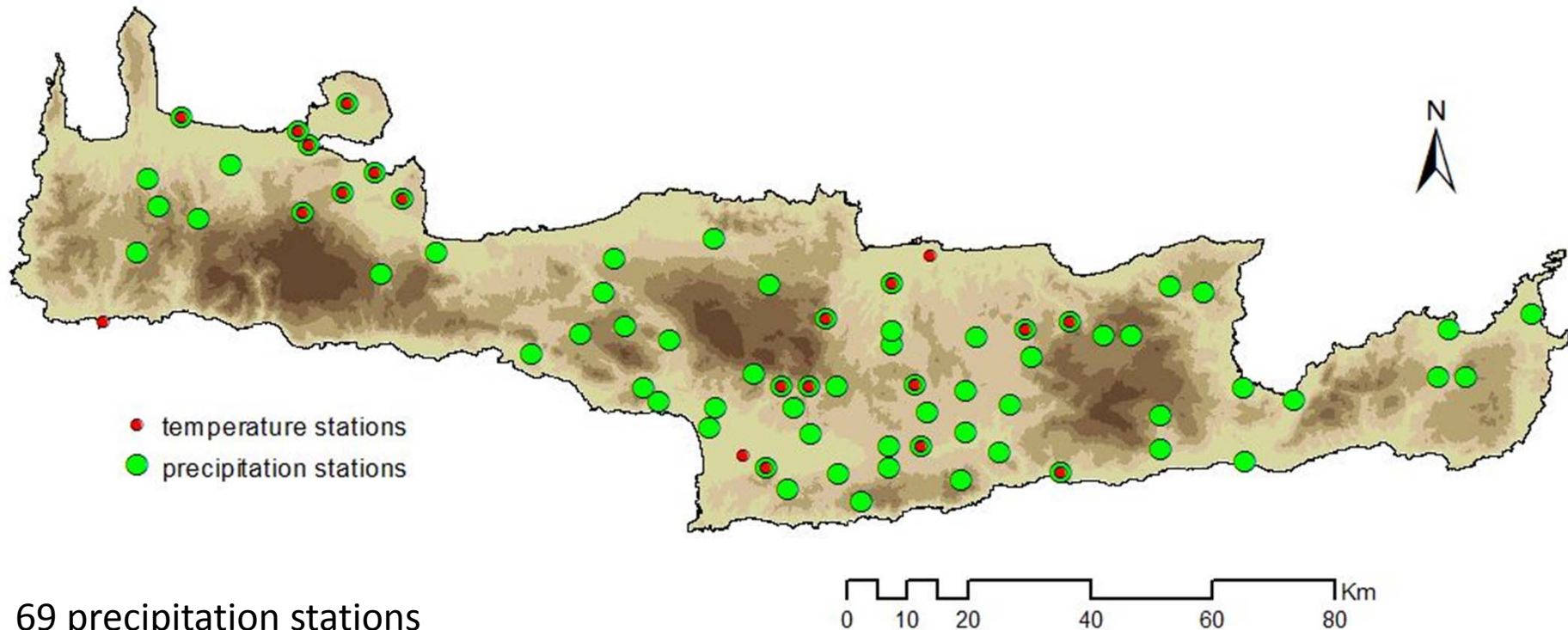
14 land uses - 6 dominant (arable land, pasture, forest, urban area, water and range grasses)



12 soil classes



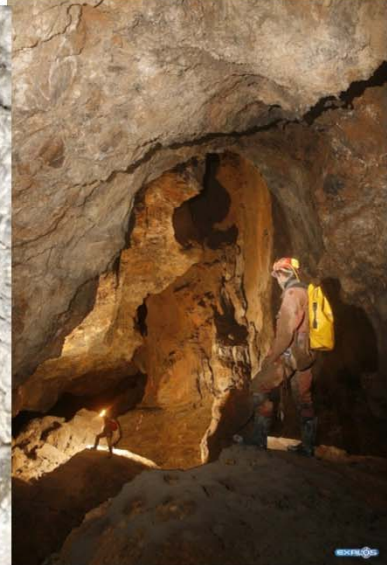
Crete SWAT Model Input - Stations



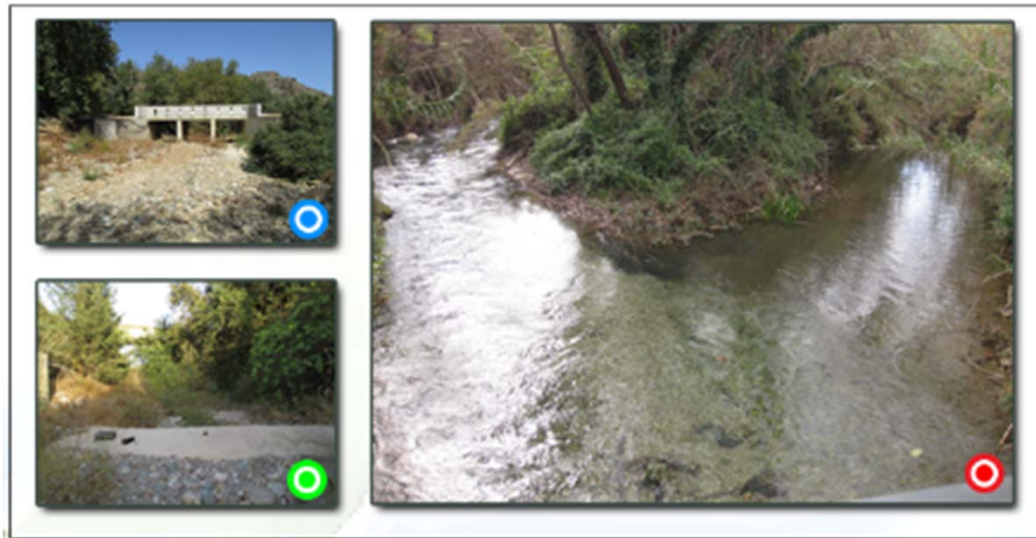
- 69 precipitation stations
- 21 temperature stations
- New meteorological data were collected (1970-2009) and the database was updated
- Model was run for the 1980-2009 period on a daily basis



Karstic Reservoirs (Greek Speleological Society) Chania 1110 m below surface
(1600 -490 m) Liontari sinkhole

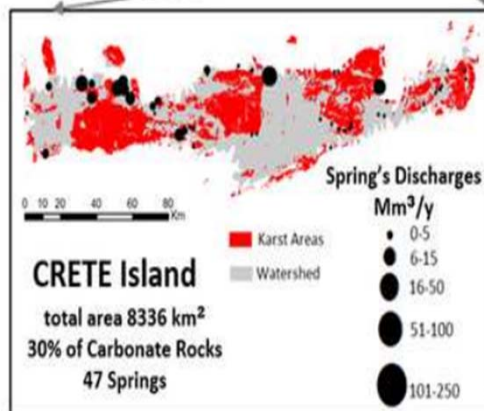


Temporary Rivers and Flush Floods





Modeling Framework



SETUP SWAT MODEL

Adapted SWAT

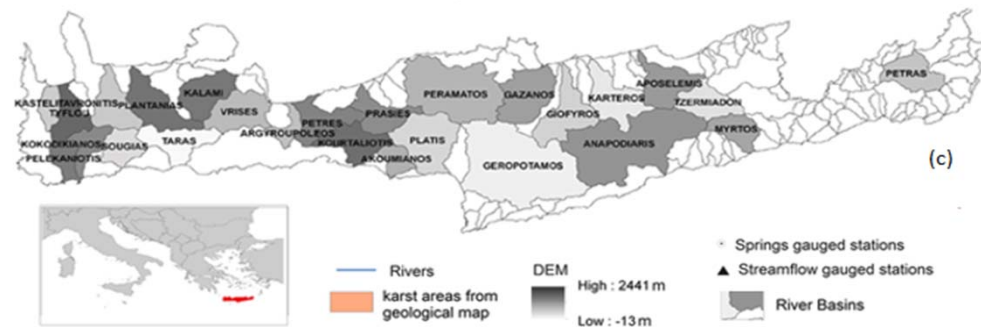
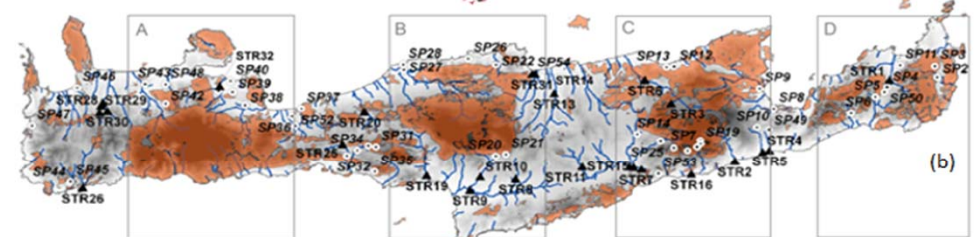
SWAT

STEP-WISE CALIBRATION
&
REGIONALIZATION

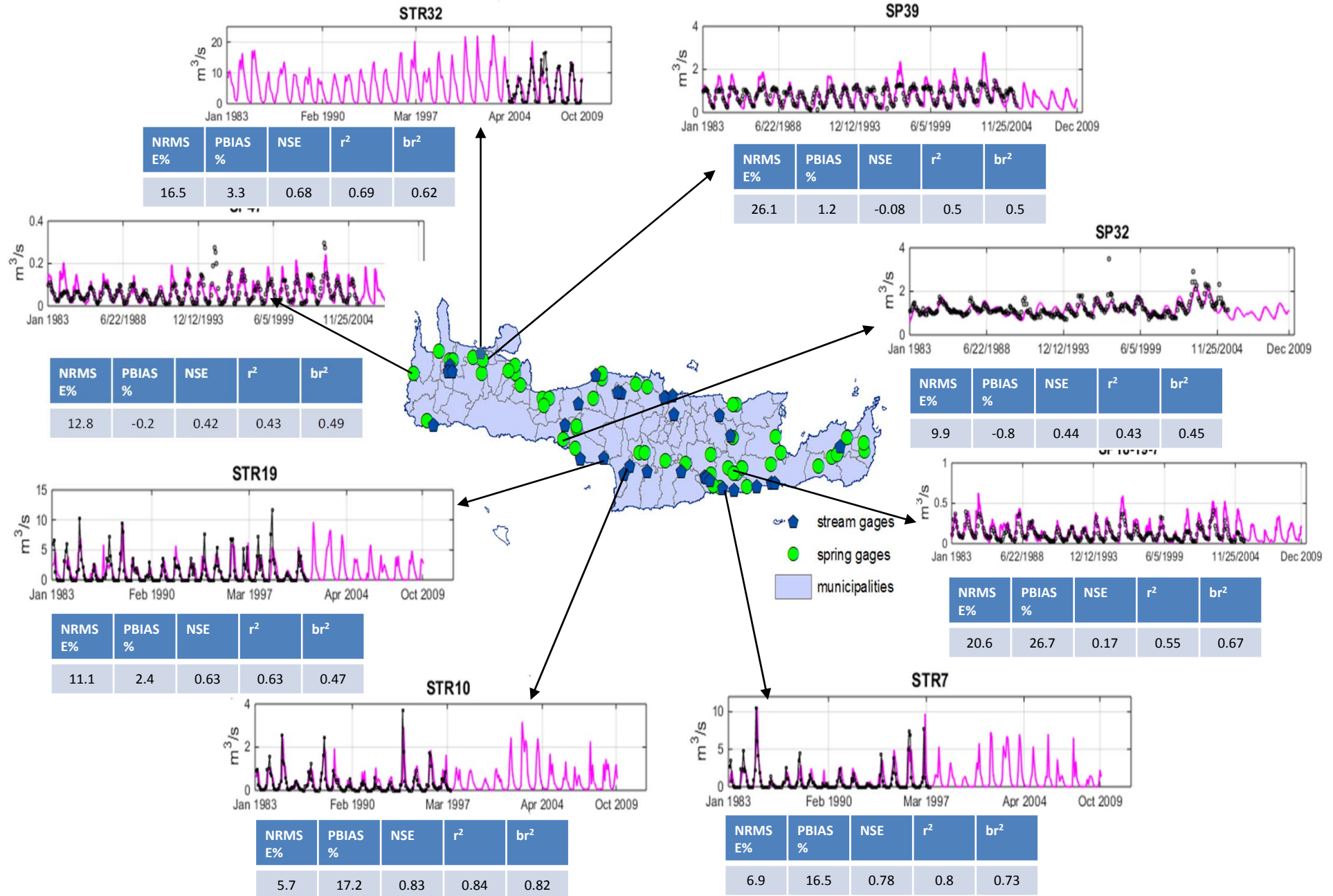
Karst-flow model

Introduction of Springs

COMPLETE VALIDATION

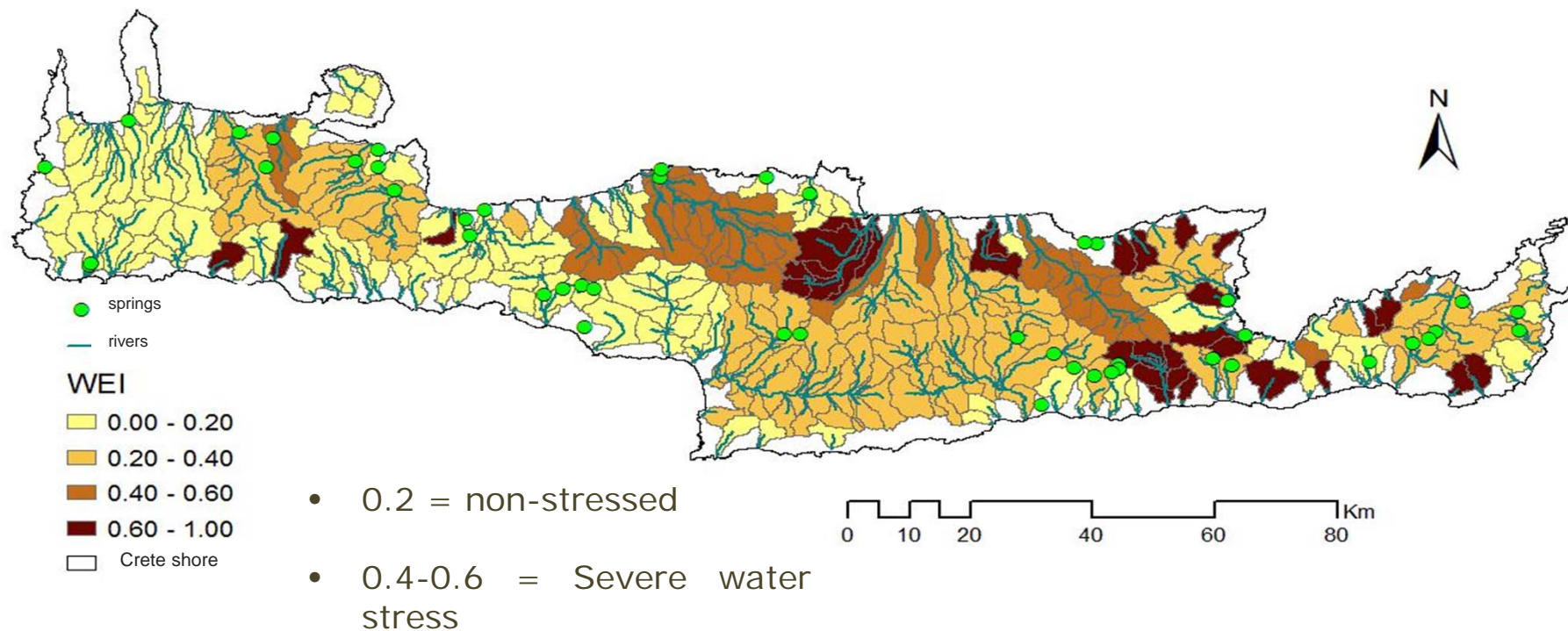


Crete SWAT Model – Goodness of fit





Water Exploitation Index (WEI)



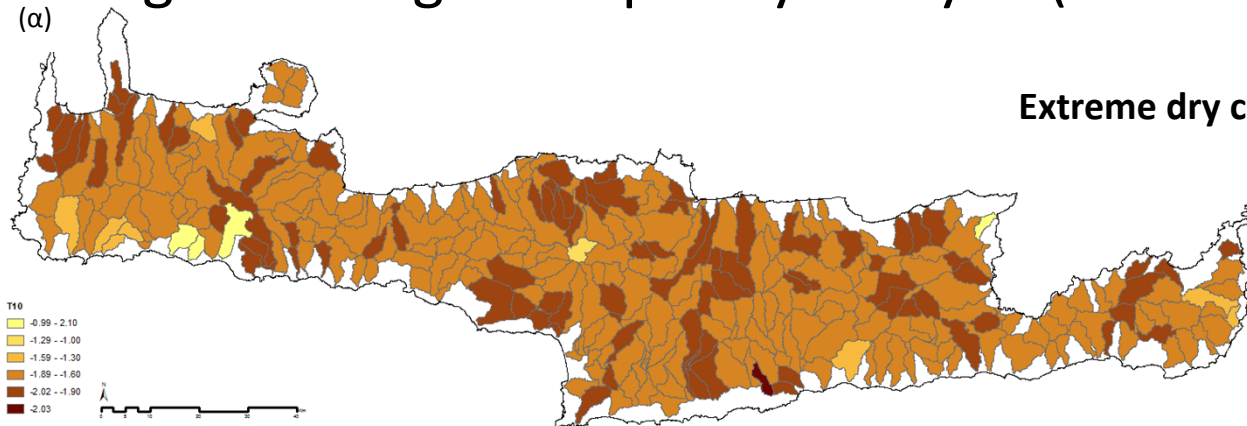
WEI = (total annual freshwater abstraction for all uses)/ (long term annual average of freshwater resources, where data are averaged over a period of at least 20 consecutive years)

Hydrological Drought Frequency Analysis (1983-2009)

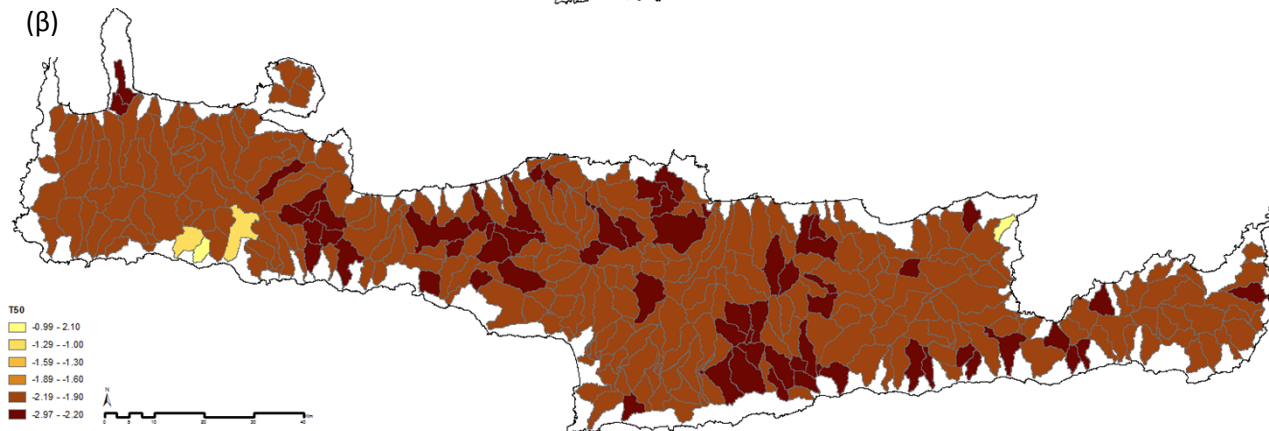
Use of the
annual
minimum SRI
index
&
GEV
distribution

SRI 3 Index

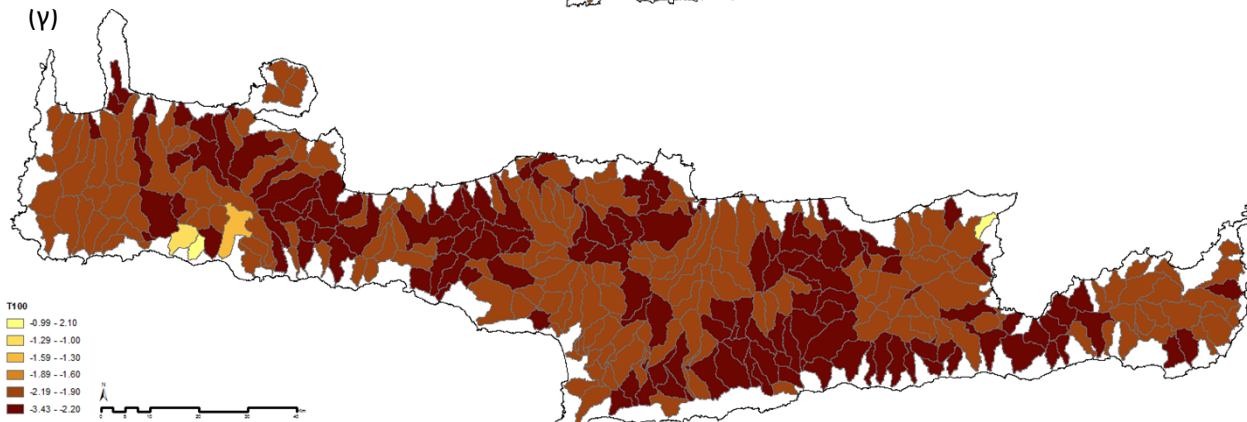
Extreme dry conditions: SRI < -2



(α) T=10



(β) T=50



(γ) T=100

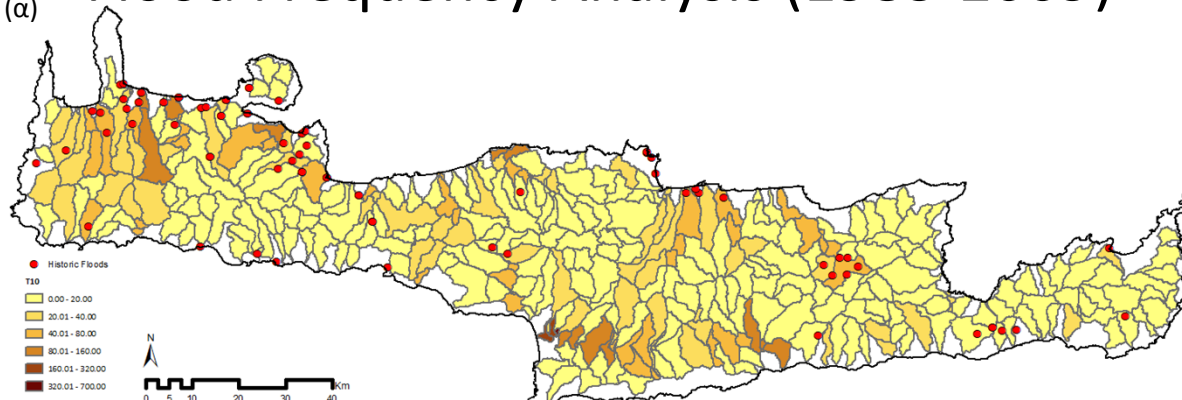
Flood Frequency Analysis (1983-2009)

Use of Q (m³/s)
SWAT model
results
&
GEV
distribution

In this analysis
daily discharge
values are
used.

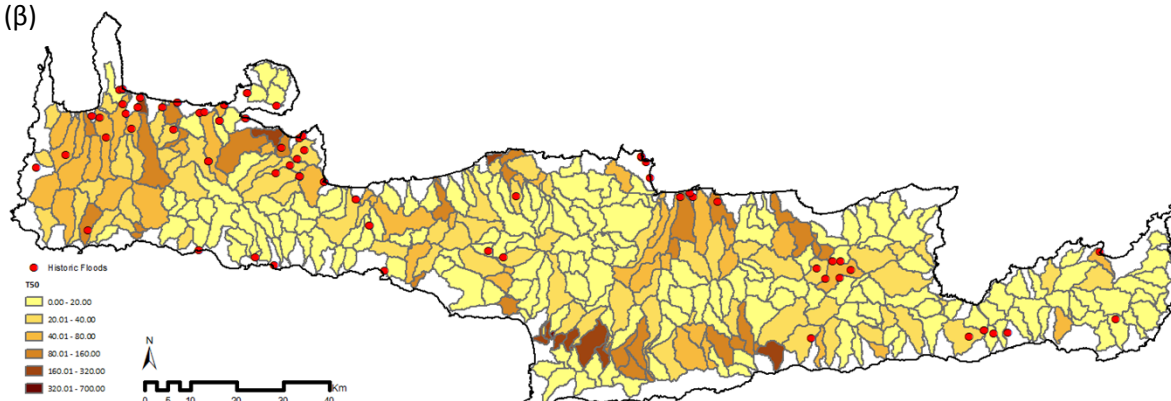
Red dots are
historical flood
events.

(α)



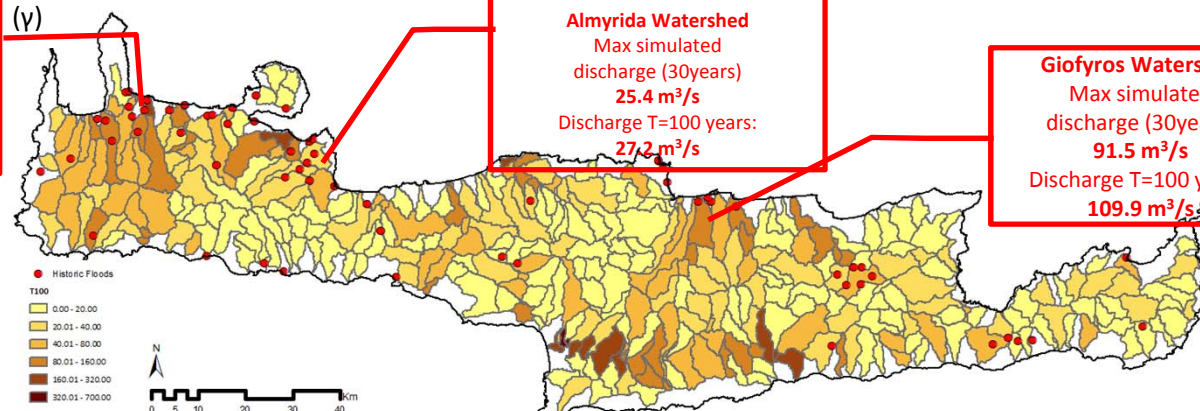
(α) T=10

(β)



(β) T=50

(γ)



(γ) T=100

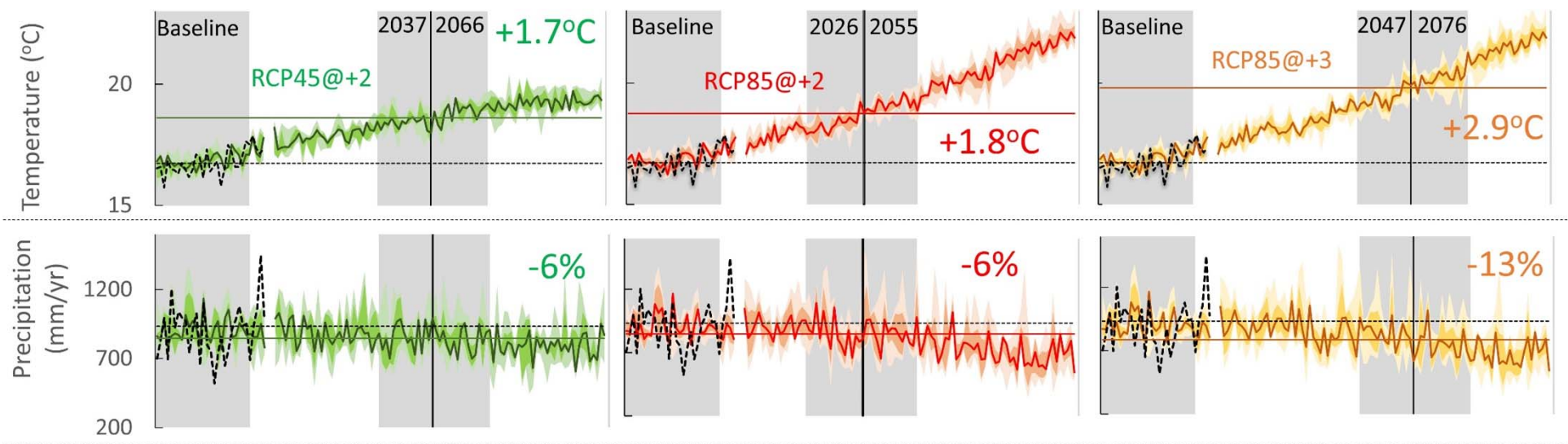
Keritis Watershed
Max simulated
discharge (30years)
102.8 m³/s
Discharge T=100 years:
151.1 m³/s

Almyrida Watershed
Max simulated
discharge (30years)
25.4 m³/s
Discharge T=100 years:
27.2 m³/s

Giofyros Watershed
Max simulated
discharge (30years)
91.5 m³/s
Discharge T=100 years:
109.9 m³/s

Climate data were obtained from regional climate models EURO-CORDEX initiative with 0.11 degrees horizontal resolution (approx. 12.5km). Eleven experiments available from five RCM runs under RCP2.6 (2 runs), RCP4.5 (5 runs) and RCP8.5 (4 runs) were downscaled and bias-adjusted. A list of the RCM models, the driving GCM and the scenarios is provided.

RCM	Driving GCM	RCPs
CSC-REMO2009	MPI-ESM-LR	2.6, 4.5, 8.5
IPSL-WRF331F	IPSL-CM5A-MR	4.5
KNMI-RACMO22E	EC-EARTH	4.5, 8.5
SMHI-RCA4	EC-EARTH	2.6, 4.5, 8.5
SMHI-RCA4	HadGEM2-ES	4.5, 8.5



Transient response of temperature, precipitation and water availability at local scale (Crete) according to RCP4.5 and RCP8.5. Strong dashed line represent local observations, colored line correspond to the multi-model median, strong shaded envelope correspond to the interquartile range and the light shaded envelope to the 5th to 95th percentile range.

(For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article)

Thank you.....

