Springer
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Paper number:
814

Quantification of predictive uncertainty in climate change context using airGRpackages : case of Medjerda catchment, Tunisia

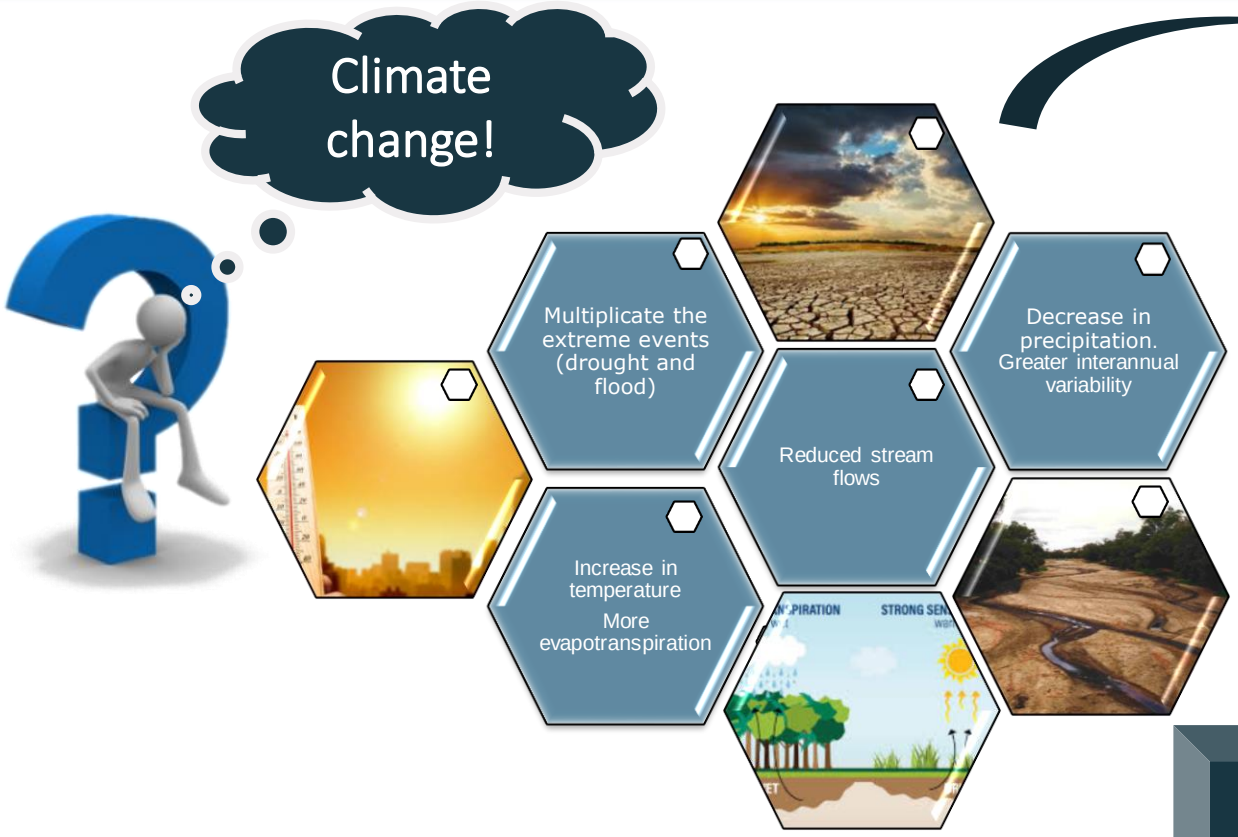
K.GADER(1), A.GARA(1,2), M.VANCLOOSTER(3), M.SLIMANI(1)

1.National Agronomic Institute of Tunisia (INAT) & Laboratory of Research, Sciences, and Technologies of the Waters, University of Carthage, Tunis,Tunisia

2.Unité de recherche en Gestion Durable des Ressources en Eau et en Sol (GDRES), High School of Engineering of Medjez el Bab (ESIM), University of Jendouba, Medjez el beb, Tunisia

3.Earth and Life Institute, UCLouvain, Louvain-la-Neuve, Belgium

Introduction



Changes in the hydrological regimes of rivers

Hydrological modeling

contrasted climate conditions

predictive uncertainty in the context of climate change

Tunisia as a Mediterranean region
Is a country particularly vulnerable to Climate Change

Outline

1. Overview of the study area

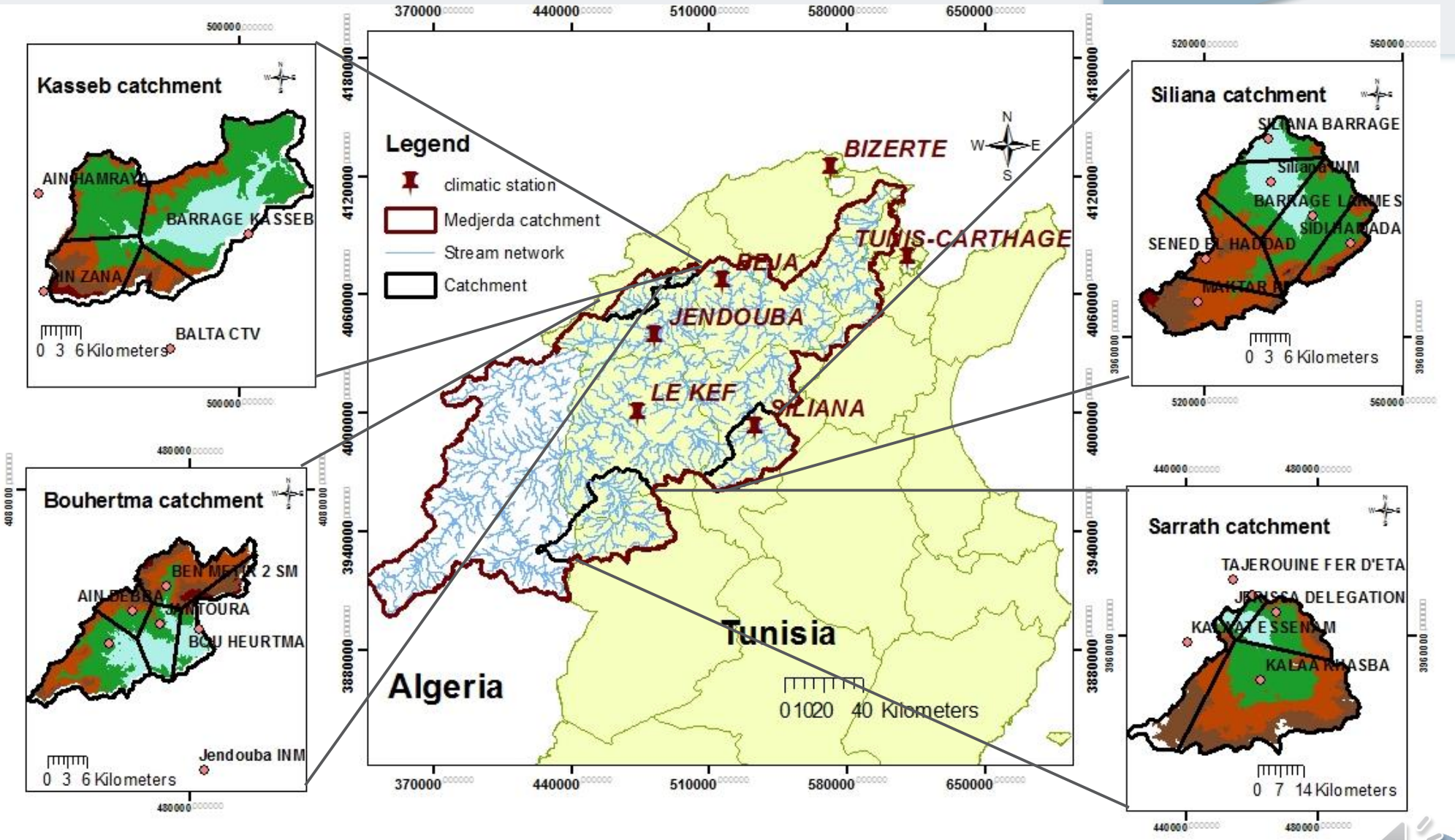
2.Summary of the general used approach

3.Data treatment

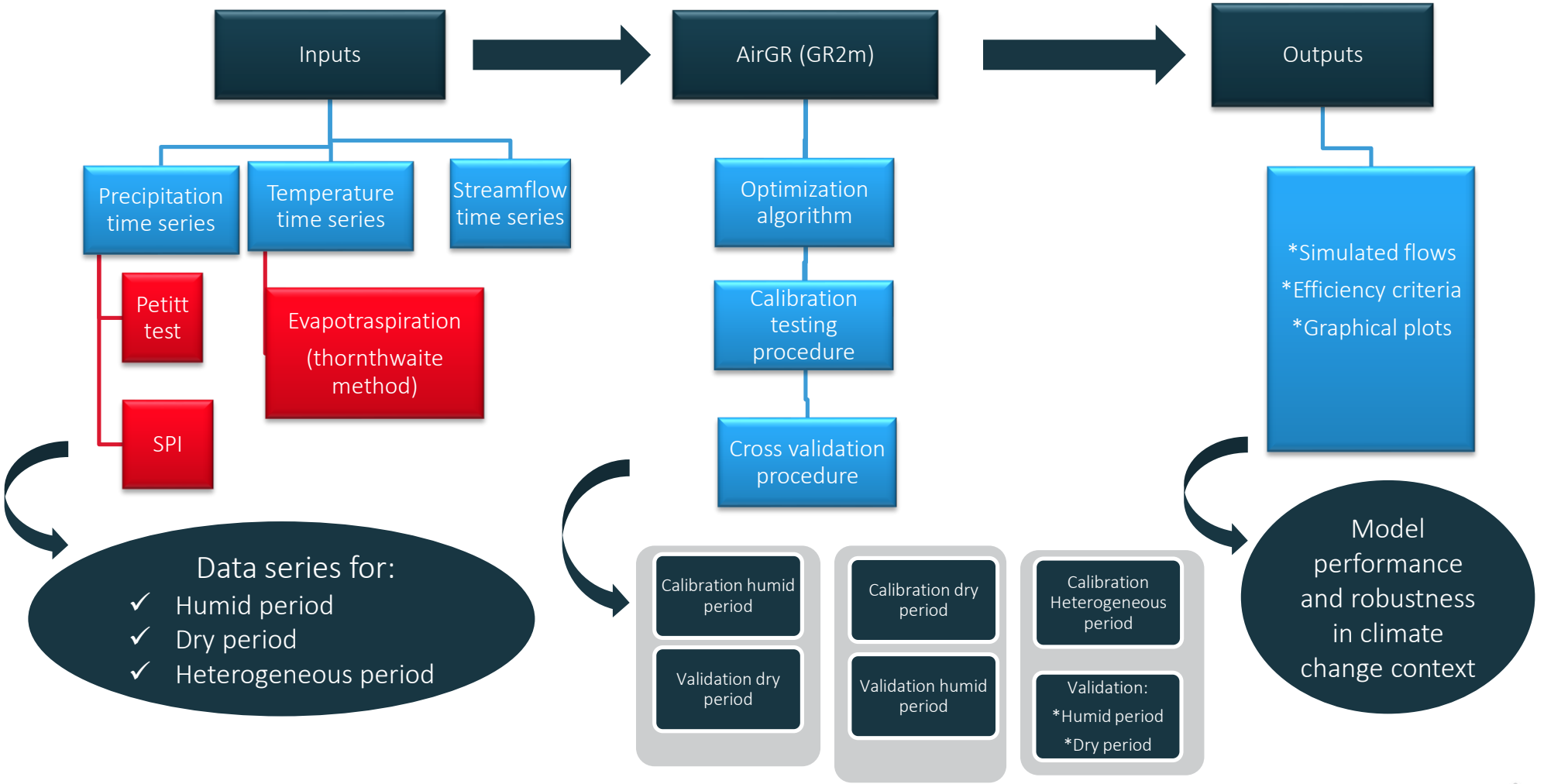
4.model performance

5.model predictive uncertainty

1.Location of the study area



2.Flowchart of the methodology



3. Data

Monthly precipitation
calculated from thiessen interpolation

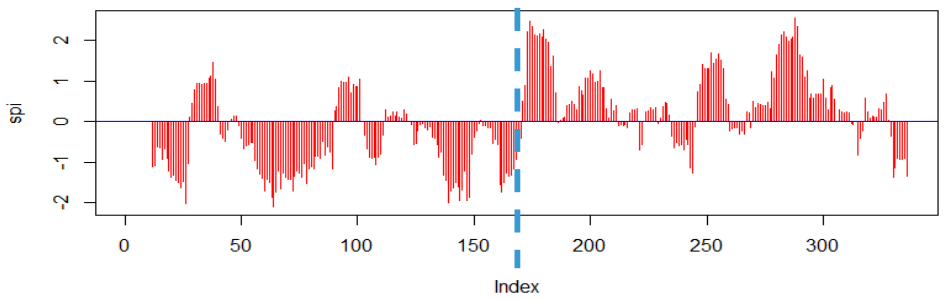
Monthly evapotranspiration
calculated from the mean monthly temperature series by application of the Thornthwaite formula

Discharge
Provided by the Ministry of Agriculture, Tunisia

Kasseb catchment (1988/2016)	• Rainfall station: AIN HAMRAYA, AIN ZANA, BALTA CTV, KASSEB DAM • Climatic station: BEJA NMI • Runoff station:KASSEB DAM
Sarrath catchment (1980/2008)	• Rainfall station: JERISSA DELEGATION, KALAA KHASBA, KALAAT ESSENAM, TAJEROUINE AIN ZOUAG • Climatic station: LE KEF NMI • Runoff station: PONT ROUTE
Siliana catchment (1988/2016)	• Rainfall station: SENED EL HADDAD, SIDI HMADA, SILIANA DAM, MAKTAR PF, LAKHMES DAM, SILIANA NMI • Climatic station: SILIANA NMI • Runoff station:Siliana DAM
Bou Heurtma catchment (1992/2016)	•Rainfall station: AIN BEYA OUED RHEZAL , AIN DEBBA , BEN METIR 2 SM , BOU HEURTMA DAM, JANTOURA , JENDOUBA NMI •Climatic station: Jendouba NMI •Runoff station: BOU HEURTMA DAM

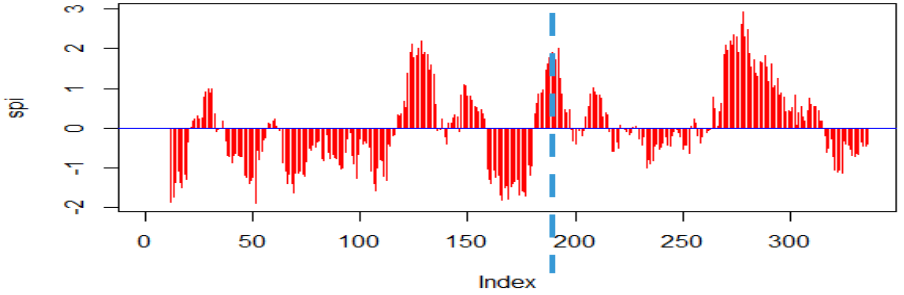
SPI

09/2001



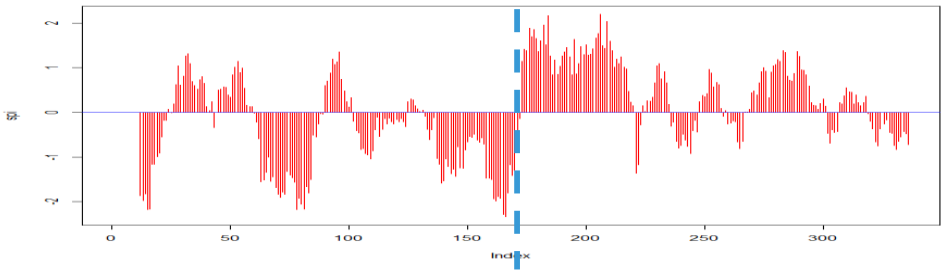
Kasseb catchment

09/1995



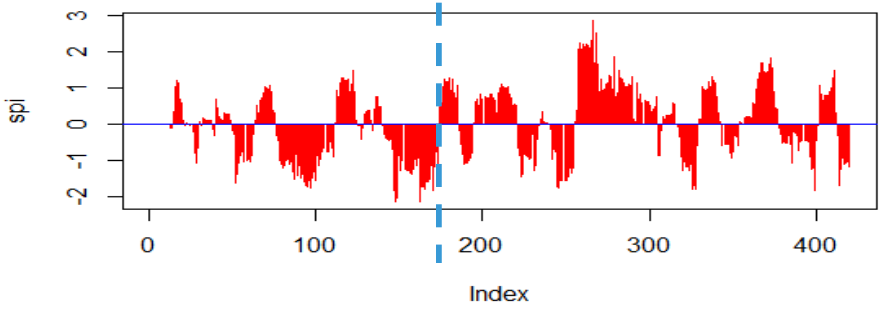
Sarrath catchment

09/2002



Siliana catchment

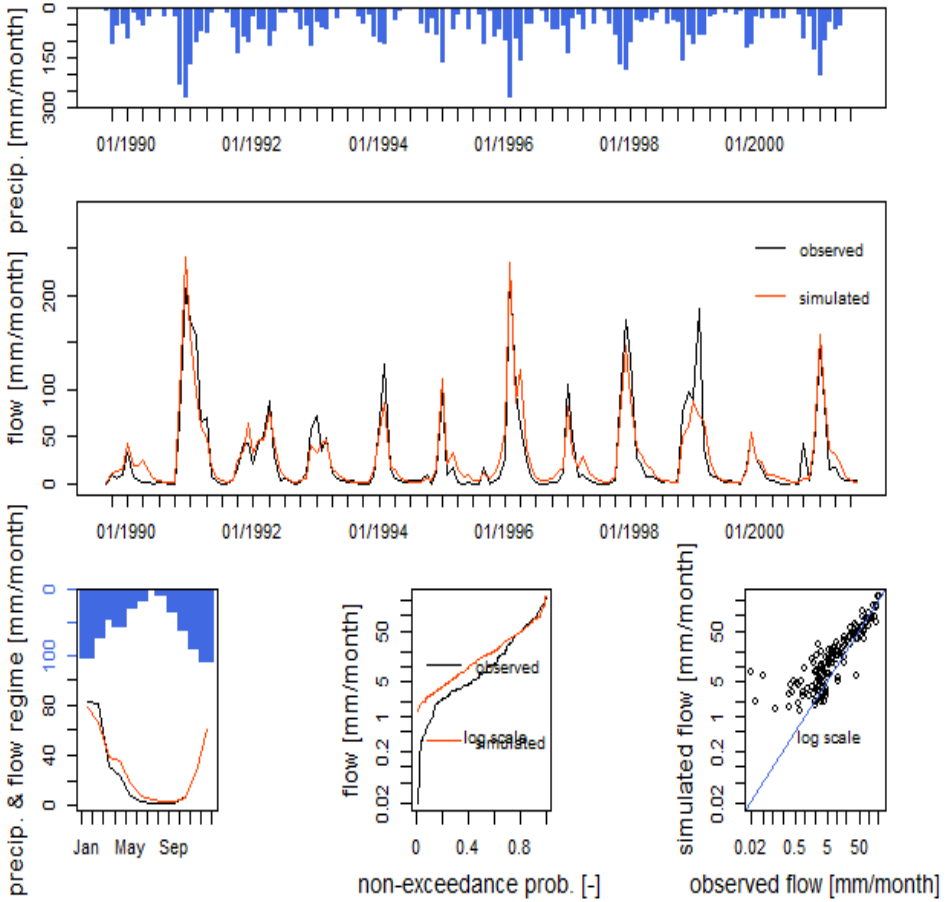
09/1995



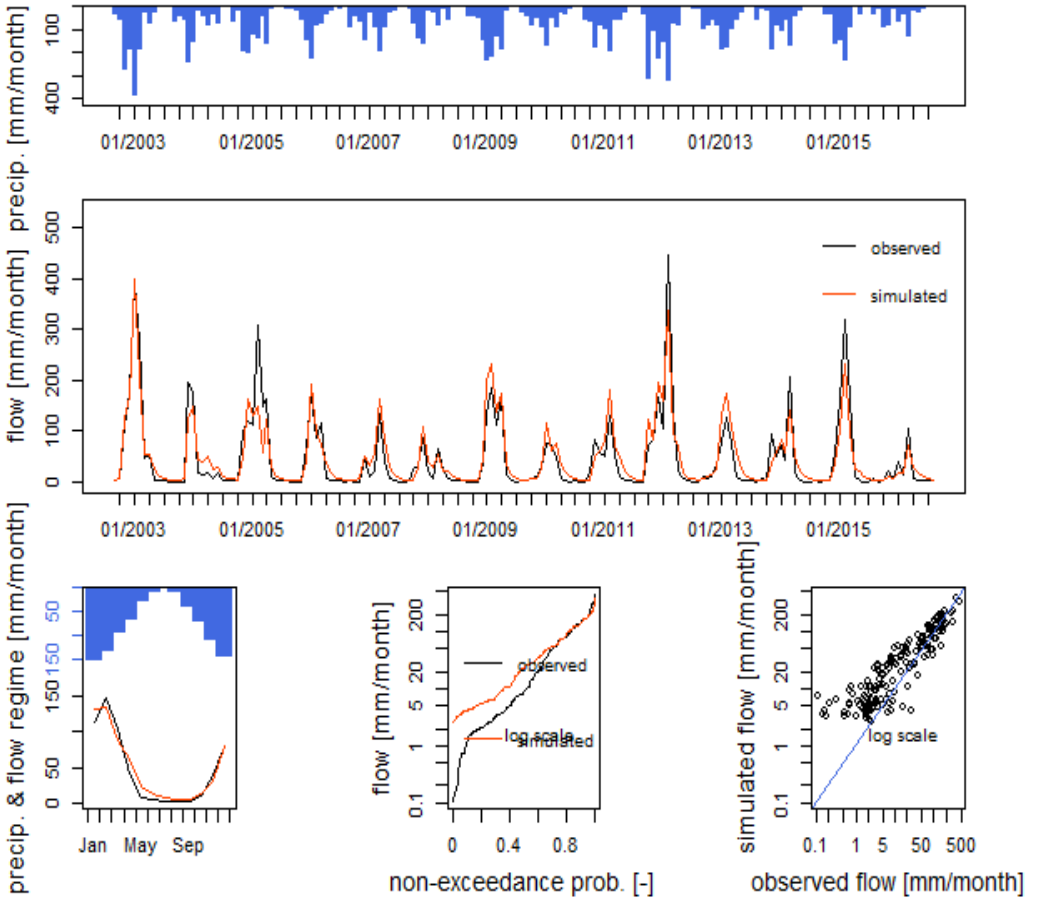
Bouhertma catchment

4. Model performance

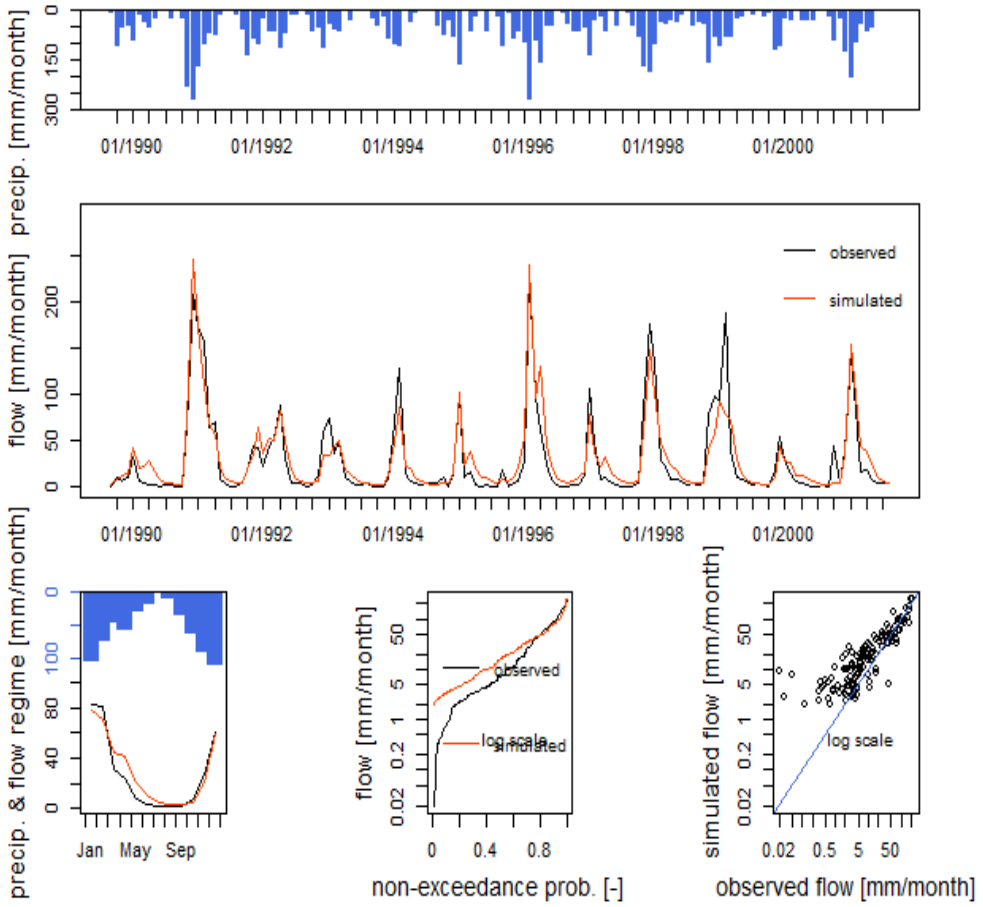
Kasseb catchment



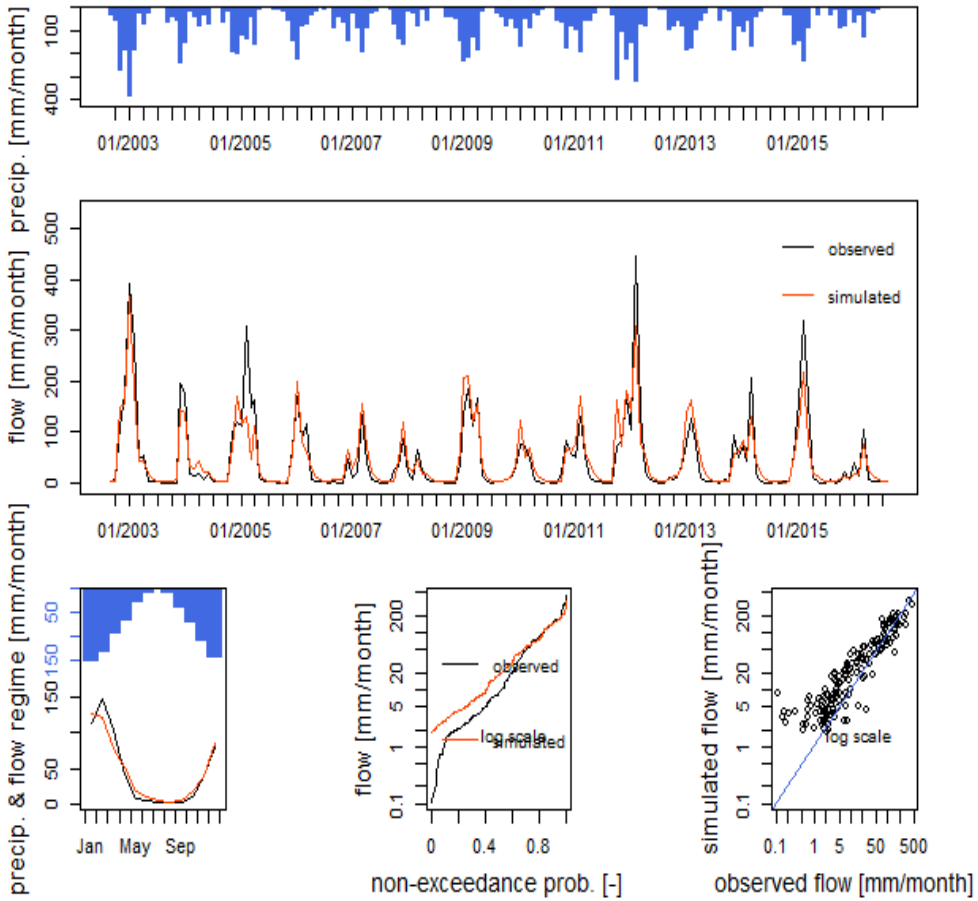
Calibration dry period (NSE= 86%)



Calibration humid period (NSE= 85%)



validation dry period (NSE= 83%)

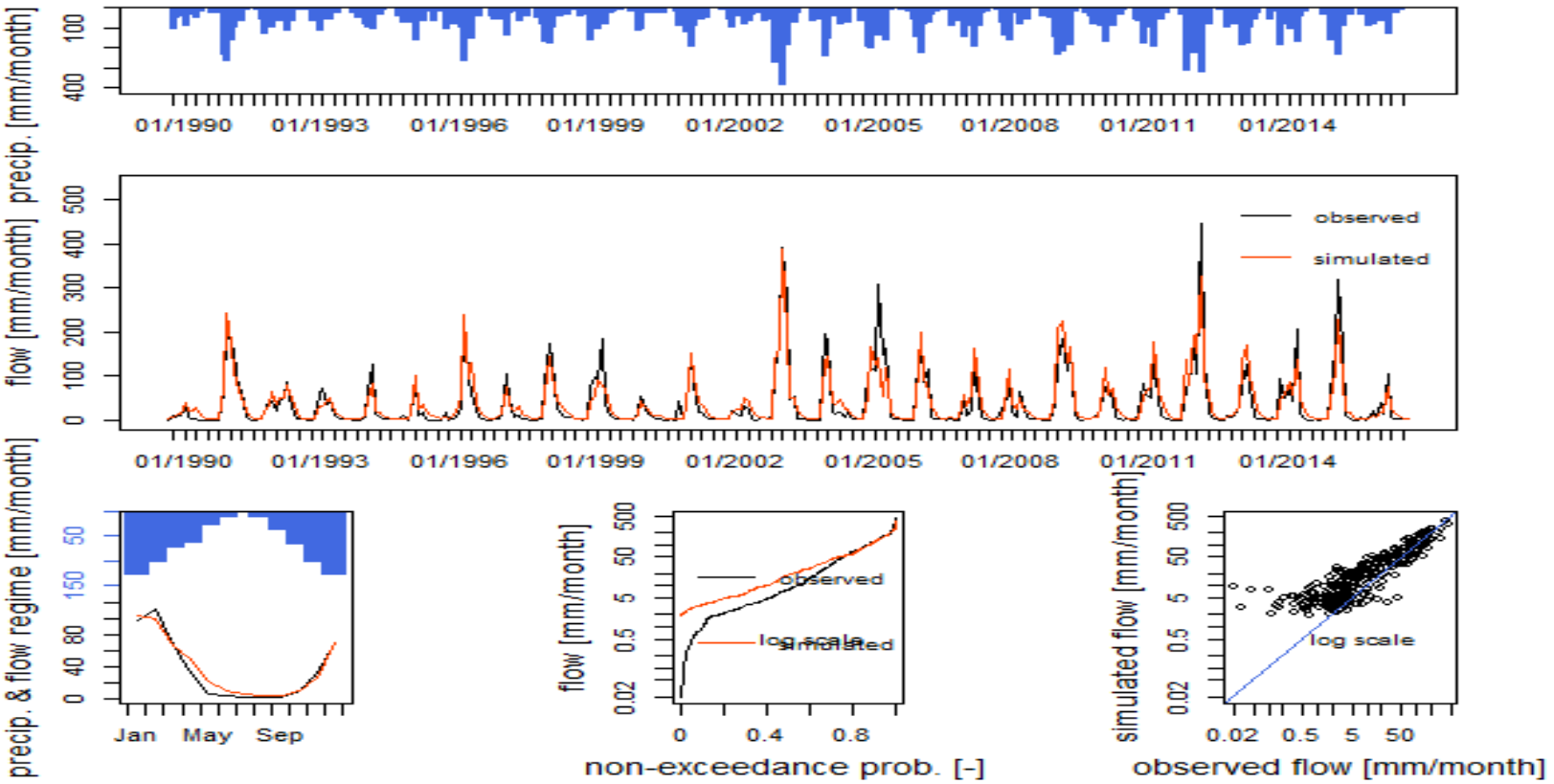


Validation dry period (NSE= 83%)

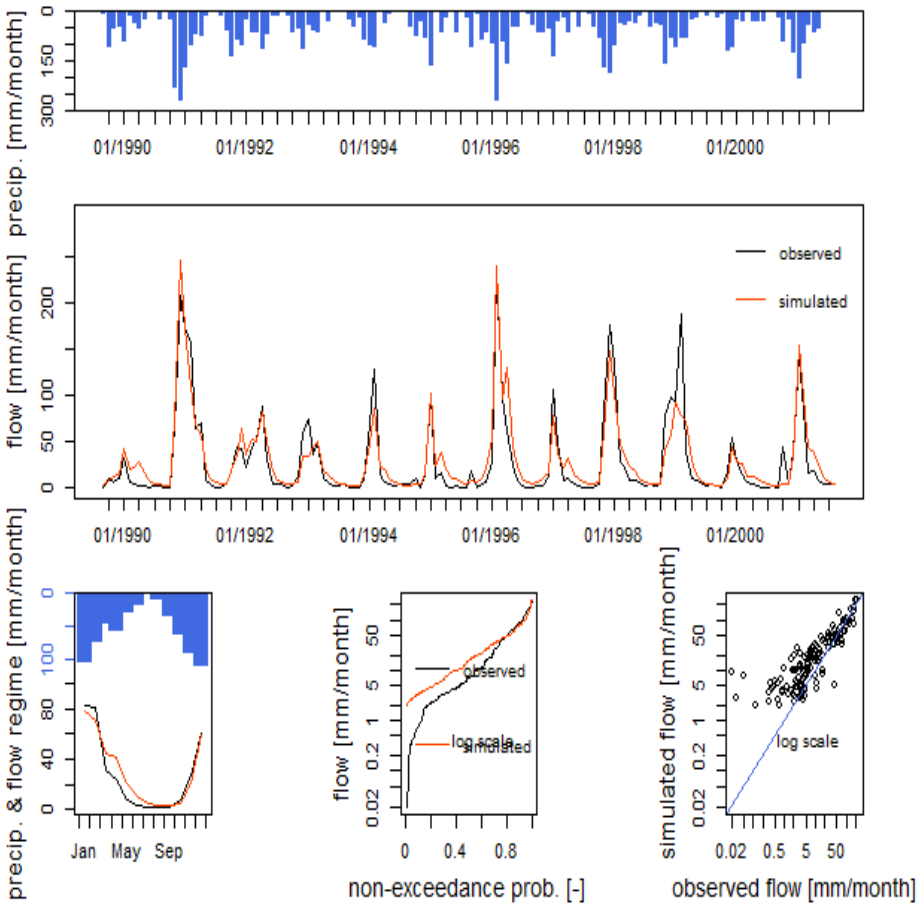
Catchment	Period	NSE	KGE	RMSE	Pbias	RSR
Kasseb	*calibration dry period*	86	90	17,1	5,6	40
	calibration humid period	85	80	29,4	7,0	40
	validation dry period	83	80	18,6	11,3	40
	validation humid period	83	80	30,7	1,0	40
Sarrath	*calibration dry period*	68	80	1,1	-5,4	60
	calibration humid period	77	80	1,0	-3,0	50
	validation dry period	67	70	1,1	-6,5	60
	validation humid period	77	90	1,0	-0,1	50
Siliana	*calibration dry period*	63	70	2,0	-22,8	60
	calibration humid period	77	80	3,1	-15,1	50
	validation dry period	50	70	2,0	-3,8	70
	validation humid period	70	50	3,5	-34,5	50
Bou Heurtma	*calibration dry period*	77	80	12,8	-10,2	50
	calibration humid period	80	80	21,7	4,3	40
	validation dry period	58	60	17,4	30,0	60
	validation humid period	65	50	29,0	-28,7	60

5.Model predictive uncertainty

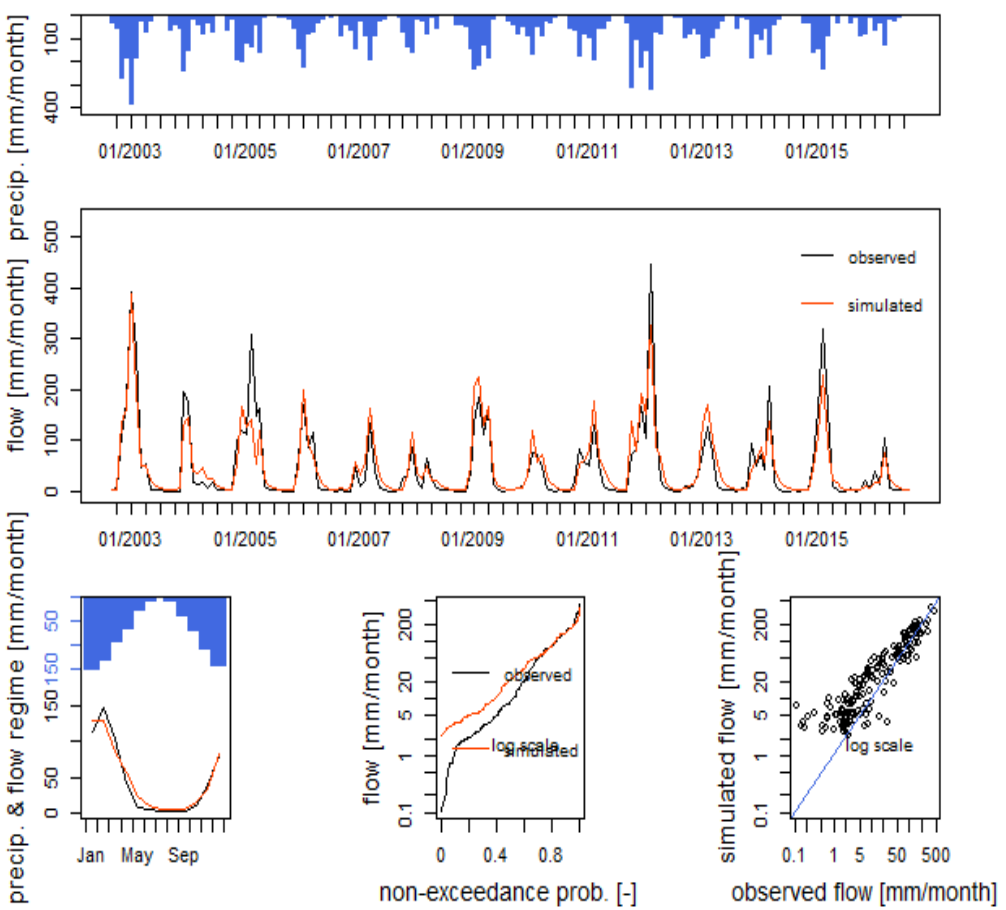
Kasseb catchment



Calibration Heterogeneous period
(NSE= 85%)



Validation dry period (NSE= 85%)



Validation humid period (NSE= 84,5%)

Catchment	Period	NSE	KGE	RMSE	Pbias	RSR
Kasseb	calibration	85	80	24,5	7,2	40
	validation dry period	85	80	17,7	9,4	40
	validation humid period	84	80	29,6	5,0	40
Sarrath	calibration	75	80	1,0	-4,0	50
	validation dry period	67	70	1,1	-8,0	60
	validation humid period	78	90	1,0	-3,7	50
Siliana	calibration	75	80	2,7	-18,1	50
	validation dry period	76	70	3,2	11,3	40
	validation humid period	58	80	1,3	-5,8	60
Bou Heurtma	calibration	78	80	19,7	2,1	50
	validation dry period	64	70	16,1	19,4	60
	validation humid period	80	80	22,0	-3,8	40

Conclusions

- This study aimed to quantify the applicability and the robustness of the conceptual hydrological model GR2m, developed under the AirGR package available for R language in the Medjerda catchment in Tunisia under changing climate conditions.

- Results show that the different catchments in the Medjerda proved the good performance of the simple water balance model GR2m used to simulate the runoff for different historical climate conditions having heterogeneous physiographic and climate conditions.
- Based on these results we were able to confirm that the calibration over a long period with a changing climate that best fits the prediction is recommended to be used for future climate simulations in climate change impact studies.

- Our study helps ensure the rigourous quantification of climate change impact on the hydrological regime at a catchment scale.

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Thank you!

khouloud GADER
khouloud.gader@yahoo.fr

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