

# THE 5TH INTERNATIONAL SYMPOSIUM ON GEOSCIENCES AT THE SERVICE OF SUSTAINABLE DEVELOPMENT CIGSDD2023, TEBESSA, ALGERIA

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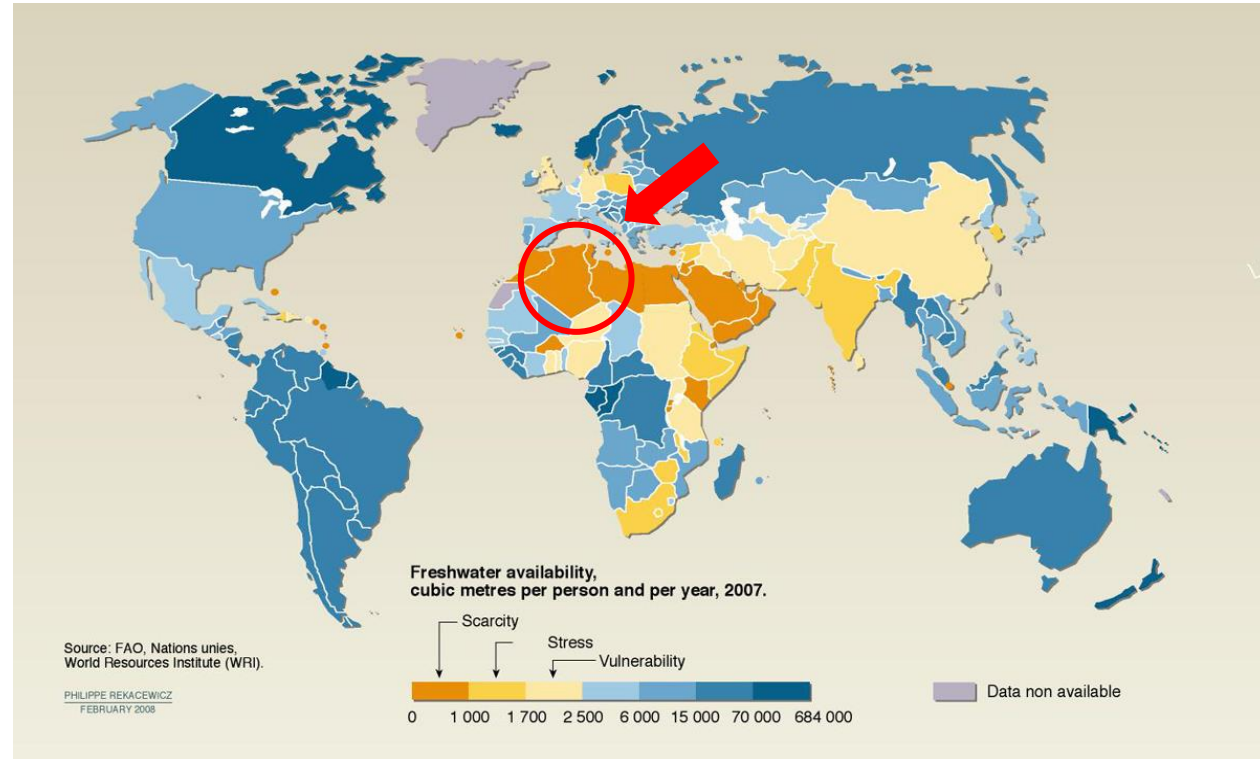


## Hydrological modeling of the Boukerdane watershed (Algeria) Dam using a GIS and SWAT model

# PROBLEMATIC ?



According to the **FAO** (Food and Agriculture Organization of the United Nations)?



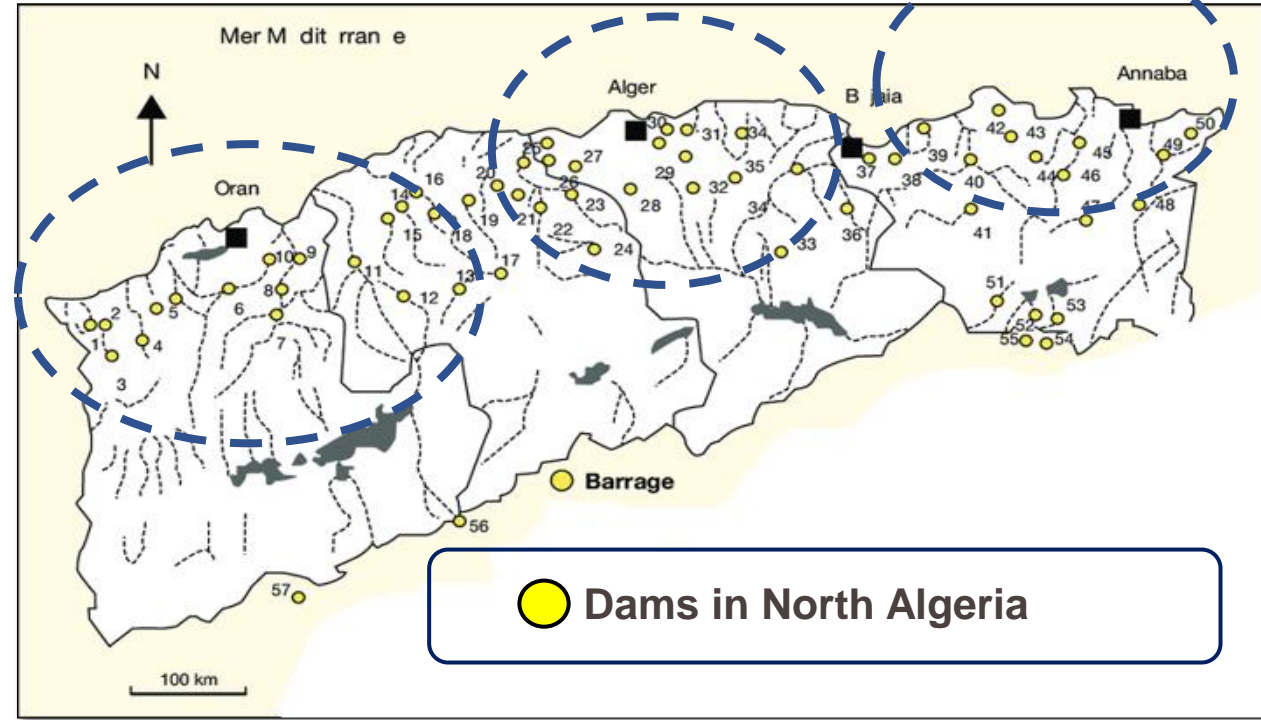
Algeria is in the 1st level or significant water stress (shortage), with less than 1000 m<sup>3</sup> per year and per capita

# PROBLEMATIC ?

These dams are fed by rainfall



It is intended primarily for:



The dams in Algeria is a major surface resource

IN 2020 Algeria has 80 dams in operation, divided in North Algeria from east to west

## THE OBJECTIVE

## The objectives of this work



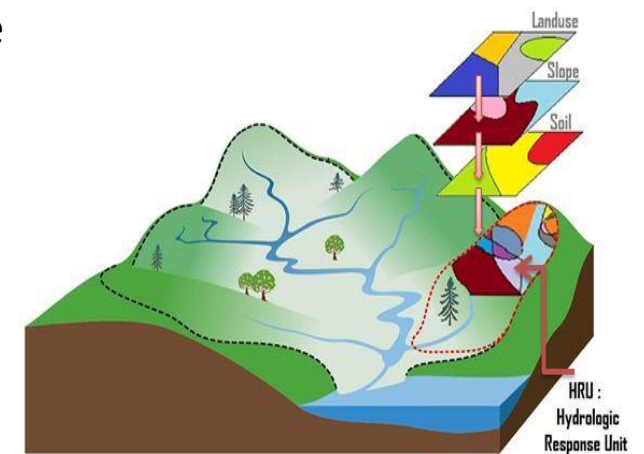
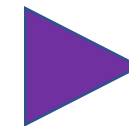
- Calibrate and validate the SWAT model on the Boukourdane reservoir watershed.
- Estimate water yield and the components of the hydrological balance of the watershed.
- Estimate the volume of water entering the Boukourdane reservoir located at the outlet of the watershed in order to develop an effective decision-making framework to facilitate, plan and evaluate the management of this important reservoir.

# modèle SWAT ?



- SWAT was chosen because it is an integrated, physics-based, semi-distributed, continuous-time watershed model that allows for long-term simulation.
- In addition, its adaptation to different regions of the world has been well established.
- The hydrological cycle simulated by SWAT is based on the water balance equation.
- The model provides all components of the water balance (surface runoff, evaporation, lateral flow, recharge, percolation, sediment production, etc.) at the level of each watershed and is available annual time steps

SWAT can analyze the watershed as a whole or by subdividing it into sub-watersheds containing homogeneous portions called **Hydrological Response Units (HRUs)**.

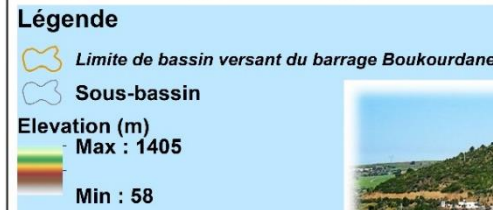
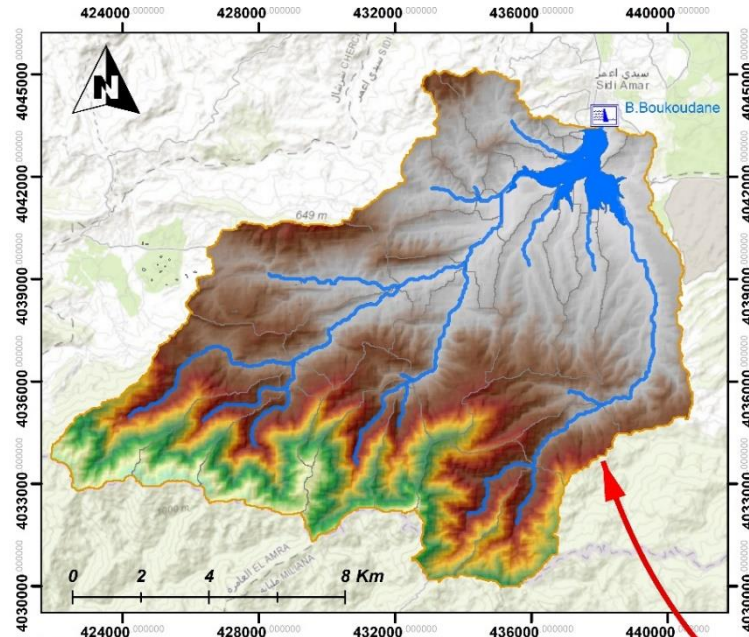


# The study area?

- Area = 158 km<sup>2</sup>
- Perimeter = 84 km
- Maximum Elevation = 1405 m
- Minimum Elevation = 58 m

- Mediterranean-type climate
- Average annual rainfall is 550-800 mm/year
- Average annual temperature is 19.2/23.5 °C
- Average annual potential evapotranspiration is 1200-1450 mm

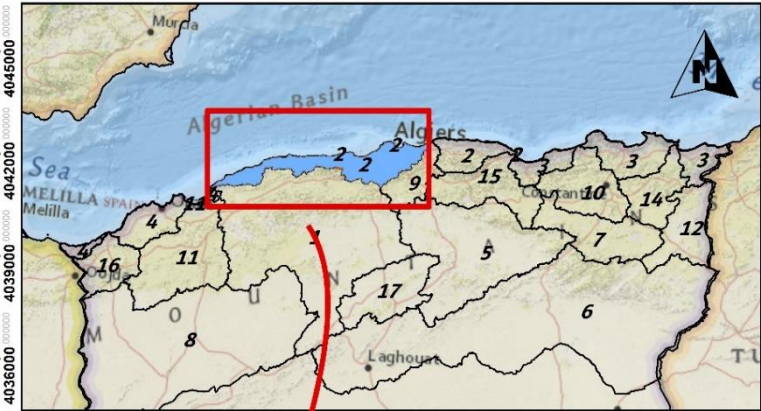
- The height of the dam is H=15 m
- Capacity is =106 million m<sup>3</sup>



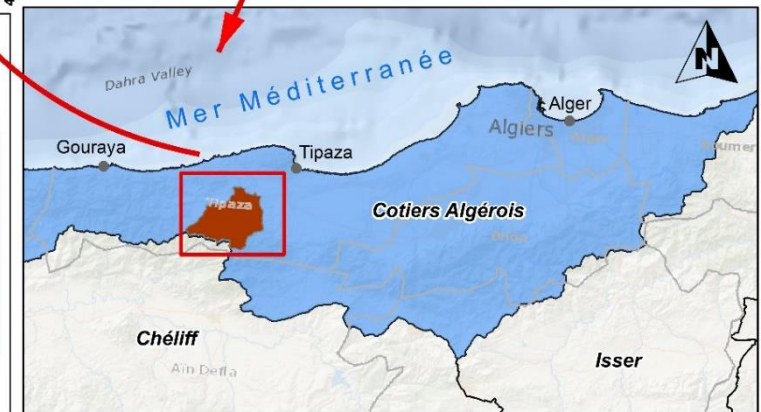
*l'auteur : SEDRATI CHAFIK*

*Date: 19/11/2022*

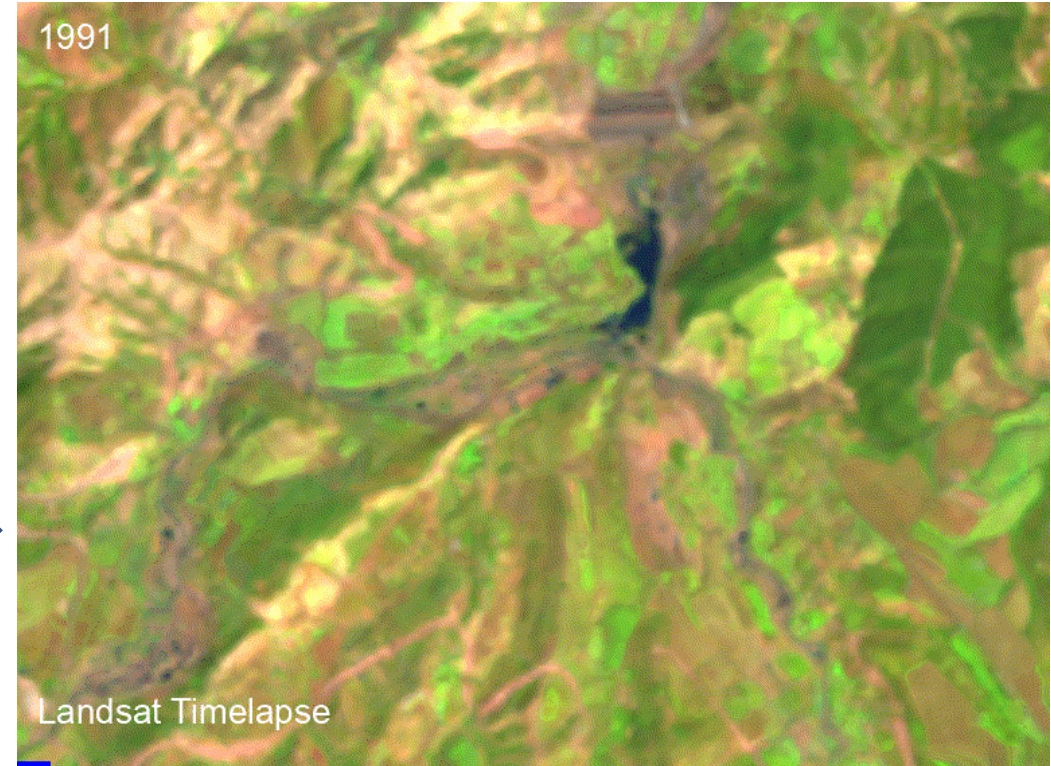
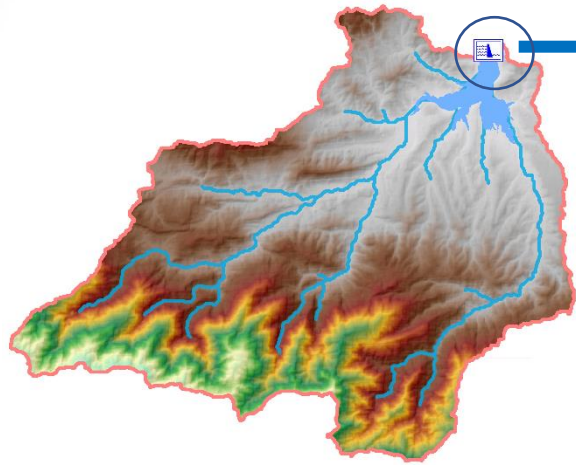
*systeme de projection WGS84 UTM zone 31*



(01) Chélif	(07) Hauts plateaux constantinois	(13) Sahara
(02) Cotiers Algérois	(08) Chott chergui	(14) Seybouse
(03) Cotiers Constantinois	(09) Isser	(15) Soummam
(04) Cotiers Oranais	(10) Kébir Rhumel	(16) Tafna
(05) Chott Melhrir	(11) Macta	(17) Zahrez
(06) Chott el Hodna	(12) Medjerdah	



# The study area?

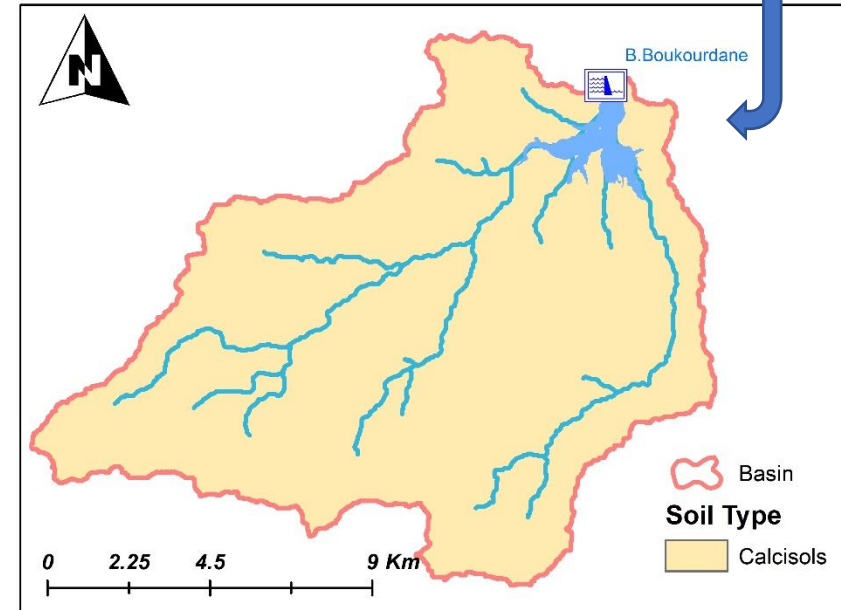
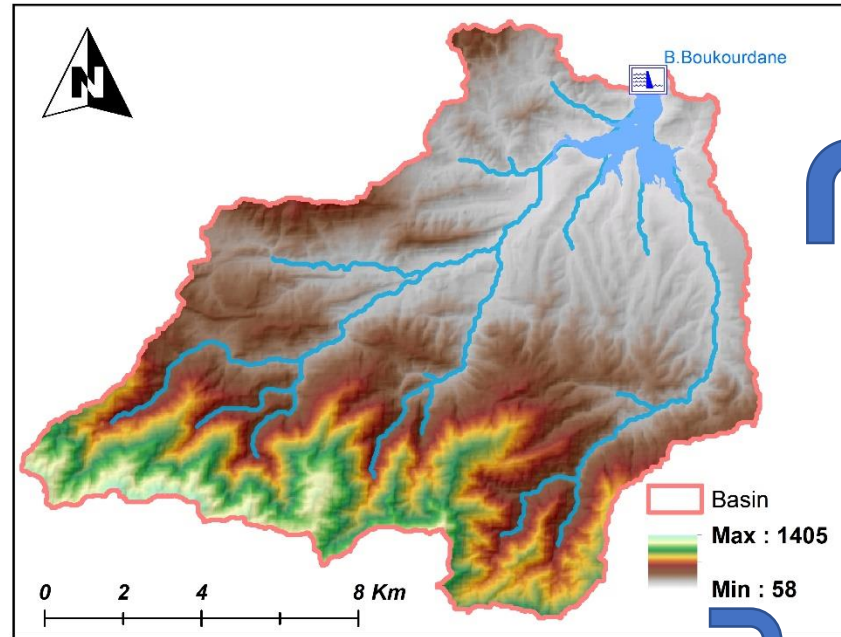


Daily flow at the outlet of the Boukerdane watershed dam between  
January 1991 and December 2020 (ANBT)

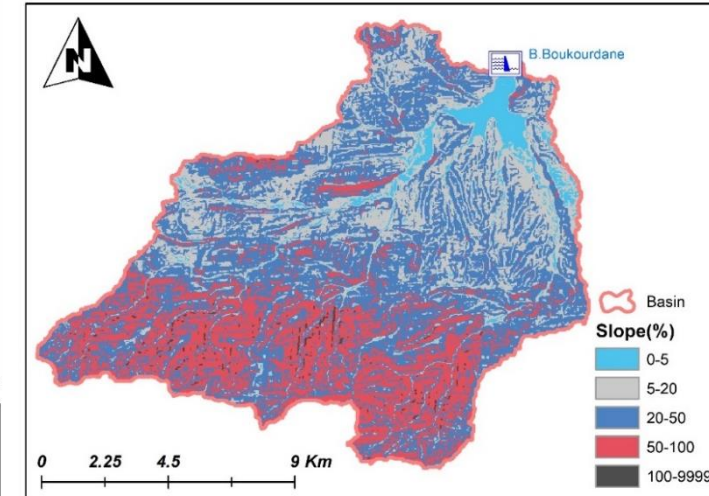


# Input data

Digital Elevation Model (DEM) data with a resolution of 30x30 meters



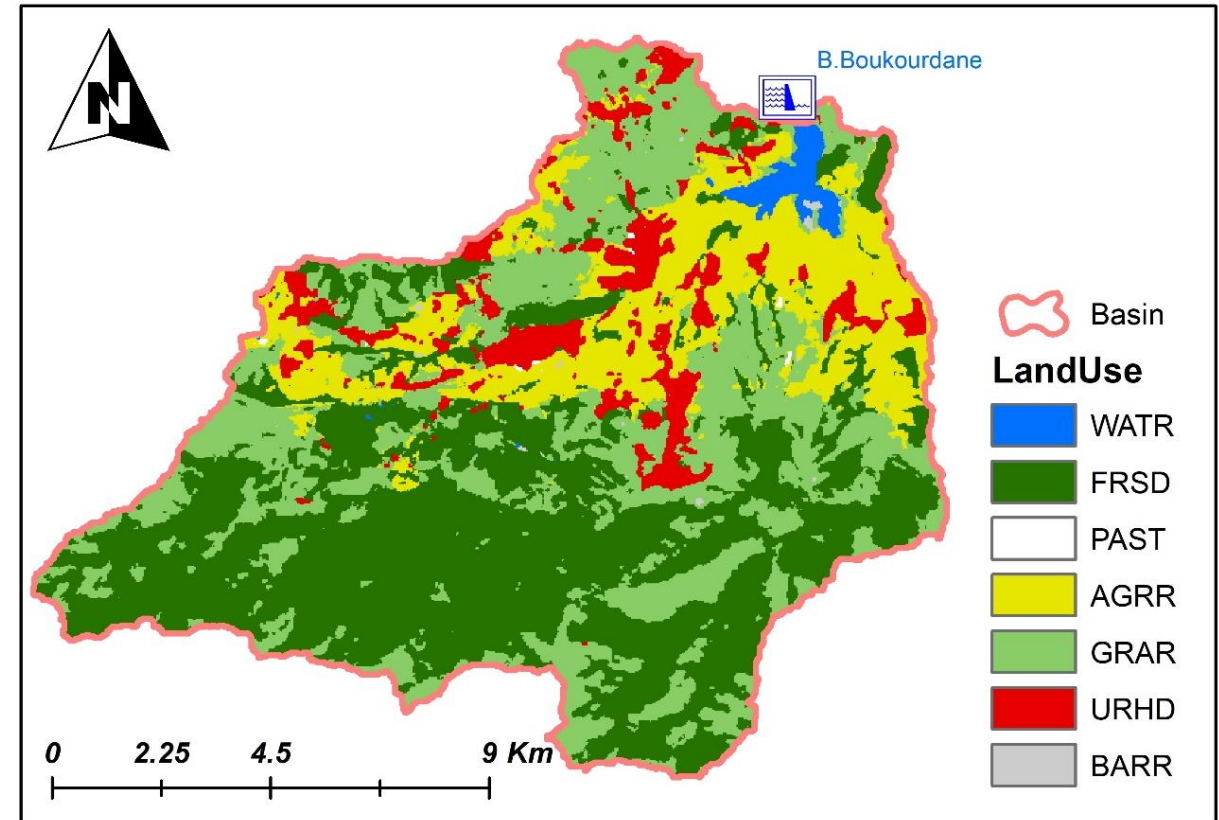
a soil map (FAO World Soil Map)





# Input data

Land Use	Code	Area(%)
Water	WATR	0.64
Forest-Deciduous	FRSD	<b><u>45.64</u></b>
Pasture	PAST	0.04
Agricultural Land-Row Crops	AGRR	18.71
Grarigue	GRAR	<b><u>31.41</u></b>
Residential-High Density	URHD	3.61
Barren	BARR	0.15



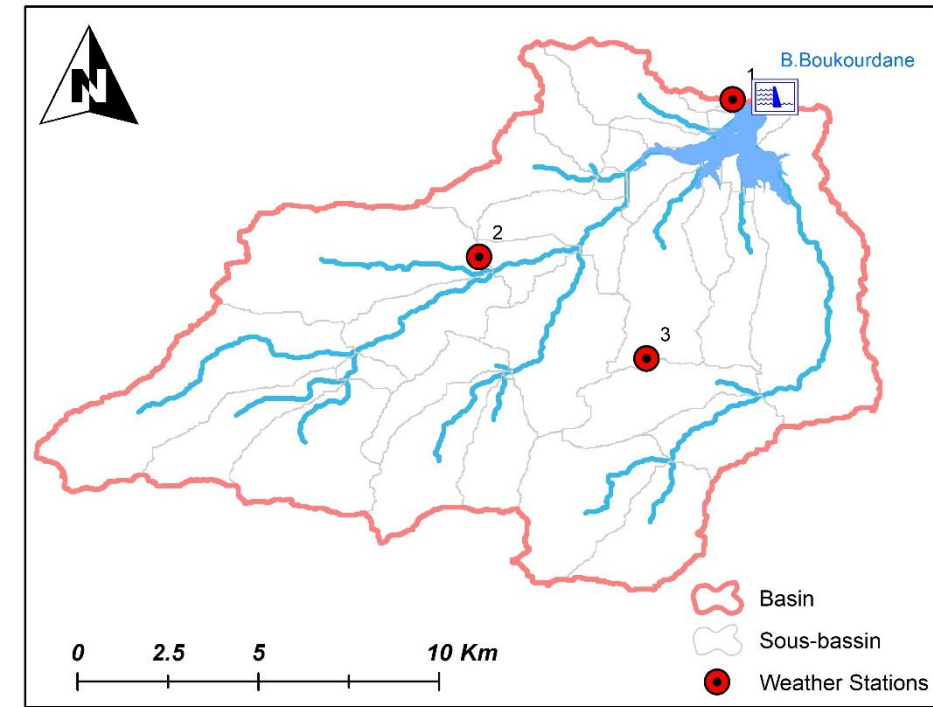
esri

Land use/land cover map for  
2021 with a resolution of 10x10  
meters

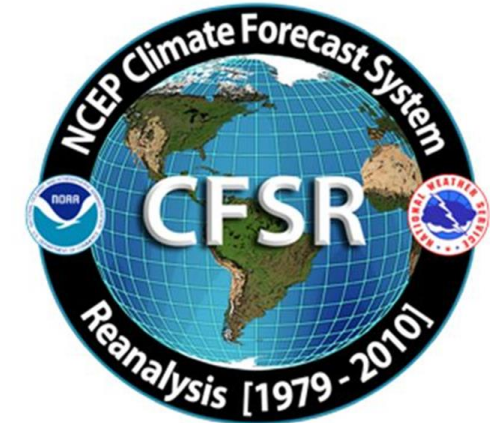
<https://livingatlas.arcgis.com/landcover/>

# Input data

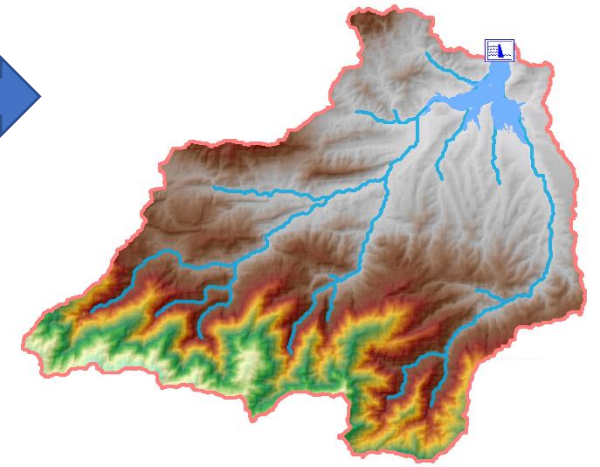
➤ Daily rainfall data series from three rainfall stations for the period of 1996 to 2010 provided by the National Hydraulic Agency (ANRH)



➤ Daily data for maximum and minimum temperature, wind speed, relative humidity, and solar radiation were downloaded for the available stations within the study area from the global weather database website at the following URL: <http://globalweather.tamu.edu/home/view/3668>.



# Model calibration and validation



## Calibration parameters

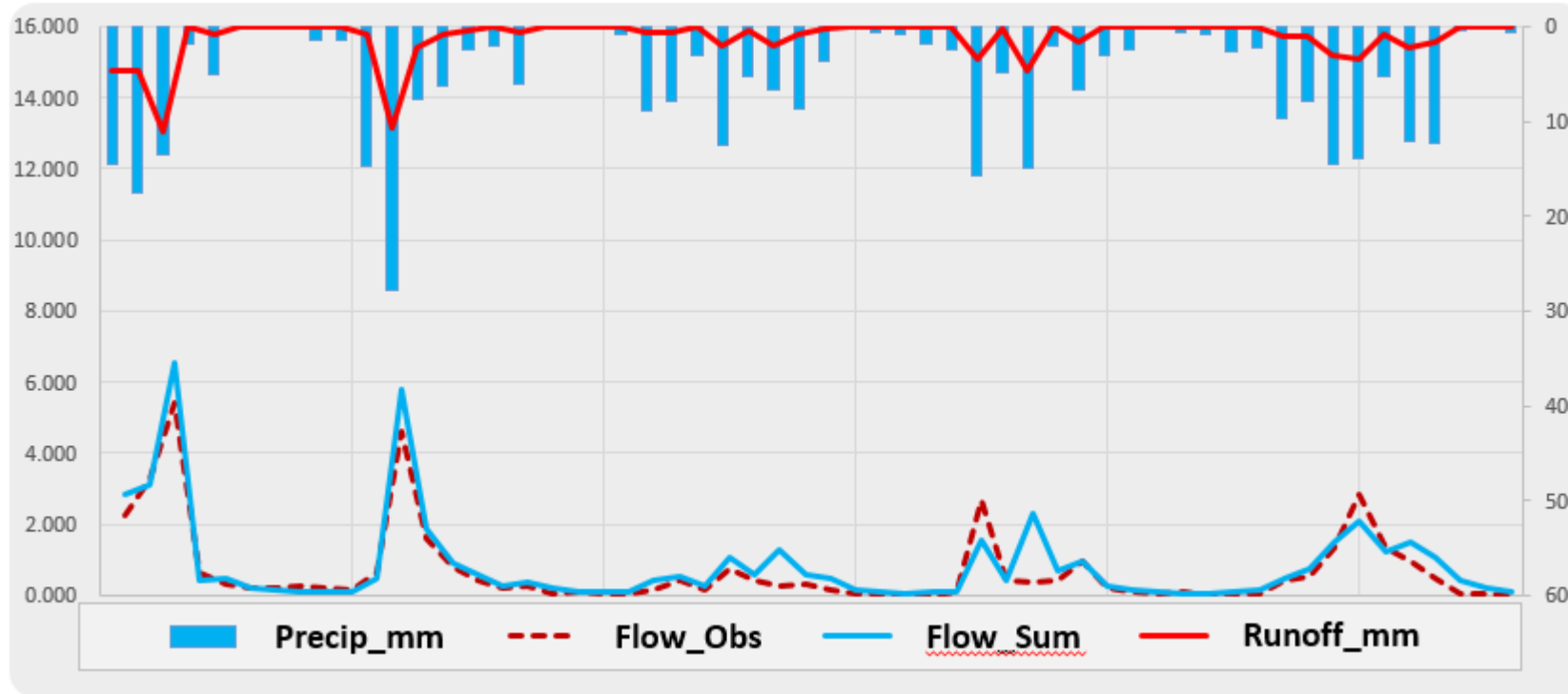
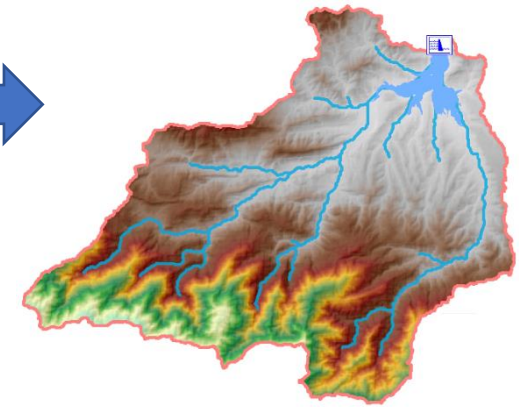
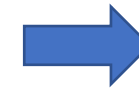
## Description

CN2 (FRSD)	SCS runoff curve number factor
CN2 (GRAR)	
GW-DELAY.gw	Groundwater delay (days)
GW_REVAP.gw	Groundwater "revap" coefficient
Sol_AWC.sol	Available water capacity of the soil layer (mm H2O/mm soil)
SLOSOIL.hru	Slope length for lateral subsurface flow



# Calibration

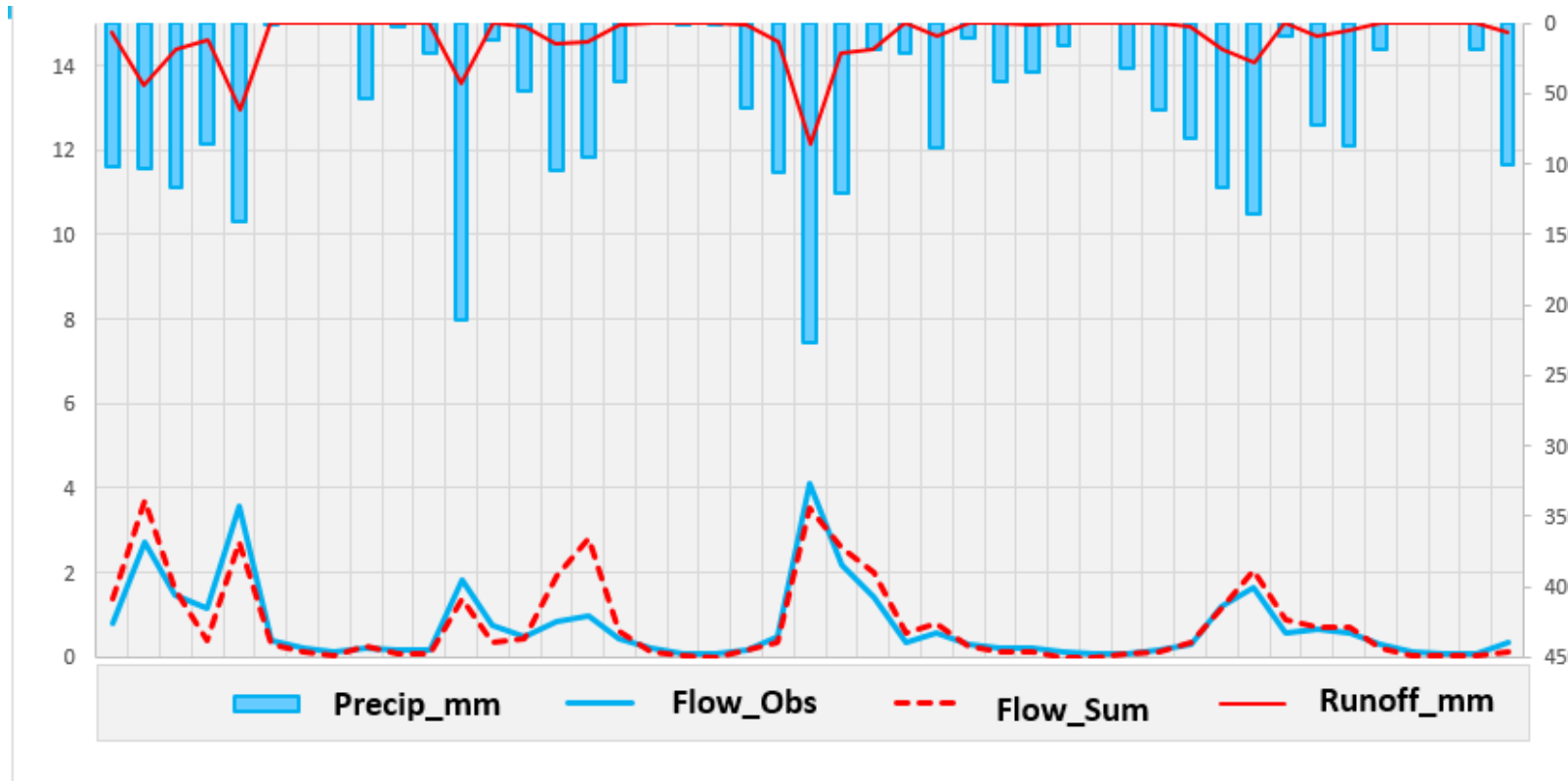
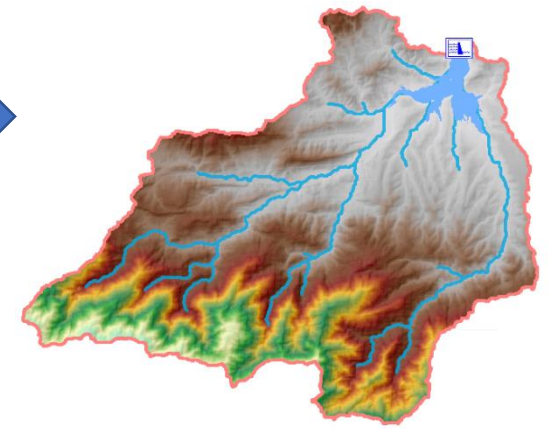
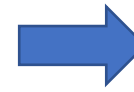
# Model calibration and validation



Calibration period: **January 1999 to August 2003.**

Calibration	
Statistical criteria	Value
R2	0.94
Nash	0.84
RSR	0.41
PBIAS	-23.2%

# Model calibration and validation



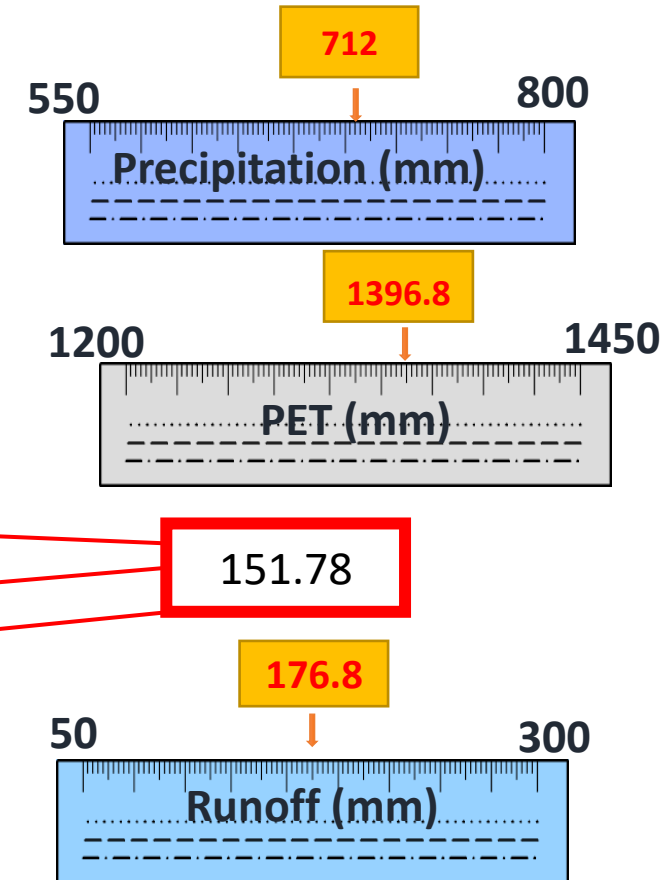
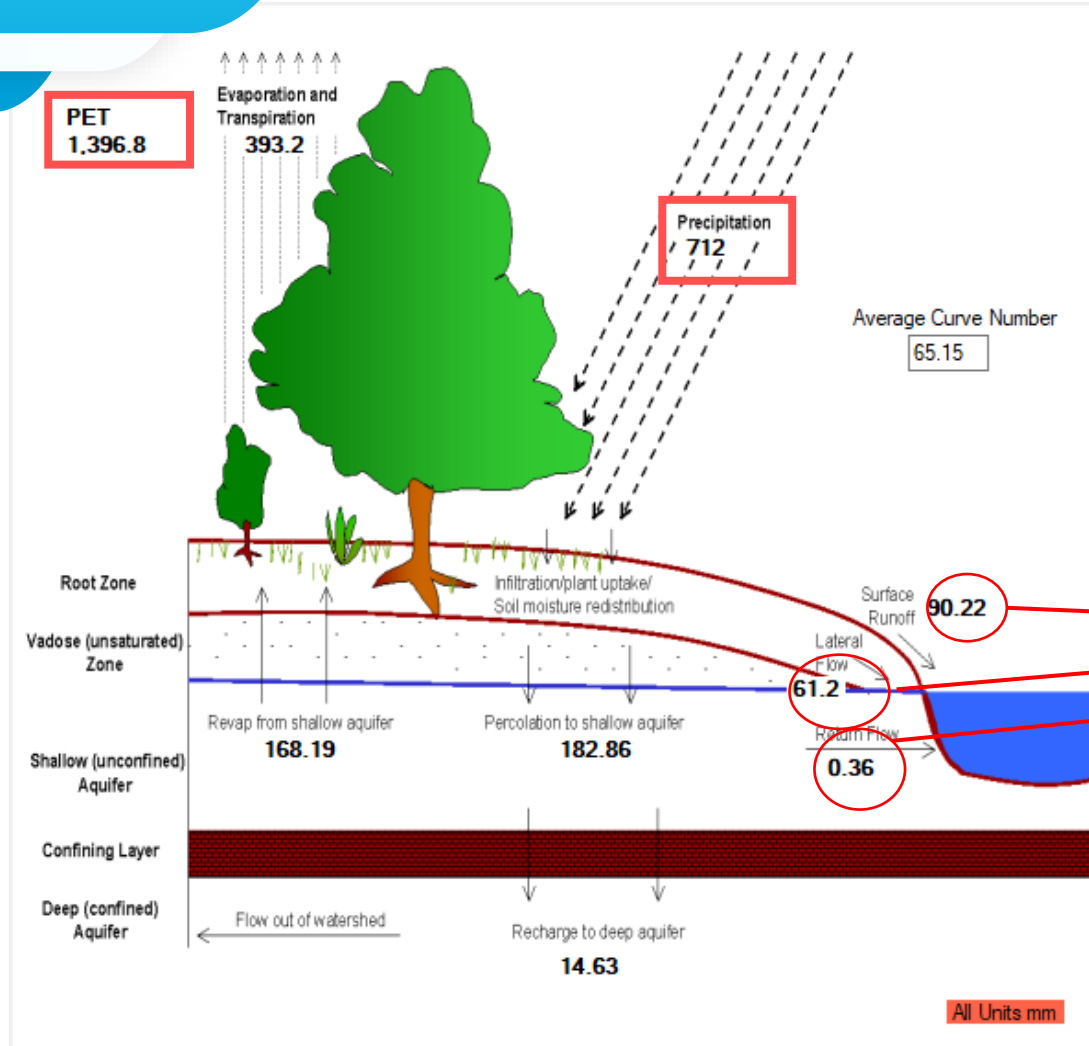
Validation period: January 2006 to September 2009

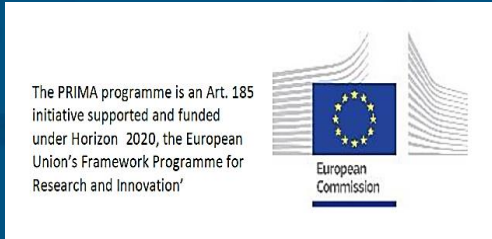
Validation	
Statistical criteria	Value
R2	0.89
Nash	0.80
RSR	0.45
PBIAS	+6.72 %

# Bilan hydrique de bassin



Interannual hydrological balance (in mm) of the Boukourdane reservoir watershed (1996-2010) formatted with the SWAT Check program





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Contact

**THANK YOU FOR YOUR ATTENTION!**  
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