



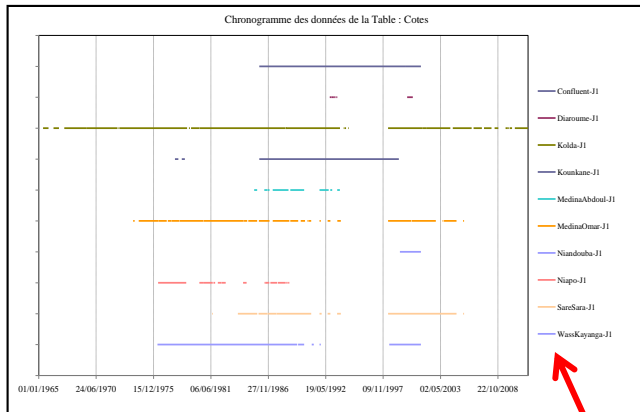
OCP Policy Center Conference series

# Contribution of rainfall-runoff modeling to the knowledge of water resources in Senegal

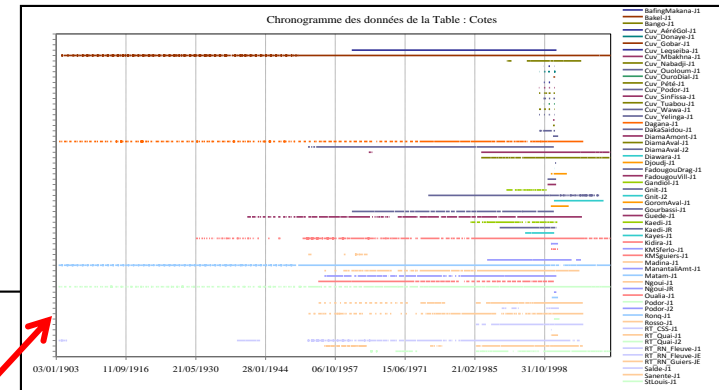
Ansoumana BODIAN & Alain DEZETTER & Honoré DACOSTA

11-13 June 2014

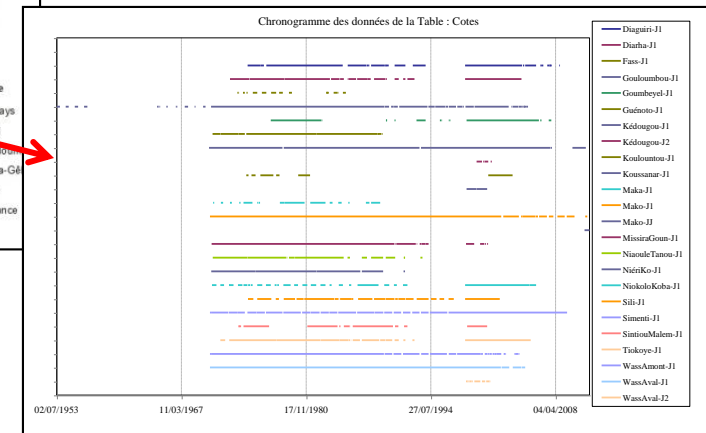
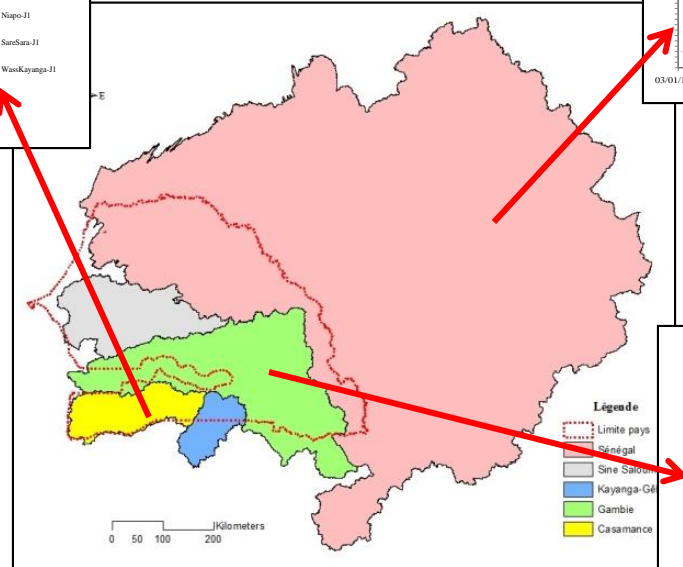
# Problem of hydrological monitoring



Chronogram of available discharges:  
Casamance river



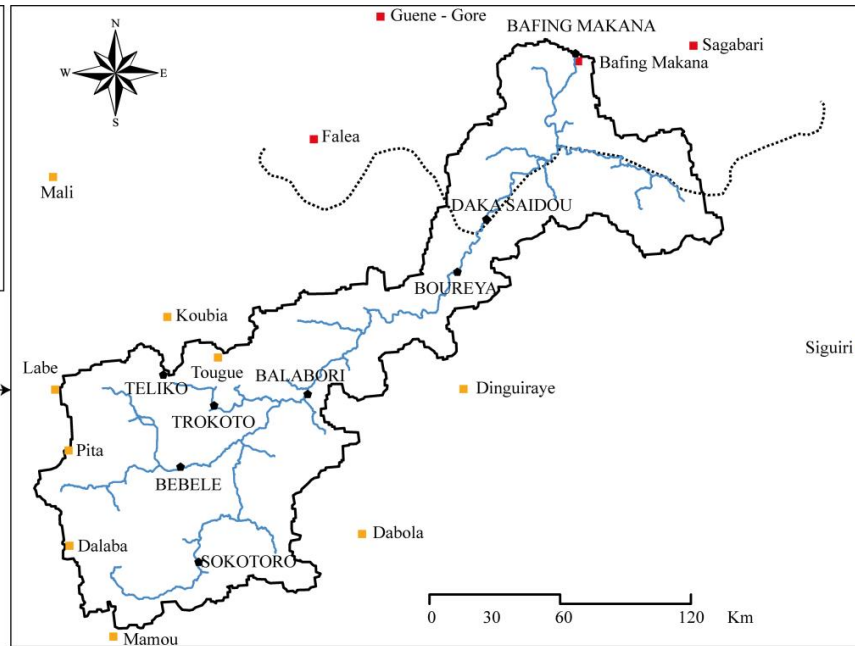
Chronogram of available discharges:  
Senegal river



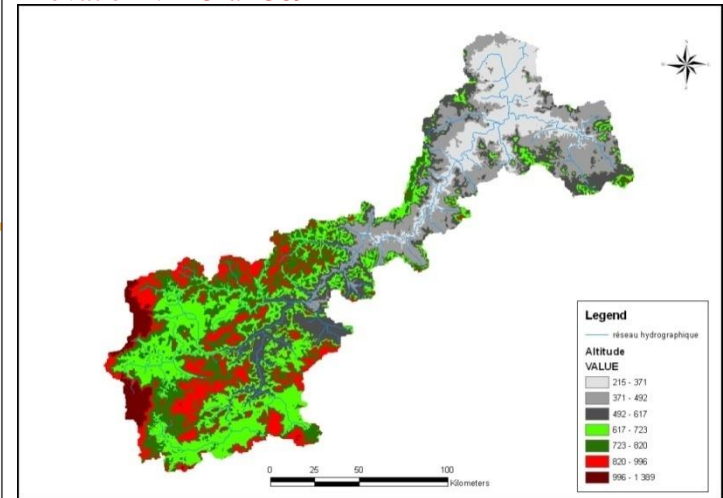
Chronogram of available discharges:  
Gambia river

Focus on the upper basin of Senegal river

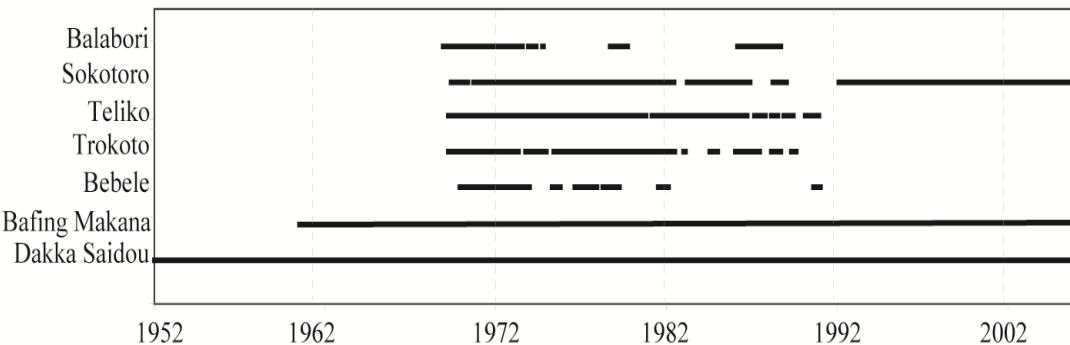
# Presentation of upper Senegal river basin



Upper Senegal river at Bafing Makana station  
 Area : 21290 Km<sup>2</sup>  
 Elevation : 215 à 1389 m

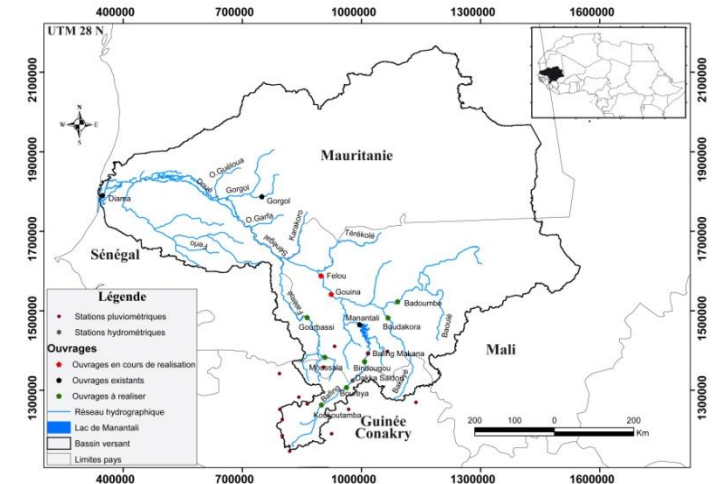


Location of upper Senegal river basin in West Africa



Chronogram of available monthly discharges

Elevation

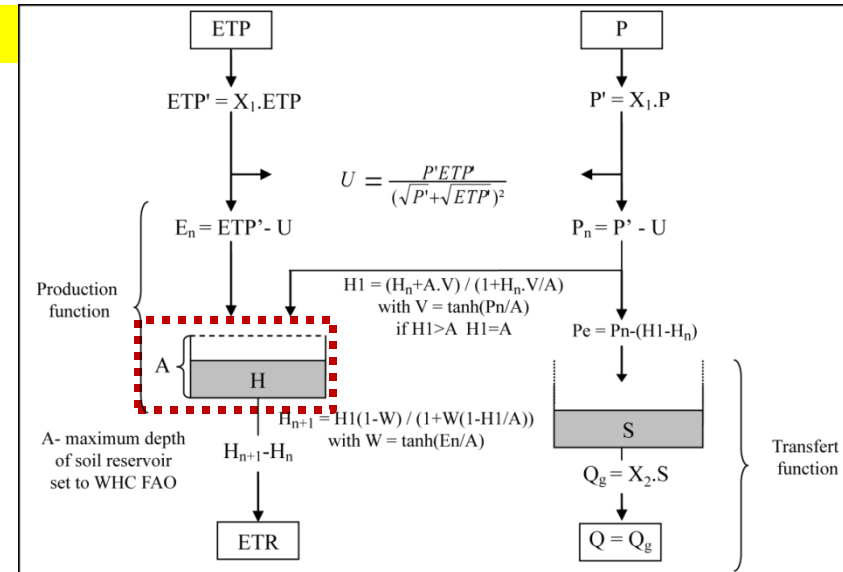
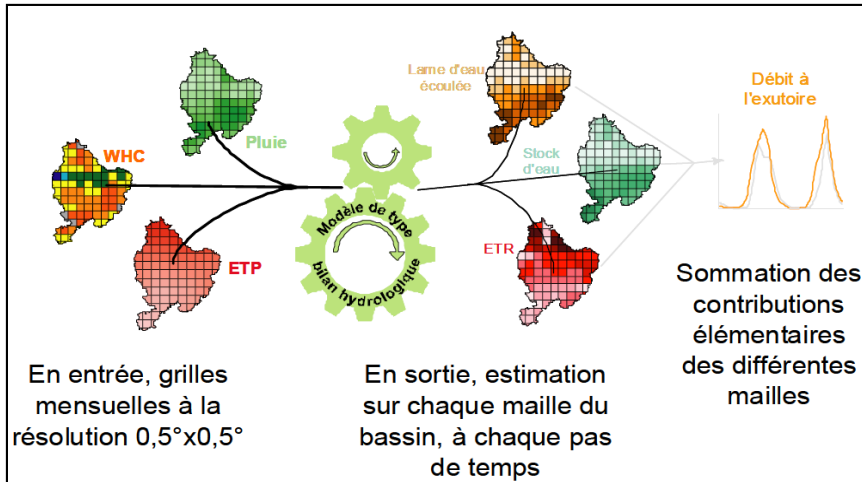


Hydraulic structures in the Senegal River Basin (Bodian et al, 2013)

# Presentation of the GR2M model

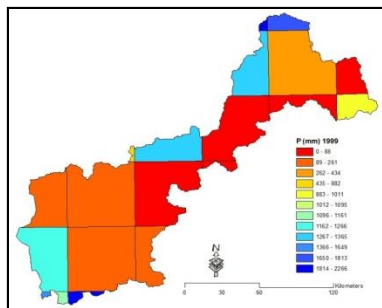
GR2M- Global : conceptual hydrological model that works on a monthly base

- Two parameters: **X1** (production function) **X2** (transfert function)
- Soil Water Holding Capacity  $A \leftrightarrow$  WHC

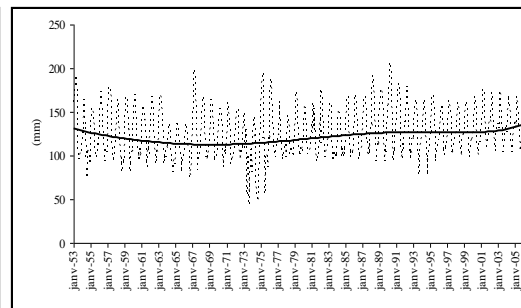
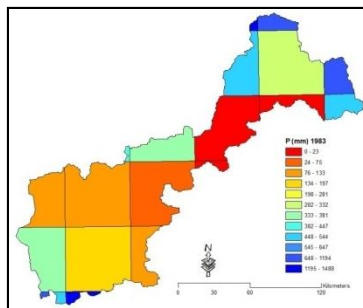


Conceptual scheme of the GR2M model (<http://webgr.irstea.fr/>)

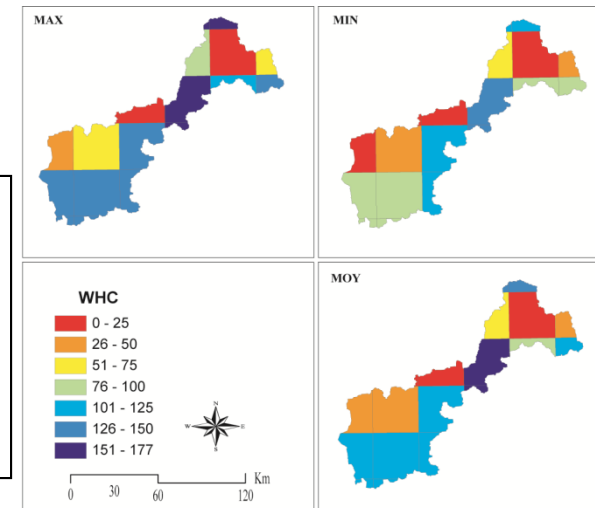
Operation of the semi-globale version (Ardoin, 2004)



Rainfall



Potential EvapoTranspiration



Soil Water Holding Capacity

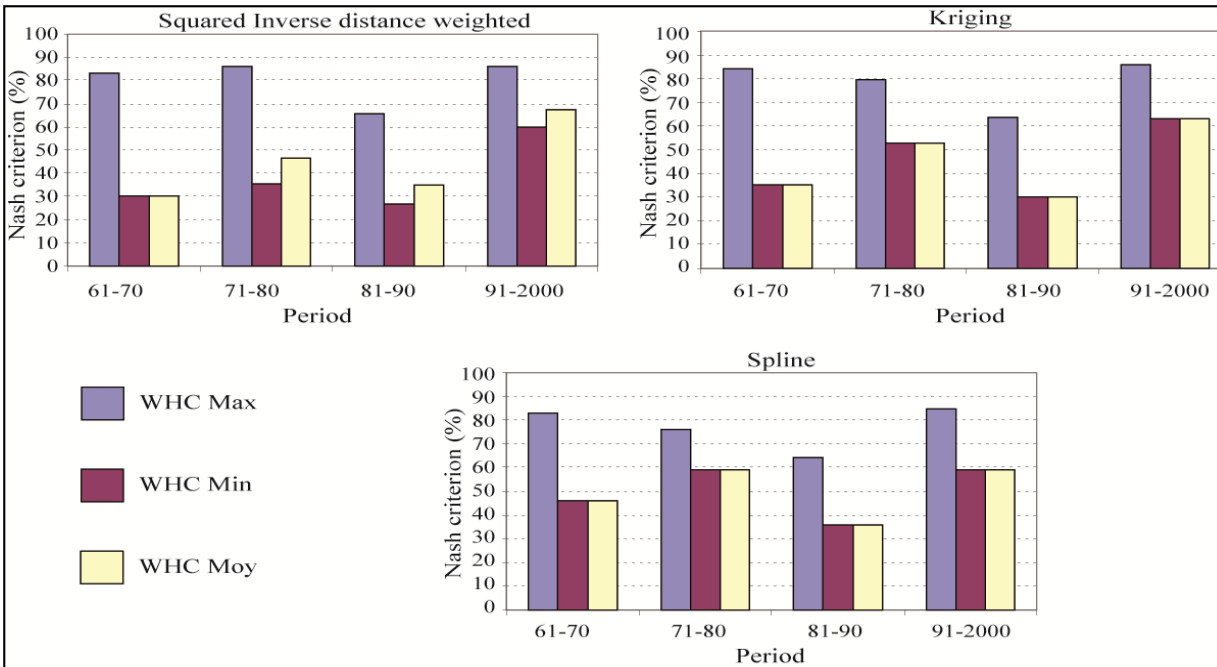
# Analysis of the sensitivity of the model to the input data

## Summary of available data

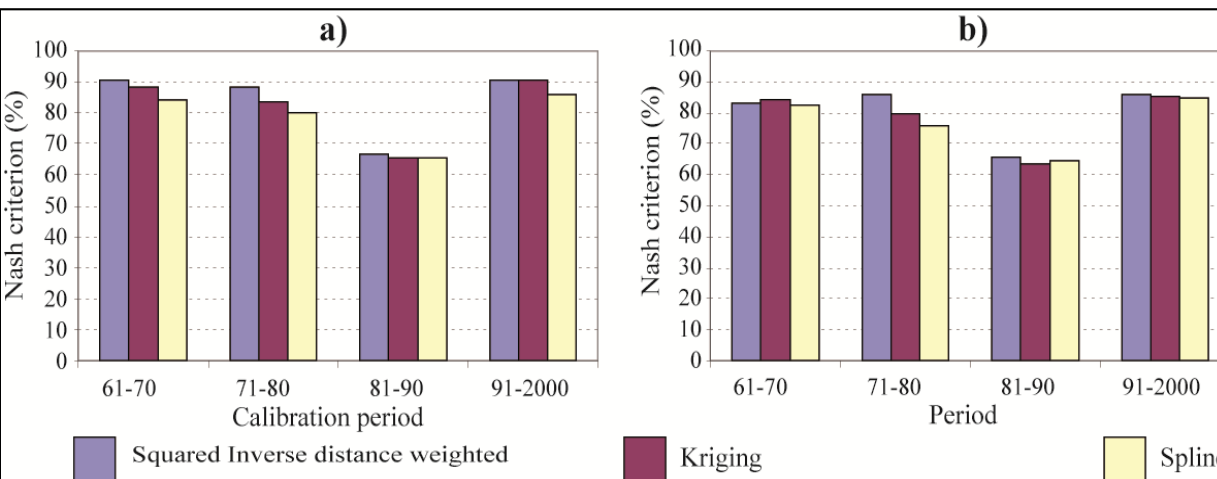
RAINFALL	PET	WHC	DISCHARGE
<ul style="list-style-type: none"><li>✓ Kriging Grid</li><li>✓ IDW Grid</li><li>✓ Spline Grid</li></ul>	Mean	<ul style="list-style-type: none"><li>✓ WHC Max grid</li><li>✓ WHC Min grid</li><li>✓ WHC Moy grid</li></ul>	Monthly average flows

Need to analyze the sensitivity of the model to the input data

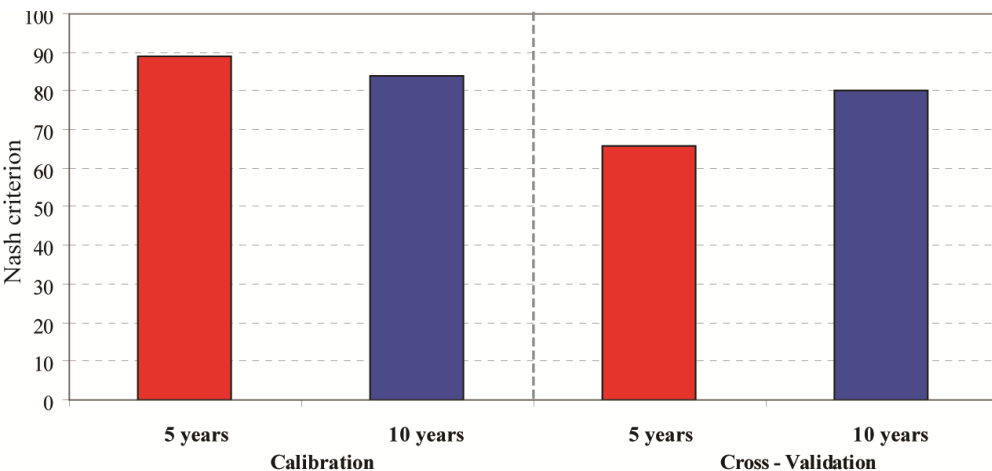
# Analysis of the sensitivity of the model to the input data



GR2M- Results of the sensitivity of the model to the input data WHC and rain **calibration and cross-validation at Bafing Makana** (*with 10 years long period*)



# Performance of the model based on the Time slicing



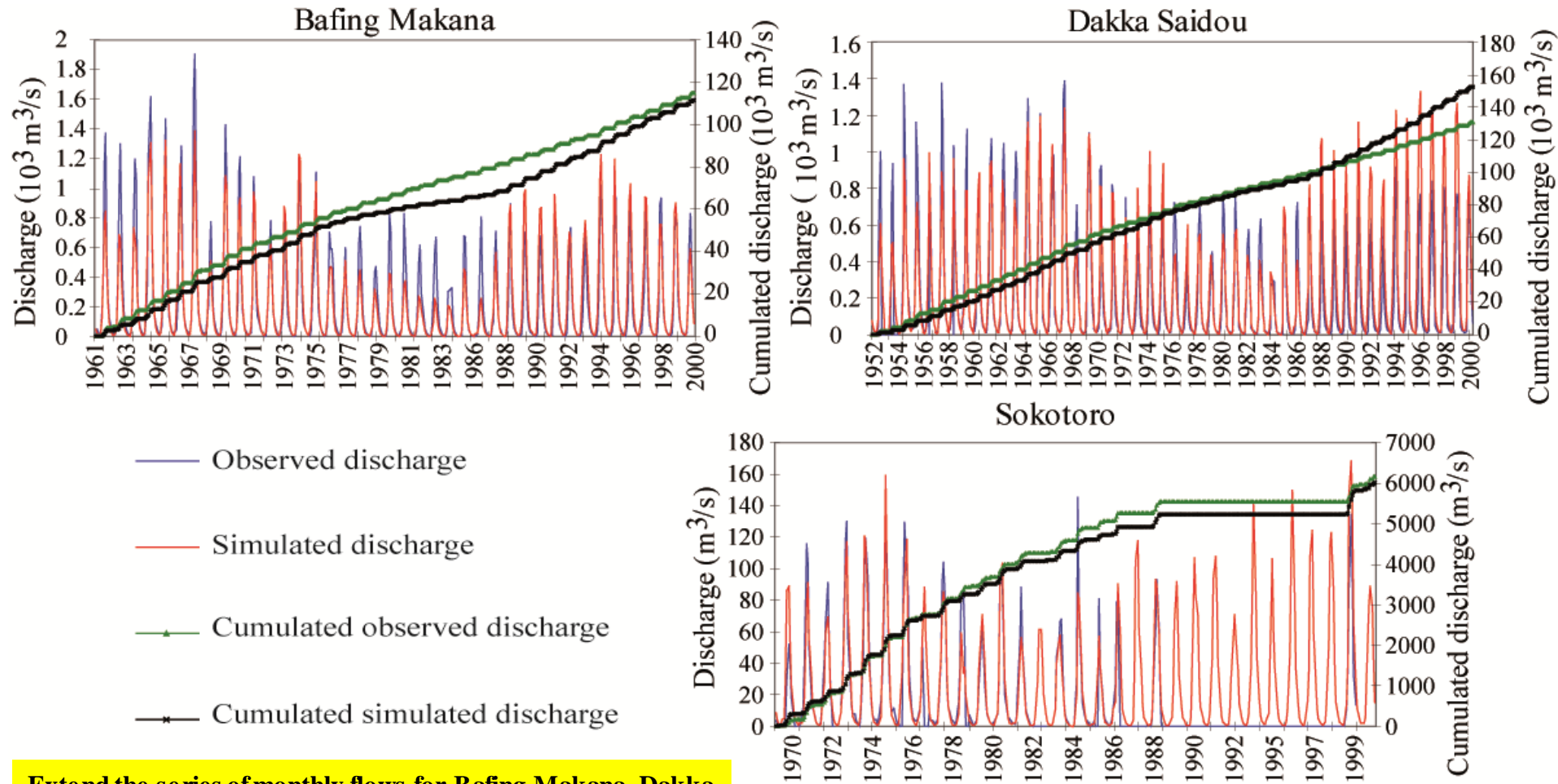
GR2M – Model skill with respect to different periods in Bafing Makana

GR2M – calibration and cross-validation results for Bafing Makana

Calibration period	61-70	71-80	81-90	91-2000	
X1 calibrated	0,4438	0,3855	0,3746	0,3435	
X2 calibrated	0,5493	0,55051	0,55852	0,51767	
Nash criterion	<b>0,905</b>	0,881	<u>0,668</u>	<b>0,905</b>	
Correlation Mensuelle	0,952	0,94	0,831	0,954	
					Mean nash
Nash Validation (p 61-70)		0,866	0,852	0,776	0,831
<b>Nash Validation (p 71-80)</b>	0,822		0,880	0,841	<b>0,861</b>
Nash Validation (p 81-90)	0,594	0,666		0,643	<u>0,655</u>
Nash Validation (p 91-2000)	0,643	0,851	0,869		0,860
Mean nash	<u>0,686</u>	0,759	0,874	0,742	

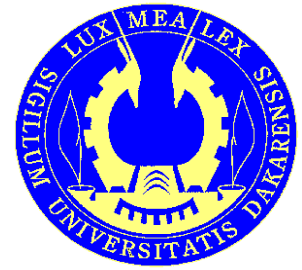
# Application of the model and flows simulation

## GR2M – Flows Simulation at Bafing Makana station



Extend the series of monthly flows for Bafing Makana, Dakka Saidou and Sokotero basins from 1960 to 2000.





**THANK YOU FOR YOUR  
ATTENTION!!!**

