



Cairo University

Impacts of the Proposed Water Resources Development Projects in the Blue Nile Basin on Nile River Inflows at Aswan

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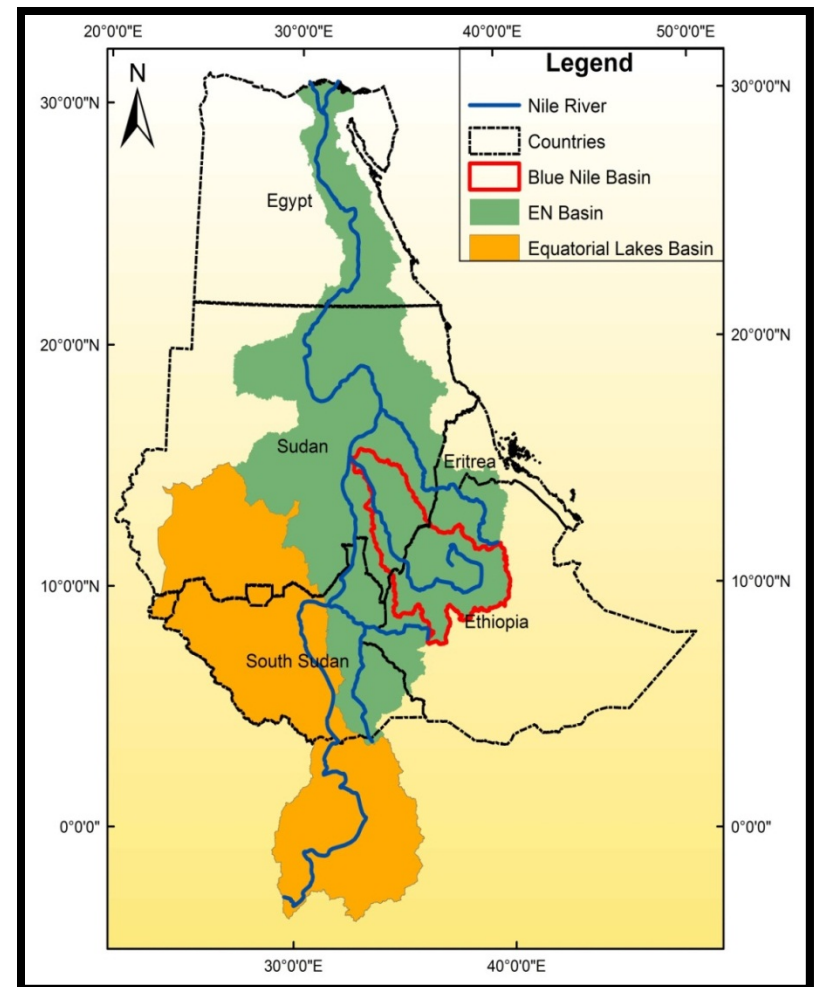
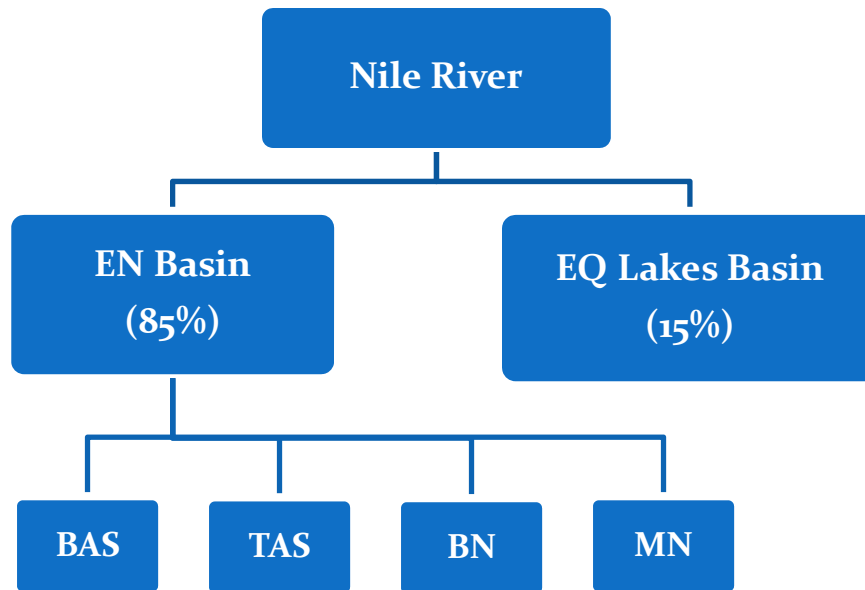




Overview

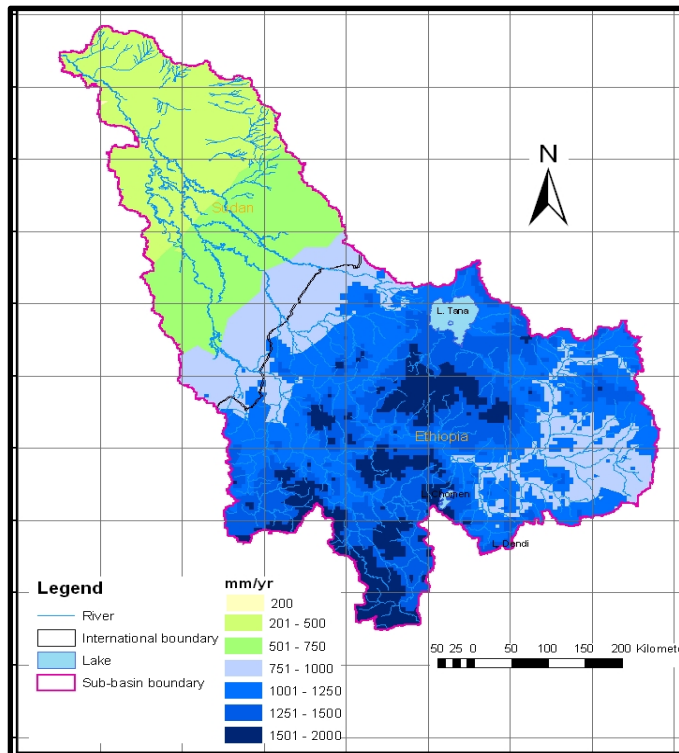
- Introduction
- Methodology
- Data Collection
- Model Setup
- Baseline Simulation
- Scenarios and Results
- Conclusion & Recommendations

Introduction

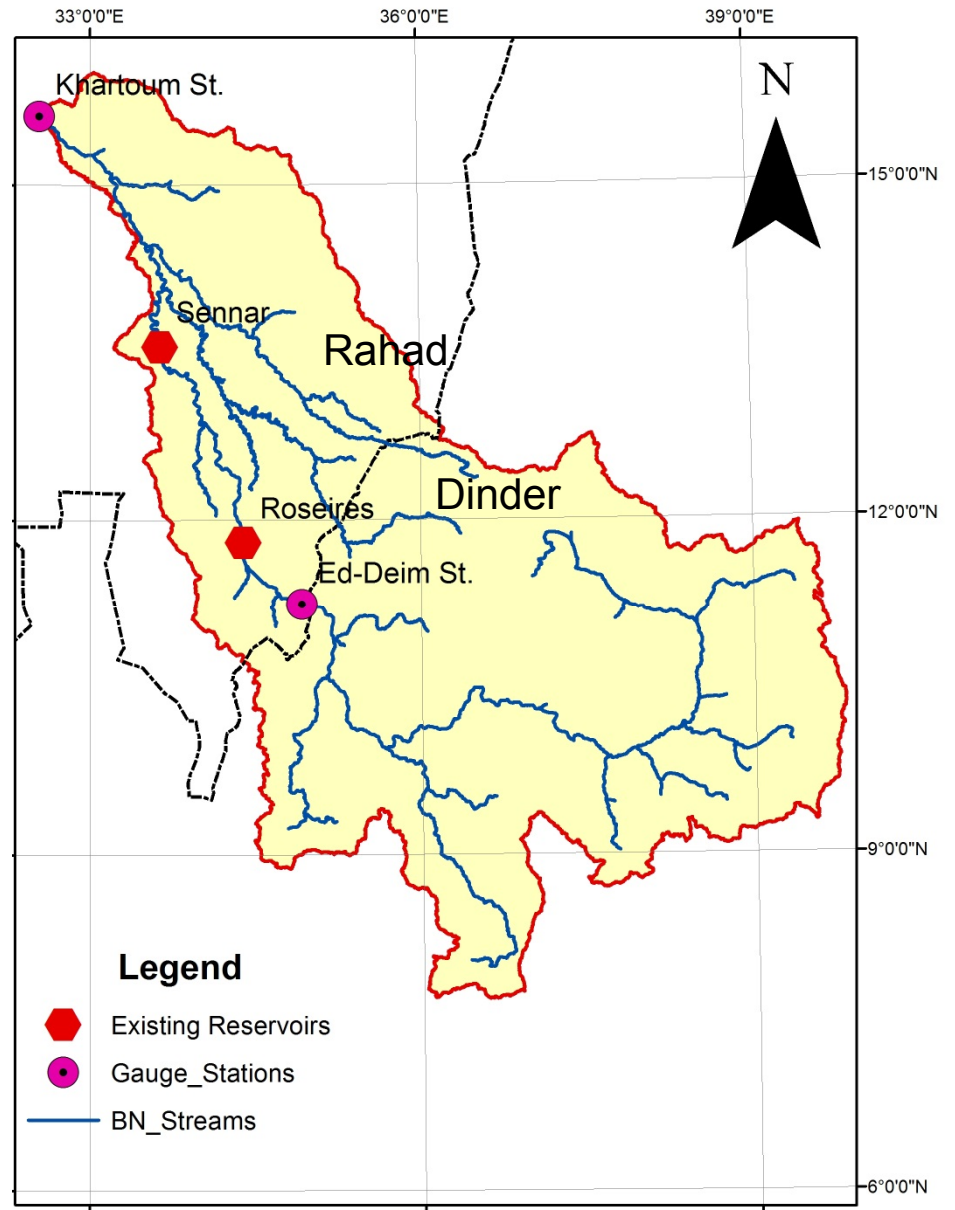


- Flow at Blue Nile.
- BN Existing Reservoirs.

Dam	Storage (BCM)	Capacity (MW)
Sennar	0.5	Null
Roseires	6.4	415



Cont., Introduction: Study Area

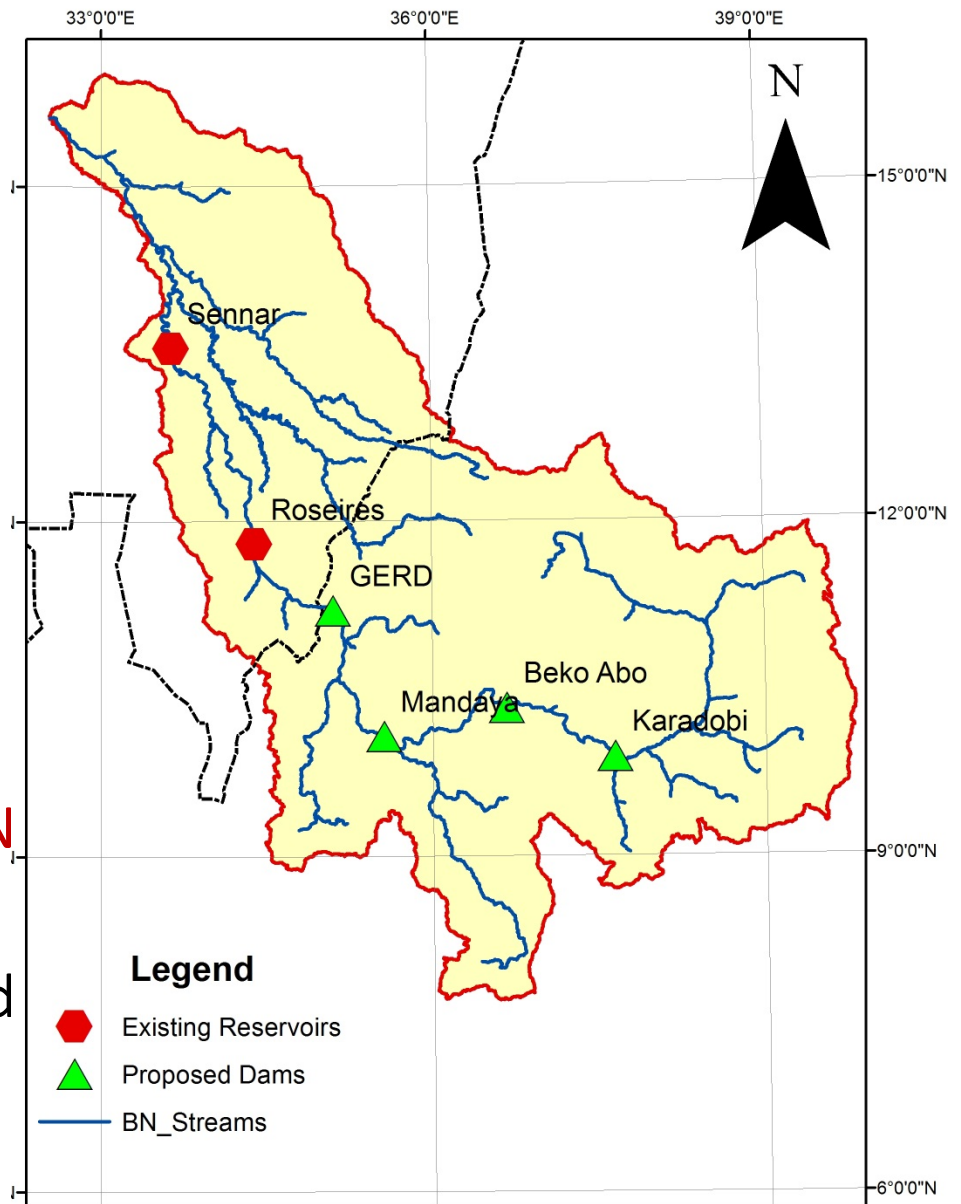


Cont., Introduction

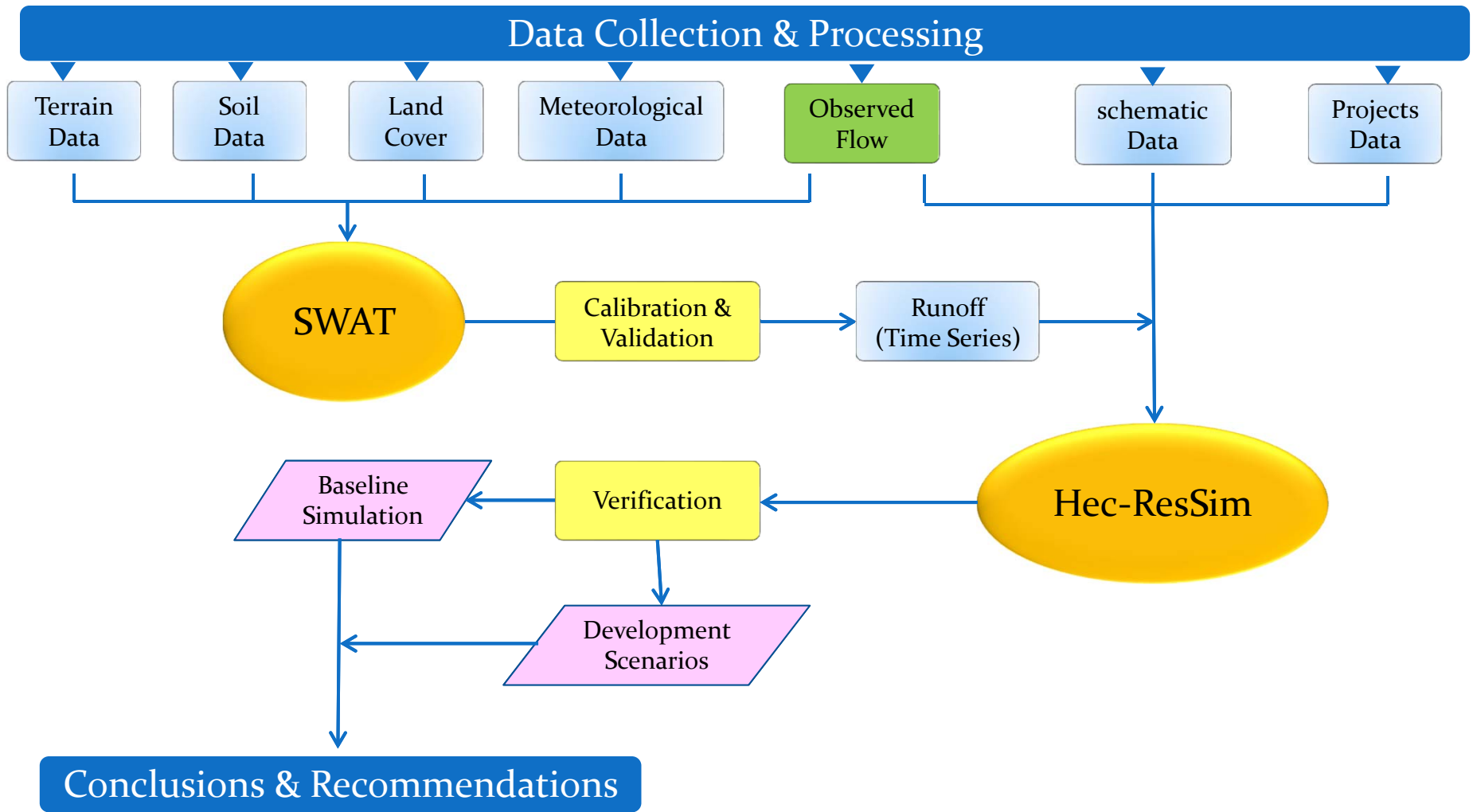
- Problem Statement.
- BN Proposed Dams:

Dam	Storage (BCM)	Capacity (MW)
Karadobi	40.2	1600
Beko Abo	31.7	1940
Mandaya	49.5	2000
Renaissance	74	6000

- Research Objectives:
 - Base line reference for BN basin.
 - Impacts of the Proposed dams in BN basin.



Methodology



Data Collection

- Data required for Reservoir simulation Model

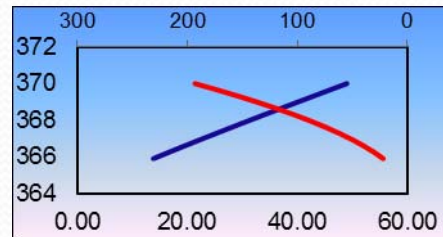
- Model Schematic Data :

- River Network: (USGS HydroSHEDS)

- Junctions

- Existing & Proposed Projects Data:

- Reservoir Data:

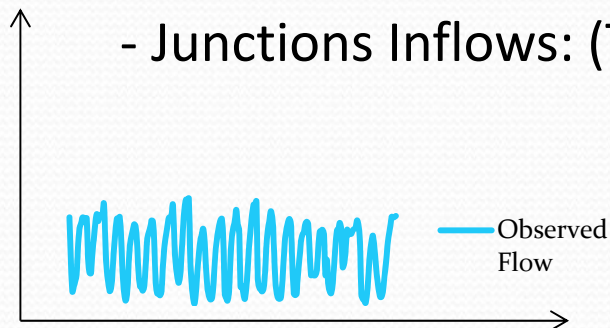


(ENTRO Hydropower Toolkit, 2012)

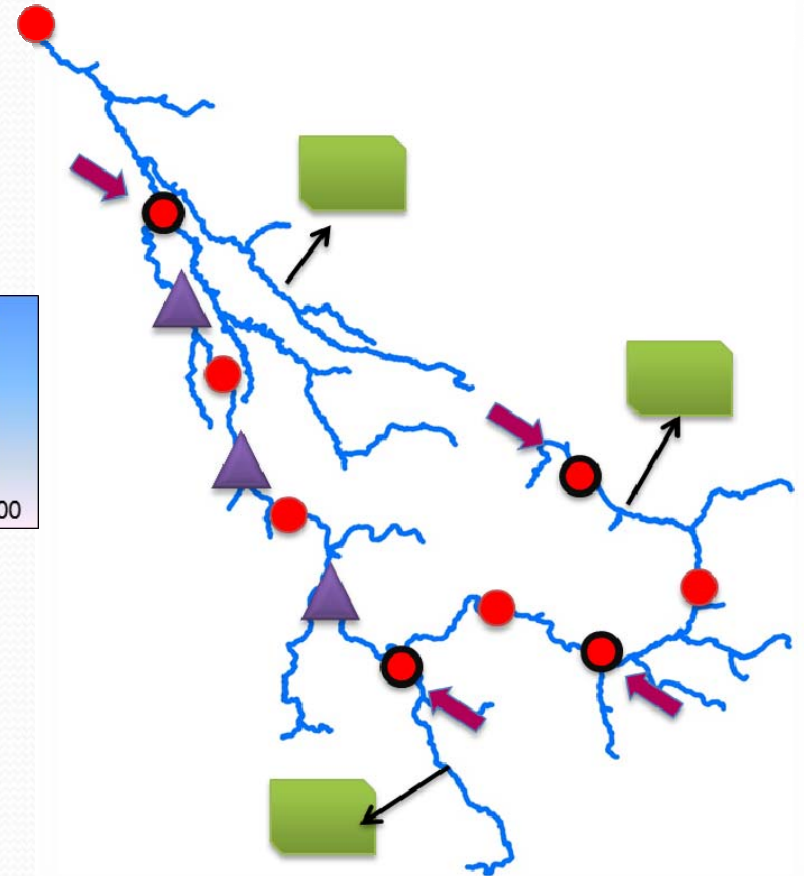
- Flow Data:

- Observed Flow Records

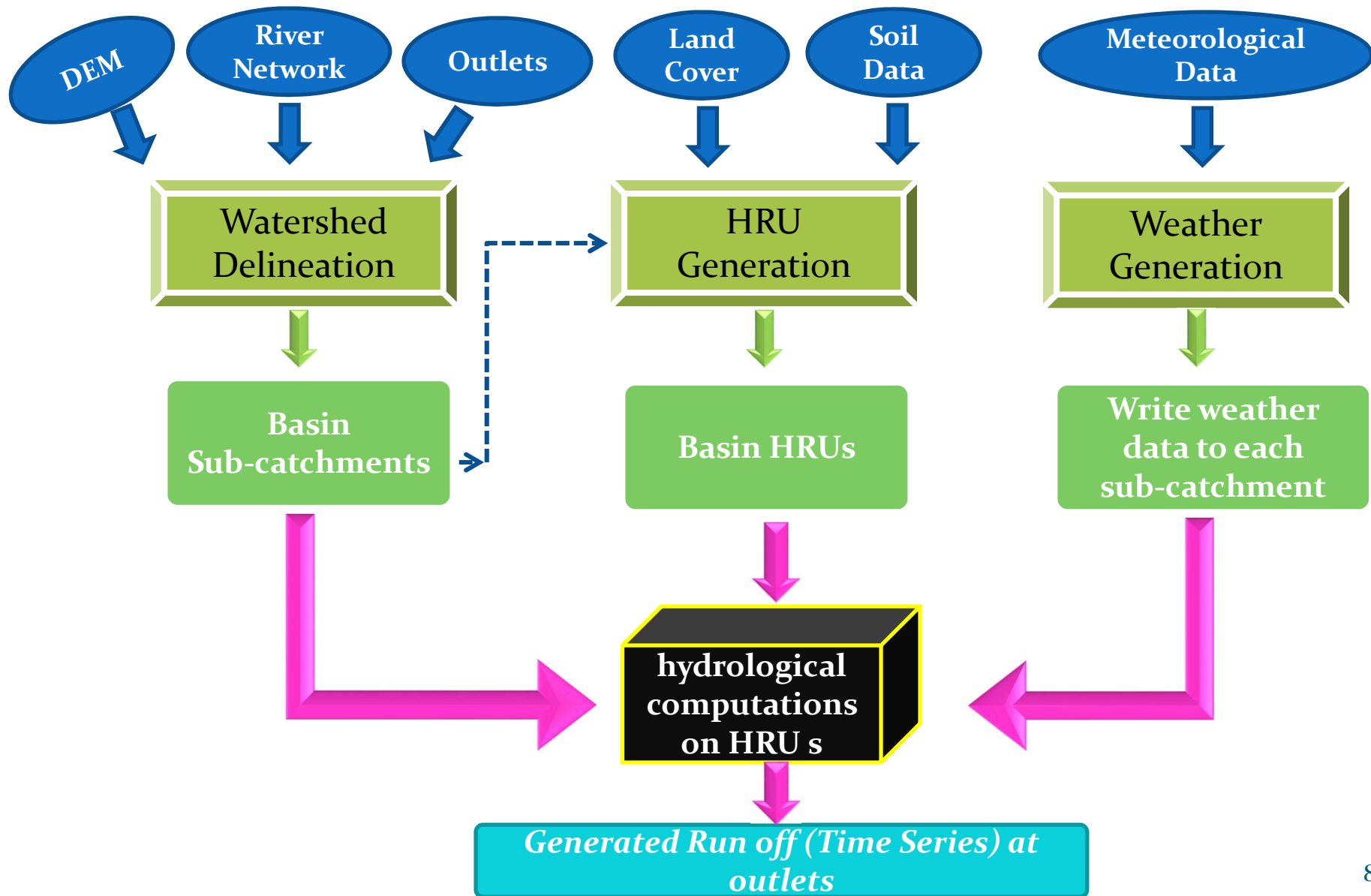
- Junctions Inflows: (Time series flow)



Arc-SWAT



SWAT Model



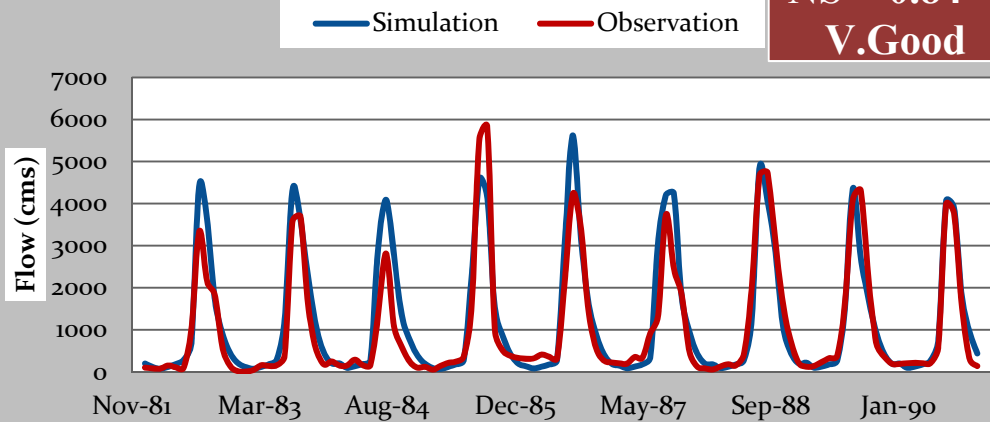
SWAT Calibration and Validation

Khartoum Station

Calibration

Khartoum St.

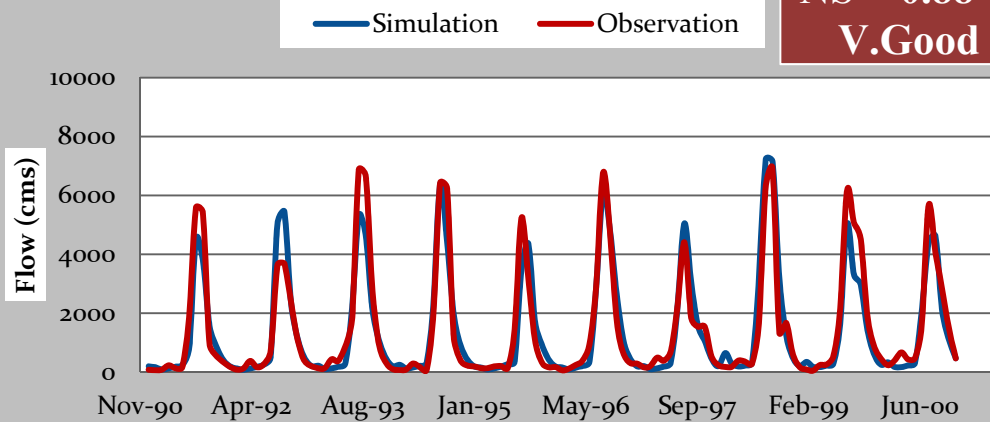
$R^2 = 0.86$
NS = 0.84
V.Good



Validation

Khartoum St.

$R^2 = 0.89$
NS = 0.88
V.Good



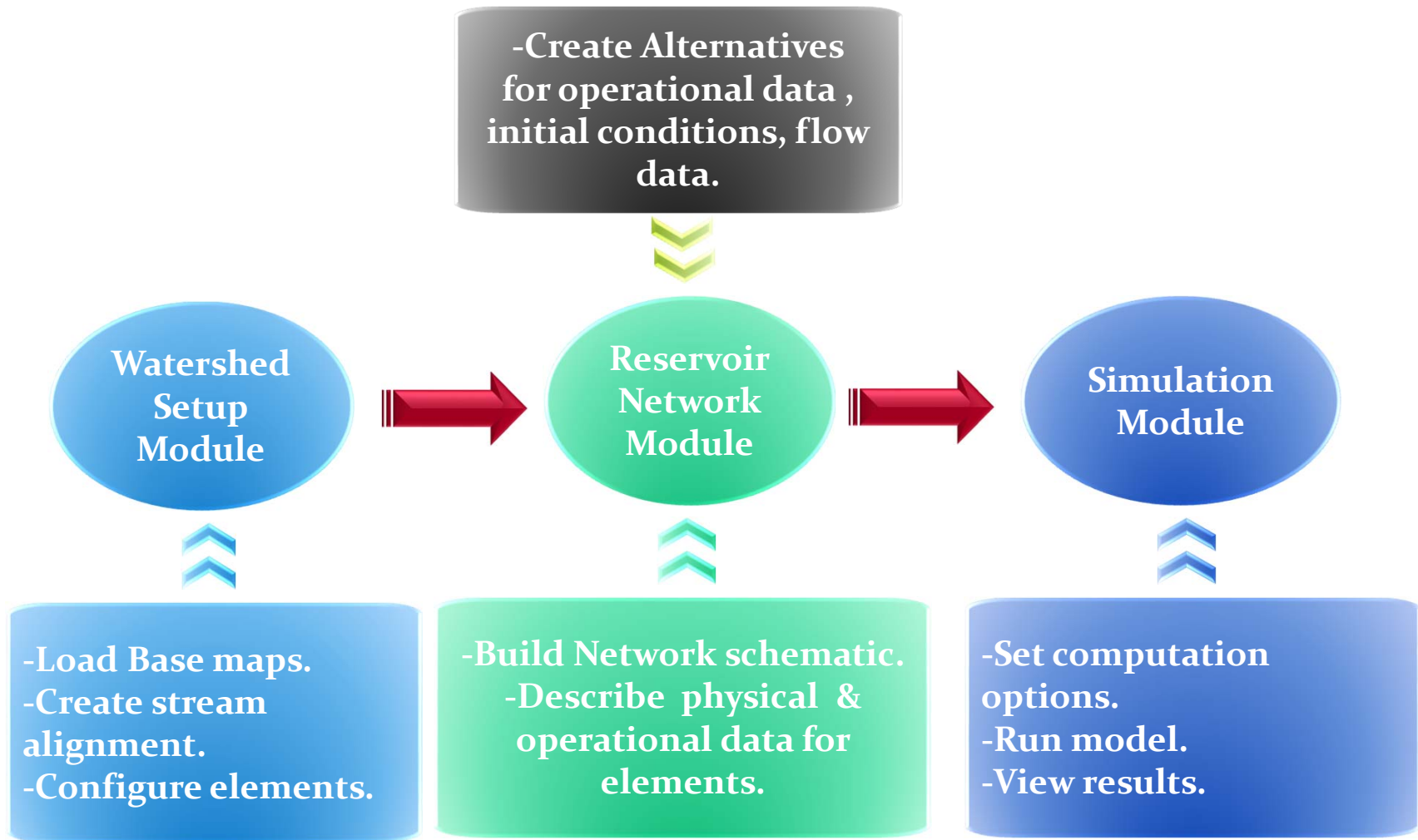
Where,

- NSE : Nash-Sutcliffe Efficiency

Coefficient

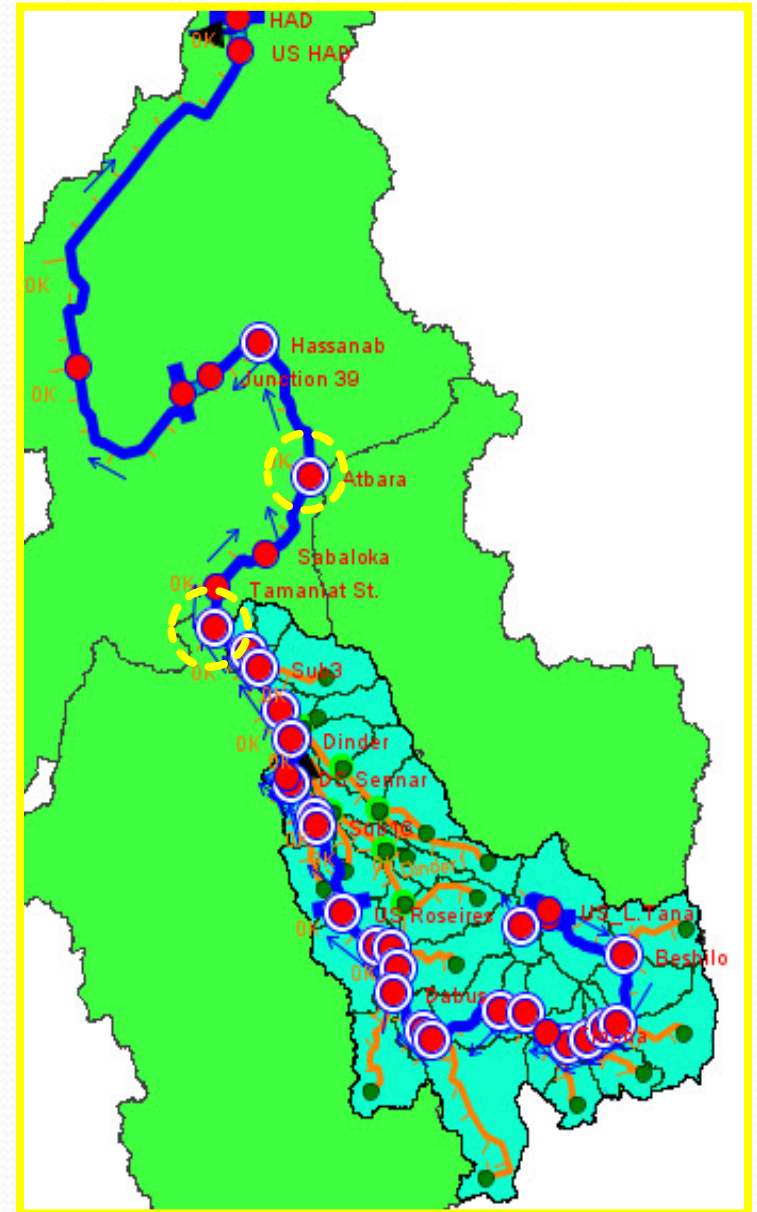
- R^2 : coefficient of determination⁹

Hec-ResSim Model



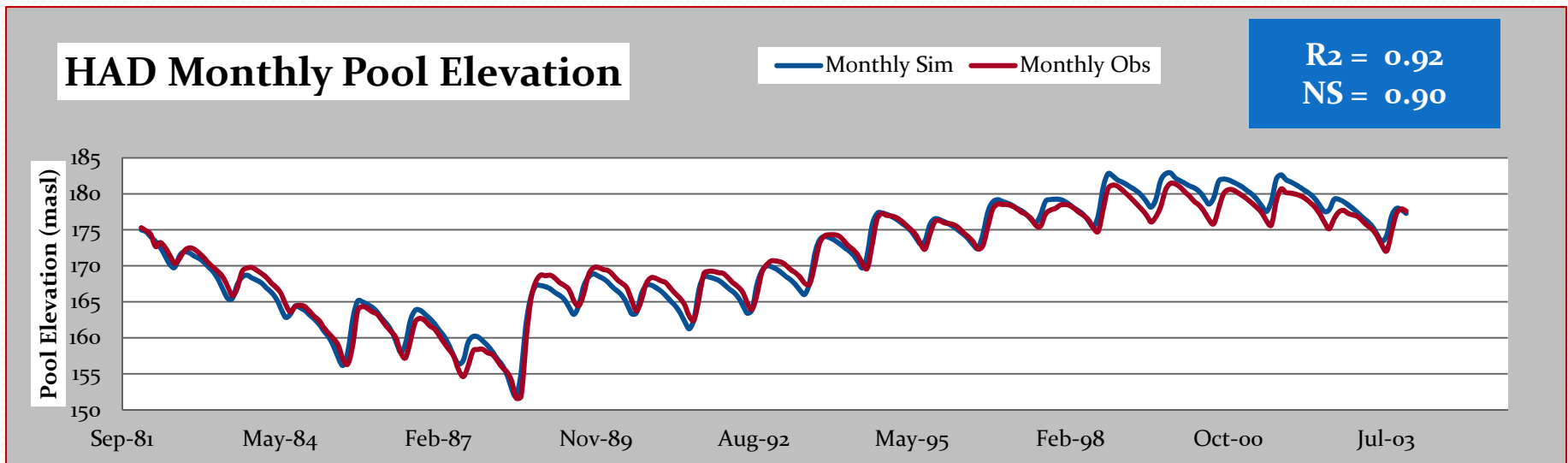
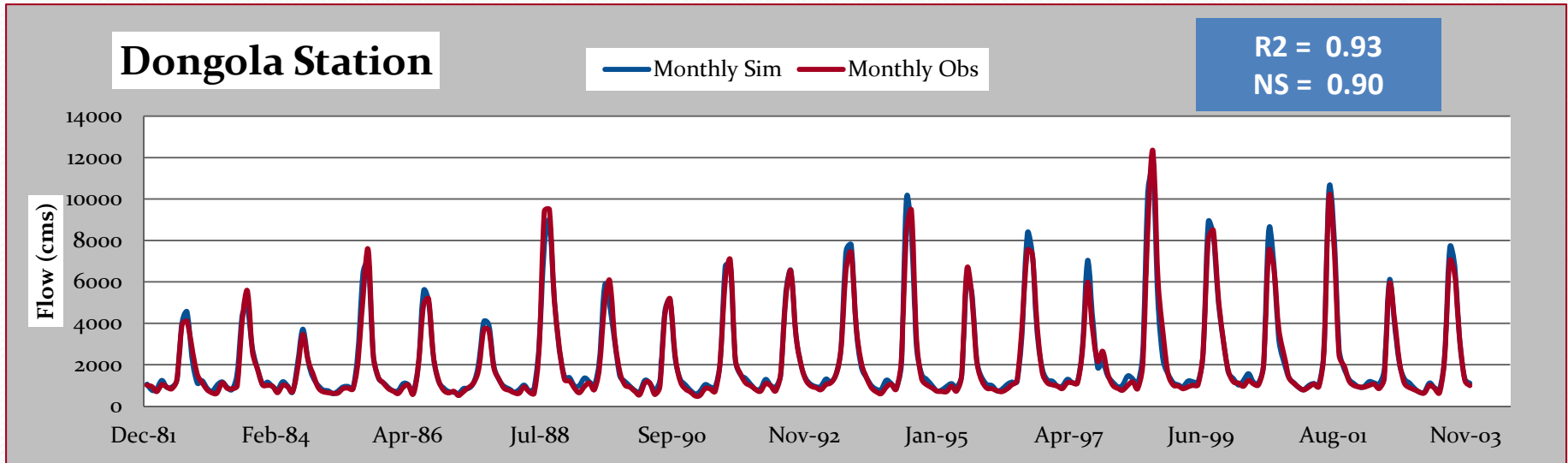
Model Setup

- Model extended to HAD.
- Junction inflows : (Generated SWAT Flows)
- Other basins :
 - White Nile at Khartoum
 - Atbara
- Temporal extend : (1982 - 2003)



Model verification

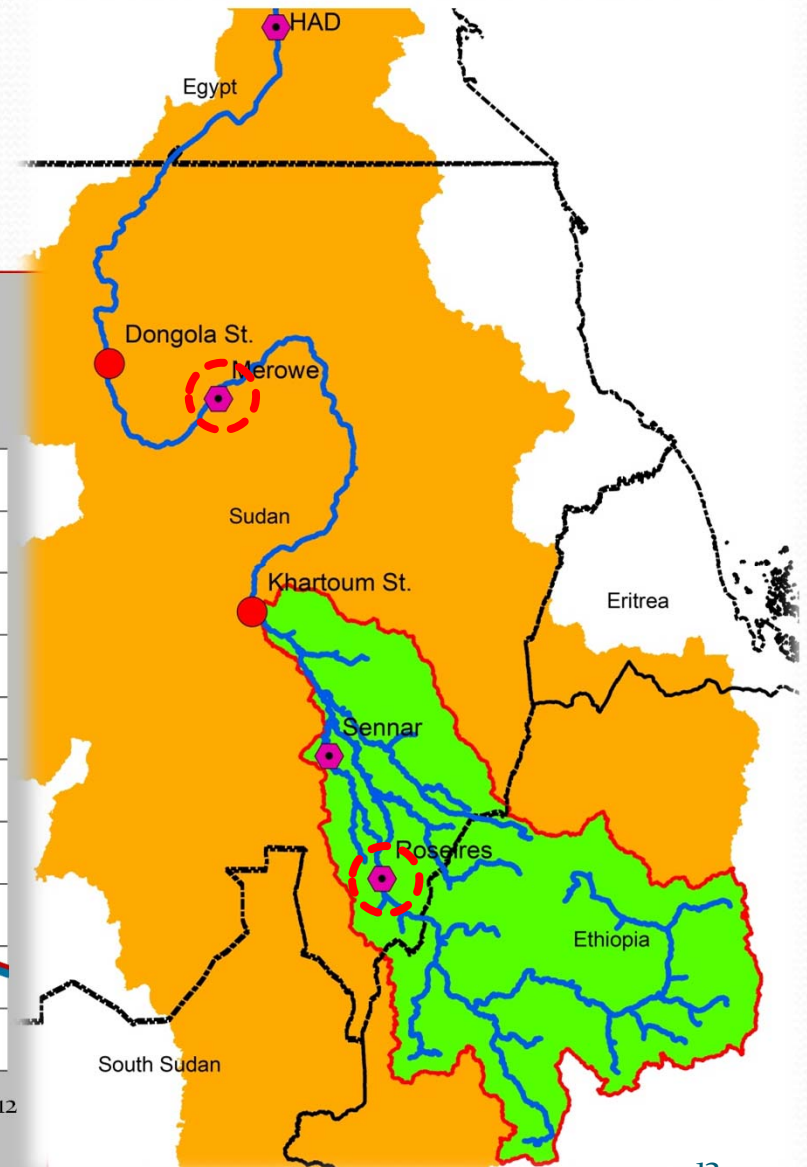
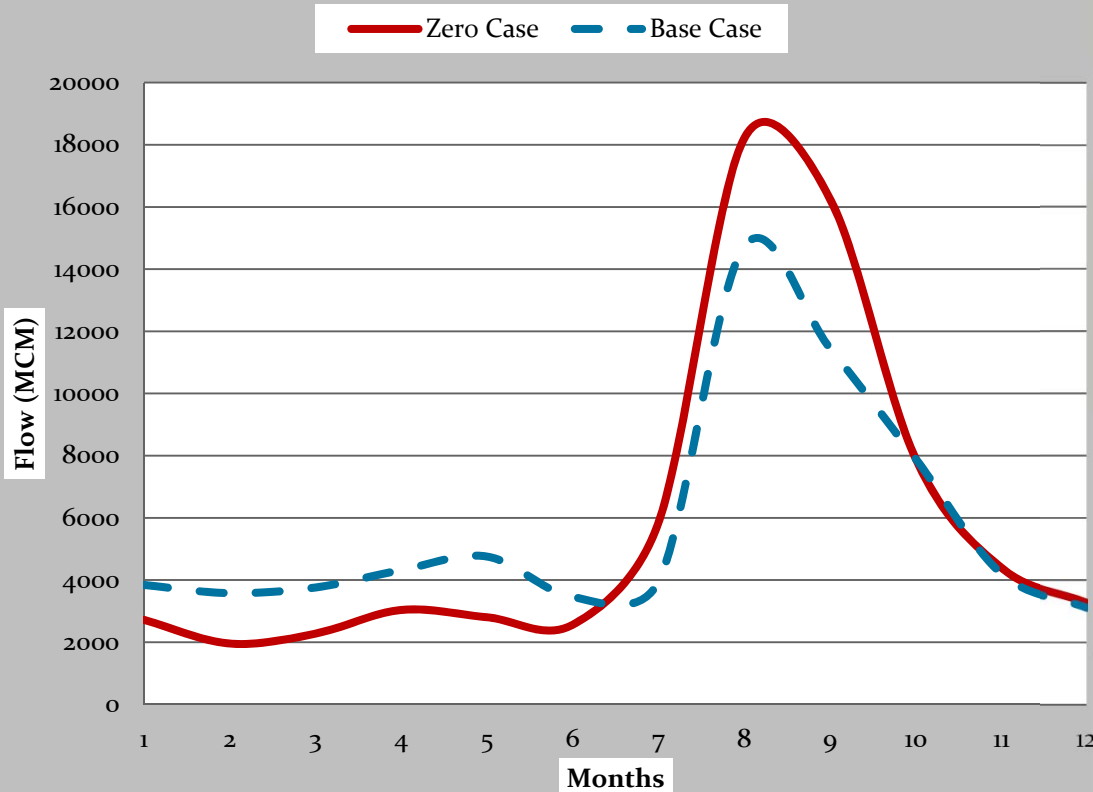
- HAD verification



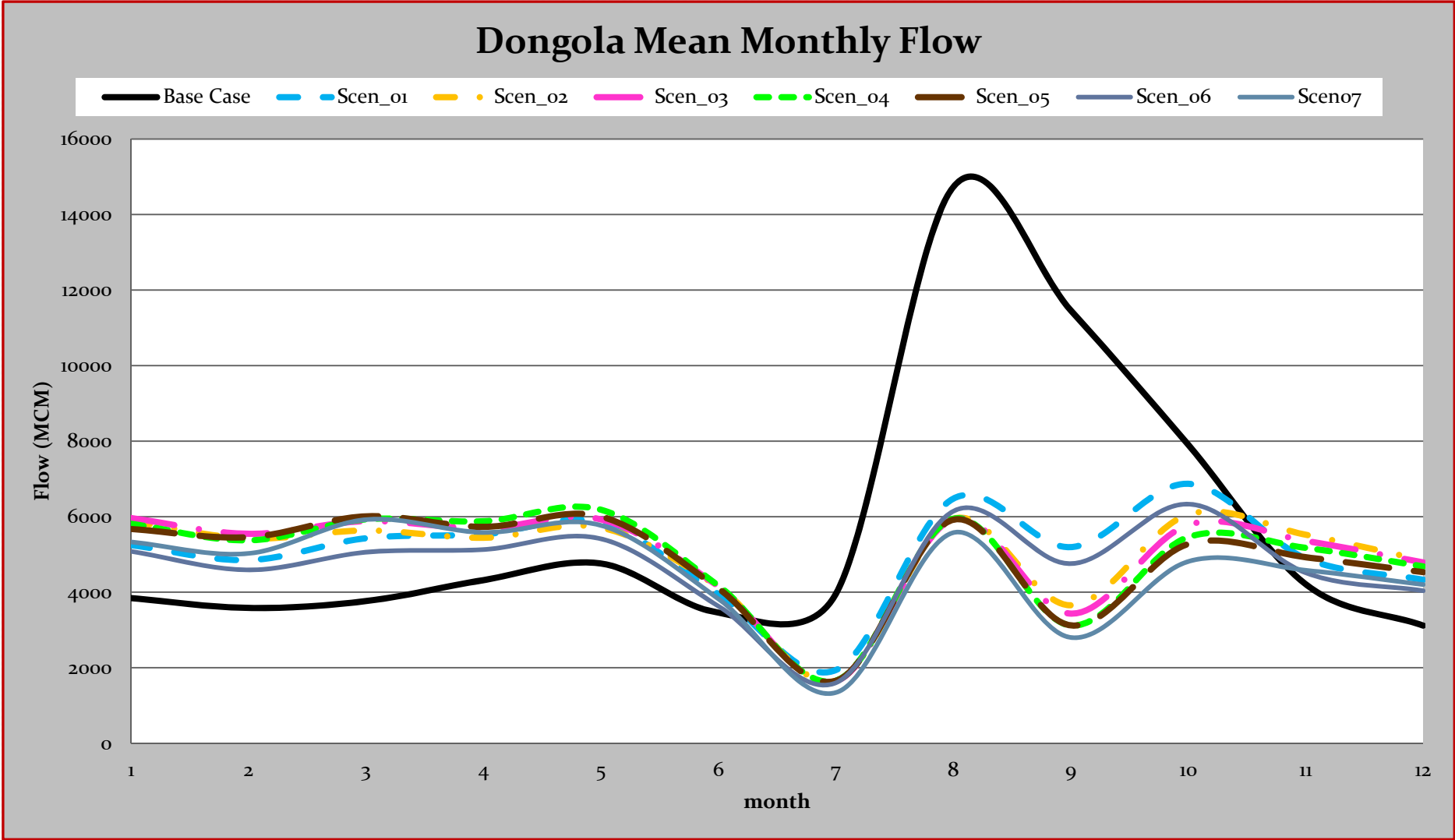
Baseline Simulation

Merowe Dam	Storage (BCM)	Installed Capacity (MW)	Operation Year
	12	1250	2010

Dongola Station_Mean Monthly Flow

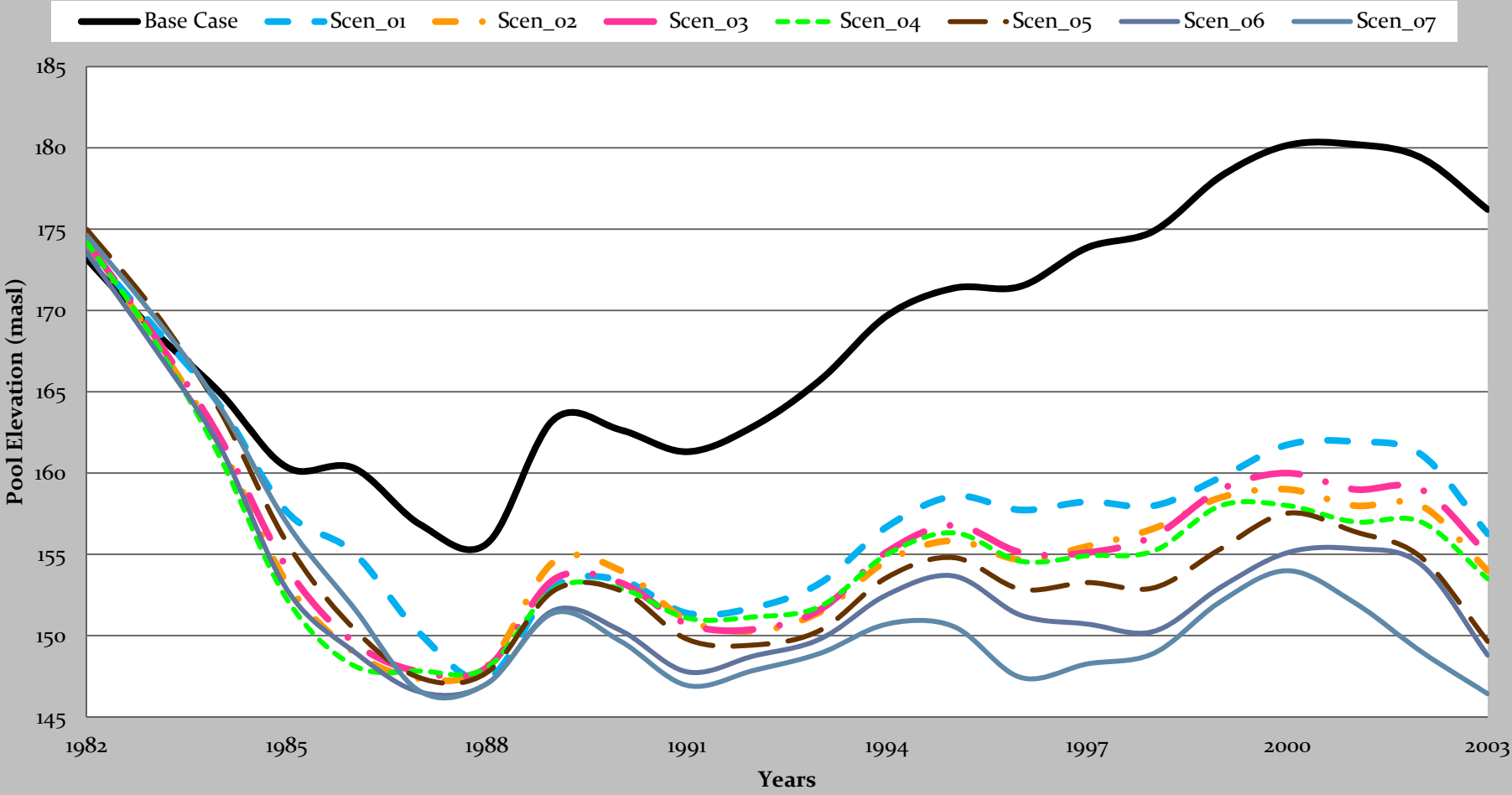


Cont., Scenarios and Results



Cont., Scenarios and Results

HAD Annual Pool Elevation (masl)



Cont., Scenarios and Results

Scen. Type	Scen.	Reductions at HAD					
		Flow (BCM)		Pool Elevation (m)		Power (%)	
		Max	Mean	Max	Mean	Max	Mean
H.P. Scenarios	Scen.01	16.67	8.54	19.95	10.97	23.01	17.37
	Scen.02	21.01	9.19	22.21	12.89	29.51	22.41
	Scen.03	22.58	8.99	21.21	12.60	30.21	22.03
	Scen.04	23.85	9.70	23.21	13.29	30.37	23.27
	Scen.05	30.37	10.69	26.57	13.86	32.24	25.09
(H.P. + Irr.) Scen.	Scen.06	33.06	12.82	27.42	15.45	40.48	30.09
	Scen.07	35.96	14.34	30.38	16.21	55.32	33.29

Conclusion & Recommendations

- A coupled calibrated/validated SWAT–HEC-ResSim model for the BN Basin is developed.
- The impacts of seven water–based development scenarios in the BN Basin on the inflows arriving at Aswan, HAD pool elevation and hydropower are investigated.
- For the Hydropower scenarios, it is shown that in case that the four dams are built on the Blue Nile, Egypt will face an annual average inflow reduction of 10.7 BCM and maximum power reduction of 32 % at HAD .
- For the (H.P. + Irr.) Scenarios, the reductions increase up to 14.3 BCM in flow and 55 % in power at HAD.
- The impacts of climate change scenarios on the water yield from BN and its development scenarios could be investigated using this modeling framework.



Credits and Thanks

- Irrigation and Hydraulics Department - Faculty of Engineering - Cairo University.

THANK YOU