



Can SWAT capture stream flow variability in a semi-arid climate ? An application in Muttama catchment, Australia

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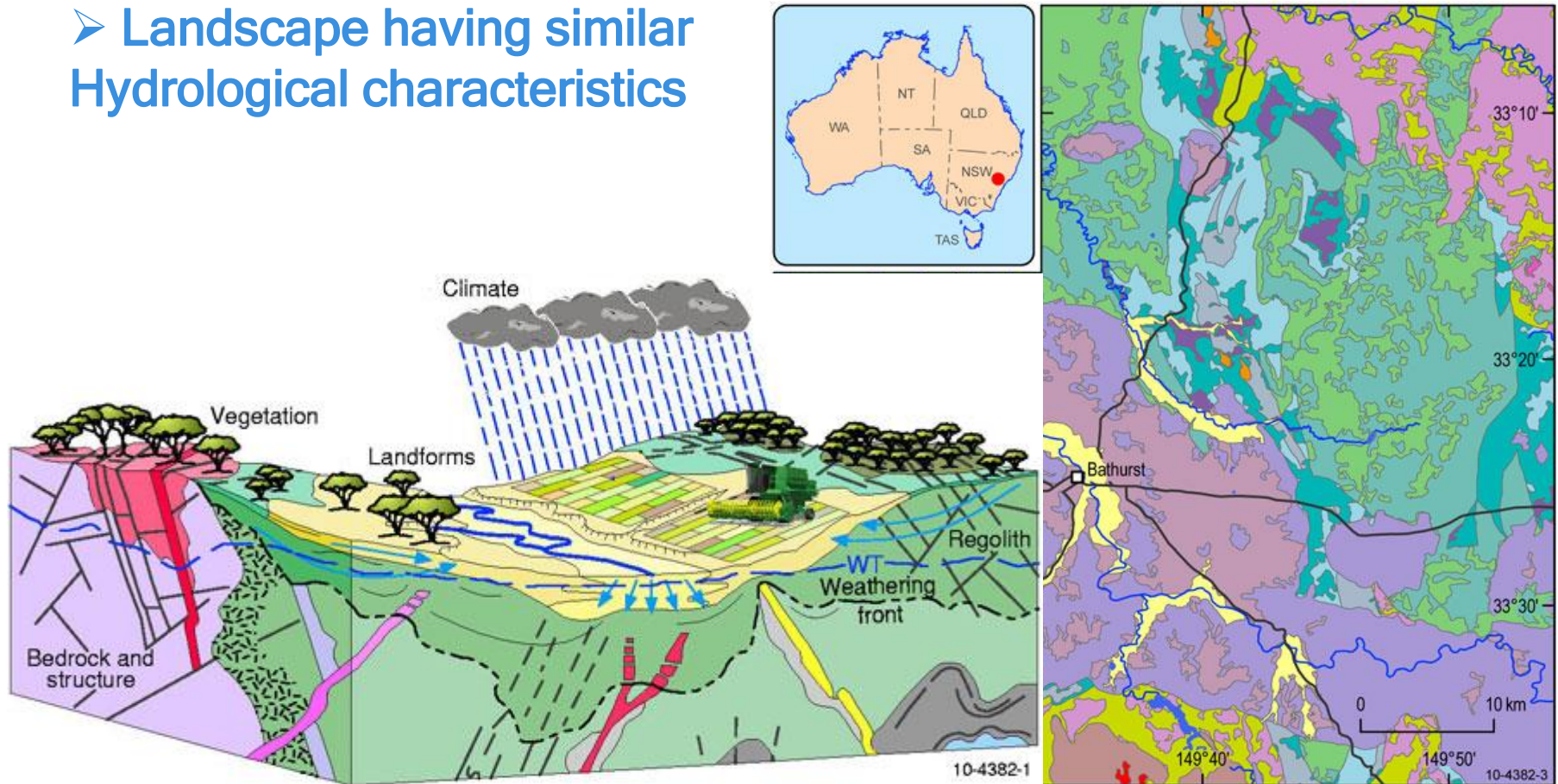
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- Widely used for water management & land use change study
- Few studies in Australia
- Studies are mostly limited to Annual and Monthly scale
- Ability to predicts at HGL level
- Semi distributed approach

- A Frame work for water resource management
- Landscape having similar Hydrological characteristics

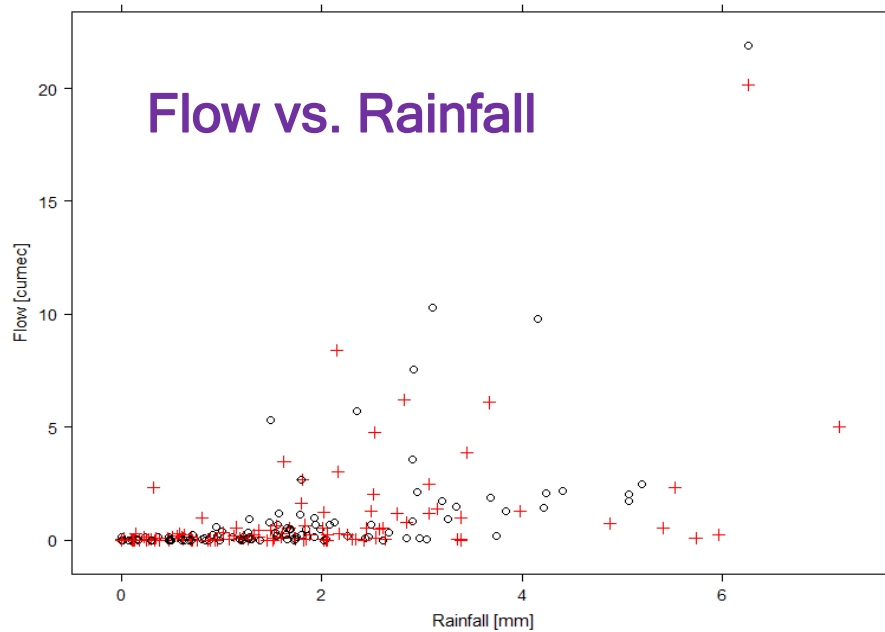
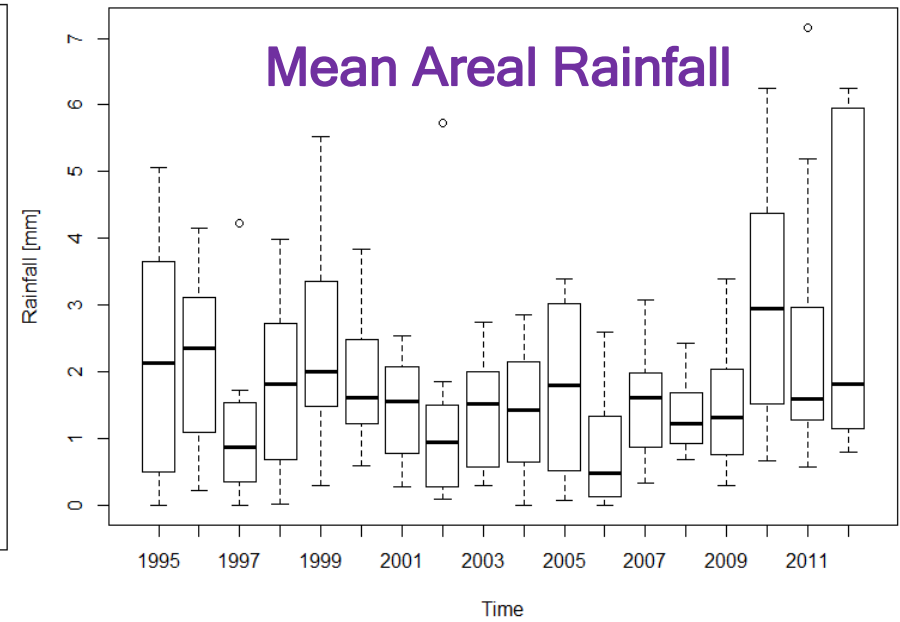
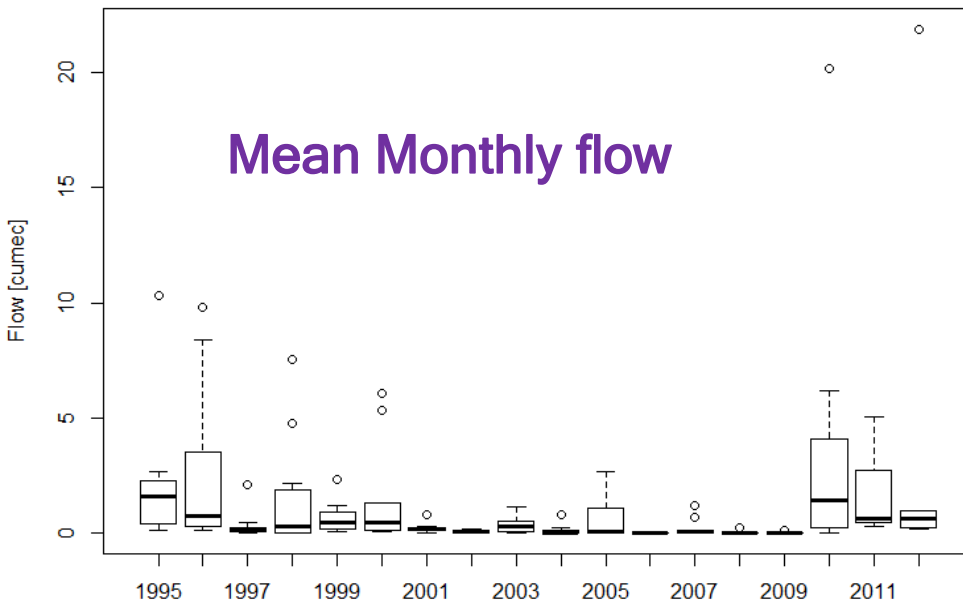


Source: geoscience, Australia

Variability of Australia's climate: It never rains but it pours

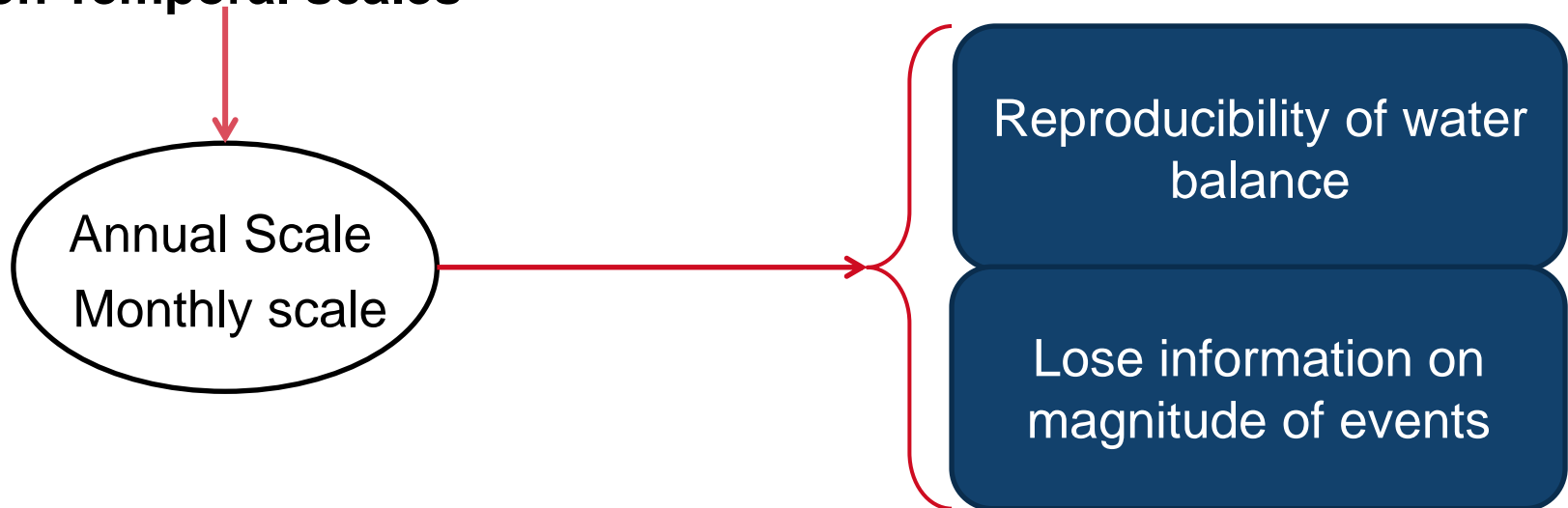
Semi- arid nature in Muttama catchment

- Seasonal flow variability is extreme
- Precipitation below potential ET
- Very low flows or zero flows
- Dry period relatively longer than wet period
- Non- linear rainfall pattern

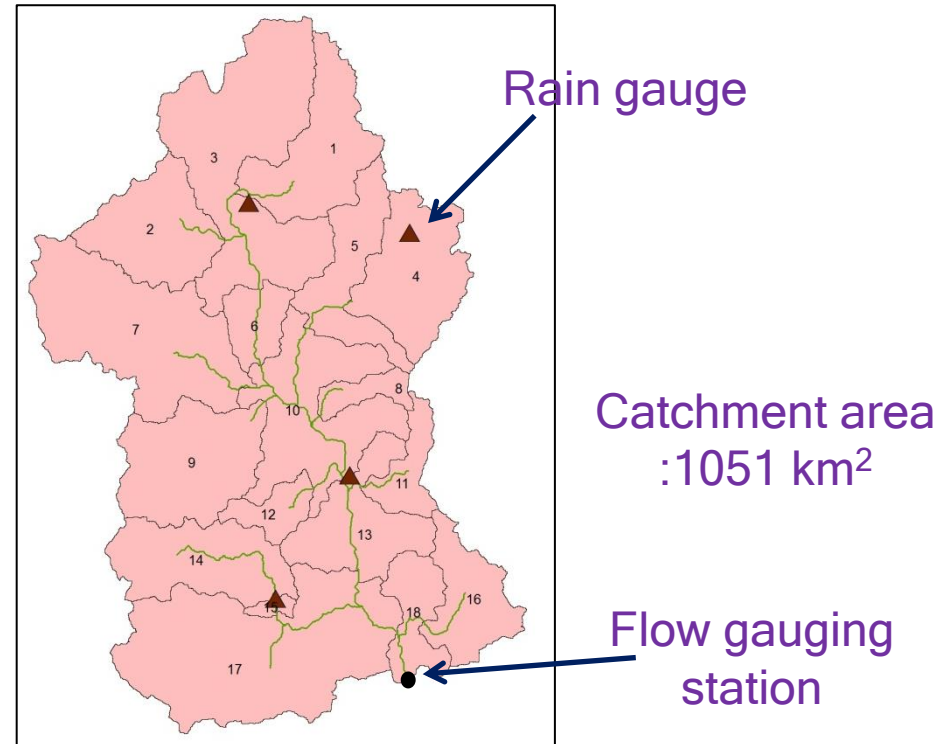
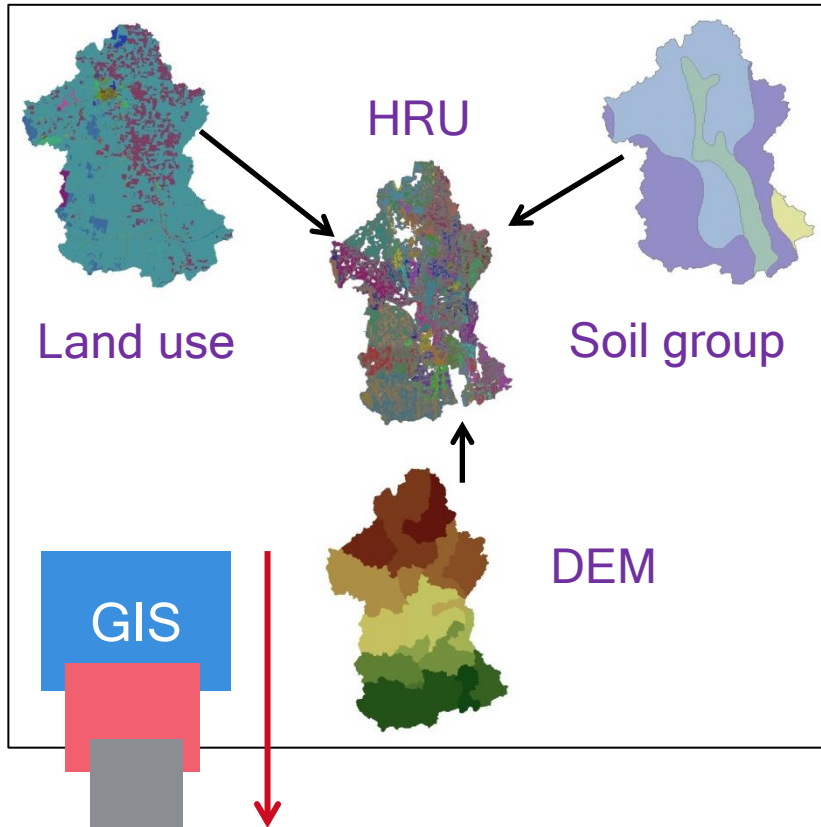


- Average annual Rainfall
600 - 650 mm
- Average Annual aET
400 - 600 mm

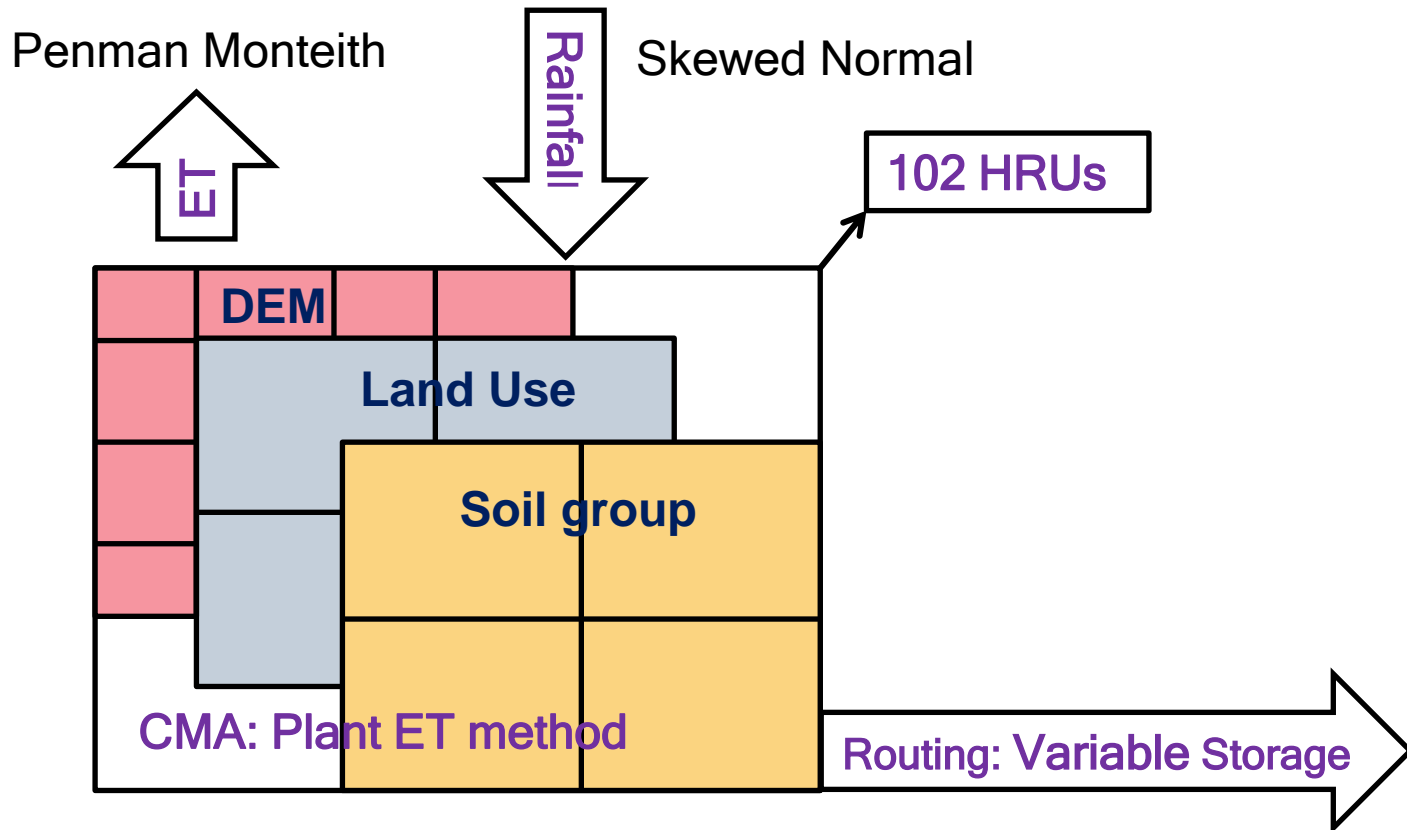
SWAT Modeling on Temporal scales



- Simulate seasonal high and low flow (daily scale)
- Evaluate performance criteria (estimating daily flows)

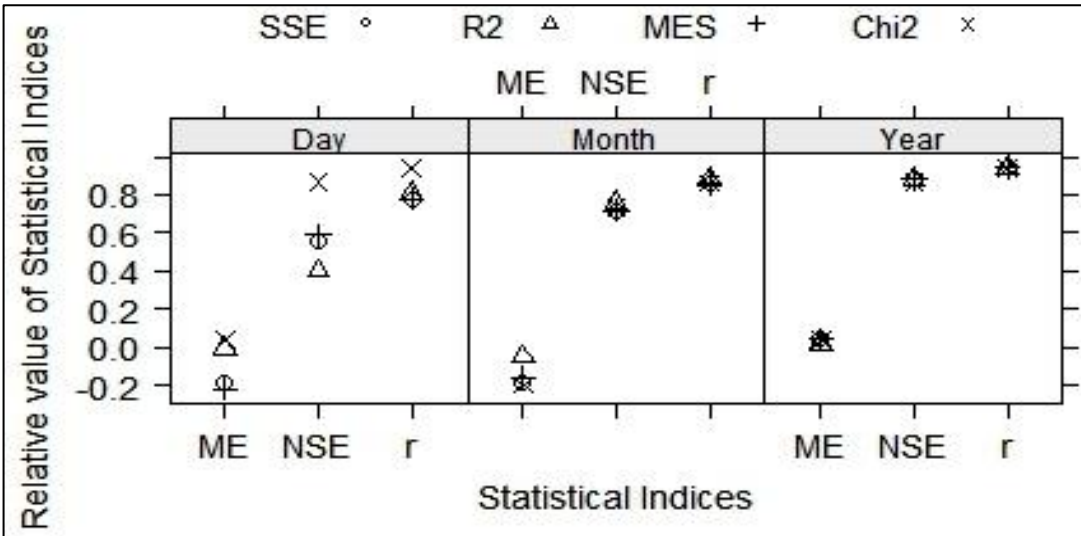


- 18 yrs. of Rainfall and Flow data
- Dominant land use: Dry land cropping



Warm up	Calibration	Validation	Optimization Method
1 yr.	10 yrs.	7 yrs.	SUFI-2

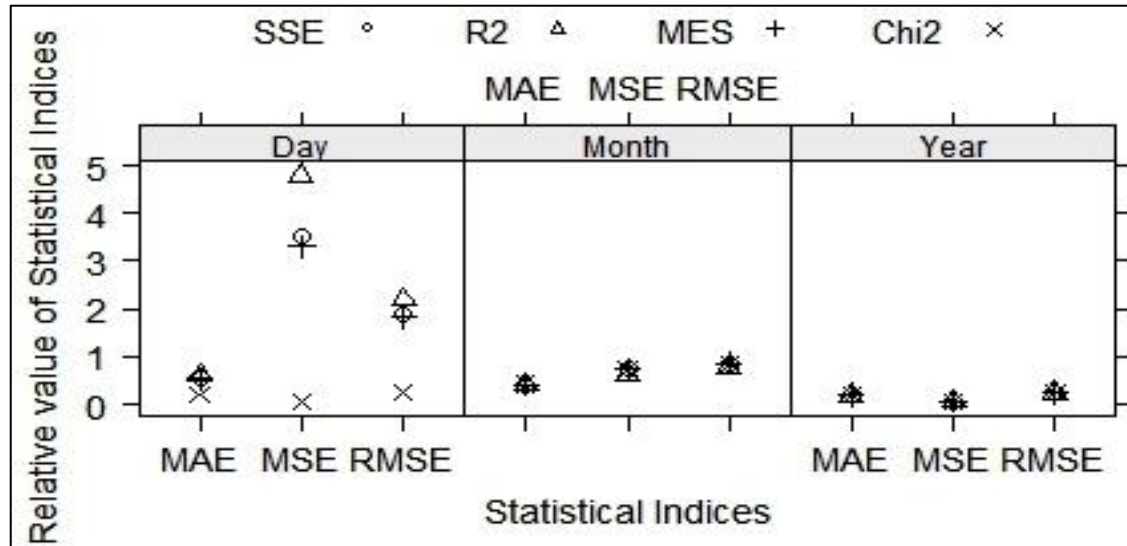
Model Result analysis (Objective Function)



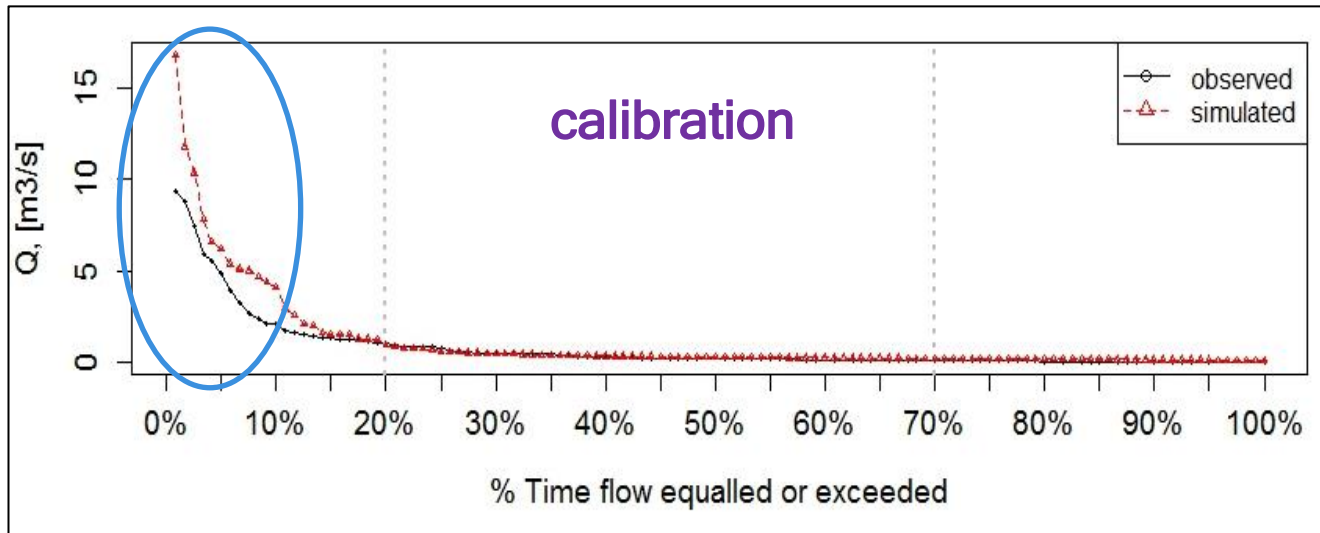
SSE: Sum of Squared Error
MSE: Multiplicative form of squared Error

R²: Coefficient of determination

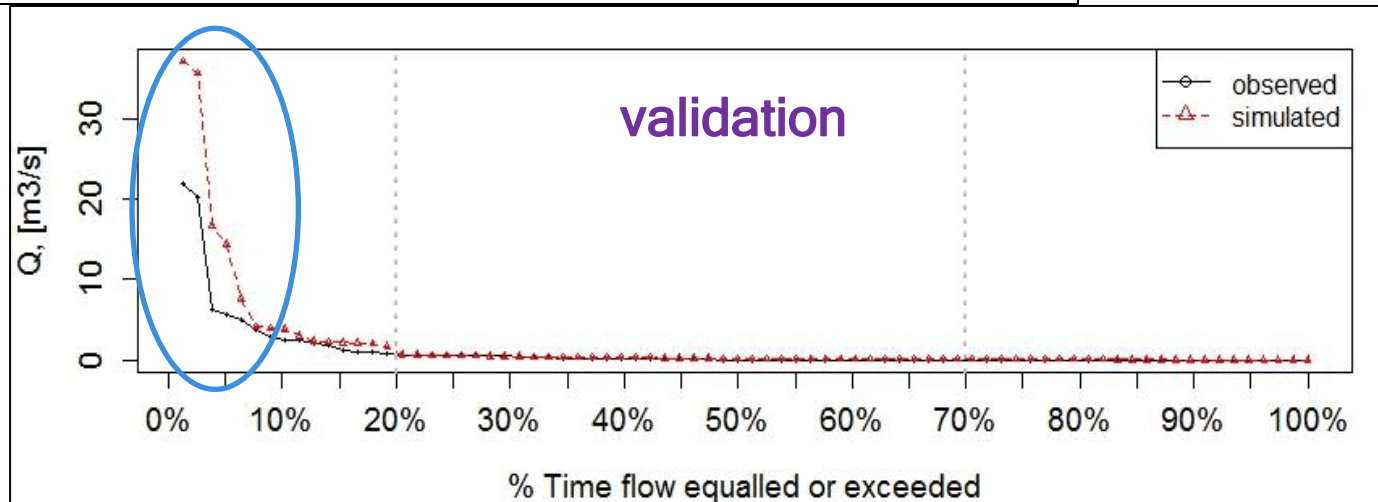
Chi² : Chi Squared

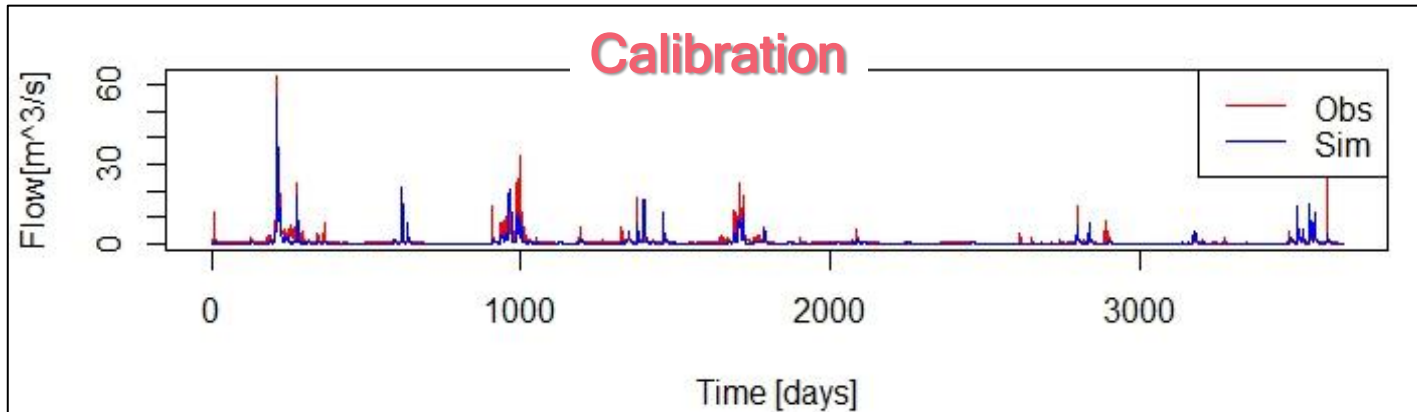


Objective function: bR2



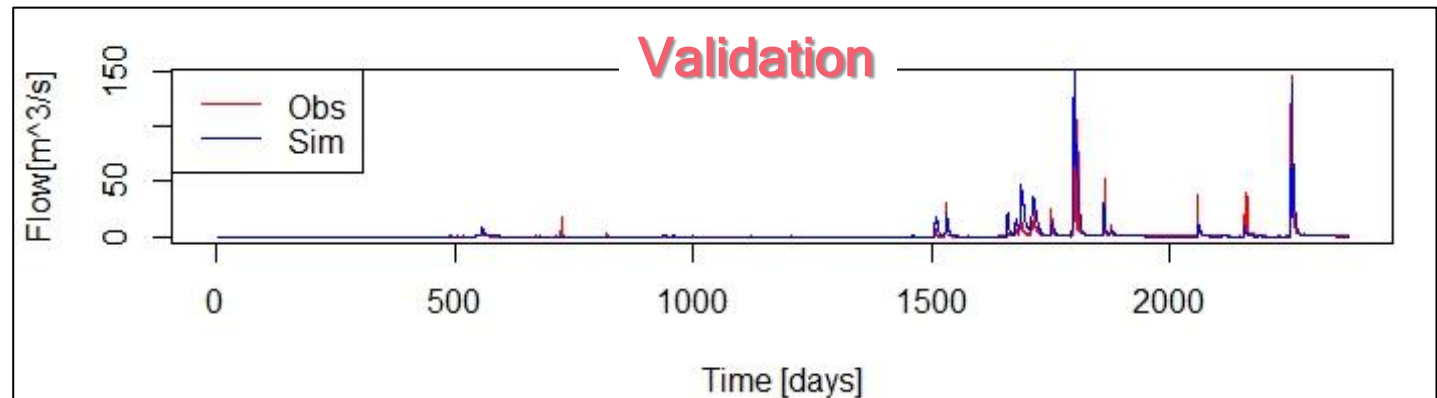
Monthly
FDC





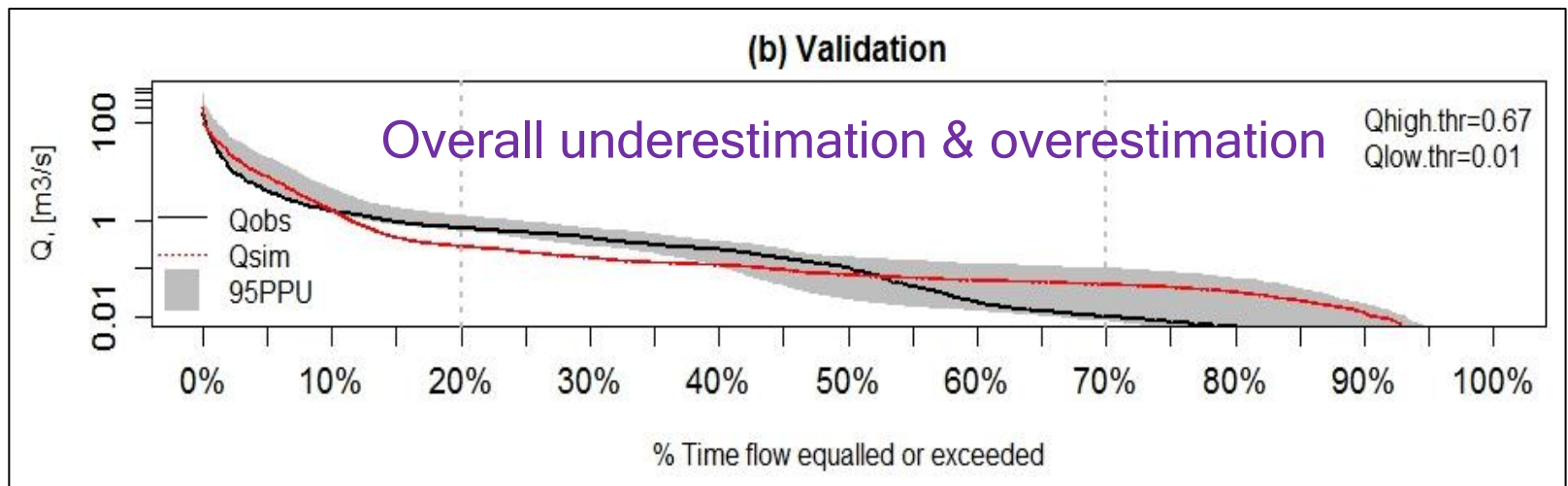
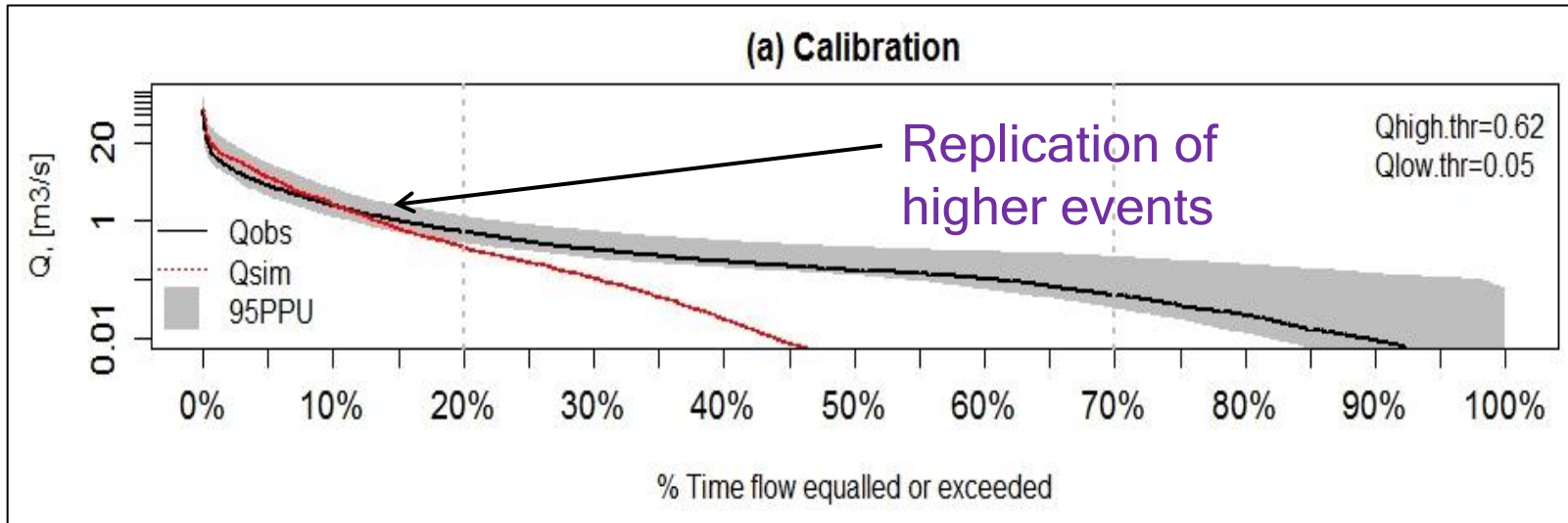
NSE : 0.61

NSE : 0.37



Indication of Catchment behavior:

- Response to rainfall highly non-linear
- Data is non-stationary

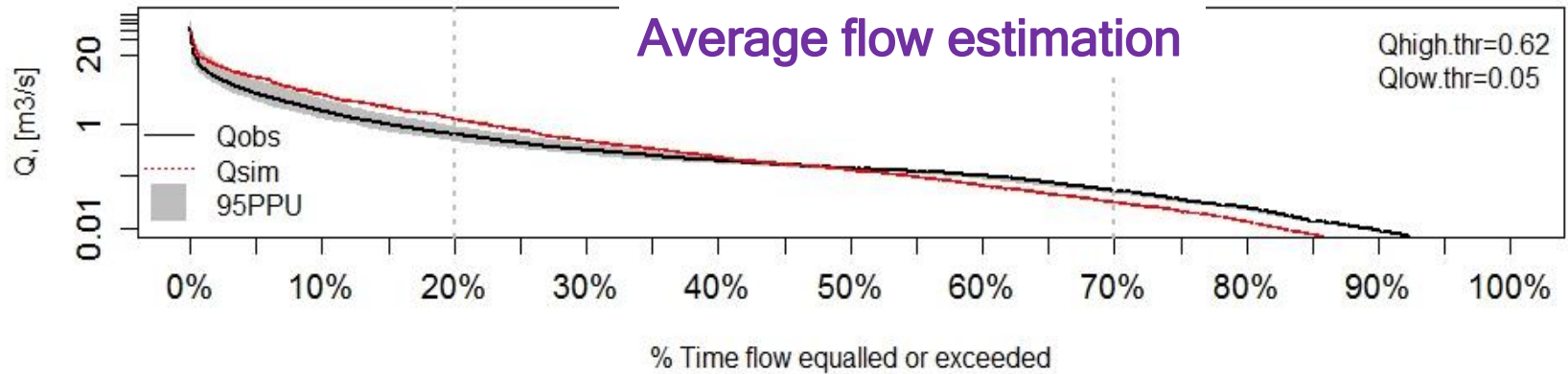


- Capture majority of observation with 95% uncertainty band
 - P-factor
(% of measured data bracketed by 95 % PPU calculated within simulated values)
 - R-factor
(average thickness of confidence band divided standard deviation of observation)

Calibration	Validation
P-factor: 0.67	P-factor: 0.49
R-factor: 0.23	R-factor: 0.15

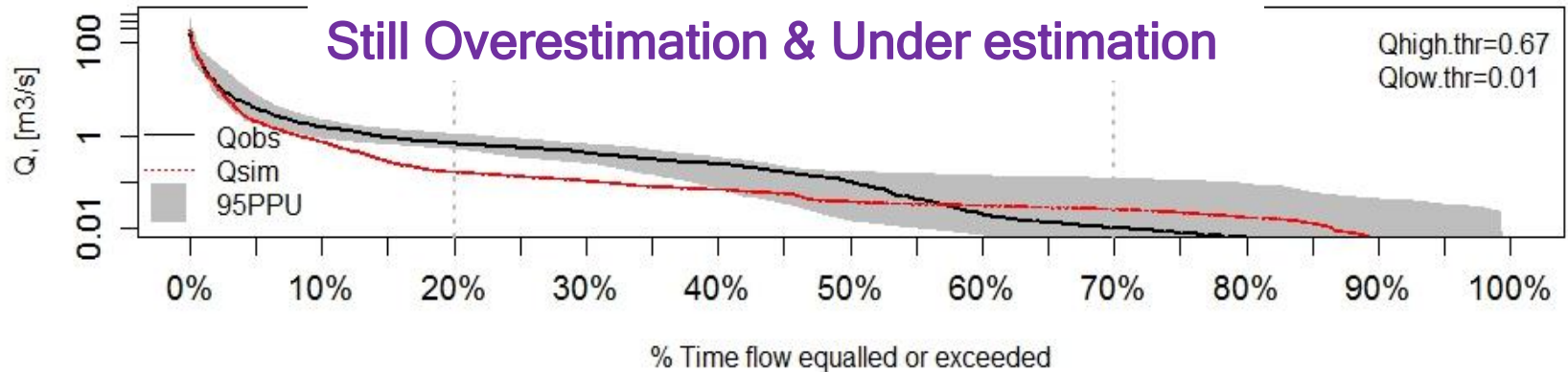
(a) Calibration

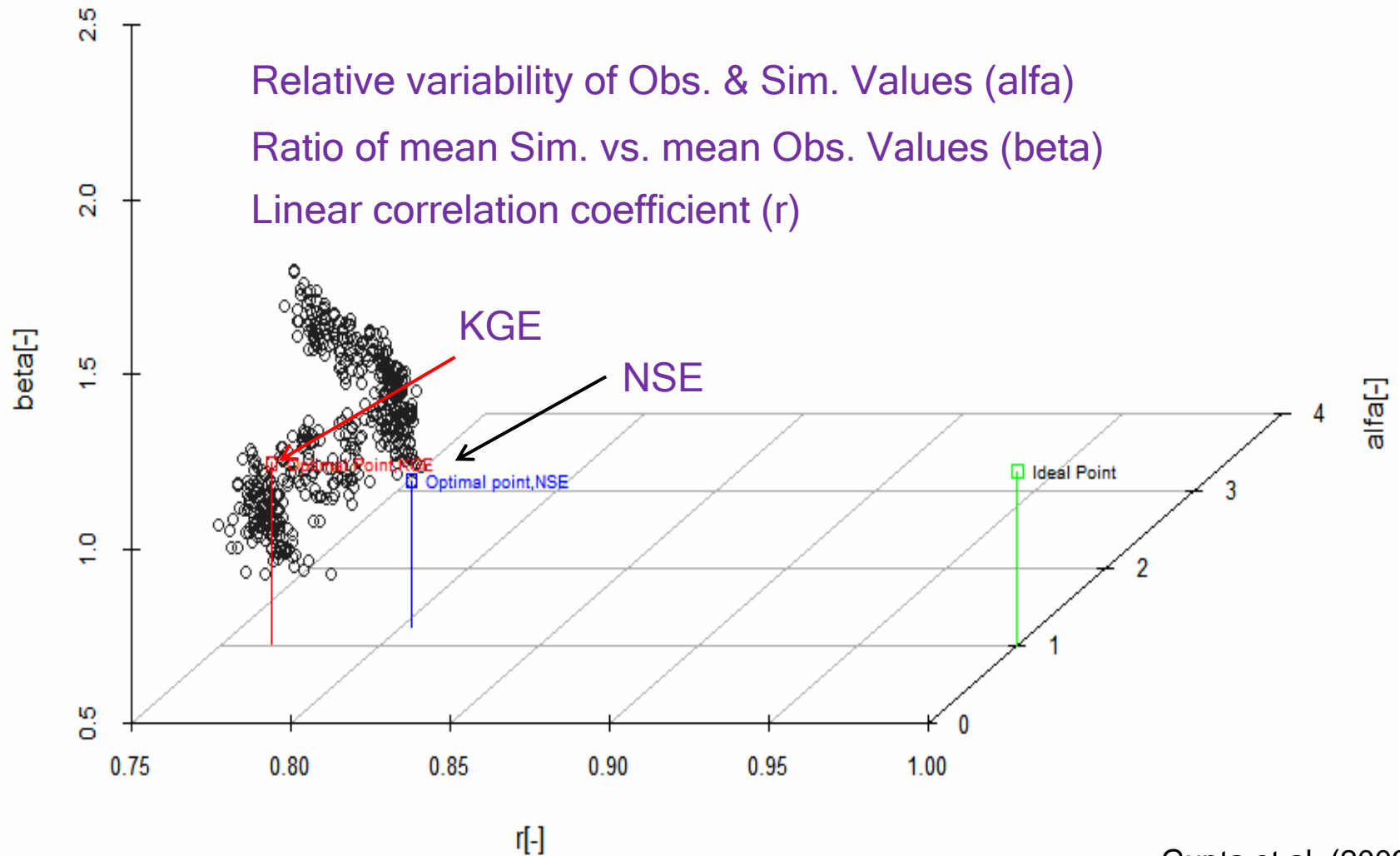
Average flow estimation



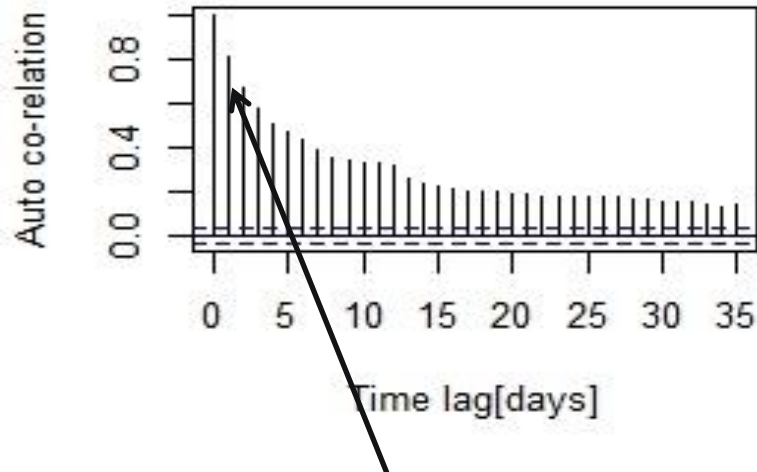
(b) Validation

Still Overestimation & Under estimation



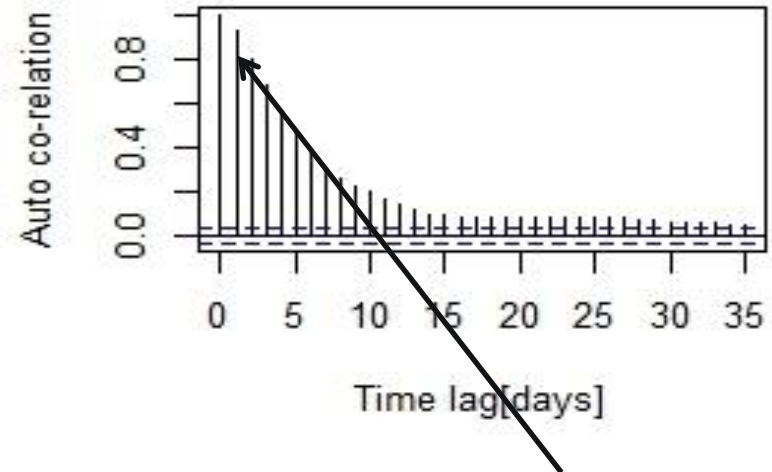


Observed Flows



Reality (less correlation)

Simulated Flows



More correlation

Underestimation could be:

- model structure incorporating lateral & ground water flow
- Routing of flow into channel
- Parameters controlling the slow flow behavior of the model

Model struggles with extreme flow (in semi-arid climate) estimation

Several reasons :

- Effect of the Objective function
- Calibration of the model (lot of parameters)
- Model structure describing the catchment process
(result is an “averaging error” rather better fit)