

ECWS-7
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Chaired by Prof. Dr. Athanasios Loukas



A monthly water balance model for assessing streamflow uncertainty in hydrologic studies

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OUTLINE



The UTHBAL model

HydroPSO algorithm

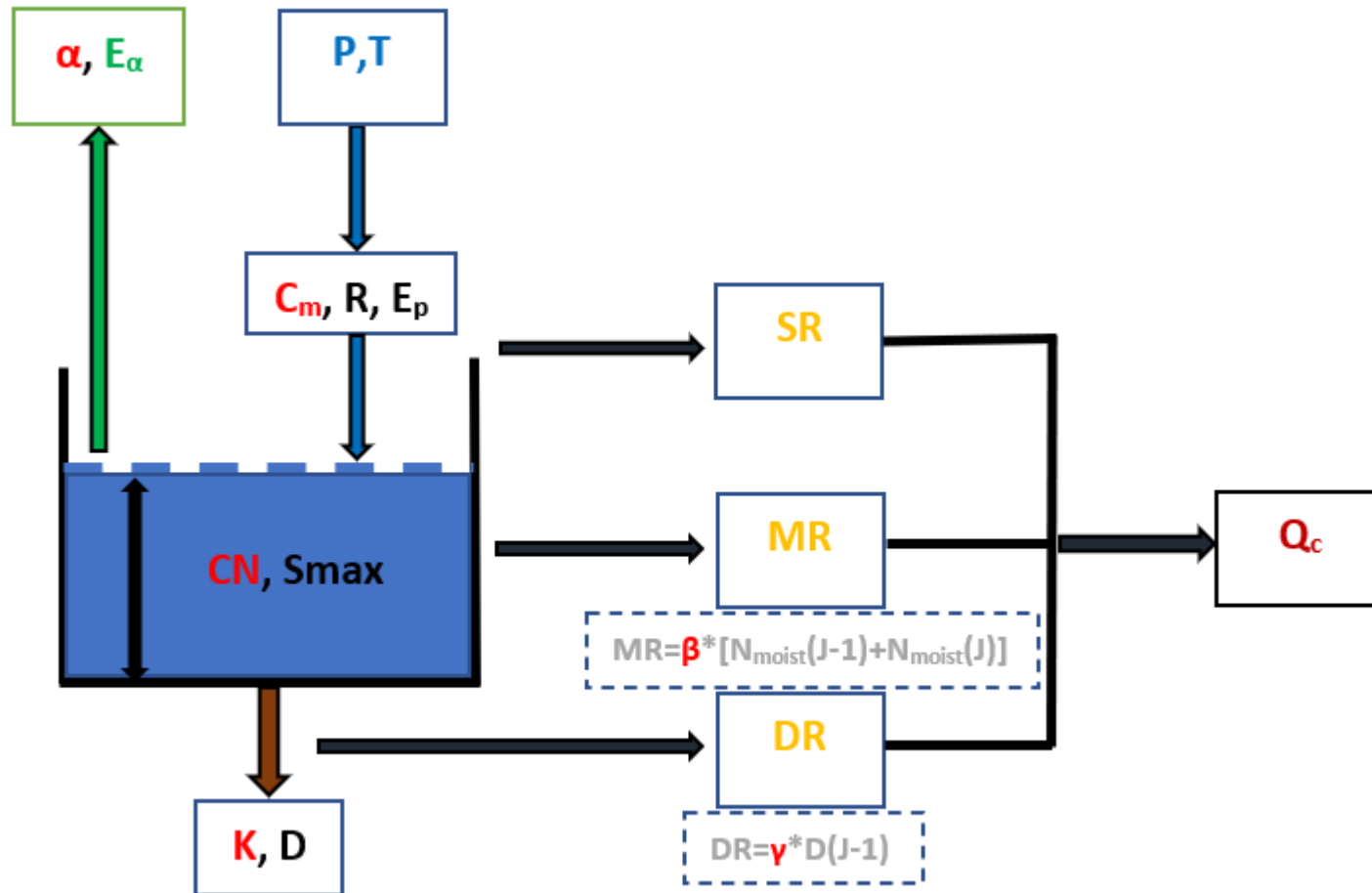
The R-UTHBAL model

Portaikos river watershed

Application and Results

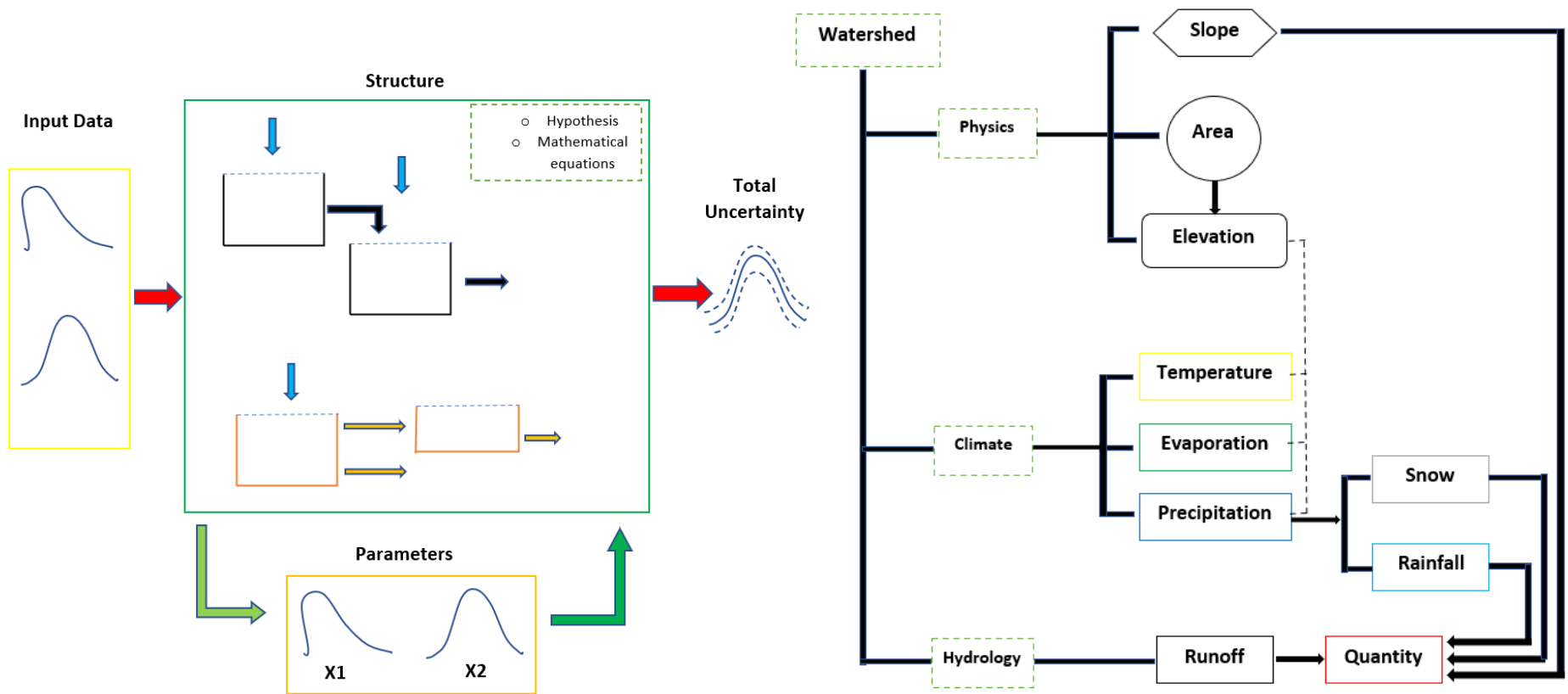
UTHBAL MODEL

Flow Diagram



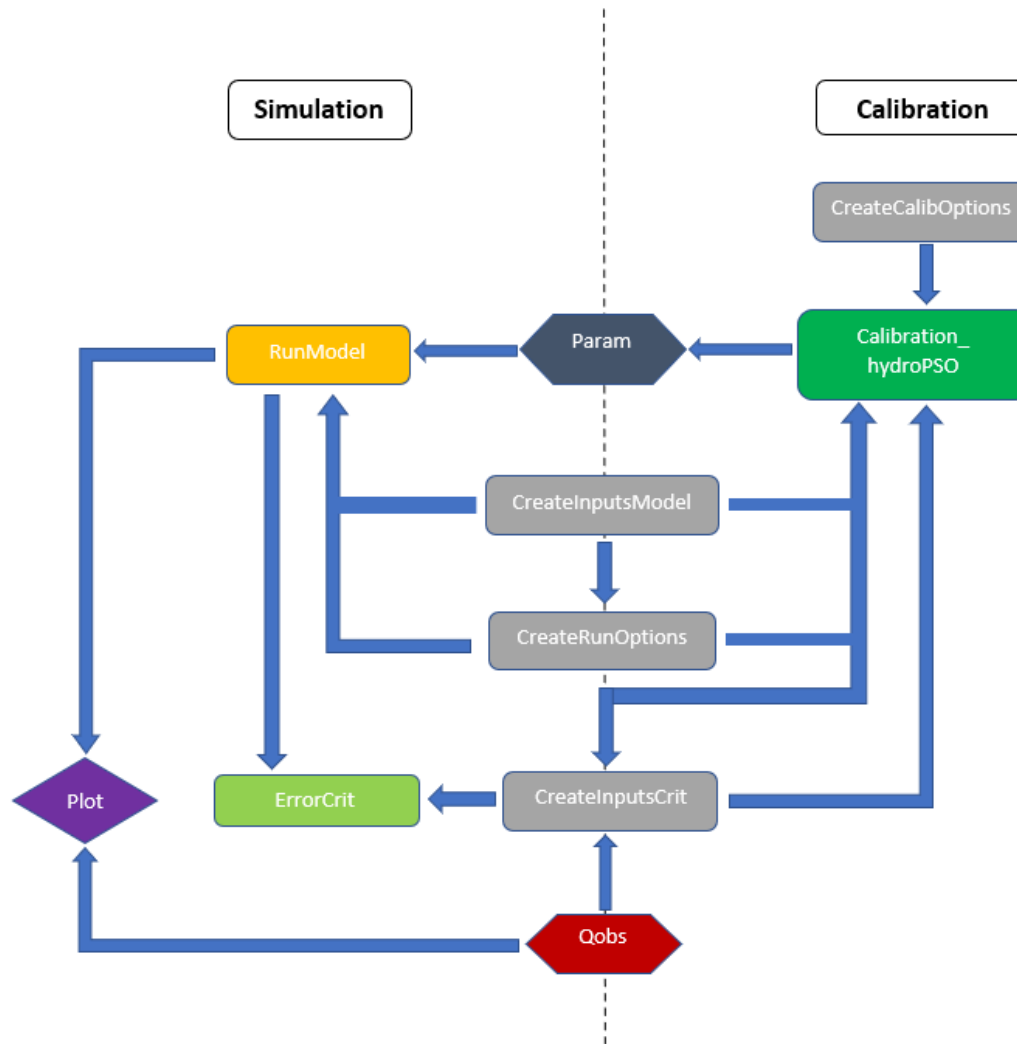
UTHBAL MODEL

Redesign of model structure



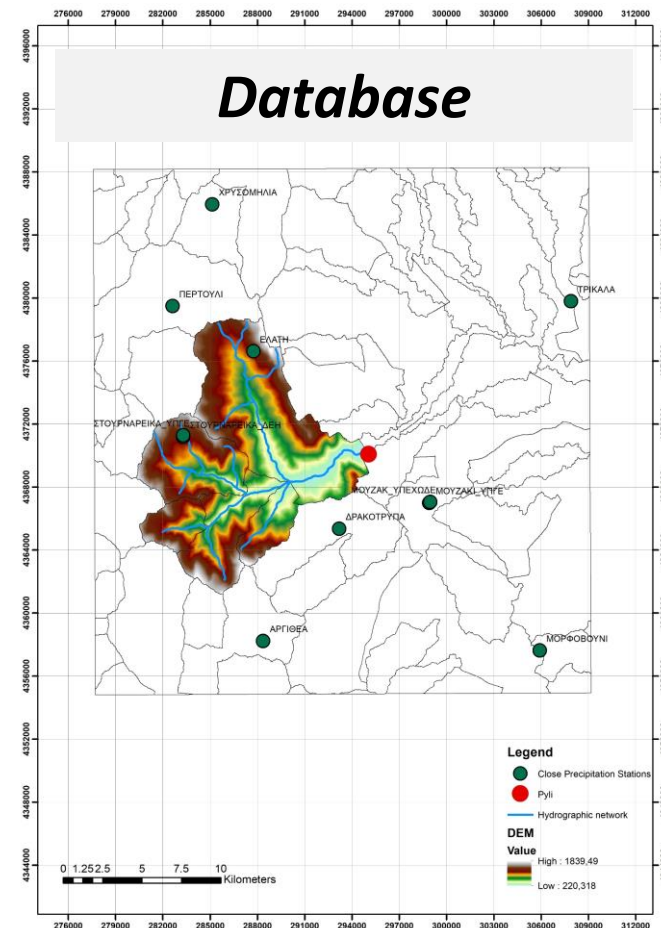
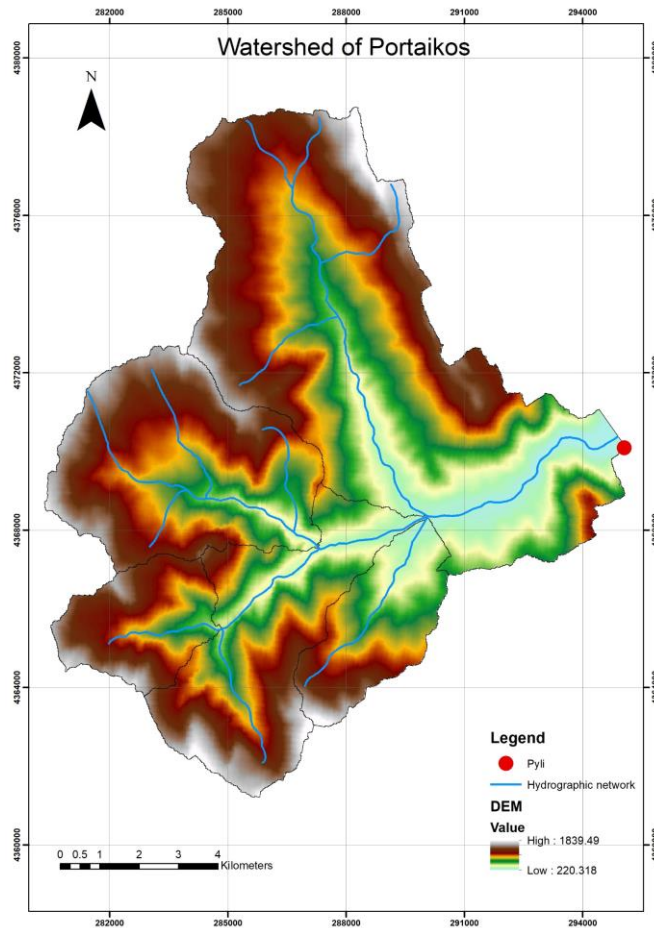
The R-UTHBAL MODEL

The R workflow environment with hydroPSO algorithm



APPLICATION OF THE METHODOLOGY

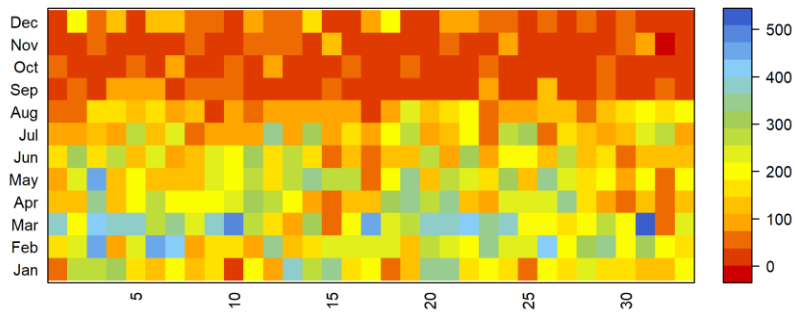
Portaikos river watershed, Thessaly, Greece



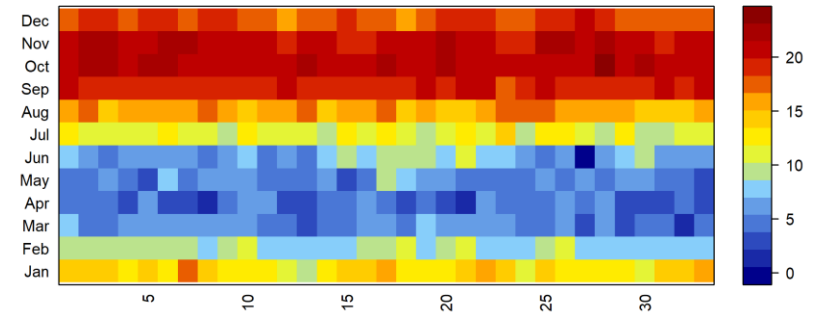
INPUT DATASETS

Hydrologic Period: Oct 1960 - Sep 1993

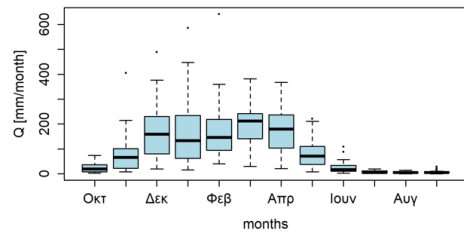
Monthly precipitation at Pili Basin, [mm/month]



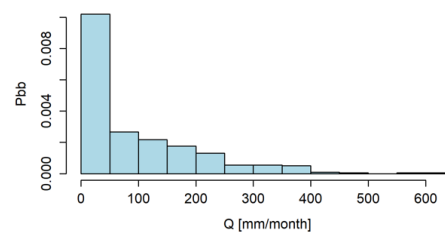
Monthly Temperature at Pili Basin, [°C/month]



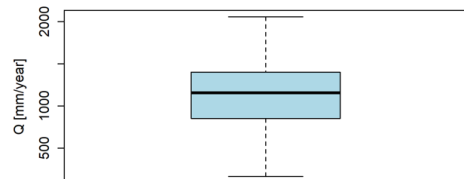
Monthly Boxplot at Pili Basin



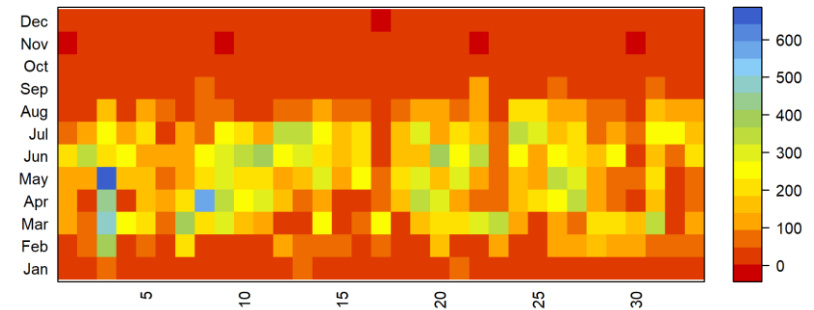
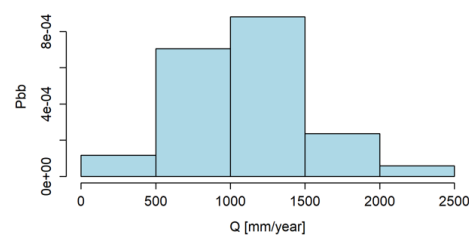
Monthly Histogram at Pili Basin



Annual Boxplot at Pili Basin



Annual Histogram at Pili Basin





R-UTHBAL MODEL

Sensitivity Analysis Results

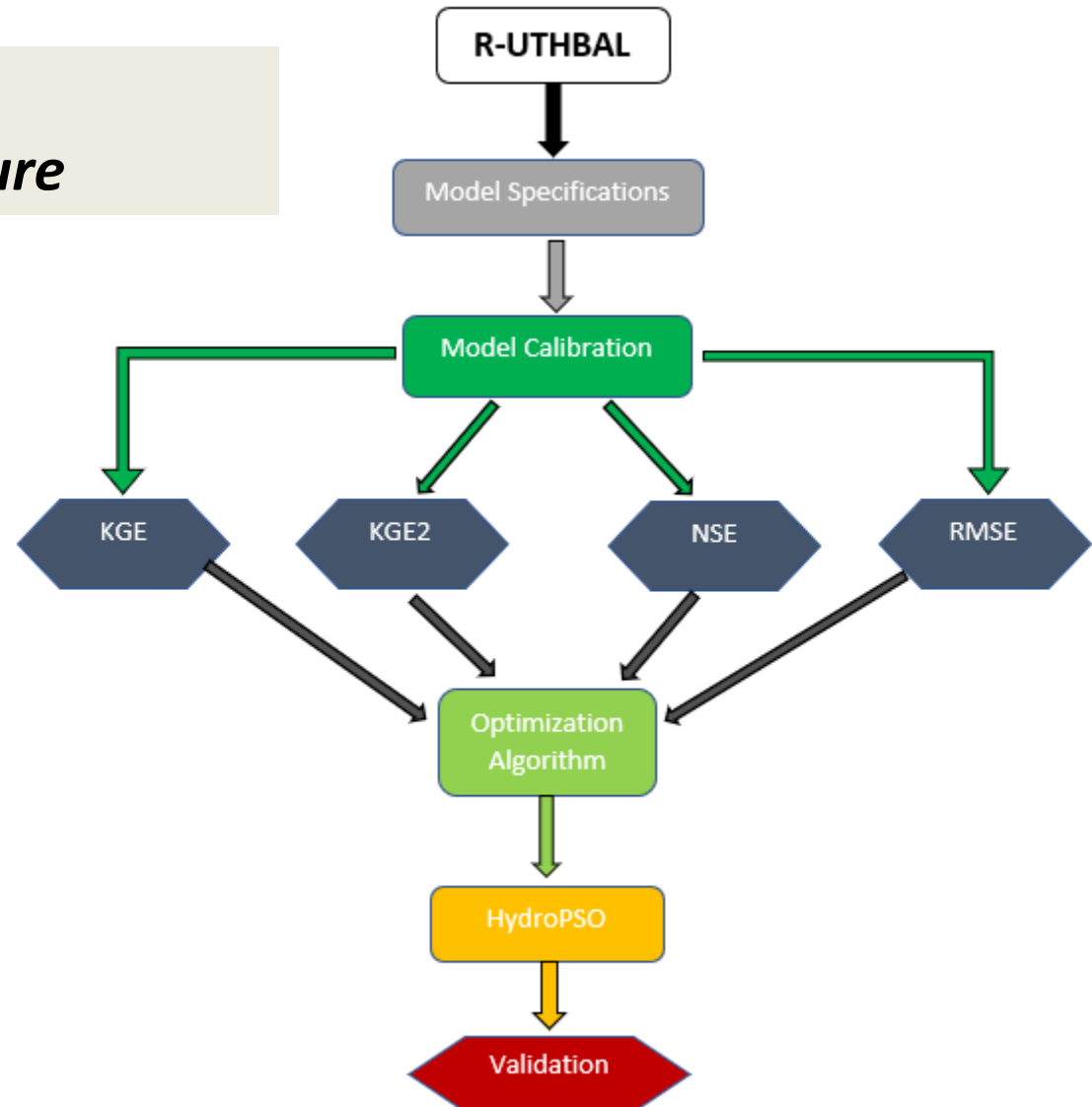
Model parameter range values, sensitivity analysis results and optimised model parameters using the R-UTHBAL model and hydroPSO algorithm

Parameter	Min Value	Max Value	Ranking Number	Normalised Relative Importance (%)	Optimised Value 1960-1977	Optimised Value 1977-1993
C_m	0	12	6	09.96	80.244	166.2
CN	30	100	5	14.47	60.300	172.9
K	0	1	4	17.16	24.810	177.3
$\alpha = \alpha AET$	0	1	3	18.70	93.055	200.0
$\beta = CONMR$	0	1	2	19.66	7.979	125.9
$\gamma = CONGROUND$	0	1	1	20.02	192.678	232.9

R-UTHBAL MODEL APPLICATION

Water Balance Modelling Procedure

Objective Functions



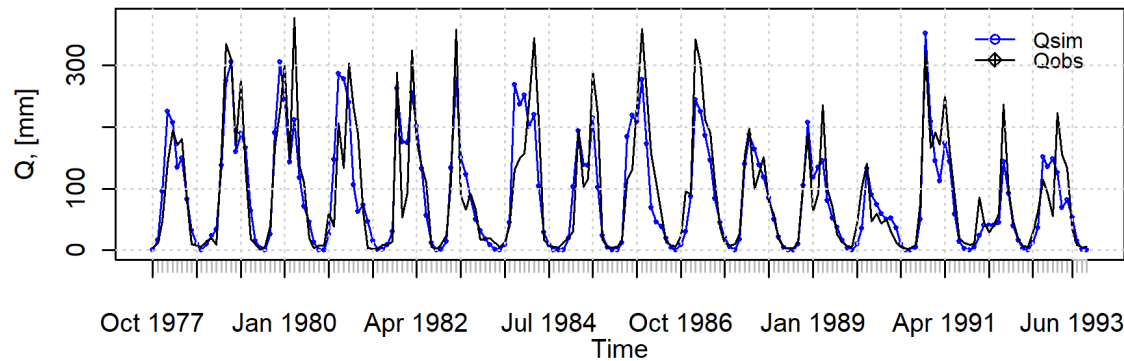
R-UTHBAL MODEL RESULTS

Validation Results:

Monthly and annual graphs using several performance indices for validation period Oct 1977 – Sep 1993

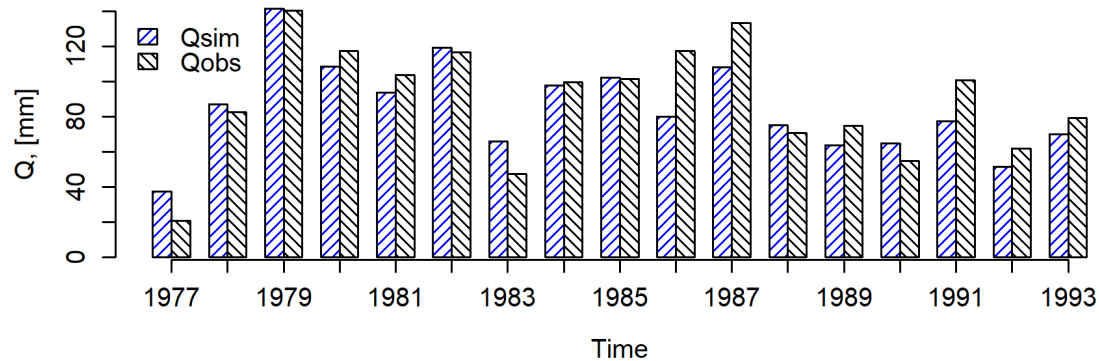
Observed and simulated streamflows

Monthly UTHBAL: Pili Basin



MAE = 31.89
RMSE = 47.83
NRMSE = 49.3
PBIAS = -6
RSR = 0.49
rSD = 0.9
NSE = 0.76
mNSE = 0.6
rNSE = -0.54
d = 0.93
md = 0.79
rd = 0.55
r = 0.87
R2 = 0.76
bR2 = 0.65

Annual UTHBAL: Pili Basin

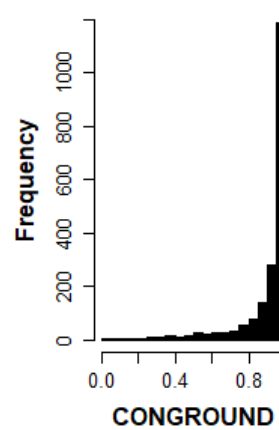
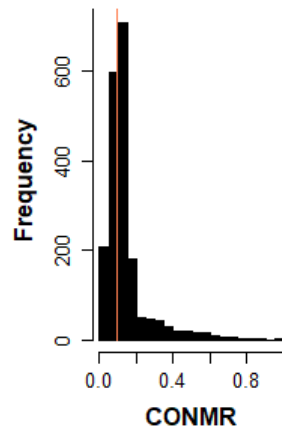
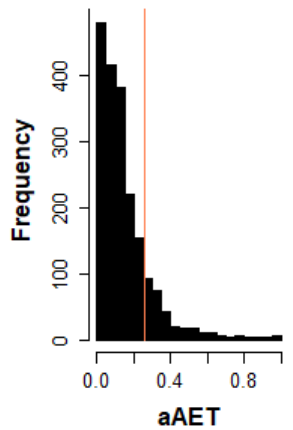
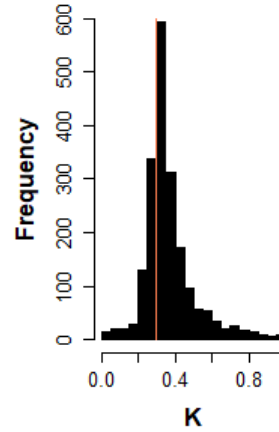
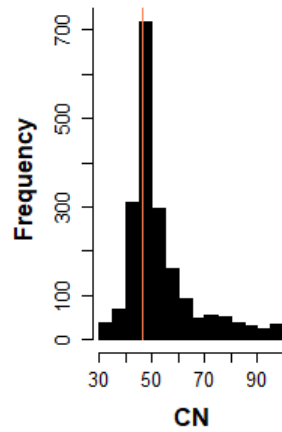
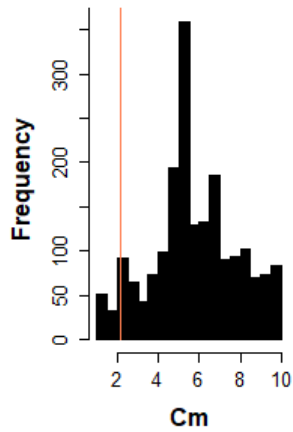


MAE = 11.59
RMSE = 15.1
NRMSE = 46.8
PBIAS = -5.2
RSR = 0.47
rSD = 0.82
NSE = 0.77
mNSE = 0.56
rNSE = 0.46
d = 0.93
md = 0.76
rd = 0.83
r = 0.89
R2 = 0.8
bR2 = 0.73

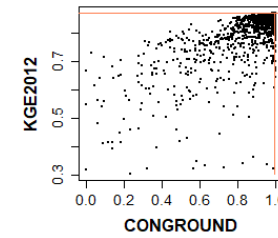
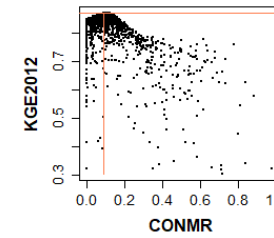
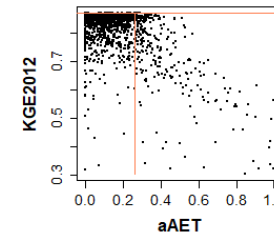
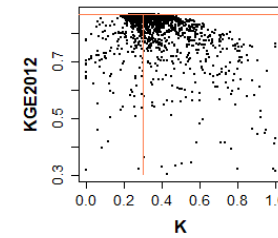
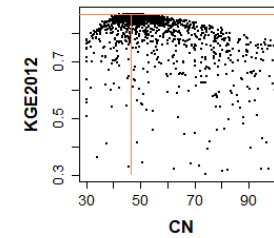
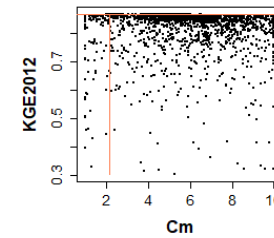
R-UTHBAL MODEL RESULTS

Model Parameter Results: Calibration Period

UTHBAL: Pili Basin

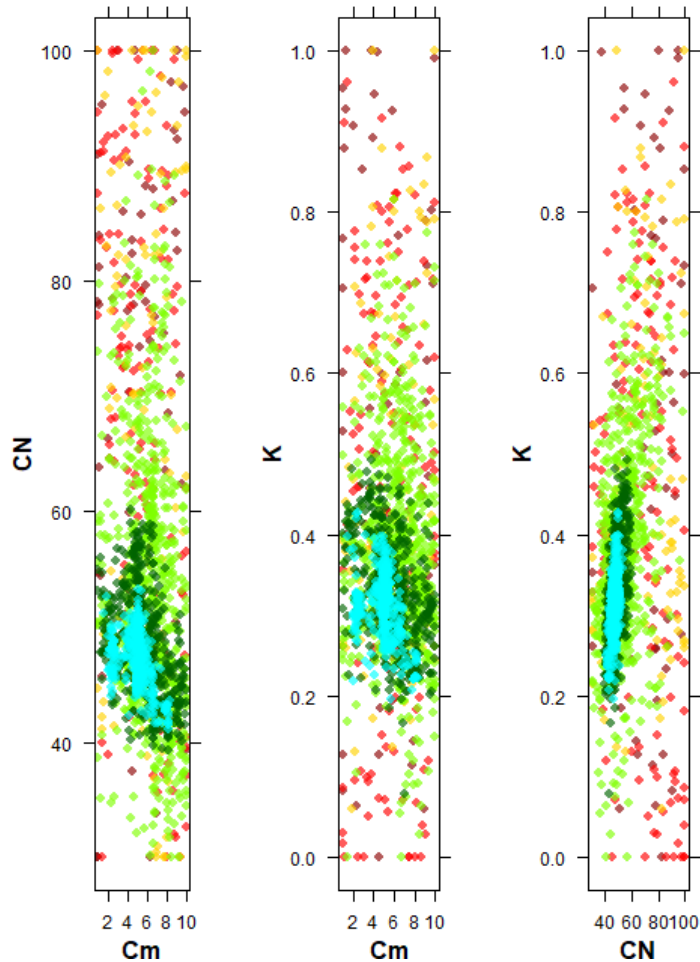


UTHBAL: Pili Basin



R-UTHBAL MODEL RESULTS

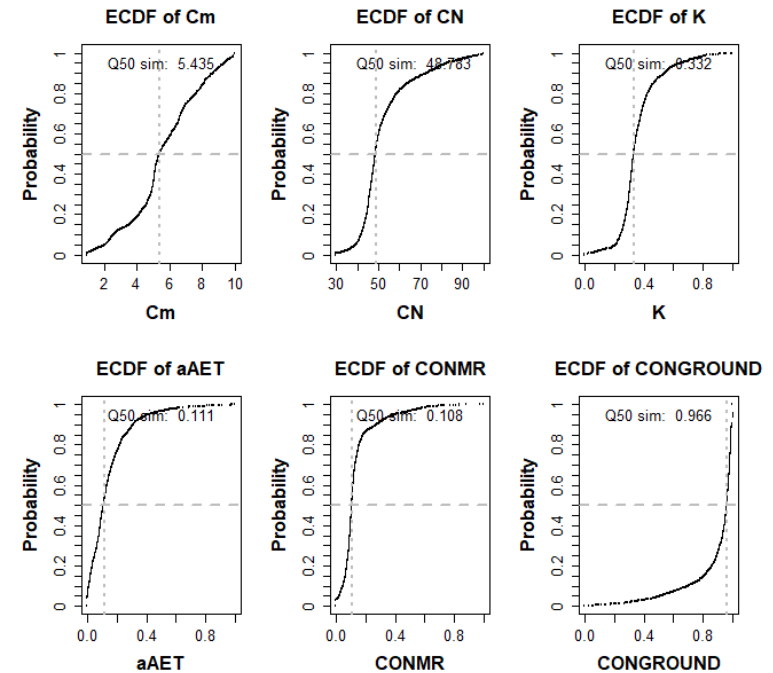
Model Parameter Results: Calibration Period



KGE2012

- (0.303, 0.595]
- (0.595, 0.733]
- (0.733, 0.769]
- (0.769, 0.851]
- (0.851, 0.861]
- (0.861, 0.868]

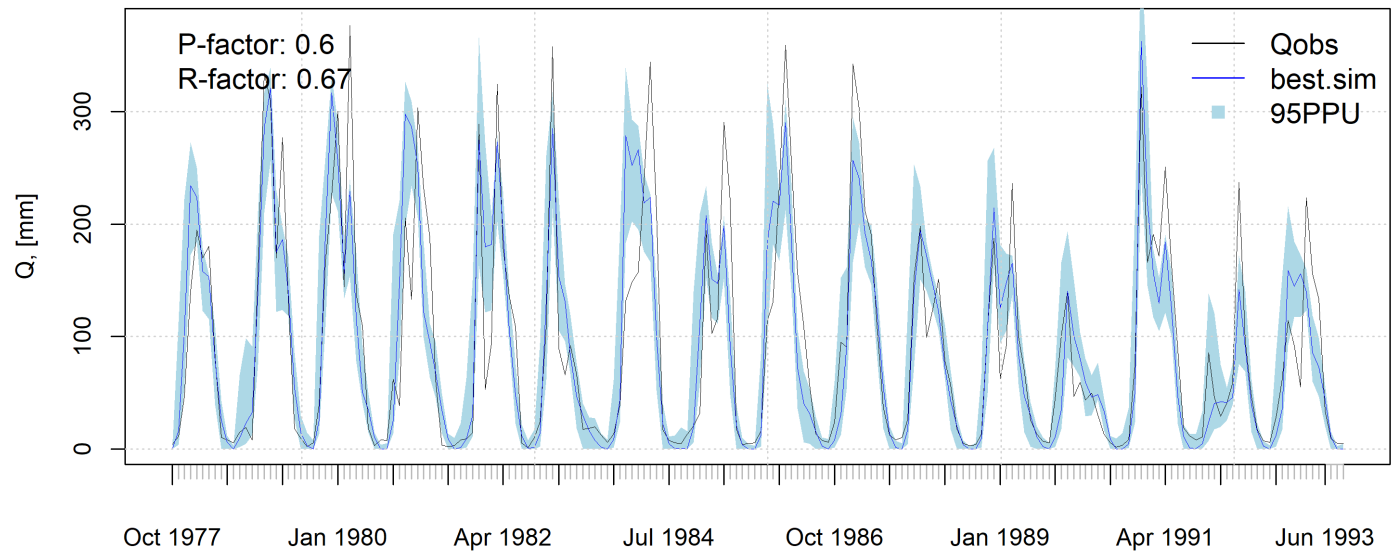
UTHBAL: Pili Basin



R-UTHBAL MODEL RESULTS

Uncertainty Analysis Results: Validation Period

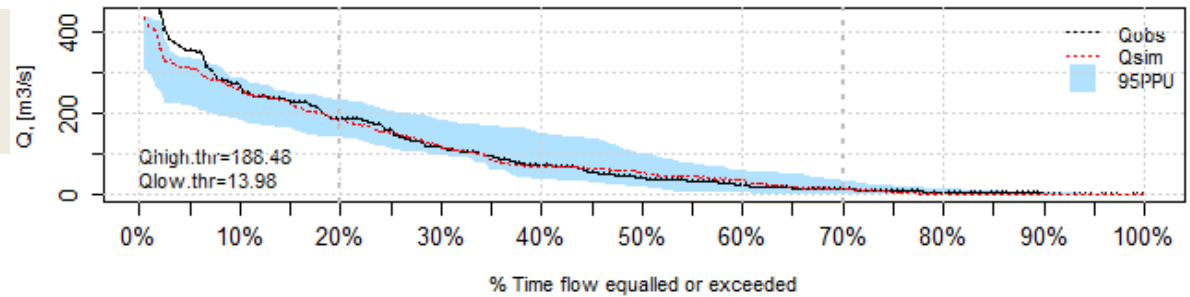
Uncertainty bounds UTHBAL: Pili Basin



Observed and
simulated
streamflows

R-UTHBAL MODEL RESULTS

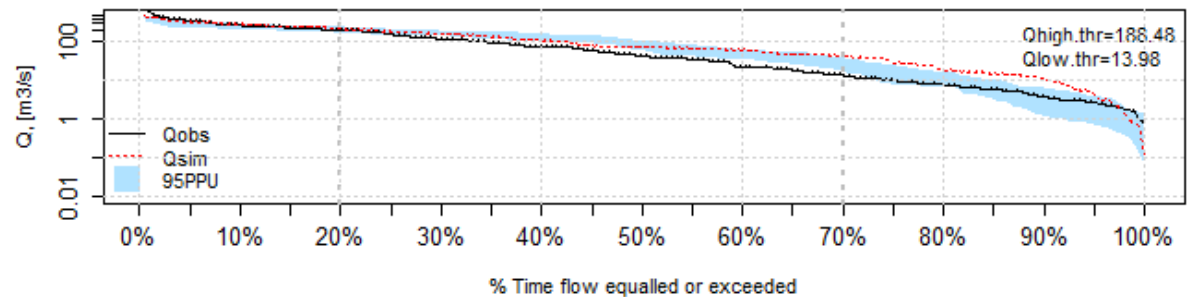
Flow duration curves UTHBAL model: Pili Basin



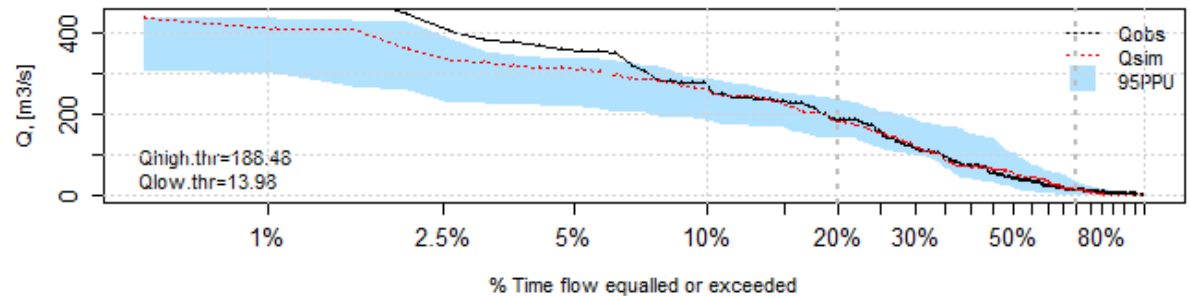
**Uncertainty Analysis Results:
Validation Period**

**Observed and
simulated
streamflows**

Flow duration curves UTHBAL model: Pili Basin



Flow duration curves UTHBAL model: Pili Basin





THANK YOU FOR YOUR ATTENTION

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Session:

Hydrological Modelling of Basins under Variable Conditions

More Info:

<https://sciforum.net/paper/view/14192>

[A monthly water balance model for assessing streamflow uncertainty in hydrologic studies](#)