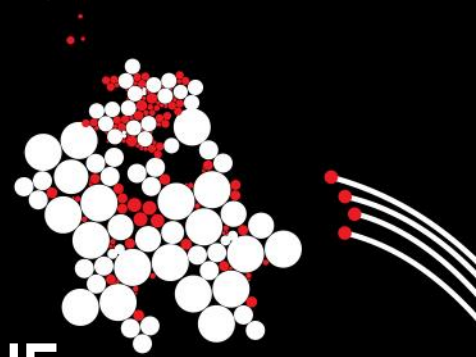


UNIVERSITY OF TWENTE.



EXTREME HIGH FLOW SIMULATIONS IN THE MEUSE RIVER BASIN

A HYDROLOGIC MODEL INTER-COMPARISON STUDY USING SYNTHETIC
WEATHER DATA

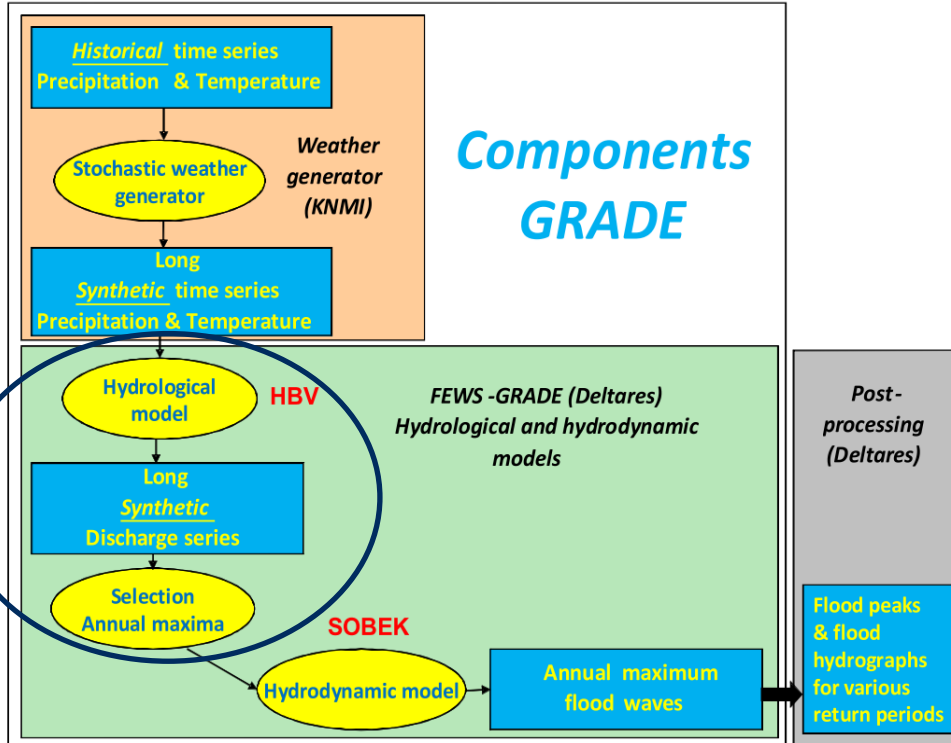
NIELS VAN DEN BRINK



CONTENT

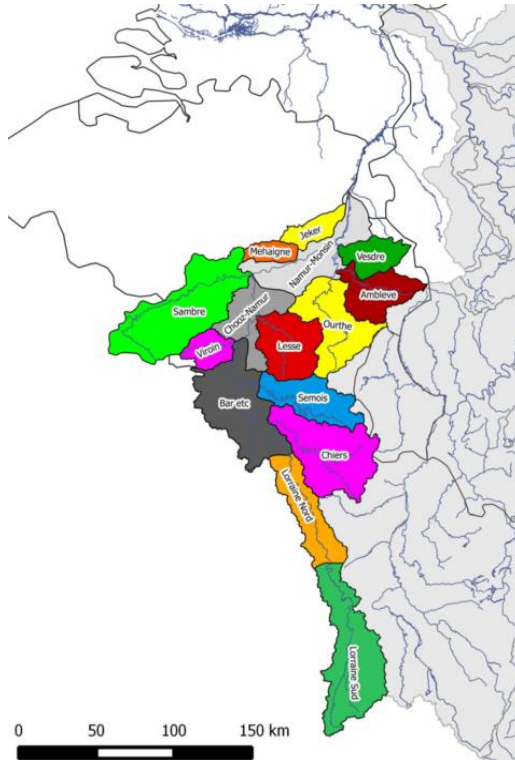
- GRADE instrument
- Research objective
- Calibration process
- Calibration/validation results
- Hydrographs in validation period
- Gumbel plot

GRADE INSTRUMENT



- Weather generator
- HBV model
- Hydrodynamic SOBEK model

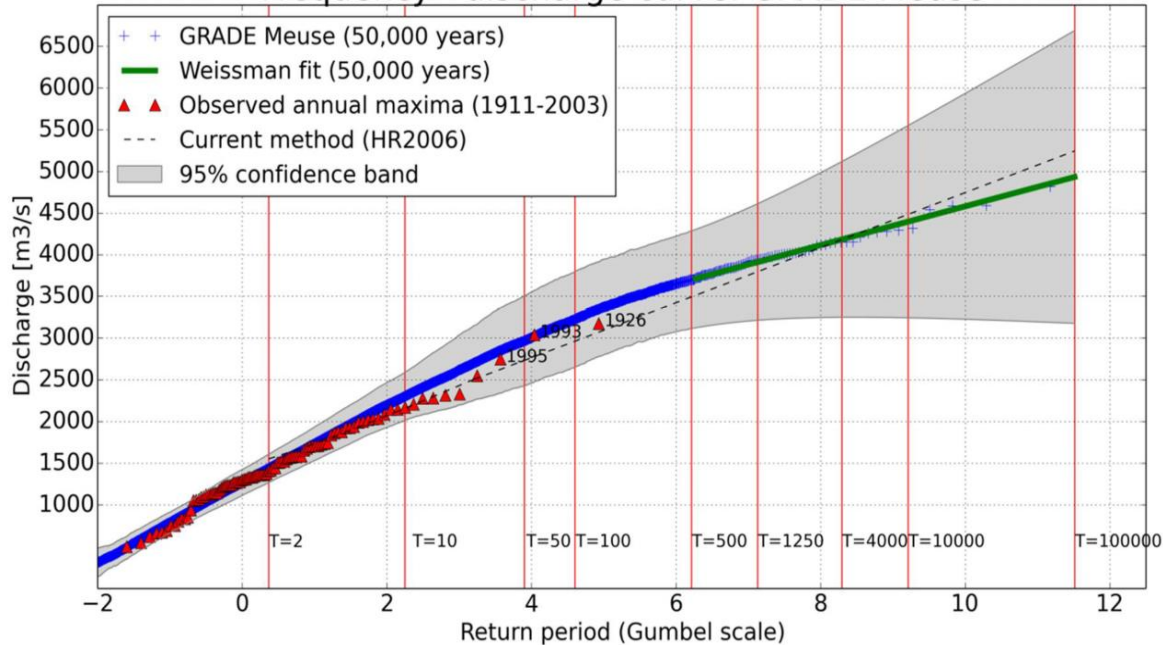
HBV MODEL IN THE GRADE INSTRUMENT



- 15 sub-basins
- GLUE analysis

GRADE INSTRUMENT RESULTS

Frequency - discharge curve: GRADE Meuse



- Annual maxima Gumbel plot
- No upstream flooding
- 95% confidence band

RESEARCH OBJECTIVE

- *To study the effect of hydrological model structures on their capability to reproduce statistical characteristics of extreme high flow events using synthetic weather series.*

IMPORTANT RESEARCH ASPECTS

- Model selection
- Calibration process
- Hydrologic routing

MODEL SELECTION

- Conceptual hydrological models
 - GR4J
 - Hymod
 - HBV

CALIBRATION PROCESS

- Aggregated objective function

- $$\frac{NS}{1+|RVE|}^* \rightarrow \frac{NS}{1+|RVE| + \frac{|REVE(T=10)| + |REVE(T=25)|}{2}}$$

- Optimization algorithm
 - SCE-UA

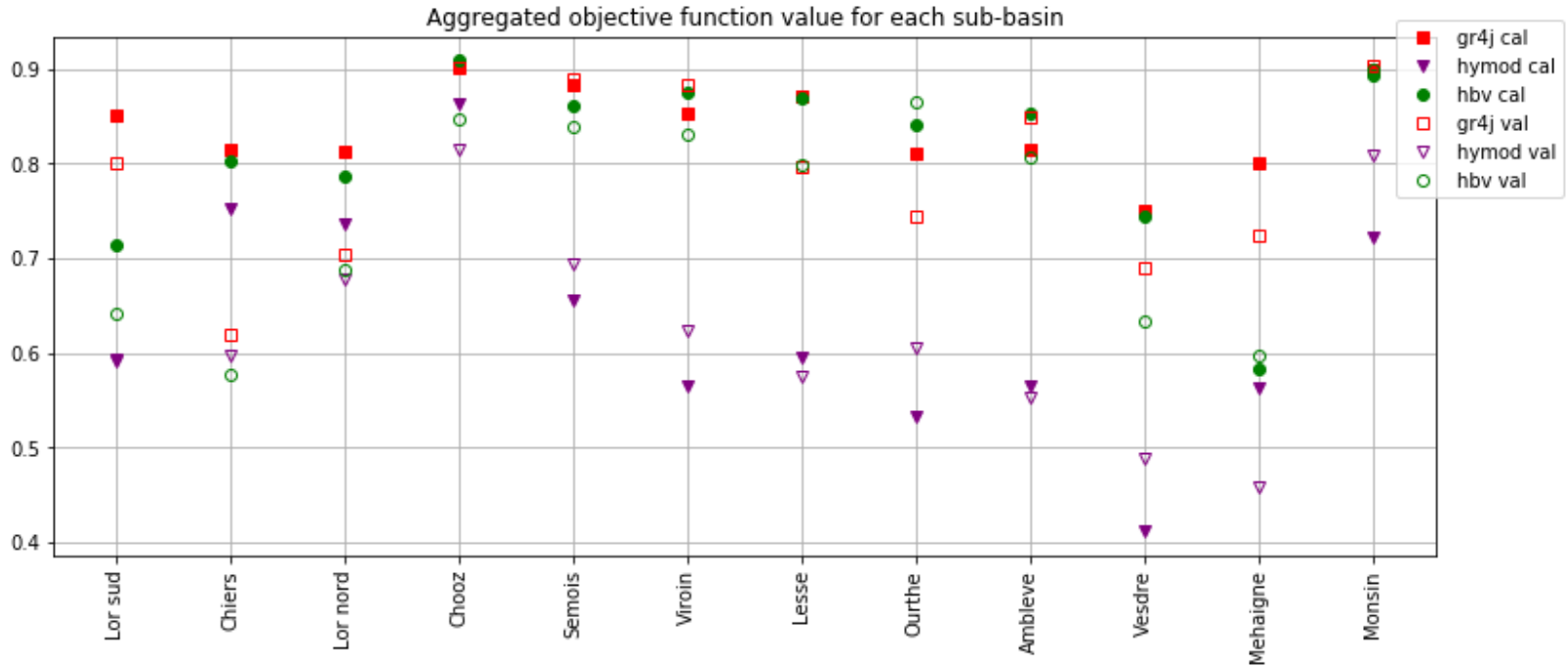
HYDROLOGIC ROUTING

basin numbers	Stenay	hours	days	applied lag
1	St-Mihiel, Stenay	17.35	0.72	0.7
Chooz				
2	Carignan ,Chooz	32	1.33	1.35
1, 3	Stenay ,Chooz	32	1.33	1.35
5	Membre ,Chooz	8	0.33	0.35
6	Treignes ,Chooz	4	0.17	0.15
Monsin				
1, 2, 3, 4, 5, 6	Chooz, Borgharen	16	0.67	0.65
8	Gendron, Borgharen	13	0.54	0.55
7, 9	Namur-Salzinne, Borgharen	7	0.29	0.3
10	Tabreux, Borgharen	7	0.29	0.3
11	Martinrive, Borgharen	7	0.29	0.3
12	Chaufontaine, Borgharen	5	0.21	0.2
13	Statte, Borgharen	4.97	0.21	0.2
14	Namur - Monsin, Borgharen	0	0	0
Directly from Berger & Mugie, 1994				
Estimated based on Berger & Mugie, 1994				
Assumed lag				

- Lag of the discharge per sub-basin
- Same routing for each model
- Based on discharge at Monsin

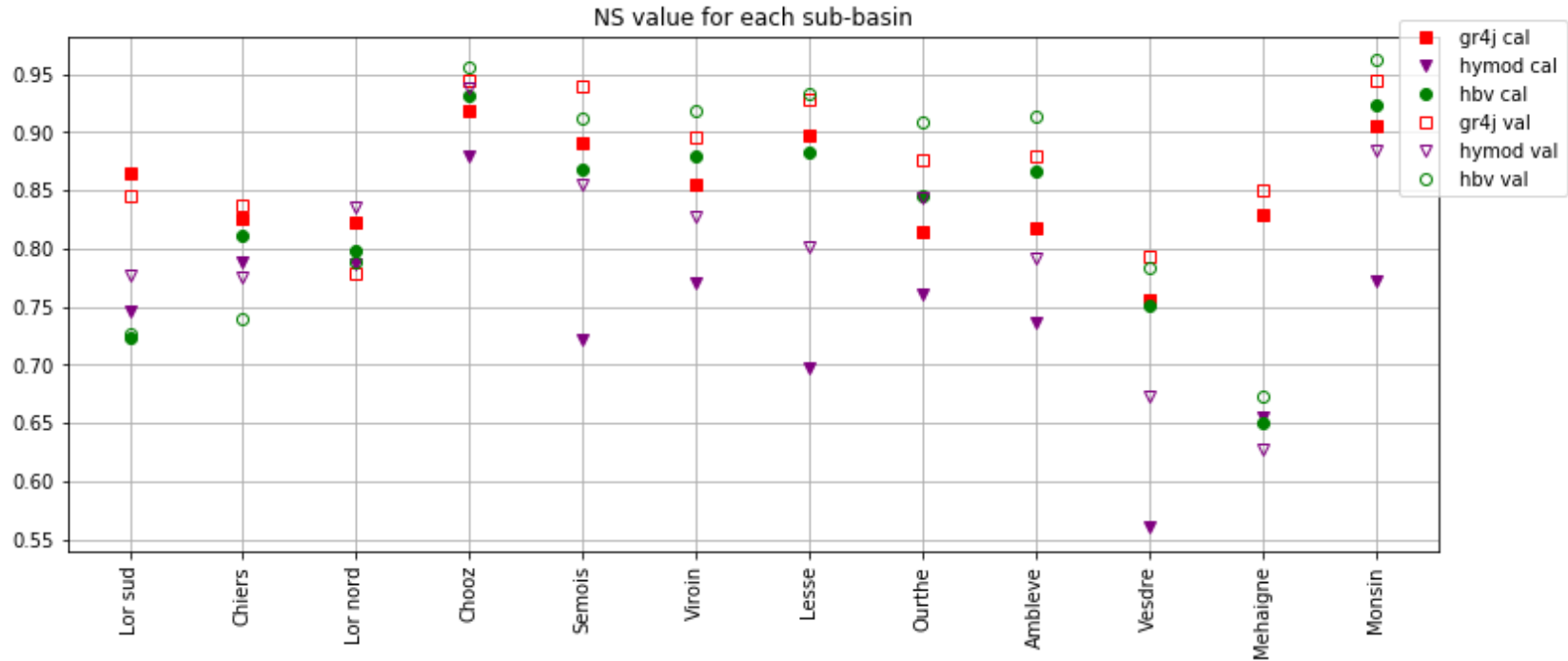
CALIBRATION/VALIDATION RESULTS

AGGREGATED OBJECTIVE FUNCTION



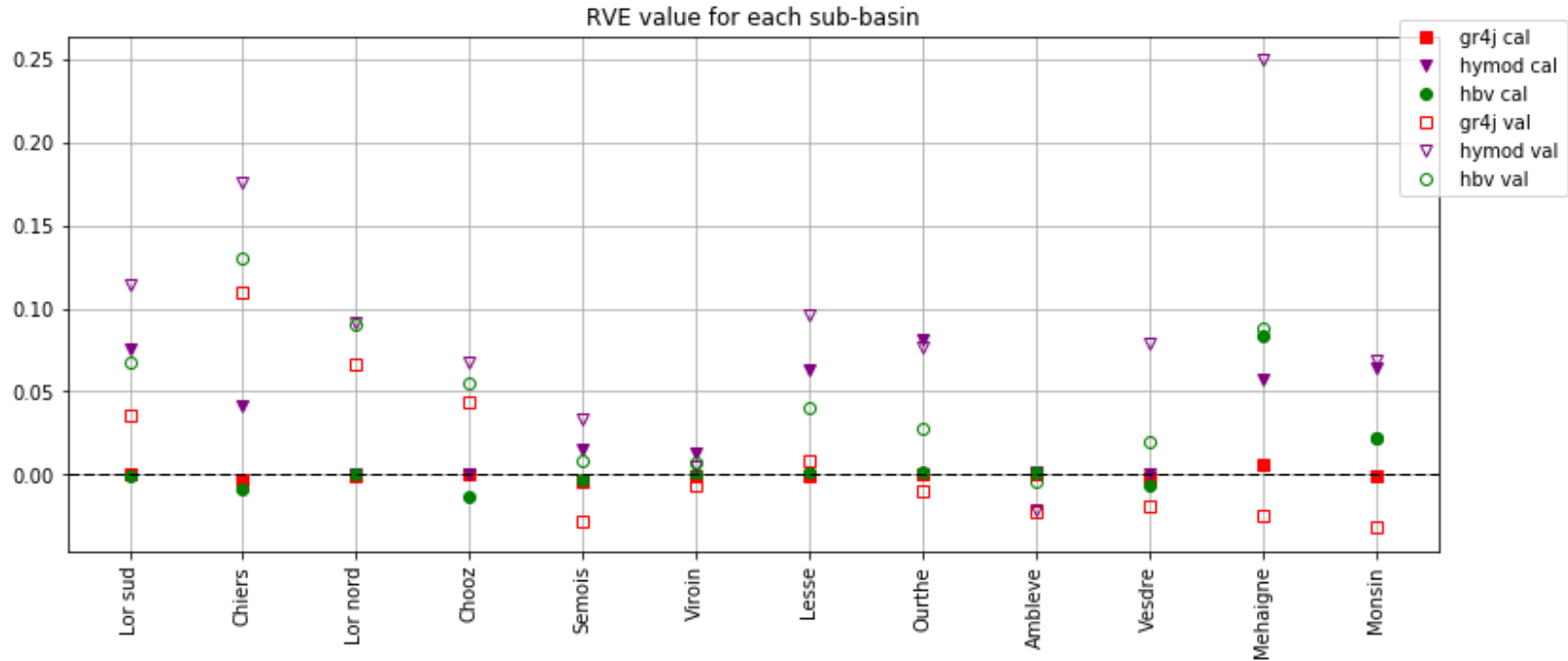
CALIBRATION/VALIDATION RESULTS

NASH-SUTCLIFFE COEFFICIENT



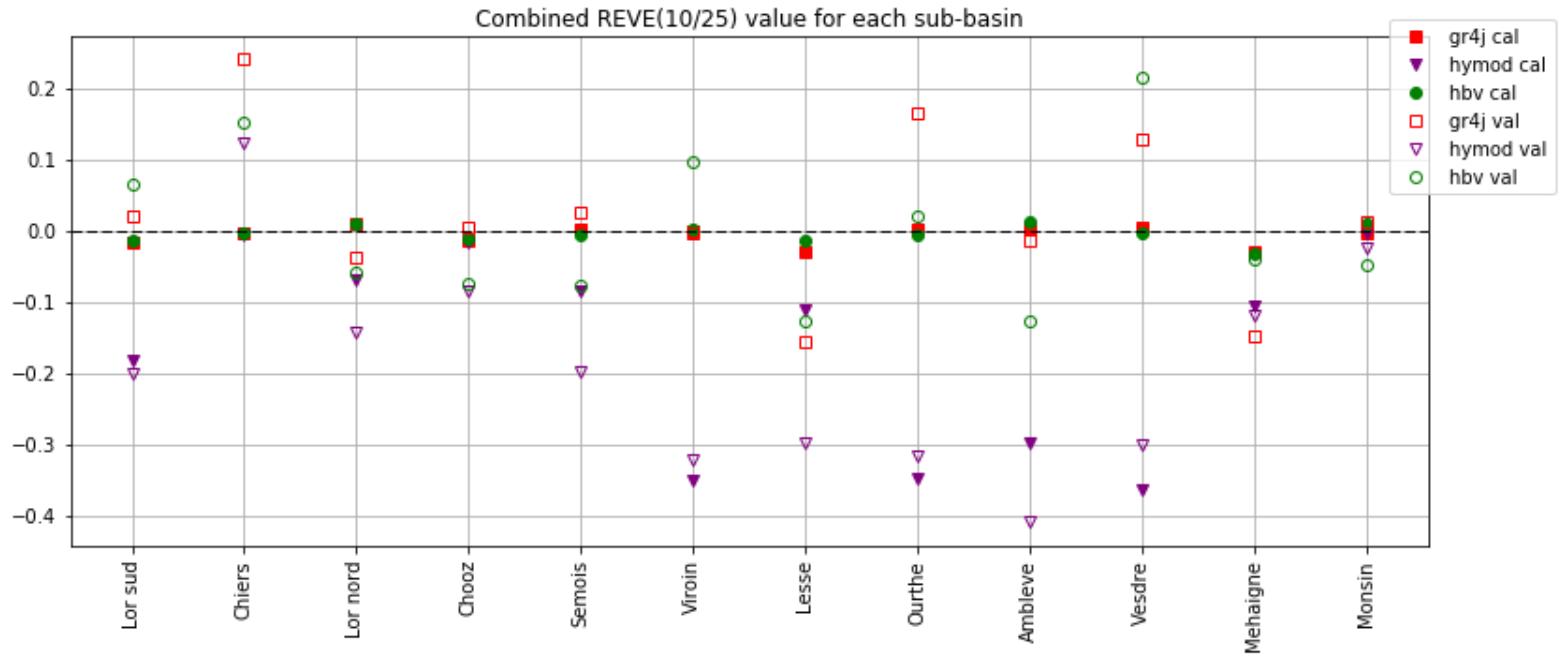
CALIBRATION/VALIDATION RESULTS

RELATIVE VOLUME ERROR



CALIBRATION/VALIDATION RESULTS

AVERAGE OF REVE(T=10) AND REVE(T=25)



CALIBRATION/VALIDATION RESULTS SUMMARIZED

- Objective function values GR4J/HBV are comparable
- In general Hymod shows “lower” objective function values
- NS value is better in validation period/other objective function values are better in the calibration period.

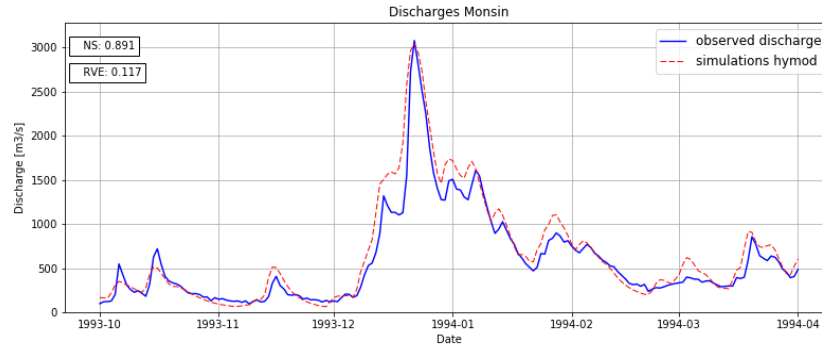
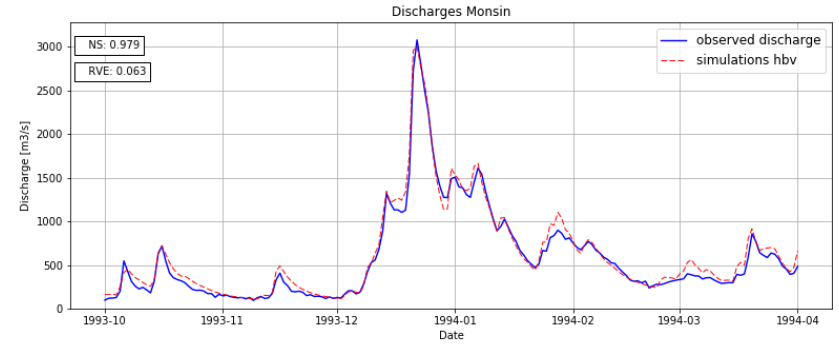
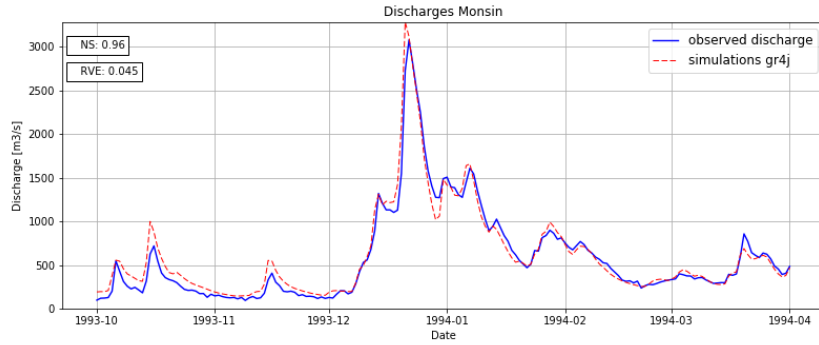
(HYDROGRAPH PERIOD)

GR4J

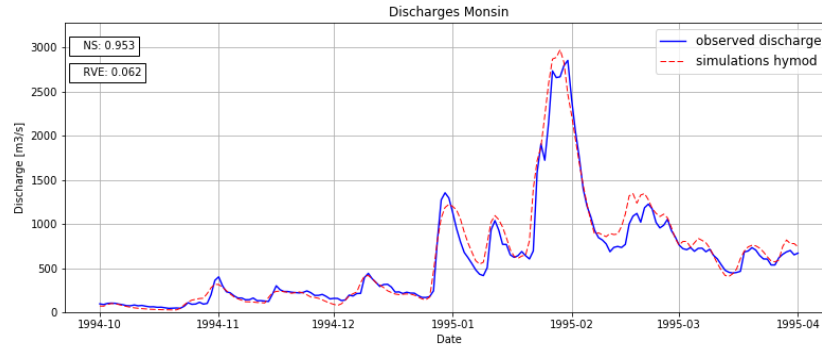
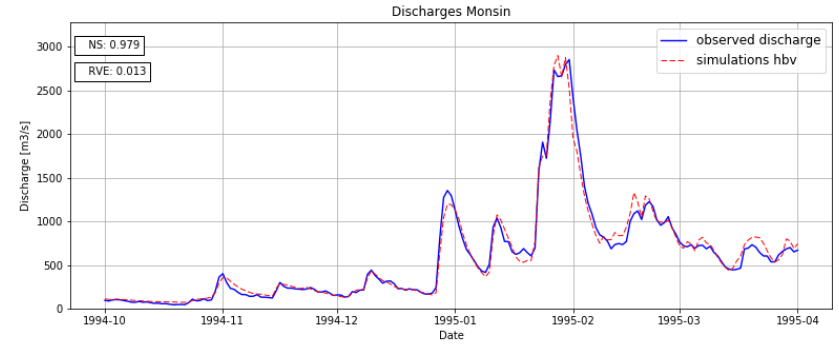
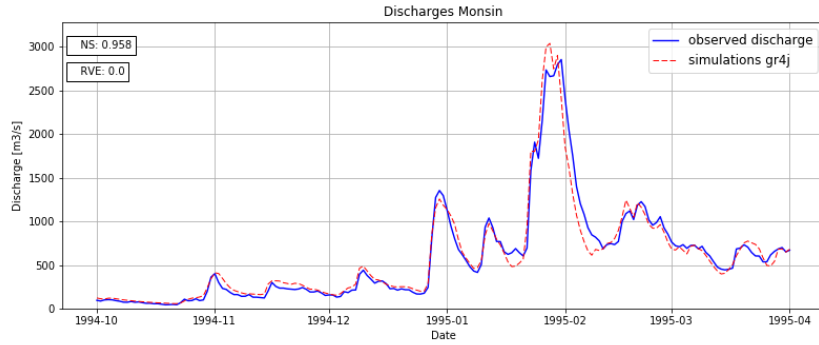
HBV

Hymod

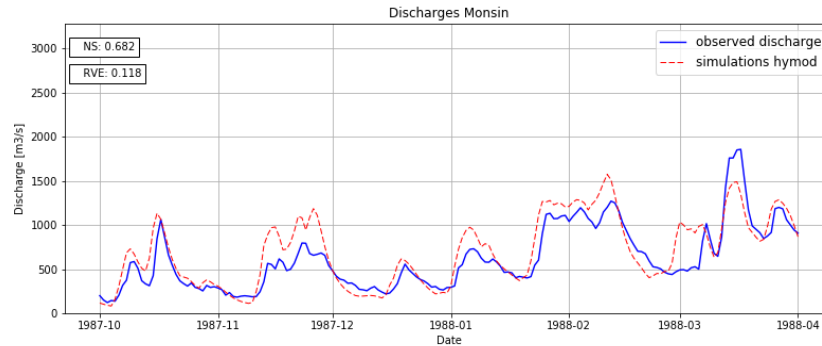
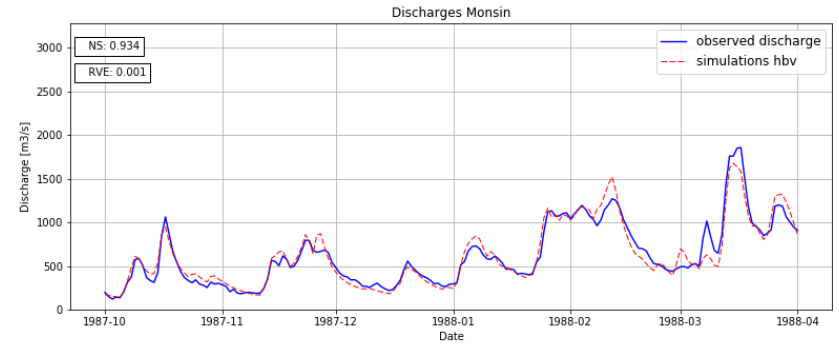
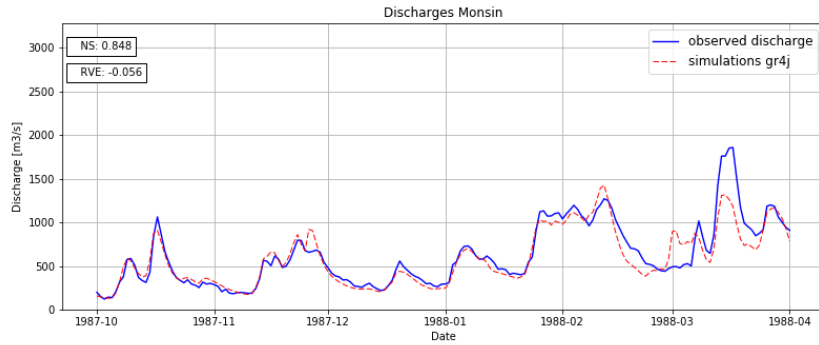
OKT 1993 – JUN 1994



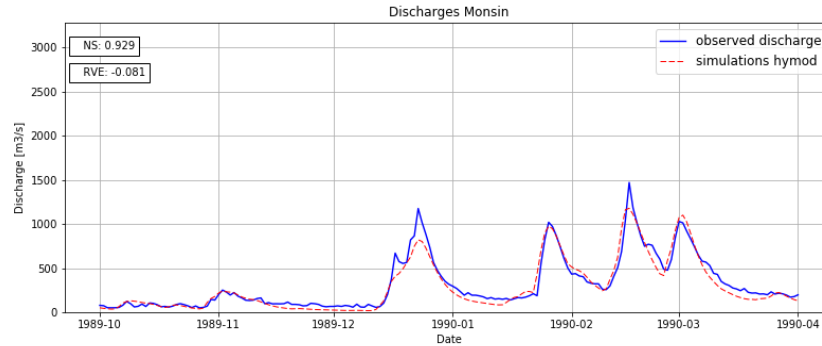
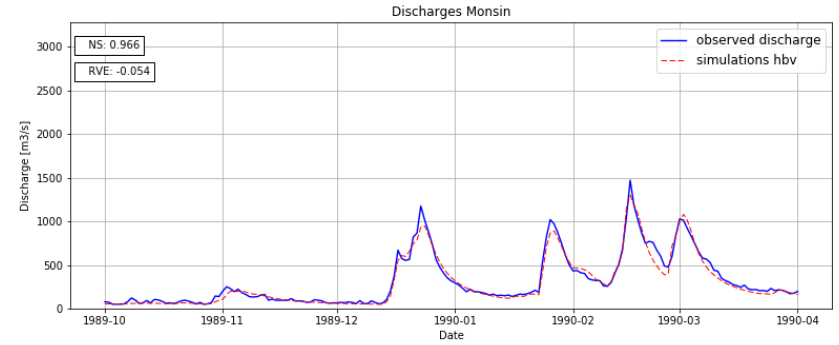
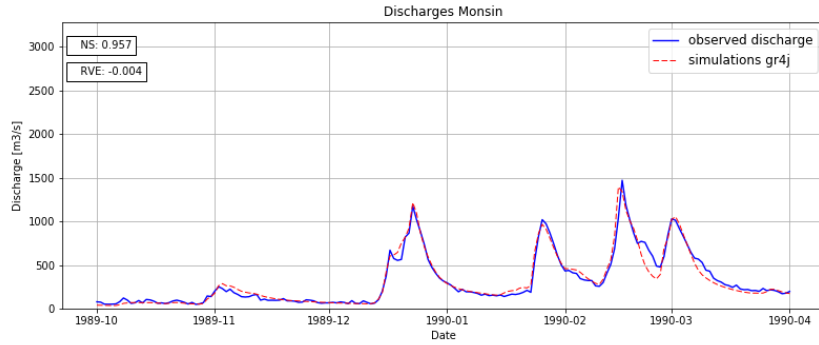
OKT 1994 – JUN 1995



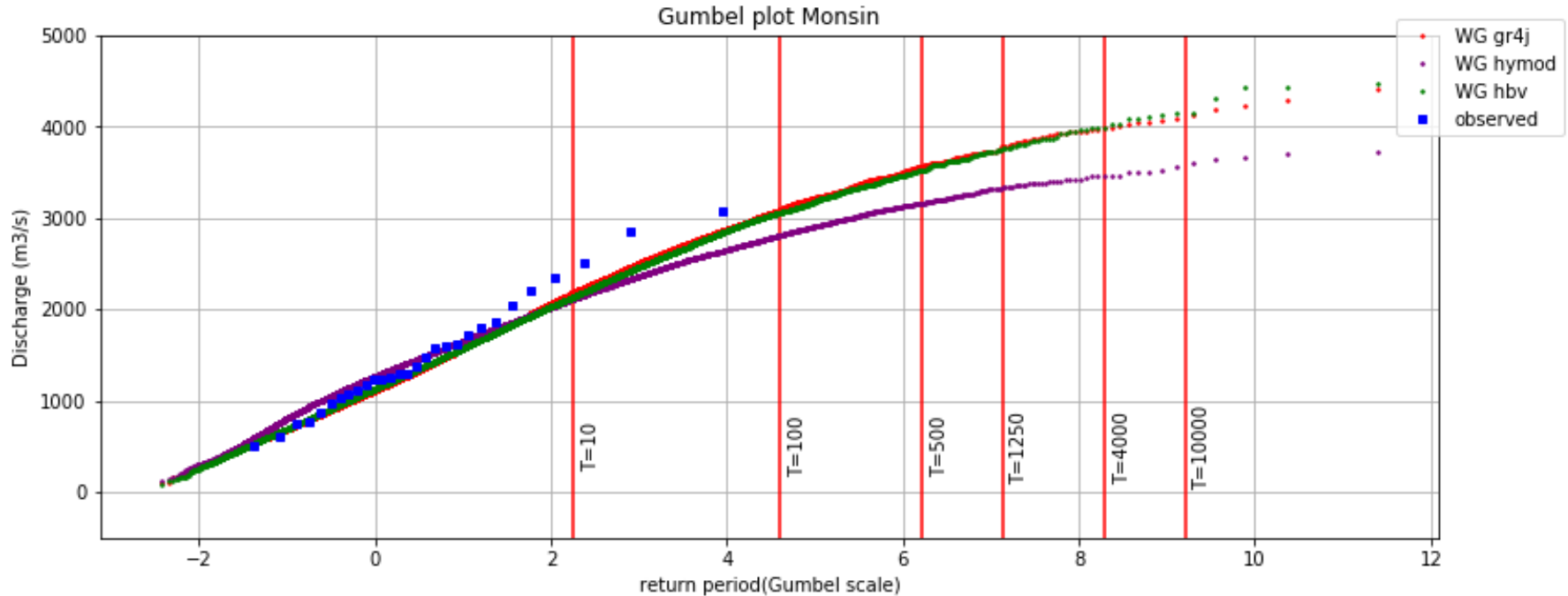
OKT 1987 – JUN 1988



OKT 1989 – JUN 1990



GUMBEL PLOT YEARLY MAXIMUM DISCHARGES



REMARKS

- Research scope
- Uncertainty

QUESTIONS ?
