Inter-comparison and assimilations of Remote sensing ET into spatially distributed Hydrological model (SWAT), Upper Blue Nile River Basin

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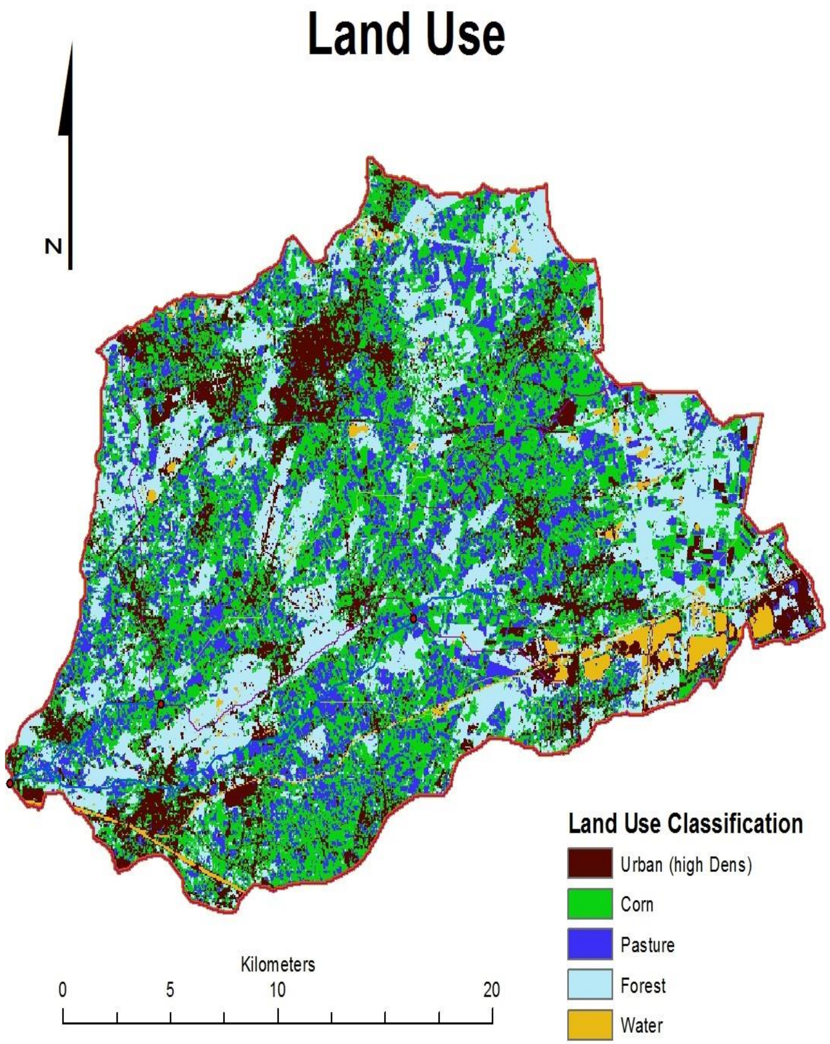
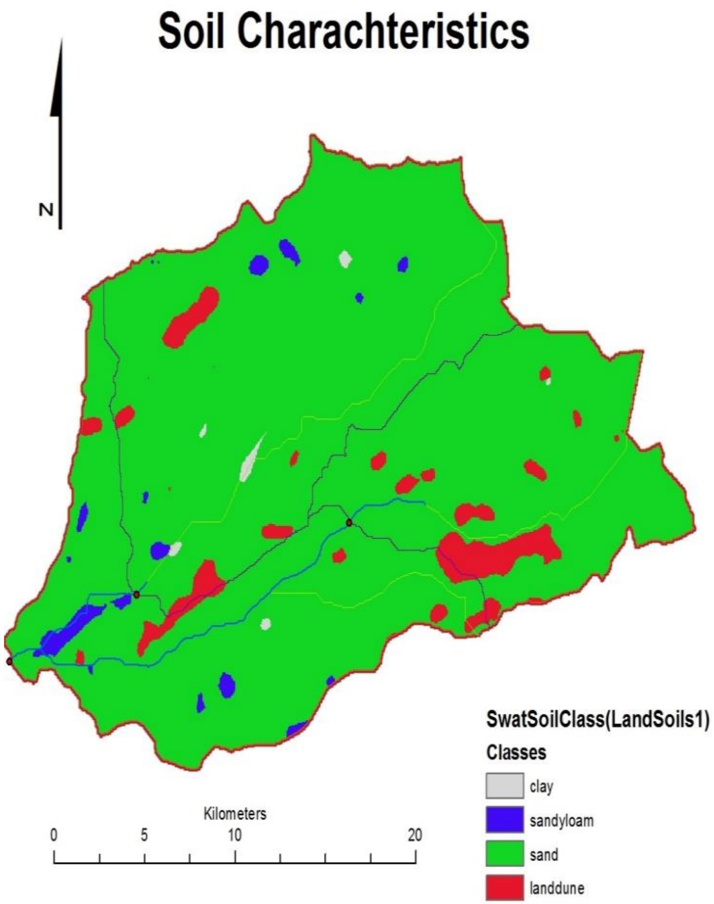
Introduction

- SWAT has been teaching SWAT within IUPWARE programme at Vrije Universiteit Brussel as workshop for ‘surface water modelling’
- Objective of the workshop is to predict future (2080) climate change impact were investigated using CCI-HYDR perturbation tool for Belgium.

- In this study Multiple HRU and dominate Landuse, soil and slope model built up process were inter compared
- Due to the alteration of the current state of our ecosystem; researchers, decision makers and individuals questions the possible fate future system.

Soil & Land use Characteristics: sandy & agricultural

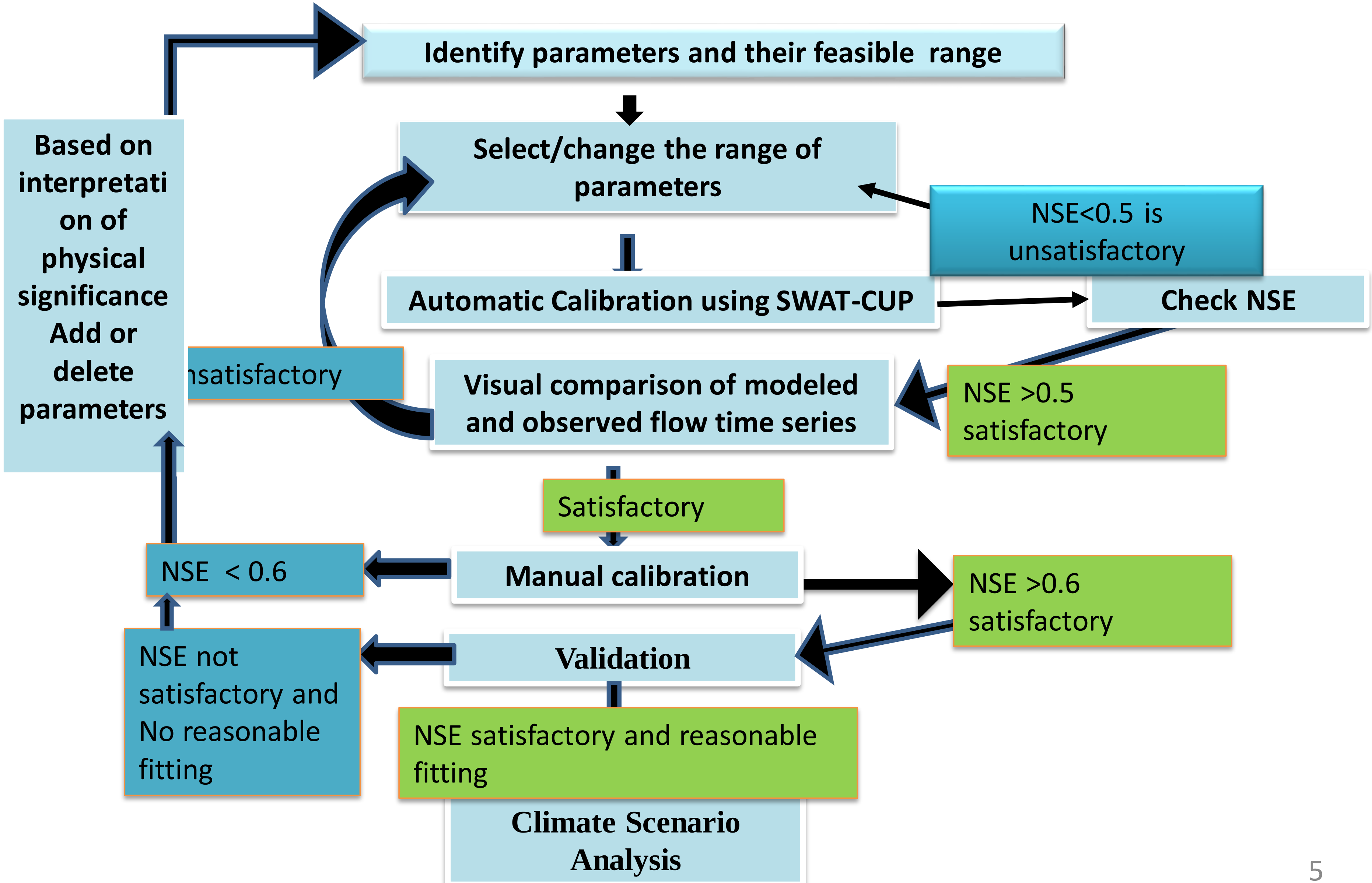




Objectives:

- To identify the suitable SWAT model; modelling techniques for Kleine Nete watershed
- To explore the watershed response and model outputs using Dominate Landuse, soil and slope built-up approach
- To investigate the watershed response and the hydrology using Multiple HRUs' built-up approach
- Finally, to project & investigate the future climate change impact on surface and groundwater component.

Methodology



- Outlines:
  - Introduction
  - Objectives
  - Methodology
  - Result & Discussion
  - Conclusion

Parameters Selection

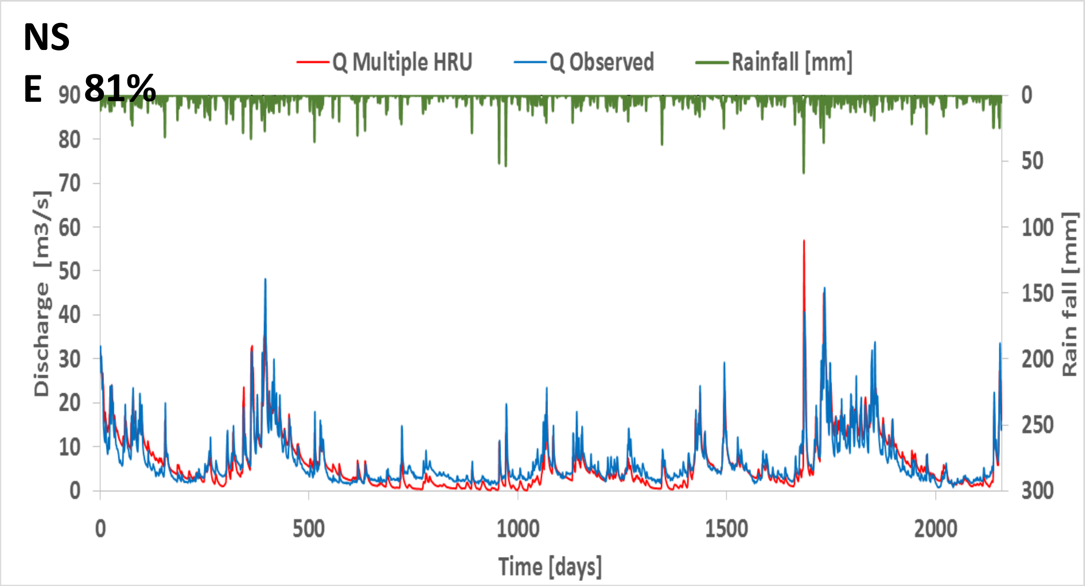
- Land use type
- Ground and surface water interaction
- Soil characteristics
- Evaporation potential
- Sensitivity analysis

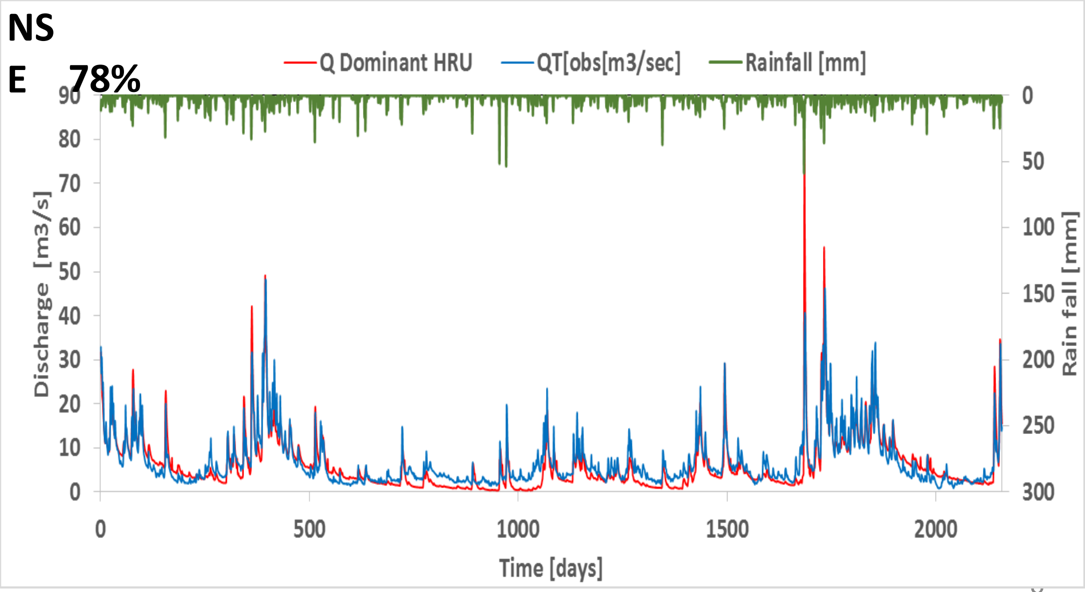
Parameters	Values		Description
	Multiple HRU	Dominant HRU	
CN2[--]	79.02	83.2	Curve number
ALHA_BF[--]	0.8	0.07	Base flow alpha factor
GW_DELAY[days]	41.00	79.07	Groundwater delay
GWQMIN[mmH2O]	387	115.25	Threshold depth of water in the shallow aquifer required for return flow to occur.
GW_REVAP[--]	0.08	0.06	Groundwater "Revap" coefficient.
REVAPMIN[mmH_2O]	87.05	192.62	Threshold depth of water in the shallow aquifer for Revap to occur.
RCHRG_DP[--]	0.34	0.48	Deep aquifer percolation fraction
SOL_AWC[mmH_2O/mm of soil]	0.02	192.62	Available water capacity of the soil layer
CH_N2[---]	0.09	0.03	Manning's "n" value for the main channel.
CH_K2[mm/hr]	21.85	0.18	Effective hydraulic conductivity in main channel alluvium.
ESCO[---]	0.88	0.66	Soil evaporation compensation factor.
SURLAG [Days]	9.00	5.24	Surface runoff lag time.
SOL_K[mm/hr]	452.47	108.52	Saturated hydraulic conductivity

Calibration

Period :

- 1/1/1994 – 31/12/1999

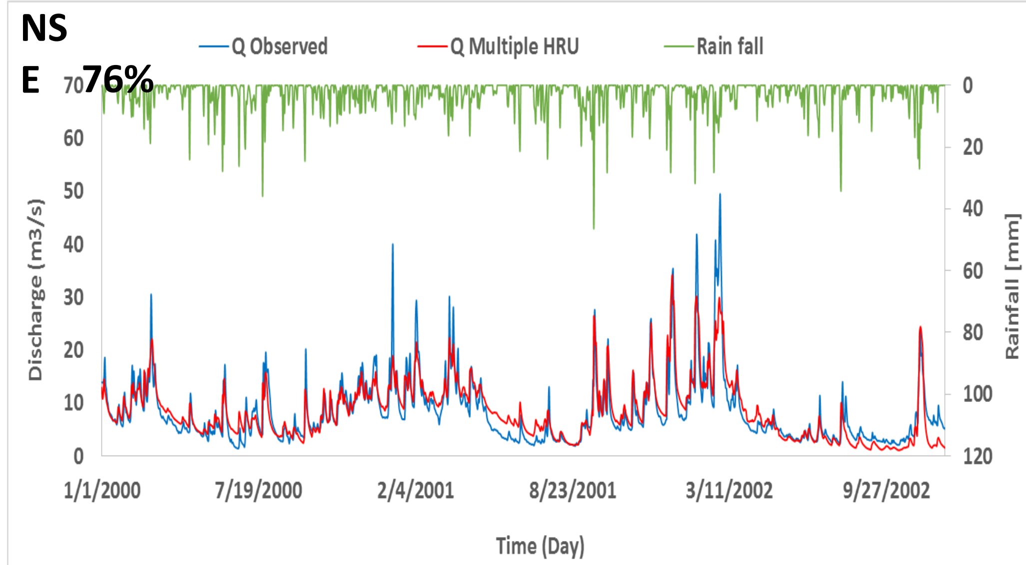


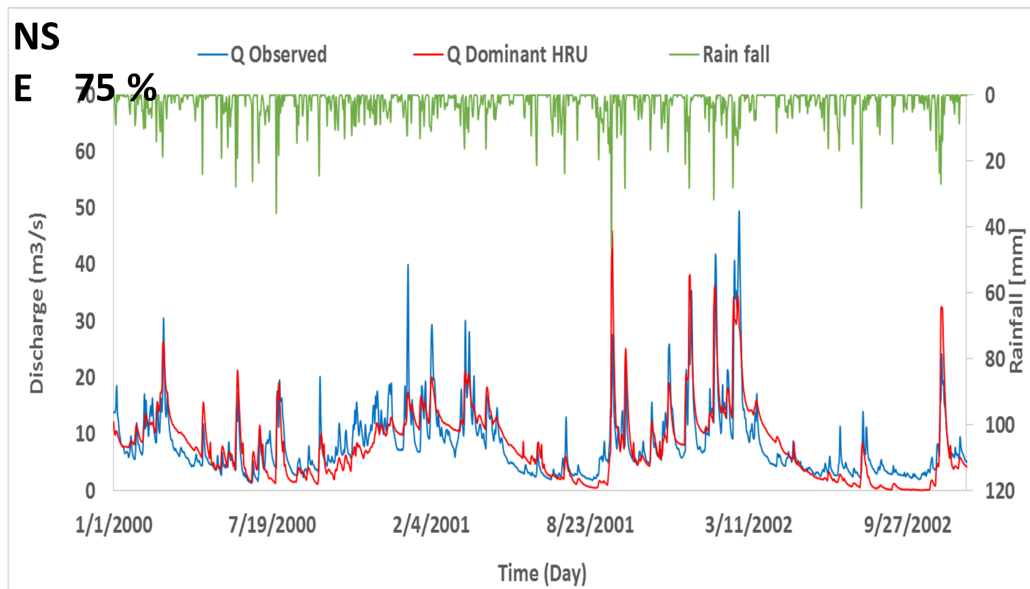


Validation

Period :

- 1/1/2000 – 31/12/2002

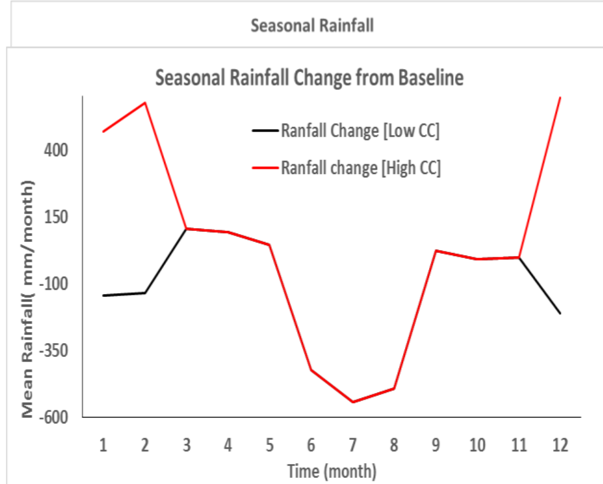




CC Impact by 2080

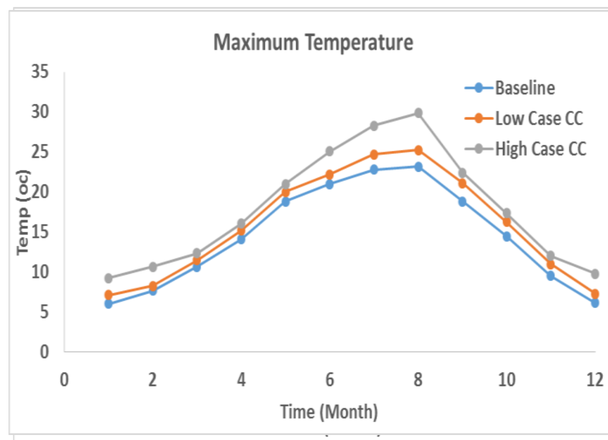
Climatic variables:

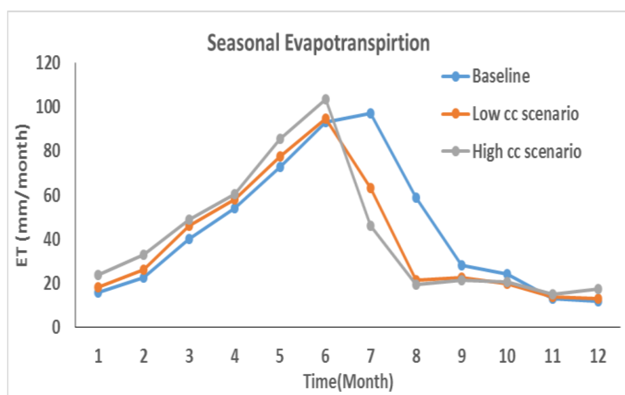
- Precipitation
- Temperature
  - Expected to increase in all the seasons for both CC cases
  - T_{min} & T_{max} expected to increase at max; during winter about 230% & 50% respectively for high CC scenario
- ET



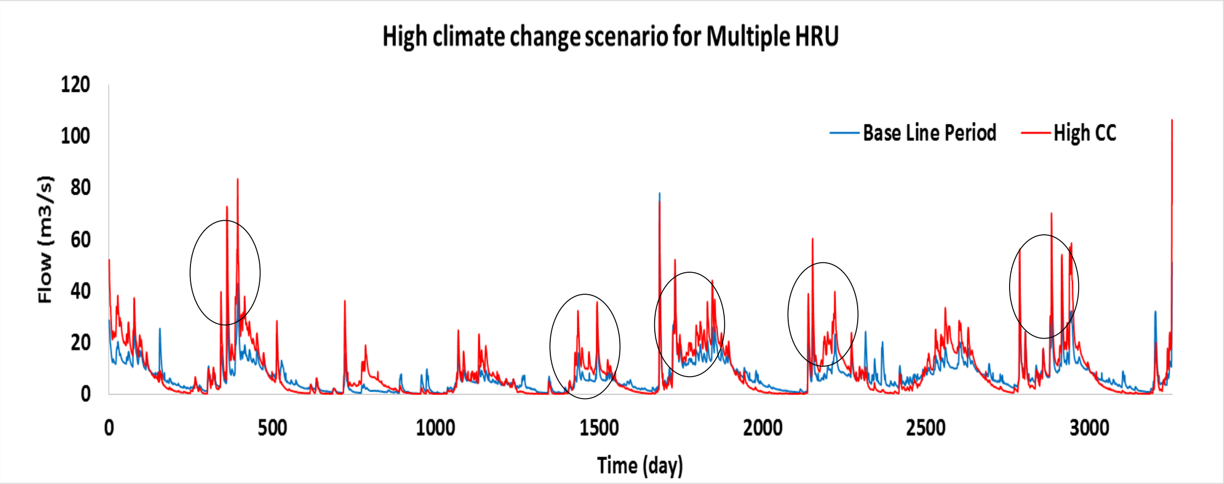
Dry (Summer)Season
↓ 58% in both CC Cases

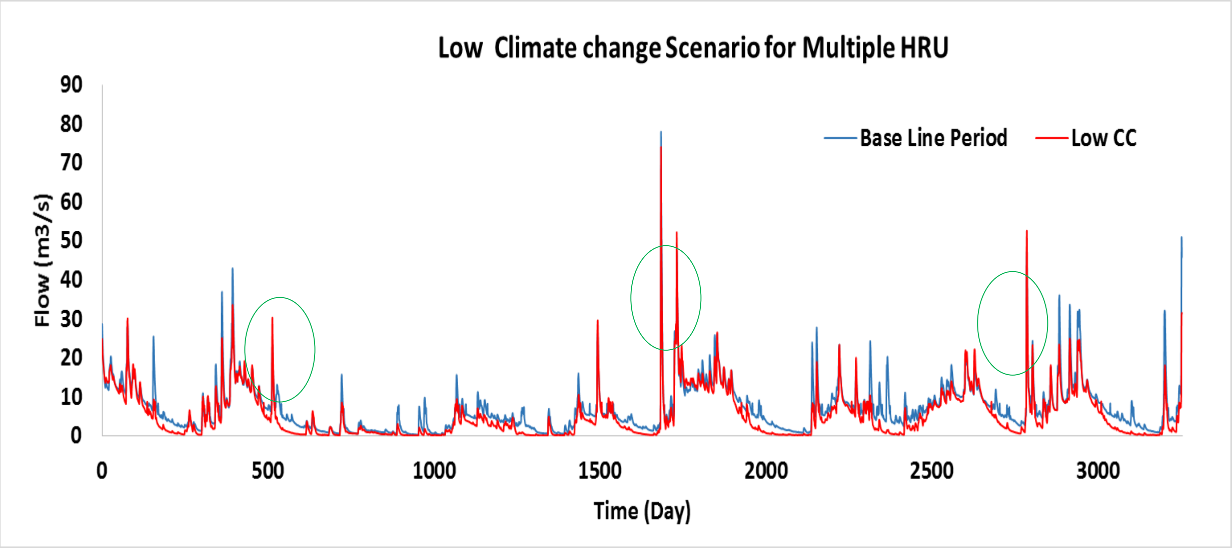
Wet (Winter) season
▲ 52% in Highest CC
▼ 18% in Lowest CC



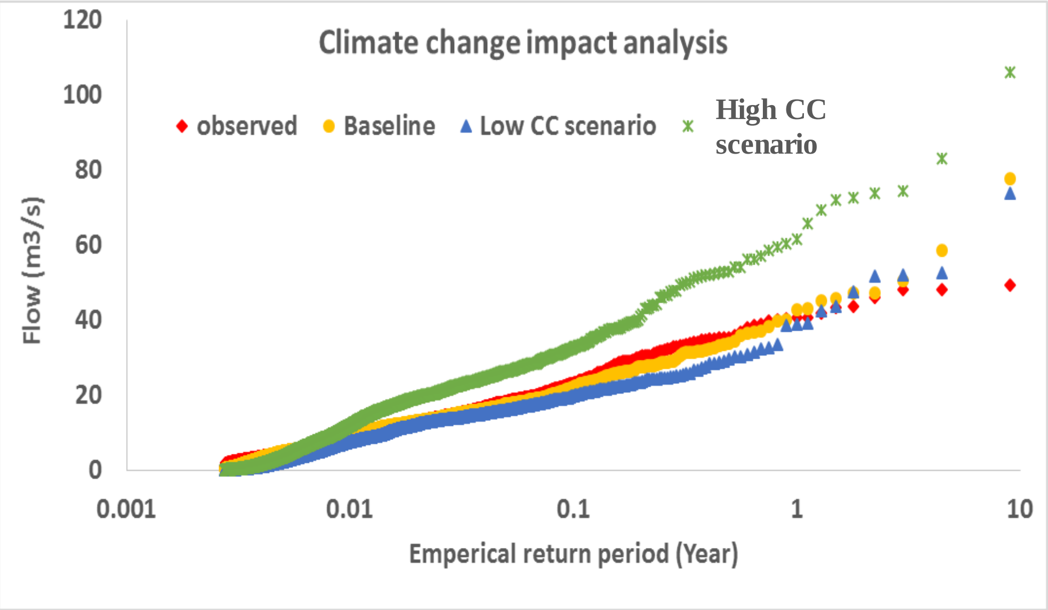


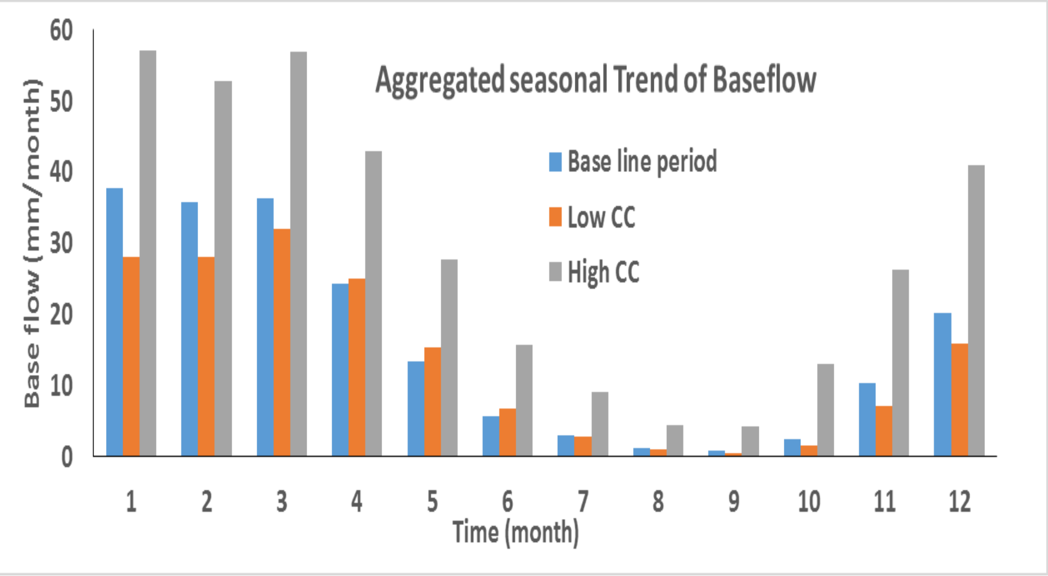
- More frequent peaks were observed at high climate change scenario
- Less peaks (flooding) expected at low climate change scenario
- Low flows decrease in reference with baseline on both cases (most likely drought & surface, shallow and ground water decline)





- High CC: More flooding
- Low CC:
  - Declined water yield
- Seasonal fluctuation of groundwater observed at High cc
- Which could cause seasonally dependent & unstable water table condition.





Conclusion

Climate Scenarios	High		Low	
Seasons	Wet	Dry	Wet	Dry
Groundwate Contribution	58%	-43%	-10%	-48%
Stream Flow	44%	-23%	-35%	-44%

- Multiple HRU definition provides more logical representation of the Hydrologic process in the Kleine Nete catchment.

- According to the climate change investigation by 2080:

  - The basin would likely experience noticeable flooding, Hydrological Drought, Ground water table fluctuations and salt water intrusion into the system by the end of 21st century.
  - Engineers and Decision makers have to take into account these possible future hydrologic fluctuations before setting any strategies related to water in the catchment and its vicinity.

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