Sensitivity of the SWAT model to the soil and land use data parametrization: a case study in the Thyle catchment, Belgium

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Introduction

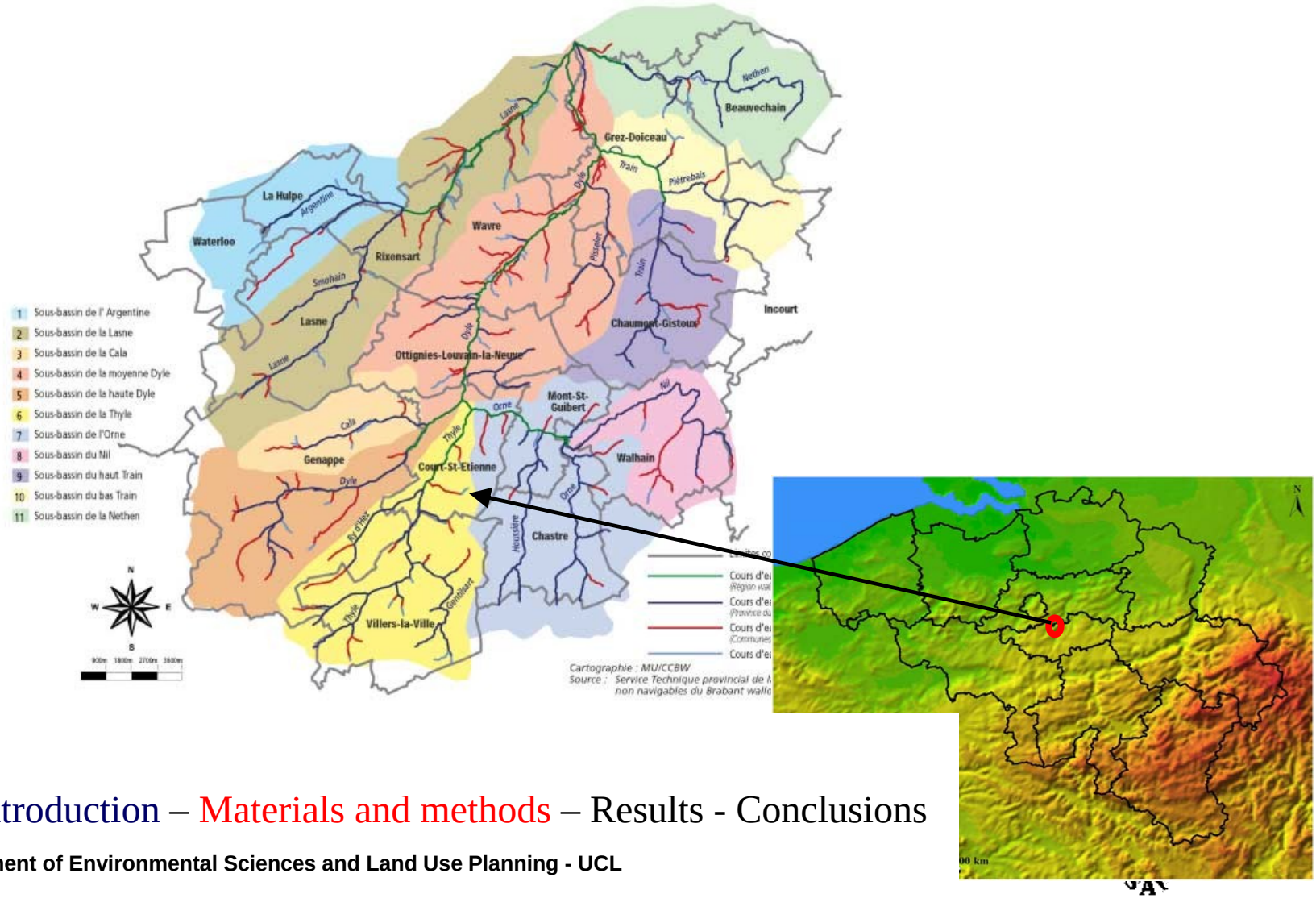
- In integrated models different parameters influence the modelled output

- To test the SWAT model to its internal pre-processing scheme performed in the ArcView software

Material and methods: Model Used

- Hydrological model: AVSWAT 2000
- Landscape model: FRAGSTAT

Studied catchment



Introduction – Materials and methods – Results - Conclusions

Studied catchment

- Size : 59 km²
- Land use:
  - Agricultural 67%
  - Forest 27%
  - Urban 5.5%
  - Industry 0.5%

Input data

- DEM map
- Mask map
- Land use map
- Soil map
- Weather data
- Soil profiles

Land use map

Land use map created for the Dyle catchment based on:

- SIGEC data set
- Landsat TM
- IGN topographical map 1:50 000

Two types of legend were used (detail and generic)

Soil map

Two maps used:

- Dominant soil map (Belgium Association map 1:500 000)
- Detail soil map (IRSIA map 1:25 000)

Scenarios

- Soil maps: 2
- Land use maps: 2
- Catchment size threshold values (CSTV): 4

- Total: 16

Evaluation

- Statistical calculation : Nash and Sutcliffe
- Fragstat indexses:
  - NP- Number of patches
  - PR- Number of patches within a landscape
  - RPR- Number of different patch type within a landscape divided by the maximum potential number of patch types
  - AI – Aggregation index
- ArcView calculation : Differences in grid values

Results

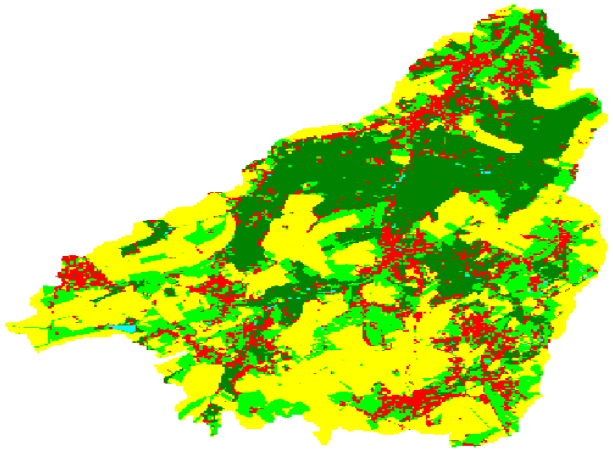
Land use –generic				
Index	NP	PR	RPR	AI
Orginal map	2150	6	-	80.18
145 sub-basins	33	4	66.67	97.46
47 sub-basins	14	4	66.67	98.48
27 sub-basins	8	4	66.67	98.92
1 sub-basin	1	1	16.67	99.73

Land use –detail				
Index	NP	PR	RPR	AI
Orginal map	5141	23	-	68.8
145 sub-basins	48	12	52.17	96.85
47 sub-basins	15	7	30.43	98.4
27 sub-basins	14	6	26.09	98.83
1 sub-basin	1	1	4.35	99.73

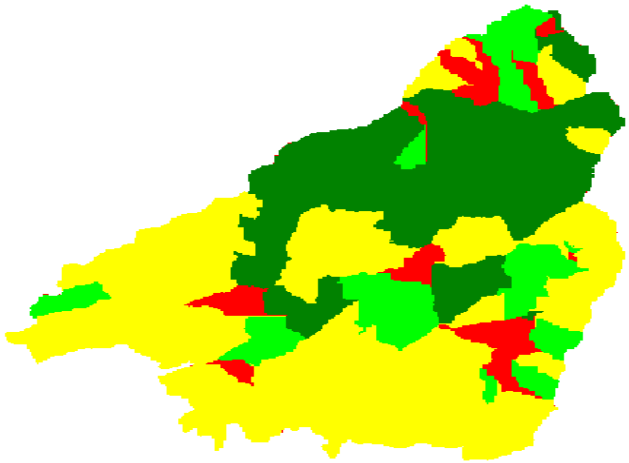
Soil map –generic				
Index	NP	PR	RPR	AI
Orginal map	28	3	-	97.60
145 sub-basins	15	3	100	97.77
47 sub-basins	10	3	100	98.47
27 sub-basins	7	3	100	98.87
1 sub-basin	1	1	33.33	99.73

Soil map –detail				
Index	NP	PR	RPR	AI
Orginal map	1159	6	-	82.21
145 sub-basins	29	6	50	97.3
47 sub-basins	8	3	50	98.79
27 sub-basins	8	3	50	98.79
1 sub-basin	1	1	16.67	99.73

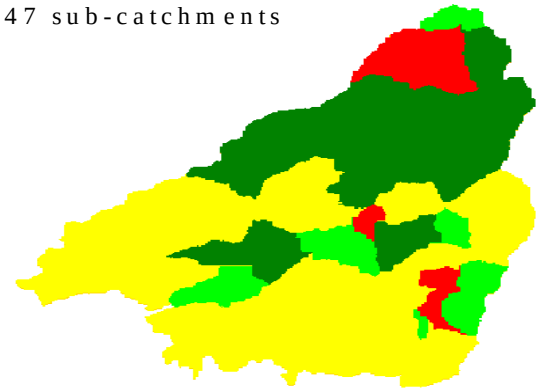
original map



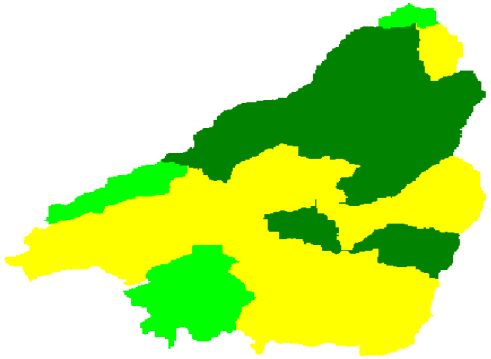
145 sub-catchments



47 sub-catchments



27 sub-catchments



1 sub-catchment

Agriculture

Forestry

Pasture

Urban area

Water

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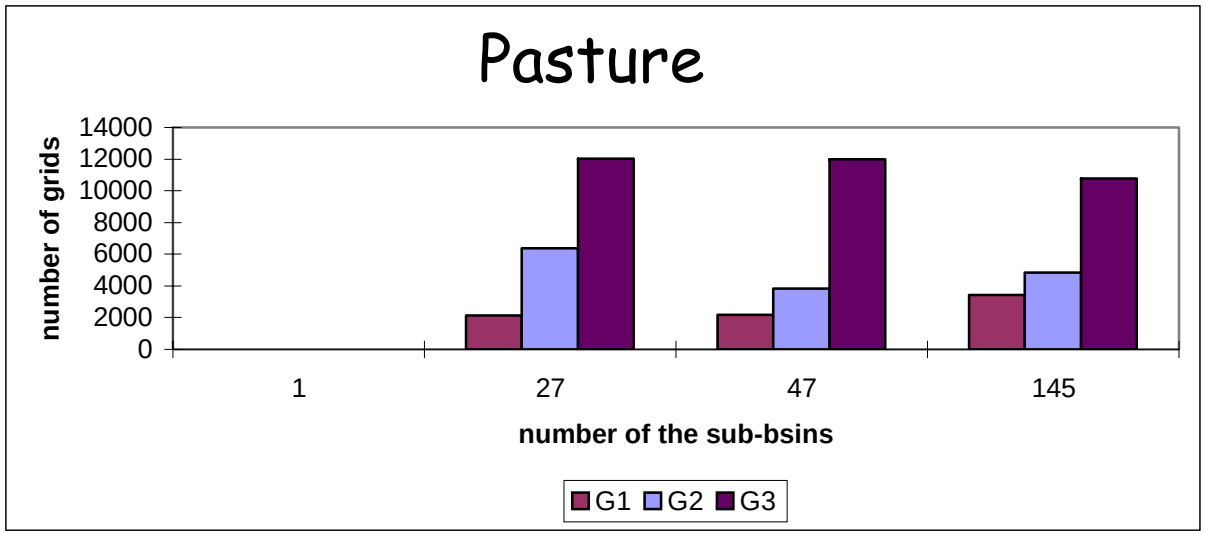
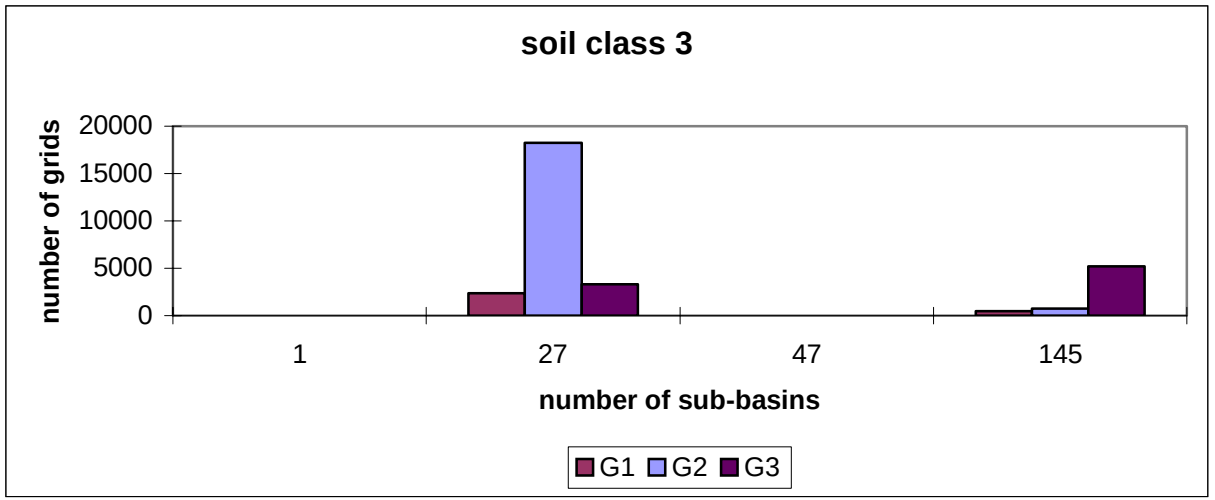
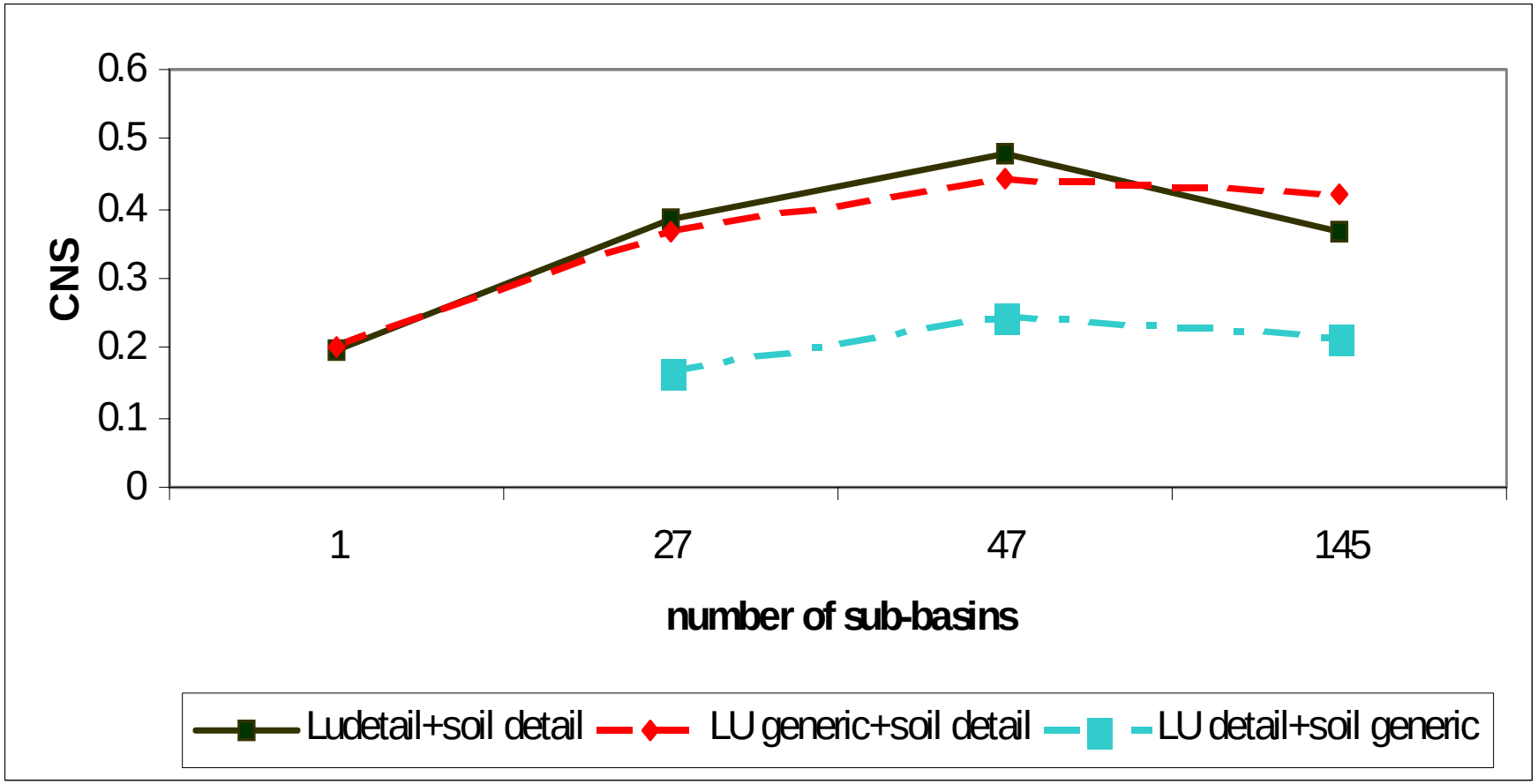

Pasture
number of grids
14000
12000
10000
8000
6000
4000
2000
0
1
27
47
145
number of the sub-bsins
G1 G2 G3


soil class 3
number of grids
20000
15000
10000
5000
0
1
27
47
145
number of sub-basins
G1 G2 G3


0.6
0.5
0.4
0.3
0.2
0.1
0
CNS
1
27
47
145
number of sub-basins
Ludetail+soil detail
LU generic+soil detail
LU detail+soil generic

Conclusions

- The model is very sensitive to the resolution and the quality of input maps
- The fragmantation of the input data and dispersion of map objects over the area are a very important driver in HRU creation
- The proper preparation of input data is crucial for proper application of the SWAT model
- It is advised to aggregate certain information before appling the model. By doing this the HRU's creation is better controlled.

Thank you for your attention