Micro-catchments classification: a tool for mud flow mitigation

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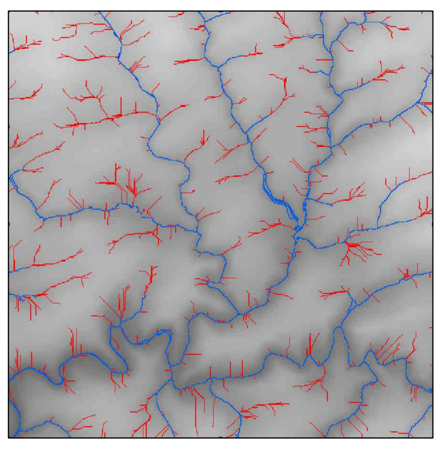
Hydrologic similarities between catchments can be of use in the context of **overland flood and mud flow hazards management**. In Wallonia, upstream micro-catchments were mapped for each runoff concentration axis. The outlets of these catchments are considered at the point where water reaches the permanent river stream. No less than 145 547 micro catchments were mapped in Wallonia (16900 km²). Their area varies between 1 and 1233 ha (mean area: 7.8 ha). A data base was built up to synthesize their major characteristics like e.g. area, shape and mean slope. No clear classification appeared.

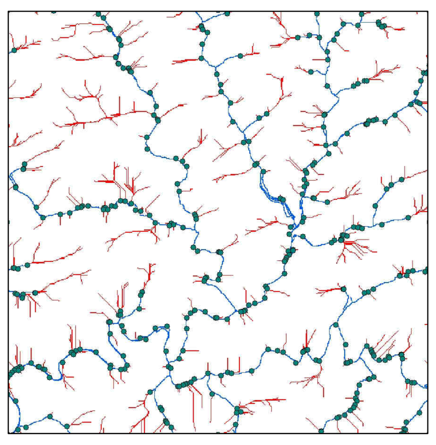
At this stage, it seems obvious that **the major components of these catchments had to be handled simultaneously from a hydrological point of view** in order to produce a clear classification.

Micro-catchments delimitation

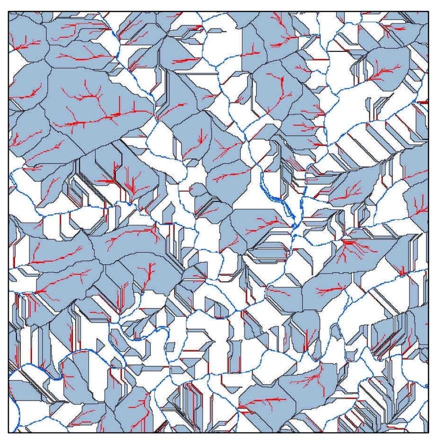
By use of the Arc Gis Spatial Analyst hydrology toolbox, the DTM produces a flow direction map and a flow accumulation map. The concentration axis that are upward the permanent streams are identified. We retained 1ha as minimum contributive area.



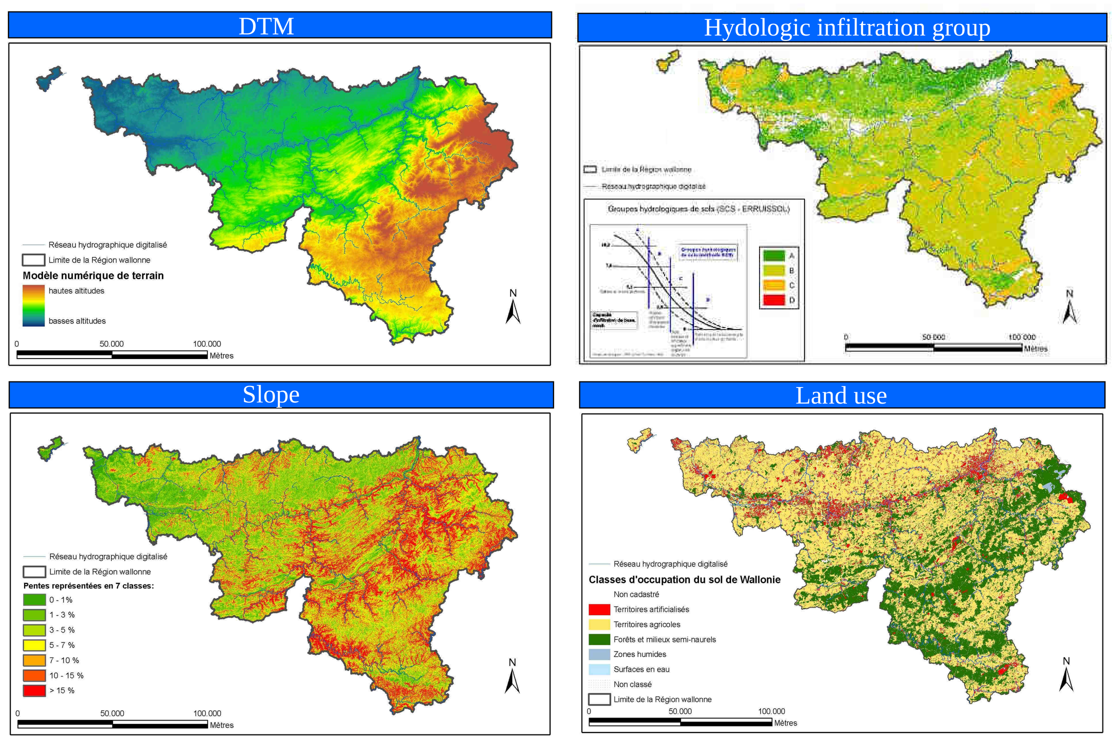
The points were a concentration axis crosses a permanent stream is considered as a catchment outlet.



By use of the watershed tool (Arc Gis Spatial Analyst), all the micro-cathments related to these outlets are drawn.



Input data



http://cartographie.wallonie.be/NewPortailCarto/

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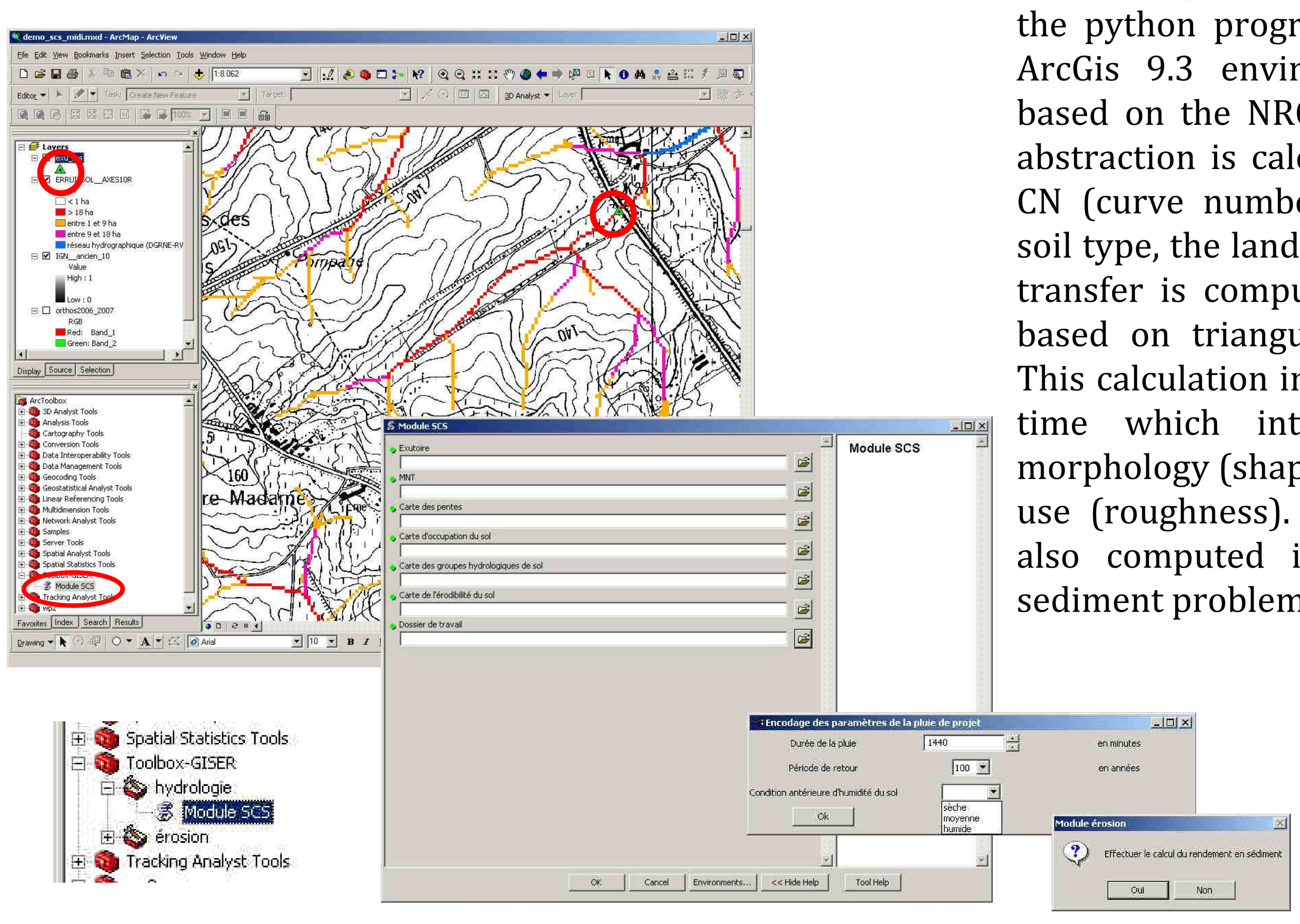
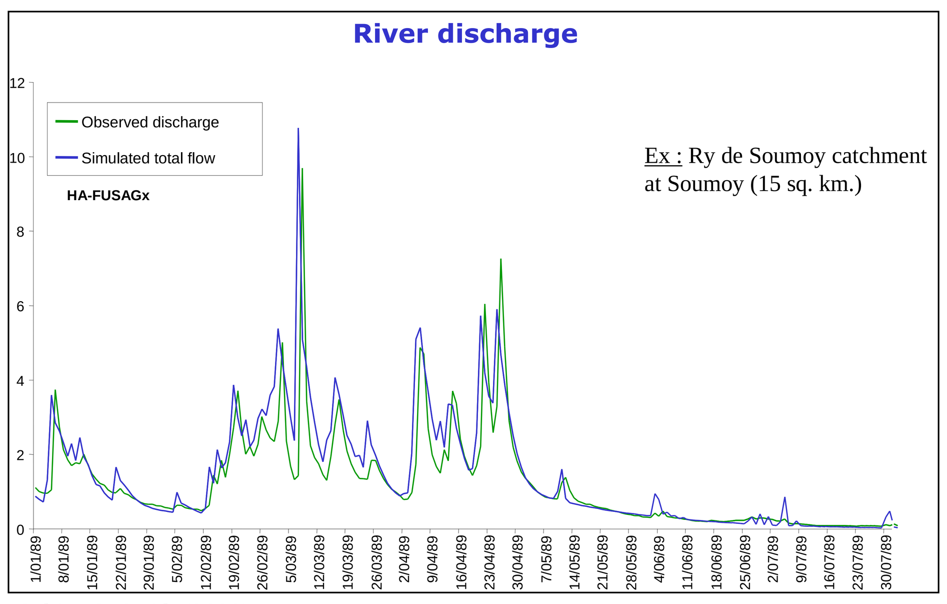
The main hydrologic significant data are available in Wallonia: the digital soil map (1/20 000), the DTM (1/10 000), digital land use (1/10 000) and spatial statistics for rain (IDF curves).

New ArcToolBox « SCS GISER »



A hydrologic model was developed using the python programming language in the ArcGis 9.3 environment. This model is based on the NRCS – USDA method. Rain abstraction is calculated on the basis of a CN (curve number) which integrates the soil type, the land use and the slope. Water transfer is computed using a convolution based on triangular unit hydrogrammes. This calculation includes the concentration time which integrates the catchment morphology (shape and slope) and the land use (roughness). The MUSLE equation is also computed in order to handle the sediment problem.

Hydrological modelling's results



Sohier C. & Al. (2009).

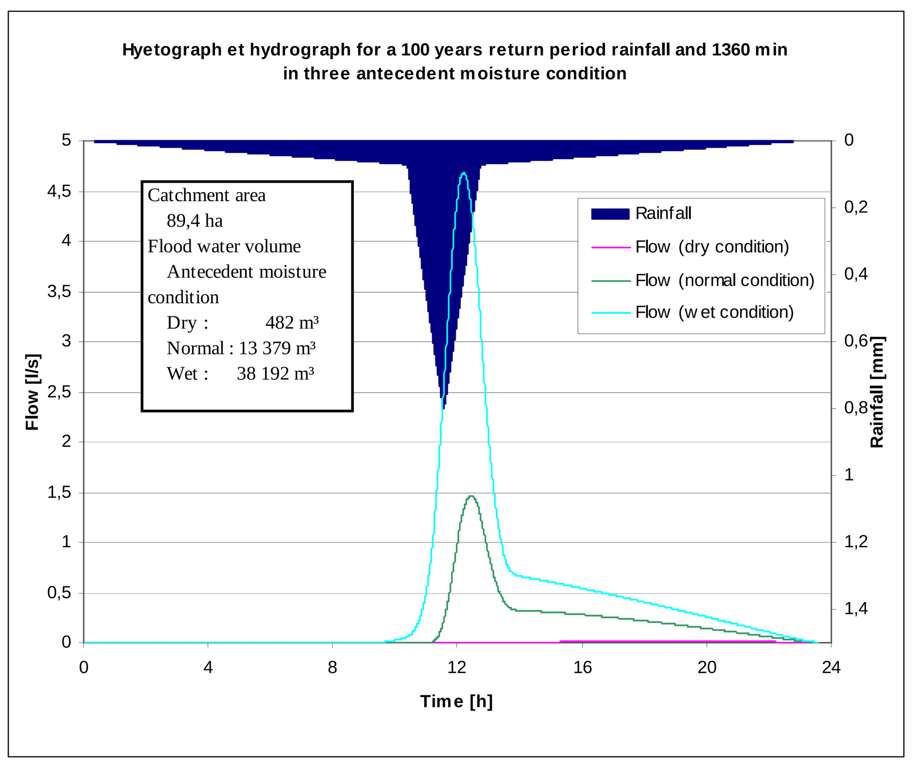
The CN and MUSLE semi-empirical methods give very interresting results at a larger scale in Wallonia. They still have to demonstrate their efficiency at the micro-catchment scale, but as shown below, they can be of use in natural risks caracterisation.

The results of this Arc Tool box consist in a full project hydrograph.

This modelling application gives :

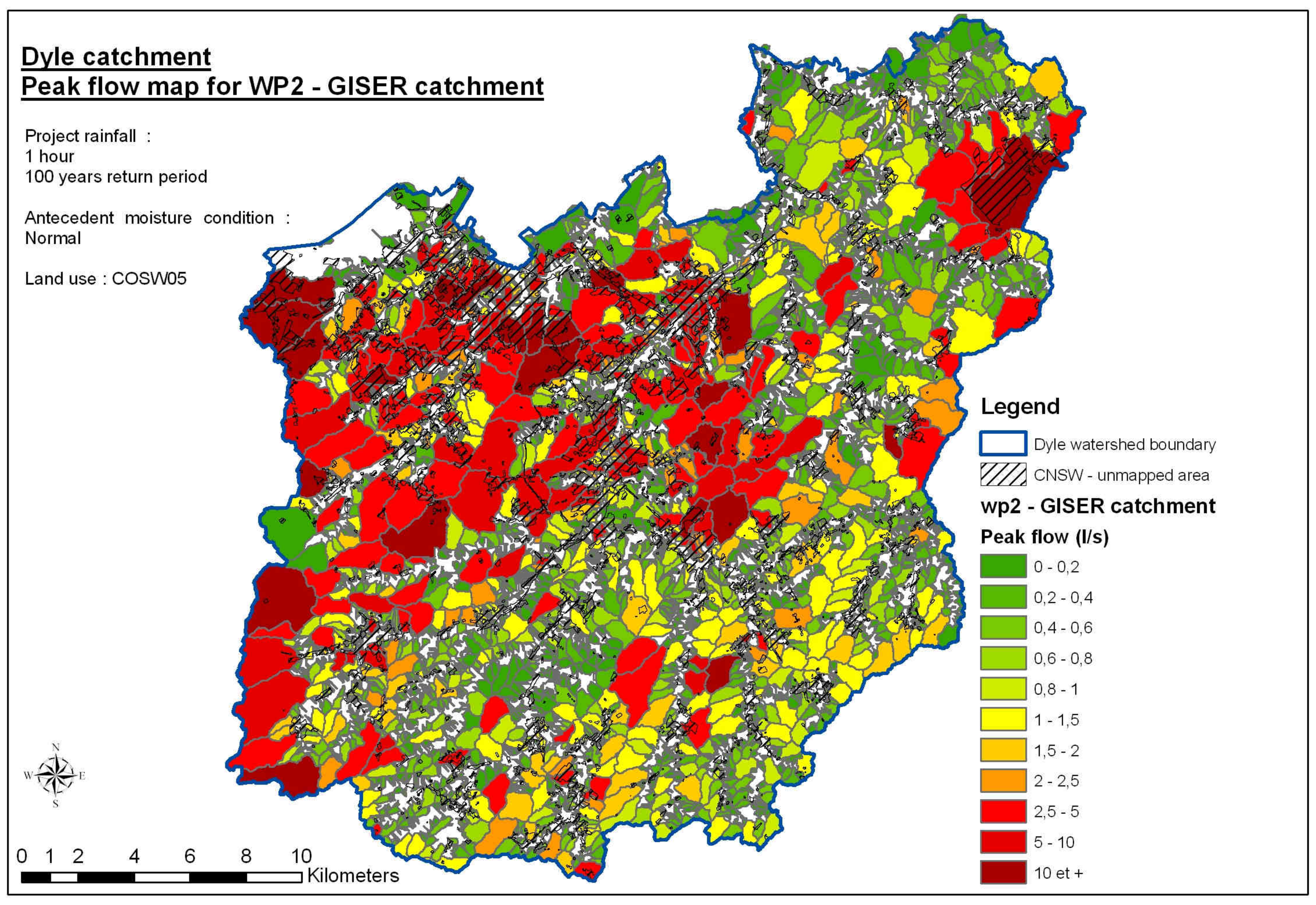
- Peak flow value,
- Flood water volume,
- Sediment yield

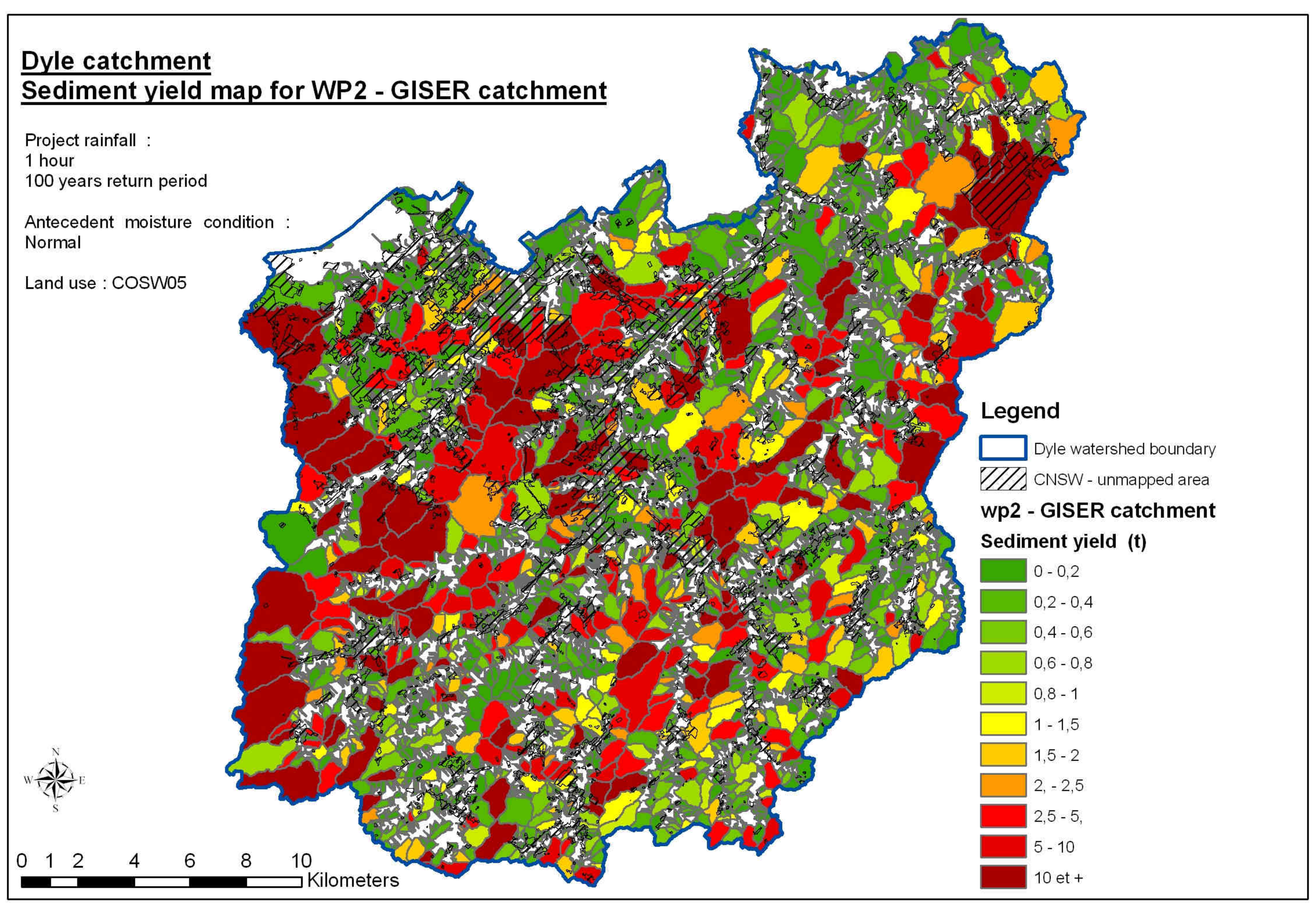
in response to a project rainfall computed for each micro-catchment.



Overland and mud flow risks maps

The aforementioned variables can be considered as integration factors of the whole hydrological context of the micro-catchments. It allows us to build advice on overland flow and mud flow mitigation. This approach can also be of help to compare ungauged micro-catchments between each other and possibly transpose the soil conservation practices from a site to another.





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