

ApsûGIS : a GIS-tool for groundwater vulnerability assessment using physical criteria

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OVERVIEW



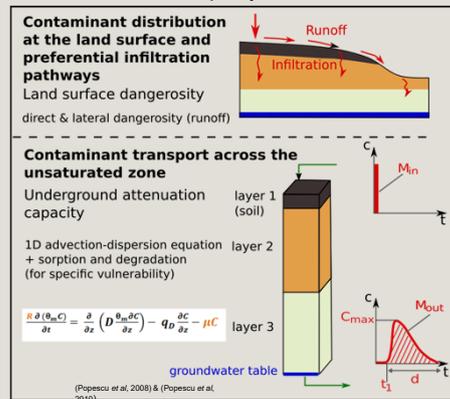
Convention between Hydrogeology and Environmental Geology (LIEGE University) and Walloon Region

2004: development of the method and application to a small area (Néblon basin)

2016-2018 : adaptation of the method and application to the entire Walloon Region

1. THE APSÛ METHOD

The Apsû method is based on a quantitative description of contaminant transport processes in the subsurface. It is based on the source-pathway-receptor approach, driven by two concepts: land surface dangerousity and subsurface attenuation capacity.



Vulnerability classes are based on physically-based criteria reflecting the sensitivity of groundwater to pollution events, namely contaminant travel time across the unsaturated zone (t_t), pollution duration (d), or contaminant concentration (C_{max}) or relative quantity of pollutant (M_{out}/M_{in}) at the groundwater table.

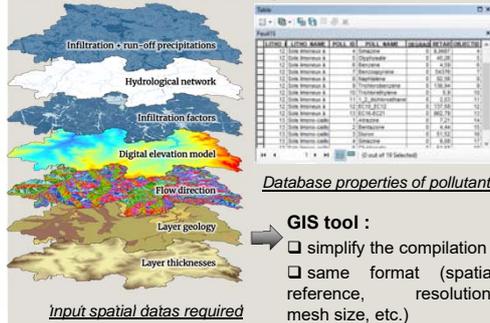
A GIS tool based on the APSÛ methodology was developed for mapping groundwater intrinsic and specific vulnerability.

This decision support tool is designed for groundwater resource managers to determine the areas most sensitive to a polluting incident.

2. GIS SYSTEM

To apply the Apsû method, a GIS-based tool under ArcGIS software has been developed: The GIS-tool embeds all the data within a same software environment, to ensure integrity and compliance of the input data and the vulnerability maps produced with Apsû method.

The GIS tool provides spatial and tabular data management, as well as user-defined options for creating vulnerability maps. Custom toolboxes have been developed to automate many geoprocessing operations and to guide the user on how to use the functions. Two databases are also integrated to define the hydrogeological properties of materials and the physicochemical properties of pollutants.



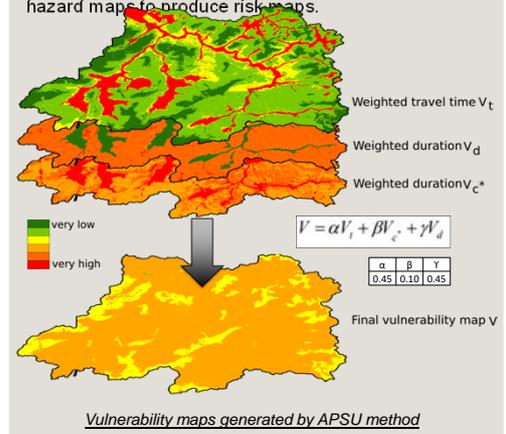
4. RESULTS

With the ApsûGIS tool several thematic maps are produced :

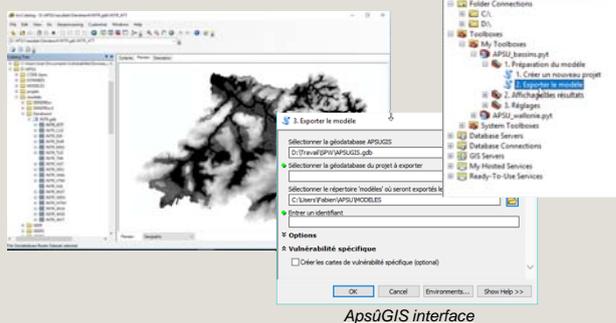
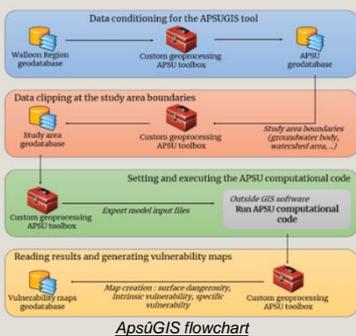
- surface dangerousity,
- maps of attenuation capacity : travel time, pollution duration, contaminant concentration or mass recovery,
- maps that cross surface dangerousity and attenuation,
- the user can also create a final map by weighting different criteria.

Data can be presented in raw or classified ways. The user can choose the symbology he considers most appropriate and choose these own interval classes according to his case study.

These vulnerability maps can be used with land use maps (industrial sites, agricultural parcels, etc.) and hazard maps to produce risk maps.



3. APSÛGIS STRUCTURE & INTERFACE TOOL



The second step is to prepare specific data for the study area, such as preferential infiltration points, hydrogeological properties of the lithologies encountered, etc.

The third step, the heaviest part in terms of computing, is provided by the computation code outside the GIS software in order to avoid locking a license during the process. This structure also makes it possible to use the Apsû computation code with any GIS software, including freeware, such as QGIS.

The last step consists of importing the vulnerability maps created by the computation code into the GIS system and formatting them in order to be exploited by the final user.

ApsûGIS is structured around 4 main steps, each assisted by specific tools to facilitate its treatment.

The first step, and by far the most important, consists in collecting from different organisms the spatial data required by Apsû, and formatting them to be used by the tool.

CONCLUSIONS

- 1 The Apsû method is physically based and allows a better understanding of the vulnerability of groundwater.
- 2 The tool ApsûGIS automate numerous operations, ensure data integrity and focus work on the specificities of the areas studied and the interpretation of the vulnerability maps created.
- 3 The modular structure of ApsûGIS enable it to be used in various study areas with different configurations (country, scale of the area and resolution of available data).

More information:

□ Popescu I.C., Gardin N., Brouyère S. & Dassargues A. (2008). <https://orbi.uliege.be/handle/2268/3595>

□ Popescu I.C., Brouyère S., Derouane J. & Dassargues A. (2010). <https://orbi.uliege.be/handle/2268/14373>