

Recent developments in the Apsû method for processes-based groundwater vulnerability mapping

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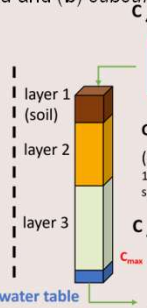
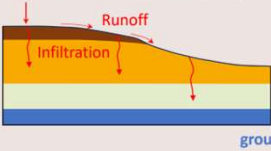
1. Theoretical background

The APSÛ method is based on a quantitative description of contaminant transport process in the subsurface. It is based on the source-pathway-receptor approach, driven by two concepts : (a) *land surface hazard* and (b) *subsurface attenuation capacity*.

Contaminant distribution at the land surface and preferential infiltration pathways

(a) Land surface hazard

direct & lateral land surface hazard (runoff)

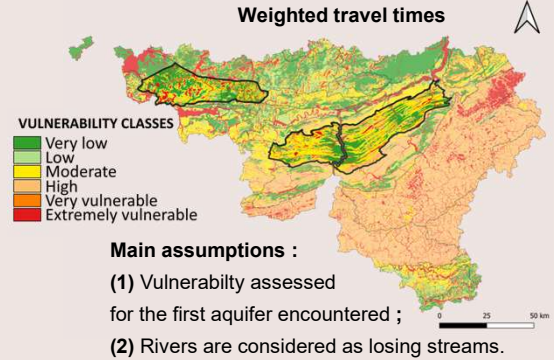


Contaminant transport across the unsaturated zone

(b) Underground attenuation capacity

1D advection-dispersion equation + sorption and degradation (for specific vulnerability)

$$R \frac{\partial (\theta_m C)}{\partial t} = \frac{\partial}{\partial z} \left(D \frac{\partial \theta_m C}{\partial z} \right) - q_D \frac{\partial C}{\partial z} - \mu C$$

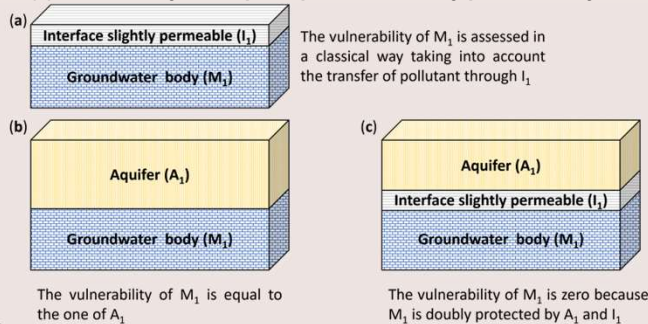


Main assumptions :

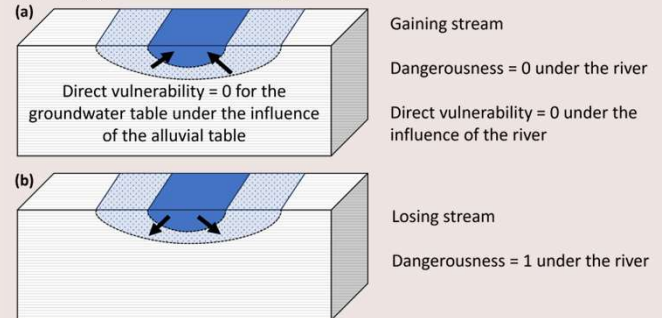
- (1) Vulnerability assessed for the first aquifer encountered ;
- (2) Rivers are considered as losing streams.

Development of **two new models** in order to map the vulnerability of **any aquifer** providing a more consistent representation of **groundwater-river interactions** and **protective layers**

(1) Vulnerability of deeper aquifer reduced by protective layers

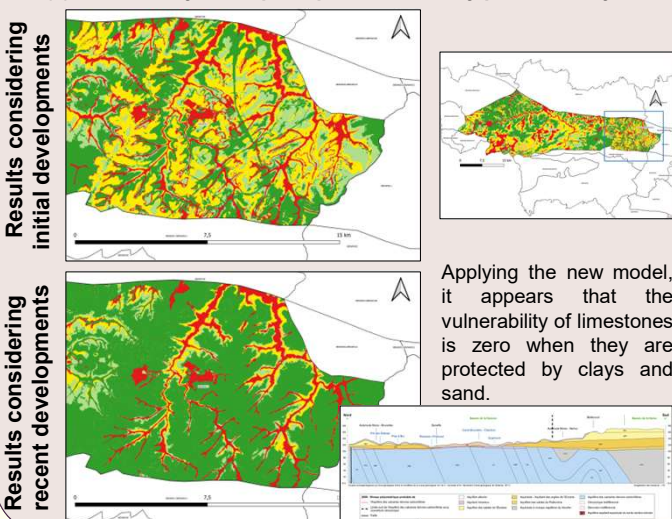


(2) Consideration of groundwater – river interactions

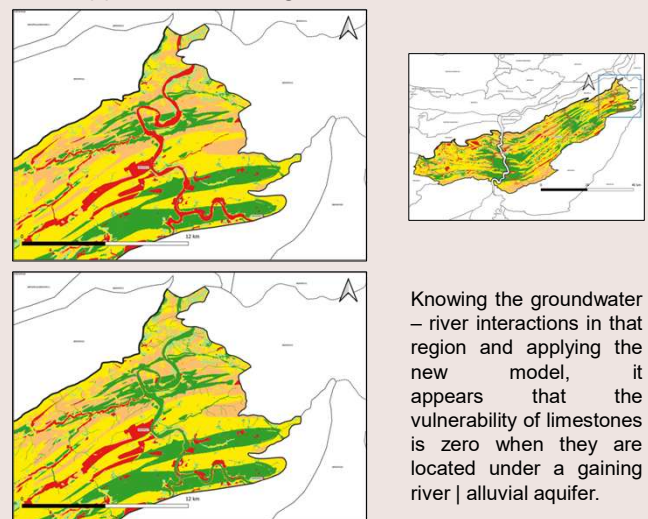


2. Results

(1) Vulnerability of deeper aquifer reduced by protective layers



(2) Consideration of groundwater – river interactions



3. Conclusion

By integrating these new features, the Apsû method now offers a more nuanced and comprehensive perspective on groundwater intrinsic vulnerability for any aquifer.

By linking process-based vulnerability mapping with site-specific assessments, it provides a robust tool for identifying areas at higher risk and guiding protective measures.

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