



An holistic view on aquifer vulnerability based on a distinction of different types of vulnerability

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AN HOLISTIC VIEW ON AQUIFER VULNERABILITY BASED ON A DISTINCTION OF DIFFERENT TYPES OF VULNERABILITY

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The concept of vulnerability is certainly useful in the field of groundwater protection. Nevertheless, within the scientific community, the definition of groundwater vulnerability is still debatable and not clear and conclusive. This is probably due to the fact that researchers often have very different experiences and education. A positive effect of it is a constant exchange of ideas, but there are also negative consequences and difficulties in deepening the issue. The different approaches are very important but they are usable only if the concept of vulnerability is standardized: thus, for the sake of clarity, a number of definitions should be laid down, based on the different types of vulnerability. These definitions can then provide the necessary holistic view for the aquifer vulnerability assessment.

Nowadays vulnerability methods focus on the degree of vulnerability and the parameters needed for its evaluation, often neglecting to clarify what is the type of vulnerability the proposed methods are referred. The type of vulnerability, indeed, is both logically and hierarchically superior to the degree of vulnerability.

More specifically the type of vulnerability represents the evaluation of the hydrogeological conditions considered in the vulnerability assessment and able to influence the way in which the contamination can take place.

Currently the only distinction, based on of the type of vulnerability, is referred to intrinsic and specific vulnerability. Intrinsic vulnerability assesses the susceptibility of the receptor based on the natural properties of the land and subsurface; specific vulnerability also includes properties of the analyzed contaminant. This distinction is useful but not exhaustive.

In addition to this, e.g., a distinction of vertical vulnerability and lateral (or horizontal) vulnerability could be very useful; generally parametric vulnerability methods only take into account the protection degree offered by the overlying lithology, considering a vertical travel pathway for the contaminant. These methods normally neglect horizontal pathway (pollution transport in groundwater according to the hydraulic gradient), so we can have an underestimation of the possible vulnerability.

The distinction, the analysis and the definition of different types of vulnerability might be positive to stimulate discussion and have a number of advantages, such as:

- to improve the clarity of the conditions of employment of a method, benefiting above all end-users and stakeholders;
- to improve the ability to compare methods for the assessment of the degree of vulnerability;
- to improve the ability to verify the effectiveness of the proposed methods.