Combination of intrinsic and specific vulnerability mapping for the protection of groundwater against diffuse pollution at catchment scale

Jean-François Vernoux, Nicolas Surdyk, Frédéric Barrez

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J.F. Vernoux, N. Surdyk (BRGM), F. Barrez (IRSTEA)

Solutions such as agri-environmental measures, land management, afforestation and grasslands are used to protect groundwater, especially when used for human water supply, against persistent chemical contaminants, such as nitrates and pesticides. The cost of such measures, which can be very important if considering the whole catchment area, requires having a specific and optimized approach based on the identification of areas where the actions will be the more efficient. A methodology was developed in order to delineate such protection areas and action plans by combining intrinsic and specific vulnerability mapping.

The proposed method of intrinsic vulnerability mapping was adapted from existing methods to different types of aquifers (continuous aquifer, discontinuous fractured aquifer, discontinuous karstic aquifer). The needed parameters for multicriteria analysis are : soil characteristics, efficient rainfall, infiltration in the overlying layers, unsaturated zone thickness, aquifer permeability and karst specific parameters. For the specific vulnerability (relative to pesticides) we used a simple indicator derived of the equation of vulnerability of groundwater from the indicator EPRIP (Padovani et al., 2004; Trevisan et al., 2009). The data needed for the calculation come from diverse sources (measures, pedotransfert functions) and are integrated with a G.I.S. This indicator uses a modified version of the attenuation factor (Rao et al., 1985) to determine if a substance has a risk to leach through the root zone and the unsaturated zone depending on the properties of the soil and the molecule. The use of the G.I.S. allows also displaying zones most at risk more easily. The choice of the indicator EPRIP as the base for this method of estimation of the specific vulnerability is a point which can be questioned. Indeed, no study of comparison selected it as the best indicator. Nevertheless several reasons have advised to select this indicator to work out a method of estimation of the specific vulnerability. This indicator allows taking into account, at the same time, properties of substances, soil and climate. Moreover, it uses another important data: pesticide application dose. This indicator was estimated within the framework of the European project CAPER (Reus et al., 2002). The used method is also open to criticism; studies are in progress to test the validity of the results on several sites.

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