

# SENSITIVITY AND VULNERABILITY TO GROUNDWATER OVEREXPLOITATION BY A 'PRESSURE STATE IMPACT' AND PROCESS BASED APPROACH

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## Abstract

A methodology is developed for proposing a groundwater vulnerability assessment in a Pressure-State-Impact causal chain that is familiar to decision makers. The 'Driver Pressure State Impact Response' (DPSIR) framework, for describing interactions between society and the environment, defines a chain of Drivers that exert Pressures on the State of a given resource, such as groundwater, which then generates an Impact that will require an appropriate Response (Kristensen, 2004).

The method is here based on the calculation of sensitivity coefficients for a user-defined groundwater state for which several physically-based indicators are proposed. These sensitivity coefficients reflect the easiness with which the groundwater state transmits pressures into impacts. They are grouped into a vulnerability matrix of pressures and impacts that quantify vulnerability for every combination of causal links identified in the DPSIR chain. For that reason, the sensitivity coefficients are converted to vulnerability, using the concept of 'transgressing a given threshold', which is commonly used in socioeconomic sciences (Luers et al. 2003). The concept of 'rising above a given concentration threshold' can be used for groundwater quality issues. The concept of 'falling below a given piezometric head threshold' can be used for groundwater quantity issues as aquifer overexploitation problems.

Outside the careful selection of the sensitivity analysis method that can significantly influence the computational effort (Beaujean *et al.*, 2013), emphasis is given to the illustration of the general methodology on a simple groundwater quantity case (of an alluvial aquifer with concerns related to water supply) demonstrating the potential use of this general and physically based vulnerability assessment method.

While the methodology is general, the choice of causal chains has to be made prior to the calculation. The vulnerability is also related to a damaged state and is related to the 'distance' between the current state and a given threshold. This choice is arbitrary such that the vulnerability is sensitive to the choice of the threshold.

## Keywords

Groundwater, sensitivity, vulnerability, DPSIR, aquifer overexploitation

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