

# Evaluation and modelling of the impact of drought on groundwater reserves in Wallonia in the context of climate change

Julien Hutzemakers, Guillaume Vandelois, Philippe Orban, Alain Dassargues, Pascal Goderniaux, Serge Brouyère

Climate change has started to impact water resources in many regions and countries. Extreme events have become more frequent, with, in particular, severe winter or summer droughts that may affect groundwater reservoirs which are essential for drinking water. The exceptionally arid winters of 2016 and 2017 in Wallonia (Belgium) opened discussions on the necessity to develop tools and indicators that allow quantifying such impacts and modelling the responses of aquifer systems to such events.

In this context, the objective here is to describe the methodology that has been developed in Wallonia (Belgium). The approach relies on numerical groundwater flow models used to obtain trends in piezometric levels and groundwater balances using different specific drought scenarios. Modelling results are used to compute spatial maps of maximal piezometric drawdowns and recovery times by comparing baseline and drought scenarios. Adopting a flow budget perspective, groundwater flow modelling results are also used to quantify indicators reflecting relative shifts in water transfers between aquifer recharge, rivers, adjacent aquifers and exploited groundwater water resources.

The approach is illustrated using different strategic regional aquifers of Wallonia modelled using various numerical groundwater flow models able to compute groundwater budgets and simulate both the partially saturated and fully saturated zones of aquifers and the interactions with surface water courses. To assess the resilience of the groundwater bodies, three different scenarios were simulated: the first entailed a series of years with typical recharge levels, the second involved three consecutive years with the same recharge as in 2016-2017, followed by years with standard recharge rates, and the third replicated the second scenario but follows the three arid years with an exceptionally wet year.

Collectively these methodologies yield a better comprehension of drought impacts at a regional scale both in terms of spatial variability and large-scale water transfers.