Uncertainty of climate change impact on groundwater resources using a surface-subsurface integrated model and considering various possible uncertainty sources.

P. Goderniaux¹, S. Brouyère, P. Orban, A. Dassargues

¹Group of Hydrogeology and Environmental Geology – Aquapôle, University of Liège, Liège, Belgium

Many studies have highlighted that climate change will have a negative impact on groundwater in many areas. However, in previous studies, the estimation of uncertainty around projections was very limited. In this study, the impact of climate change on groundwater resources is estimated for the Geer basin using a surface-subsurface integrated model. The uncertainties around impact projections are evaluated from 3 different sources: climate models, natural variability of the weather, and hydrological model.

The surface-subsurface model was implemented using the finite element code HydroGeoSphere which enables a more realist representation of the water exchanges between all domains and constrains more the calibration with the use of both surface and subsurface observed data.

The uncertainty linked to the climate model is assessed with 6 contrasted RCMs and 2 GCMs. For each RCM, 100 equiprobable scenarios representative of transient climate change conditions between 2010 and 2085 are statistically downscaled using a new stochastic weather generator and applied on the hydrological model. These scenarios enable to account for the uncertainty related to the weather natural variability. The uncertainty linked to the calibration of the hydrological model is assessed by coupling HydroGeoSphere with UCODE_2005 and by performing a complete uncertainty analysis on predictions.

Results for this study show that the uncertainty linked to the hydrological model is the most important. Although the uncertainty remains large, so that it is difficult to quantify accurately the intensity of the decrease, the climate change signal becomes stronger than the uncertainty intervals by the end of the century.