Groundwater resource in northern France from XXth to XXIth centuries
Florence Habets, UMR 7619 Métis, Paris France
Nadia Amraoui, BRGM, Orléans, France
Julien Boé, Cerfacs, Toulouse, France
Rémy Bonnet, Cerfacs, Toulouse, France
Nicolas Gallois, Mines-ParisTech, Fontainebleau, France
Patrick Le Moigne, Météo-France, Toulouse, France
Thierry Morel, Cerfacs, Toulouse, France
Nicolas Roux, Météo-France, Toulouse, France
Dominique Thiéry, BRGM, Orléans, France
Jean-Pierre Vergnes, BRGM, Orléans, France
Pascal Viennot, Mines-ParisTech, Fontainebleau, France

Ground water resource are important for human activities, however, they are at threat due to the anthropogenic pressure and climate change. Climate change projections on the groundwater resource can give some insights on the forthcoming evolution. However, studying both past and future long term evolution helps pointing out how extreme could be the future compare to the past. Long term evolution of the groundwater resource are difficult to assess in the past due to the short observation period (barely longer than 60 years). To treat both past and future periods, a rather similar methodology is used, based on climate & ocean modeling, unbiasing & downscaling methods, and hydrogeological modeling. However, to treat the past period, the availability of some observations can be taken into account to drive the climate and assess the XXth groundwater evolution.

Here, we will present results obtained with a) the Aqui-FR\(^1\) modeling system (Habets et al., 2017), that includes several regional hydrogeological modelings coupled with a land surface model (Figure 1), b) past reanalyses over France (Bonnet et al. 2017) and c) some climate projections (Dayon, 2015).

Evolution of the groundwater level is expressed using a standardized piezometric index, that

\(^1\) [https://www.metis.upmc.fr/~aqui-fr/index_eng.html](https://www.metis.upmc.fr/~aqui-fr/index_eng.html)

Figure 1: The Aqui-FR modeling system (on the left) and extension (on the right)
expresses the head according to its return period. The results show that an important drought affected the groundwater around 1944-1950 in northern France, to a stage not encounter since then, although the memory of such event is not strong, probably due to the end of World War II. Climate projections obtained according to the RCP 8.5 scenario present a large spread, going from almost no change compare to nowadays, to an important decrease far below the 10 year return period (figure 2)

![Standardized piezometric index over the Seine basin from the XXth to XXI th centuries](image)

*Figure 2: Evolution of the standardized piezometric index over the Seine basin according the present day reference Safran, the XXth century reanalysis, and 3 climates projections based on the RCP8.5 scenario*

The poster will present the methodology and extended results, including assessment using long term observed riverflow and piezometric level. Sensitivity to the groundwater abstractions will be shown.

**Acknowledgements**
This work was funded by the Onema within the Aqui-FR project, as well as by LEFE, within the VITESSE project.
Ryma Aissat, Audrey Gervereau and Pierre Salmon were master students associated to the projects.

**References**