
Characterization and classification of karstic groundwater resources

Vincent Bailly-Comte*¹, Bernard Ladouche¹, Jean-Baptiste Charlier¹, Vivien Hakoun¹, Claudine Lamotte¹, Yannick Manche², and Jean Christophe Marechal¹

¹Bureau de Recherches Géologiques et Minières (BRGM) – Bureau de Recherches Géologiques et Minières (BRGM), G-eau, UMR 183, INRAE, CIRAD, IRD, AgroParisTech, Institut Agro, BRGM, Montpellier – France

²Parc National des Cévennes – Etablissement Public Parc National des Cévennes, Florac – France

Abstract

Karst aquifers are often described as complex, highly heterogeneous hydrosystems. Groundwater flow is difficult to describe in the karstified geological reservoir, both spatially and temporally, but most (if not all) of the groundwater flow naturally converges on a limited number of outlets. Consequently, the hydrological and physico-chemical responses of karst springs provide a comprehensive understanding of the functioning of the karst system, which is the basis of the systemic approach.

Accordingly, numerous graphical, statistical or signal processing methods have been proposed to describe the rainfall/discharge relationship and get some indicators derived from the analysis of karst spring hydrographs. These indicators have been used to classify the hydrological functioning of karst systems whatever the climatic context since the work of Mangin (1975), but how can these classifications be modified to account for the availability of karst groundwater resources?

The XLKarst tool (Bailly-Comte et al., 2023) is used to apply these methods to a database of 3-year daily precipitation and flow time series collected during the hydrogeological study of the karst groundwater resources of the Causse Méjean by the Cevennes national Park (PnC) and the French Geological survey (BRGM report RP-70327-FR). Six distinct karsts systems draining the same karst plateau have been monitored to get their discharge evolution in response to relatively homogeneous recharge events on the karst plateau. This enables a direct comparison of the results in terms of karstic functioning, avoiding biases due to different climatic contexts. This presentation will first describe the functionalities of the XLkarst tool as applied to the Causse Méjean dataset. In addition to classical hydrological time-series analysis, a new approach for karst spring recession analysis will be presented based on the continuous baseflow separation of Duncan (2019). The results will be used (i) to discuss the strength and weakness of classifications of the hydrological functioning of karst systems based on recession curve analysis and base flow separation methods, and (ii) to propose an alternative that highlights the availability of the karst groundwater resources.

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*Speaker

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