
Modeling the global change impacts on the Lez karst aquifer

Résumé

The Lez karst system, located just north of Montpellier, is a major Cretaceous and Jurassic limestone karstic aquifer that supplies drinking water to 340 000 inhabitants of metropolitan Montpellier. The present water management scheme allows pumping at higher rates than the natural spring discharge during low-flow conditions, while supplying a minimum discharge rate into the Lez river for ecological purposes, and reducing flood hazards via rainfall storage in autumn.

Lez spring water is currently tapped by four pumping units consisting of two submerged pumps connected in series and operating at variable speed with an output of 600 to 1 000 l/s. These pumps are located in three of the four vertical boreholes that intercept the main karst conduit. The mean pumping abstraction rate-currently 1080 l/s or 34 Mm³/year-is sufficient to supply drinking water for a permanent population of around 340 000 inhabitants. The Lez spring system is one of the largest temporary groundwater abstraction systems in the world, similar to the Fiegh karst system, which supplies water for the city of Damas [Lamoreaux *et al.* 1989].

Semi distributed lumped model has been used to characterize the regime of the karst aquifer subjected to extensive pumping. The systemic approach uses a transfer model that is based on computing the convolution integral of up to several signals, e.g., efficient rainfall, pumping, to simulate flow rates and groundwater levels in both the karst conduit and the carbonate matrix at the aquifer outlet and in several parts of the catchment area. The model is a semi-distributed lumped model which simulates the hydrological response of the different hydrologic compartments of the karst system. Groundwater is abstracted near the system's major outlet at a higher rate than the low-water spring discharge, thereby mobilizing stored groundwater during low-water periods ('active management'). The model's results are very satisfactory, especially for the karst system outlet, where the water levels are particularly well reproduced. The model can also simulate the natural, i.e., non-pumping, state of the karst system and thereby estimate the impact of active management on the water resource. It has been used to simulate several scenarios of pumping under present and future (2045-2065) climate. It is useful in order to determine the sustainable pumping rate allowing to respect the authorized drawdown and pumps elevation

Mots-Clés: global change, pumping, modelling, lumped model, time series, active management