

KARMA Newsletter 2021

Karst aquifers contribute to freshwater supply of most Mediterranean countries and many cities are supplied by karst water, e.g., Rome, Vienna, Montpellier and Beirut. Karstified carbonate rocks are widespread in Mediterranean countries and constitute 21.6 % of the European land surface. Because of their hydraulic properties, such as rapid and turbulent flow in a network of conduits, karst aquifers often reveal highly variable spring discharge and water quality and are therefore highly vulnerable to contamination.

The **KARMA project** is a cooperation of (karst)-groundwater scientists from seven countries under the umbrella of the PRIMA initiative (<http://prima-med.org/>).

The objective of the KARMA project (2019-2022) is to achieve substantial progress in the hydrogeological understanding and sustainable management of karst groundwater resources in the Mediterranean region in terms of water availability and quality at different scales.

One of the major aims is to accomplish the first consistent and detailed Mediterranean Karst Aquifer Map (Fig.1) and database (MEDKAM).

KARMA work progress

Field work, installation of monitoring equipment, data collection and analysis defined the first 1.5 years of KARMA activities, since beginning in September 2019. In the meantime, first results were published in reports and journals and presented at international conferences and are available on the KARMA website:

<http://karma-project.org/>

To date, the KARMA working groups have successfully established the basis for developing tools for karst groundwater management, such as early warning systems for spring contamination and numerical groundwater models.

In the coming months, KARMA plans to make substantial progress in further developing the karst aquifer map, lumped parameter models, artificial neural networks and in completing tracer tests.

Where we are next!

6-10 September 2021 - IAH Conference
Belgium, Brussels

19-24 September 2021 - GEO Karlsruhe

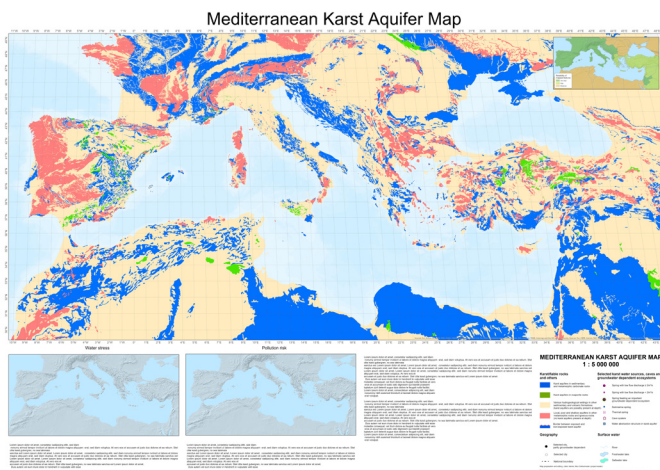


Figure 1 Draft karst aquifer map.

Examples of KARMA activities

APLIS workshop

Two online workshops on the assessment of groundwater recharge in karst aquifers using the APLIS method (Altitude, SloPe, Lithology, preferential infiltration layers, Soils) were given in December 2020 and February 2021. The workshops were hosted by CEHIUMA (University of Málaga) with participants from Spain, Italy, France, Lebanon and Germany.

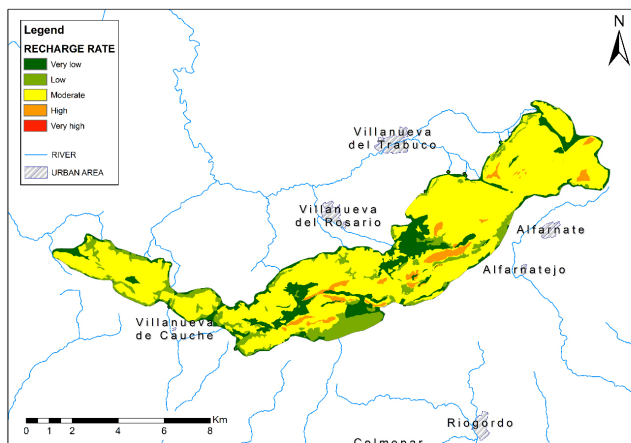


Figure 2 Groundwater recharge map of thw Malaga area (prepared by Juan Antonio Barberá).

Online survey on karst groundwater resources

A KARMA online survey was carried out in order to obtain a comprehensive picture of how groundwater experts assess the importance of the tools for improved karst groundwater management developed in the KARMA project. The results will be published soon.

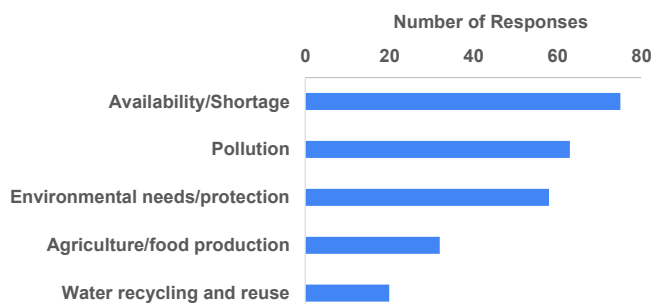
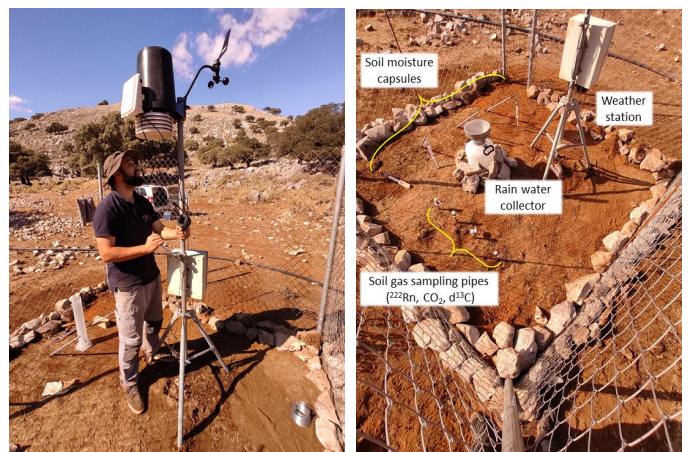


Figure 3 What the experts consider to be the most important challenge for managing karst groundwater resources over the next 20 years.

Monitoring



Particle counter, ColiMinder (encymatic activity analyser of *E. coli*) and field fluorometer were installed at Sägebach spring, Austria, in order to detect contamination events (Photo: Simon Frank).



A weather station, rain water collector, four soil moisture capsules and also four soil gas sampling pipes located at different depths were installed at Malaga test site, Spain (Photos: Jaime Fernández Ortega).