Karst aquifers of Switzerland

Toward a sustainable use of groundwater in limestone regions

**SWISSKARST**

Pierre-Yves Jeannin, Arnaud Malard, Jonathan Voullaranc, Eric Weber
ISSKA - Institut Suisse de Spéléologie et de Karstologie, rue de la Serre 68 | CH-2300 La Chaux-de-Fonds, info@isska.ch

**Project objective**

Karst aquifers represent nearly 80% of Swiss groundwater reserves (nearly 120 km³) and at least 20% of groundwater resources. In spite of their significance, the location and quantification of these reserves have not been systematically documented. This is mainly due to the lack of a dedicated and pragmatic approach for characterizing karst hydrogeological systems. As a documented overview of these aquifers does not exist, their management is far from being optimal and the study of related topics such as the protection of groundwater resources, the assessment of renewable energy or the prevention of natural hazards is not always satisfactory.

**Main results**

All along the four-years project, the documentation of karst aquifers has been extended to nearly one-third of the Swiss territory. This brought consistent insights regarding the location of the groundwater reserves and the drainage direction of the subterranean flows.

- A karst hydrogeological map which displays an "identity card" for each karst system which assesses floods and karst natural hazards.
- A list of attachments (typically literature) in their significance, the location and quantification of these reserves have not been systematically documented.
- Preventing construction from karst groundwater reserves and resources in Switzerland. Such work will precisely characterize karst hydrogeological systems. As a documented overview of these aquifers does not exist, their management is far from being optimal and the study of related topics such as the protection of groundwater resources, the assessment of renewable energy or the prevention of natural hazards is not always satisfactory.

**Outlook**

Through the Swisskarst project, it seems obvious that NPPs1 initiated a long-term work in the field of karst hydrogeology in revealing the significance of these aquifers for the Swiss society and foreign countries.

In Switzerland, cantonal and federal institutions are interested by finalizing the documentation over the territory for the coming years. They actually state for integrating concepts and results in the official geographic and geological supports.

In addition to local and private projects, collaborations that have been launched under the name of Swisskarst (Slovenia, Spain), various collaboration abroad are now under progress: Ireland, Great-Britain, France, China, etc...

**References**


KARSYS is now becoming a worldwide approach... Challenges for the coming years will be the progressive translation of this formal approach toward an integrated tool / interface which makes it possible the applications of KARSYS and the results management by non-experienced persons.

**Documentation progress (to 2014)**

Outputs of the NPPS1 project are expected to be intelligible for the largest possible audience of practitioners. In this way maps and associated documents have been developed in a formal and useful format for the documentation of karst hydrogeological systems:

- A karst hydrogeological map which displays the main characteristics of the system. New hydrogeological mapping concepts in karst areas have been developed in order to address specific questions and three sets of maps are proposed depending on the scale.
- An interactive and ready-to-use 3D model of the system which includes the same features as the map and offers predefined views focusing on particular aspects of the systems;
- A list of attachments typically illustrative in relation with the system of interest.

**Pragmatic tool**

The Swisskarst project was the opportunity to develop and improve a pragmatic approach for the characterization of karst aquifers. Through the application of four systematic steps the KARSYS approach provides a conceptual model of the aquifers which may be refined depending on the issue and the available data.

- Assessing groundwater reserves/resources.
- Assessing floods and karst natural hazards (cavities, landslides, etc.)
- Assessing potential for renewable energies, geothermal or hydropower
- Preventing construction from karst-related hazards (tunnels, waste-deposits, etc.)

These extensions may integrate additional models (inception, speleogenetic, conduits generation, etc.) and/or may require the use of hydrological and hydraulic software to answer temporal-related questions like floods prevention.

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**KARSYS: a pragmatic four-basic approach**

KARSYS has been proposed for a large number of applications according to various demands of water authorities and users. Based on the approach principles, dedicated extensions have been develop for:

- Assessing groundwater reserves/resources.
- Assessing floods and karst natural hazards (cavities, landslides, etc.)
- Assessing potential for renewable energies, geothermal or hydropower
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