



Visual KARSYS;

a software dedicated to the
management of karst
environment

Abstract

Our experience as researchers and consultants along the last decade evidenced a gap between fundamental researches in karst media and applied engineering questions. On the one hand, academic knowledge on karst aquifers was mainly developed towards time responses and their modelling. But, on the other hand, engineering questions are rather spatial issues for which concepts, approaches and tools did not significantly change over the last 20 years (although some of them did). Many approaches are still inspired and adapted from porous or fissured media, which remain inappropriate to adequately characterize properties of karst aquifers and their hydrological functioning (Goldscheider and Drew 2007). Therefore pragmatic questions regarding land-uses, groundwater supply, natural hazards, constructions, renewables energies in karst environment are still difficult to resolve. Solutions are often not optimal leading to potential risks for the environment or for the suitability of the engineering projects.

In the frame of the NRP61, SSKA developed and still improves a dedicated approach for the documentation of the karst aquifers in Switzerland. “KARSYS” (Jeannin *et al.* 2013) is a pragmatic approach which makes it possible to address the location of the groundwater resources and the main underground flows (e.g. Figure 1). It provides a concrete 3D model to support applications in the field: water supply, natural hazards, land planning, renewable energies, underground construction, etc. A direct extension of KARSYS was developed for the planning and construction of tunnels in Karst (KarstALEA-Method, Filipponi *et al.* 2012).

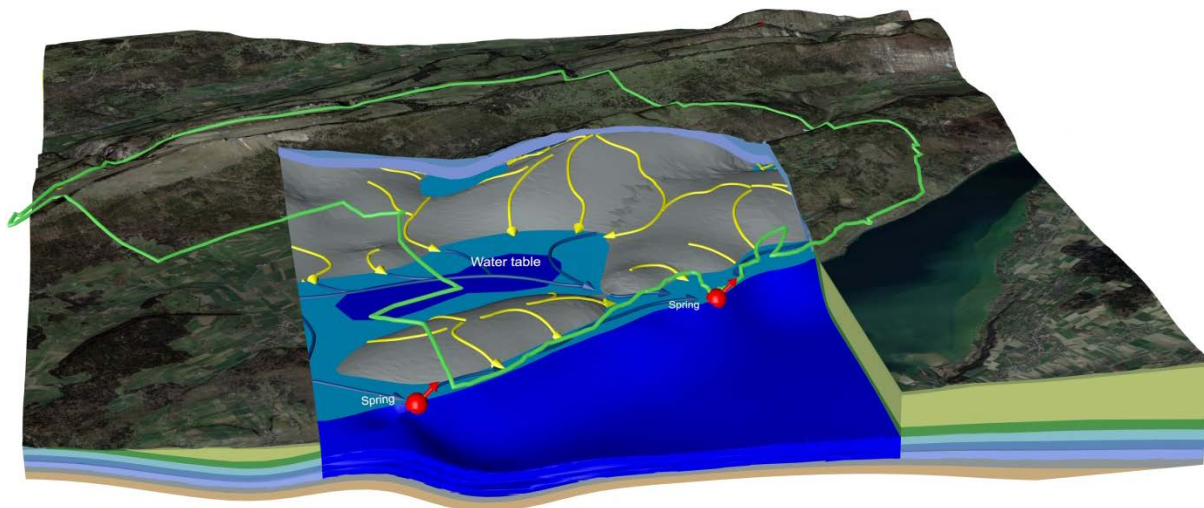


Figure 1. Perspective view of a KARSYS hydrogeological model; the model informs on the geometry of the aquifers and the main groundwater drainage axes. (Green line: Catchment area; Blue volumes: groundwater bodies; Yellow arrows: underground vadose flow paths; blue arrows: undergrounds phreatic flow paths; Red spheres: Springs).

The development of KARSYS aimed at improving the sustainable management of groundwater resources in a karst aquifer. The approach is a great success as it is actually applied in Switzerland for several cantons (VD, FR, SG, NE, BE, JU, GR, VS, SO, SZ) and FOEN, as well as abroad (Spain, Slovenia, France, Ireland).

A strong limitation in the application of our methods is that know-how and dedicated tools are only available at SSKA. It is therefore difficult for people outside SSKA to learn and apply KARSYS. However, people from Switzerland and from all over the World (Great-Britain, China, Estonia, Georgia, etc.) regularly ask our institute for learning KARSYS, and SSKA can unfortunately not satisfy all the demands. The proposed project to FOEN (grant for the “Promotion of Environmental Technologies”) aims at developing a pragmatic and usable tool for learning and applying KARSYS with less (or even no) dependence on SSKA. A web-site will be designed in order to provide a practical guideline and the necessary tools for the user to apply KARSYS. The user will be guided on the way to prepare the data, to build the 3D geological model, then the hydrogeological model and to produce output maps and 3D-models. The user-interface will include the necessary tools either to make the models directly or to import models from other software packages. It will also include visualization tools or export formats for visualization in other tools.

This option appears to be the most judicious for promoting the KARSYS approach worldwide and for providing pragmatic tools that most of the people may perform by themselves over their own working environment. In this first phase, the challenge is to develop and diffuse a web-software making possible to apply KARSYS in its standard form – the product is called “Visual KARSYS”. In the coming years it is expected that additional tools (including KarstALEA) will be implemented to “Visual KARSYS”.

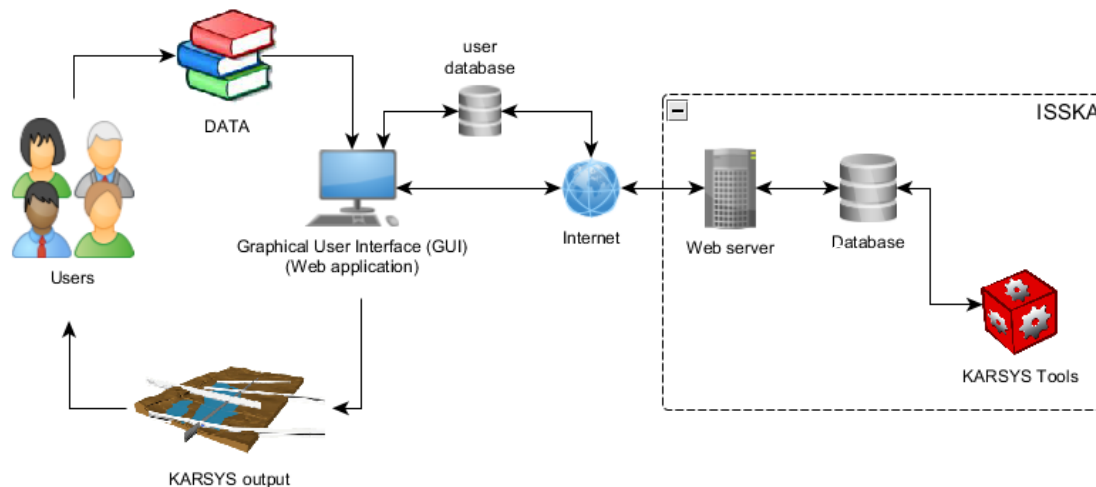


Figure 2. Visual KARSYS: The user will work directly on the web (with a web-account), introducing his data into a web-database, and using web-software. The tool and data will thus be available from anywhere in the World.

References

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- Filipponi M, Parriaux S, Schmassmann S, Jeannin P-Y (2012): KarstALEA: Wegleitung zur Prognose von karstspezifischen Gefahren im Untertagbau. *Forschungsauftrag FGU2009/003 auf Antrag der Fachgruppe Untertagbau (FGU), Bundesamt für Strassen (ASTRA), Band 1395, 200 S.*