



## Inception horizon concept as a basis for sinkhole hazard mapping

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The office for natural hazards of the Vaud canton (Switzerland) is interested for a pragmatic approach to map sinkhole hazard in karst areas. A team was created by merging resources from a geoengineering company (CSD) and a karst specialist (SISKA).

Large areas in Vaud territory are limestone karst in which the collapse hazard is essentially related to the collapse of soft-rocks covering underground cavities, rather than the collapse of limestone roofs or underground chambers. This statement is probably not valid for cases in gypsum and salt.

Thus, for limestone areas, zones of highest danger are voids covered by a thin layer of soft-sediments. The spatial distributions of void and cover-thickness should therefore be used for the hazard assessment.

### VOID ASSESSMENT

Inception features (IF) are millimetre to decimetre thick planes (mainly bedding but also fractures) showing a mineralogical, a granulometrical or a physical contrast with the surrounding formation that make them especially susceptible to karst development (FILIPPONI ET AL., 2009). The analysis of more than 1500 km of cave passage showed that karst conduits are mainly developed along such discrete layers within a limestone series. The so-called Karst-ALEA method (FILIPPONI ET AL., 2011) is based on this concept and aims at assessing the probability of karst conduit occurrences in the drilling of a tunnel. This approach requires as entries the identification of inception features (IF), the recognition of paleo-water-table (PWT), and their respective spatial distribution in a 3D geological model.

We suggest the Karst-ALEA method to be adjusted in order to assess the void distribution in subsurface as a basis for sinkhole hazard mapping. Inception features (horizons or fractures) and paleo-water-tables (PWT) have to be first identified using visible caves and dolines. These features should then be introduced into a 3D geological model. Intersections of HI and PWT located close to landsurface are areas with a high probability of karst occurrence.

### ASSESSMENT OF THE SOFT-SEDIMENT COVER

Classical geological investigations (mapping, DEM analysis, drilling, etc.) are used to establish a map of the thickness of soft-sediment on top of the limestone. This can also be included in the 3D model.

The combination of the void and soft-sediment information in the 3D model makes it possible to derive the sinkhole hazard map. This is currently being developed and applied in the Vaud canton and first results will be presented.

### BIBLIOGRAPHY

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