Integrating Geological Structures Into 3D Numerical Groundwater Flow Models

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Abstract

The 3D knowledge of complex geological systems and their integration into hydrogeological models is a prerequisite to study the dynamics of hydraulic processes at different scales. However, the integration of constructed 3D geological models (GOCAD©) into numerical groundwater flow models (COMSOL Multiphysics®) is still a challenge. The import of complex geological structures into numerical groundwater flow models requires among others, a layer-independent integration of geologic structures, most notably faults.

The proposed approach allows understanding regional ground water circulation, the effect of constructions sites (e.g. tunnels), the dynamic character of capture zones of pumping wells as well as to test how different boundary conditions and hydraulic property distribution influencing calculated flow regimes.

The pilot project in the DAVOS area (GRETA, near-surface geothermal resources in the territory of the Alpine Space) serves as an example of application of the proposed concept. The primary goal was the development of methods for the estimation of the geothermal use potential of deeper alpine aquifers and the development of model-based scenarios to set-up constraints for the exploitation of the deep aquifers.

Figures used in the abstract

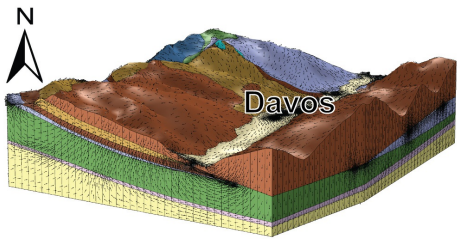

Figure 1: Result of regional scale groundwater modelling: the arrows represent the flow direction. The density of the arrows is based on a Gaussian distribution and is not to be equated with a volume or a velocity.