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Eawag Seminar Invitation

The competitive use of the subsurface: the influence of energy storage on groundwater quality

Speaker **Prof. Rainer Helmig**
Dept. of Hydromechanics and Modelling of Hydrosystems, University of Stuttgart, Germany

When **February 21, 11.00 – 12.00 a.m.**

Where **Forum Chriesbach, room C20, Eawag Dübendorf**

Abstract The subsurface is being increasingly utilised both as a resource and as an energy and waste repository. Historically, there have been few issues of concern related to competition between resources, with groundwater contamination being a notable exception. However, with increasing exploitation, resource conflicts are becoming increasingly common and complex. Current issues in this regard include, for example, the long-range impact of mechanical, chemical and thermal energy storage on groundwater resources, and the complex effects surrounding hydraulic fracturing in both geothermal and shale-gas production.

To analyse and predict the mutual influence of subsurface projects and their impact on groundwater reservoirs, advanced numerical models are necessary. In general, these subsurface systems include processes of varying complexity occurring in different parts of the domain of interest. These processes mostly take place on different spatial and temporal scales. It is extremely challenging to model such systems in an adequate way, accounting for the spatially varying and scale-dependent character of these processes. In this lecture, we will give an overview of possible utilisation conflicts in subsurface systems and of how the groundwater is affected and also review several model-coupling concepts with a focus on the author's work in this field. The concepts are divided into temporal and spatial coupling concepts, where the latter are sub-divided into multi-process, multi-scale, multi-dimensional, and multi-compartment coupling strategies. We present a large-scale simulation that will show the general applicability of the modelling concepts of such complicated natural systems, especially the impact on the groundwater of simultaneously using geothermal energy and storing chemical and thermal energy. At the same time, we will show that such real large-scale systems provide a good environment for balancing the efficiency potential and possible weaknesses of the approaches discussed.