Geophysical Research Abstracts
Vol. 21, EGU2019-5755, 2019
EGU General Assembly 2019

Urban Geology – Process-Oriented Concepts for Adaptive and Integrated Resource Management

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Urban subsurface resources and especially urban groundwater bodies are particularly vulnerable to environmental impacts, and their rational management is of major importance. Often, infrastructure development largely takes the pragmatic form of engineering for short-term economic objectives on the project-scale, whereas only solitary limited impacts on subsurface resources are regarded.

Following the book "Urban Geology – Process-Oriented Concepts for Adaptive and Integrated Resource Management", which was published in the year 2011, the authors want to give an overview on further advancements on the topic. We will discuss on how our concepts have been received, not only by the scientific community, but also by urban planners as well as environmental and water supply agencies.

We show that modern quantitative earth-sciences can contribute significantly to finding solutions concerning the sustainable use or subsurface resources (water & energy) in urban environments. There are four main elements which are important for a successful management of urban subsurface resources: (1) efficient management of subsurface data and data mining to provide geological data in 3D; data should be organized in such a way that fast data access is provided; (2) specific field investigations and experiments to study the relevant processes in urban environments and to provide adequate boundaries for numeric modeling approaches; (3) development of tools for sophisticated analysis of subsurface monitoring data and the setup of geological, hydrogeological, or geotechnical models; and (4) the development and implementation of adaptive management concepts at different scales as a base for the setup of scenario techniques in decision processes.

We present projects examples from the urban region of Basel, northwestern Switzerland, which have practical as well as research character. Thereby, we move from the project-scale to the city-scale which allows us to consider simultaneously the numerous impacts on urban subsurface resources, such as infrastructure development or groundwater and geothermal subsurface use. Our geological database together with the developed spatiotemporal high-resolution monitoring and 3D modelling tools represent a unique starting position suitable for empirical studies and hypothesis testing in the domain of quantitative information fusion of urban geological, hydrogeological, or geotechnical questions.

Huggenberger P, Epting J (2011) Urban Geology - Process-oriented concepts for adaptive and integrated resource management. Springer XVI, 216p. DOI 10.1007/978-3-0348-0185-0