Hydrogeology of Austria: Selected Papers

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Austria is a water rich country and nearly the whole drinking water supply is based on groundwater. About one half of the population gets its drinking water from springs and the other half is supplied by groundwater in quaternary sediments of valleys and basins. This high standard in drinking water supply is based on a long tradition in hydrogeological research and water resources management in Austria. Already more than 20 years ago (1994) a special issue of this journal highlighted hydrogeological research in Austria. However, in times of climate change, more intensive and increasing extent of land use and changes in energy policies the hydrogeology is exceedingly required to bridge the regional stress field between the human's encroachment into natural habitats and a sustainable use and the protection of water as the most important vital resource.

A lot of contributions related to Austrian hydrogeological research were provided at national and international conferences during the last decades. The research comprises the process based understanding of infiltration of water into the subsurface, water flow in the subsurface and hydrochemical and isotopic composition of groundwater. In addition, numerous innovative applications are daily necessary to solve hydrogeological issues related to e.g. infrastructural projects, geothermal use, water resources management and pollution of groundwater.

With this issue we want to give you an overview of recent hydrogeological research and innovative applications in Austria including also the specific point of view of federal authorities related to a sustainable water resources management. It is noteworthy that the contributions represent just a selection and don't claim to cover all fields of hydrogeological activities in Austria. The papers are based on numerous contributions at the PANGEO 2014, the Austrian conference in earth sciences.

Two contributions focus on groundwater quality issues. An isotopic data base (^{2}H, ^{3}H and ^{18}O) for Austria from 1964 to 2010 with data from all parts of the water cycle is presented by Rank et al. They present the survey of the development and change of the "isotopic environment" during the last decades, some key findings of (isotope)hydrological processes and provide some data sets meant for application purposes. Strauhal et al. discuss a complex alpine hydrogeological system with hard rock and clastic sediments affected by mass movements in the Kaunertal Valley. Based on hydrochemical and isotopic data they provide a conceptual model for the unusually high amount of dissolved solids (>1000mg/l) measured in some natural spring waters.

The findings of Orsi et al. contribute also to a better comprehension of the complex geological conditions and hydrogeological processes in alpine side valleys. They present an innovative application of Multiple Point Geostatical Simulation (MPS) to develop a 3D subsurface model as a base for a conceptual hydrogeological model of the complex sedimentary infill in the Padaster Valley.

Poltnig et al. developed an Add-in for ArcGIS 10x as a helpful tool to calculate the runout of shallow translational landslides and earth flows based on available regional scale data in Carinthia. They consider in their model the variability of the trigger and mobility of the shallow landslides as a function of water saturation in the landslides.

At regional scale the incomplete knowledge about the aquifer properties, the hydraulic behavior of faults and the boundary conditions cause uncertainties in conceptual hydrogeological models. Mechal et al. applied a multi-model approach using numerical groundwater models to identify the most reliable model for the complex hydrogeological settings of the Gidabo River Basin in the Ethiopian rift valley. Wagner et al. investigated the impact of relict rock glaciers on springs and stream flow of alpine watersheds in the Niedere Tauern Range. Based on a lumped parameter model they highlighted the relevance of such sediment accumulations related to water management issues.

Goldbrunner et al. present a geothermal project in Upper Bavaria where a doublet well was installed for district heating. Based on a conceptual model a numerical model was developed to simulate the impact of the geothermal use and reinjection of the cooled water on the temperature conditions of the subsurface.

Ferstl gives an insight into the responsibility of federal authorities related to sustainable water resources management. Within the "Arteser Aktionprogram" 59 artesian wells were decommissioned and redeveloped in Grafendorf to stop the uncontrolled outflow of deep groundwater and to protect this resource for the future. The success of the program is demonstrated by the regeneration of the deep groundwater system.

Hilberg and Eisendle-Flöckner viewed Austrian hydrogeology in hard rocks from the perspective of ground water fauna. With this visionary approach they connect the hydrogeological conditions and biological pattern to provide a basis for applying groundwater species as natural tracers considering that specific groundwater conditions cause a specific fauna.

With this special issue we are convinced to give an interesting overview of recent hydrogeological activities in Austria and hope to inspire and encourage all colleagues for the future to share their hydrogeological experiences to a broader audience and to submit and present their interesting findings.