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Rausch R. GTZ-IS, Riyadh, Kingdom of  
Saudi Arabia  
Schüth C. Technische Universität  
Darmstad

Kallioras A.  
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Kallioras



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## GROUNDWATER RESOURCES MANAGEMENT IN ARID COUNTRIES

**Rausch R.<sup>1</sup>, Schüth C.<sup>2</sup> and Kallioras A.<sup>2</sup>**

<sup>1</sup> *GTZ-IS, Riyadh, Kingdom of Saudi Arabia, randolf.rausch@gzdco-ksa.com*

<sup>2</sup> *Technische Universität Darmstadt, Germany, schueth@geo.tu-darmstadt.de,  
kallioras@geo.tu-darmstadt.de*

Although “arid hydrogeology” is a rather controversial term, the thorough investigation of current groundwater resources potential of arid regions is a key issue not only for the development of these countries but more importantly for the sustainability and preservation of available water resources for domestic use today and in the future. Most of groundwater aquifers in arid regions were recharged many thousands years ago (during wet climatic periods); hence their resources potential is mainly composed of fossil groundwaters. The majority of these aquifers appear in a state of constant depletion as outflow over-exceeds recent groundwater recharge. A prerequisite for the smart management of such groundwater resources is a sound understanding of the aquifer system based on reliable data and robust simulation models.

A brief description of groundwater resources investigations in the Kingdom of Saudi Arabia is presented here, in order to illustrate the current state of the most important groundwater aquifer systems of that arid country. The geological environments are analysed, as well as the hydrologic and climatic regime of different regional aquifer systems throughout the Arabian Peninsula.

The water resources of Saudi Arabia are made up of groundwater, surface water, desalinated seawater, and treated wastewater. The actual total water consumption for 2009 was about 19.3 BCM/a (611 m<sup>3</sup>/s) where about 14 BCM/a (444 m<sup>3</sup>/s) are taken from non-renewable groundwater resources. This amount equals about 73% of the total water consumption. Most of these fossil groundwater resources are stored in huge sandstone and limestone aquifers on the Arabian Platform in the eastern part of the Kingdom.

In the seventies and eighties of the last century a first countrywide assessment of the water resources was carried out, which was the basis for the national water master plan of the Kingdom. With growing water demand, a reassessment was necessary. Therefore, in 2002 the Ministry of Water & Electricity launched a project to investigate all aquifers in the Kingdom. Since then several aquifer studies were carried out or are in progress. Today, the Saq-, Umm Er Radhuma-, Wajid-, Wasia-Biyadh-Aruma-study are already finished. In the near future, the Dhurma-Minjur-, the Rub' Al Khali-, the Tihama-, and the Arabian-Shield-study including the Harrats will be finalized. The main objectives of all these studies are the assessment of the groundwater resources, and the assessment of the groundwater budget.

The questions to be answered are: how much groundwater is still available, what is its quality, and what are the in- and outflows to the aquifers? To answer these questions, robust and reliable data are needed, which can only be achieved by applying the latest technologies in groundwater sciences. Furthermore, research is needed for a better understanding and quantification of special features. The research topics focus on estimation of groundwater recharge, large scale groundwater modeling, and smart groundwater mining. All these investigations are the prerequisite for the smart and efficient managing of the groundwater resources and central part of the future water strategy of the Kingdom of Saudi Arabia. Furthermore, the results of the studies will serve as a blueprint for other arid countries over the world.

