

Monitoring seawater intrusion in the Chtouka aquifer, Morocco

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ABSTRACT

The joint technical cooperation project CREM (Coopération régionale pour une Gestion Durable des Ressources en Eau au Maghreb) of OSS (Observatoire du Sahara et du Sahel), BGR (Federal Institute for Geosciences and Natural Resources), and GIZ (German Society for International Cooperation) is funded by BMZ (German Federal Ministry for Economic Cooperation and Development) and fosters the exchange of groundwater management strategies between the three countries Morocco, Algeria, and Tunisia. The strategic focus in the pilot area of Souss-Massa, Morocco, by BGR is on saltwater intrusion.

The Souss-Massa Basin is the country's most important agricultural area. Groundwater from the coastal Chtouka aquifer is the main source for irrigation water. The heavy exploitation of groundwater leads to declining water level in the sub-basin, with the effect of intruding seawater from the ocean. To track the development of both, piezometric heads and salinity distribution, an adapted seawater intrusion monitoring network is set-up consisting of investigations at existing wells, the drilling of new monitoring boreholes, and the application of geophysics.

The strategy of improving the existing monitoring network is iterative: A numerical model is used to locate new monitoring boreholes, which will in turn help to improve the model. With these results, accurate predictions of saltwater intrusion can be made and scenarios of counter measures developed.

An existing three dimensional density dependent flow and transport model was used to simulate groundwater flow and salinity distributions in the Chtouka aquifer. Three new sites for the implementation of new monitoring boreholes are selected close to the coast, i.e. in the northern part of the aquifer, where the intrusion is assumed to be farthest. A first measurement campaign was launched together with the ABHSM (Agence du Bassin Hydraulique Souss Massa) and the University of Agadir in the beginning of 2018. Wells and monitoring boreholes close to the coast were visited, altitudes and water level data were gathered, and depth specific electrical conductivity profiles were taken. According to the data, depth specific sampling was subsequently performed with the help of a bailer.

The data was compared to historic data and fed into the numerical model. First results show an average groundwater depletion of up to 1.5 m per year in several locations. Countermeasures are already discussed on a high level, e.g. the construction of a water desalination plant for agricultural purposes. In international workshops, the project's results, as well as strategies are discussed with the aim to transfer the achievements to other OSS member countries, i.e. Tunisia and Algeria.