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Hydrogeological characterization of a coastal aquifer in southern Turkey

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A sustainable use of groundwater resources in the world is of rising importance, especially in areas where groundwater quality and quantity are threatened. Areas in which groundwater has to be treated carefully are for example coastal plains. They are preferential places for settlements and infrastructure routes. Therefore the water may be for example contaminated by seepage of pollutants through soil. Furthermore high amounts of water are withdrawn, often without sustainable water management systems. This can cause saltwater intrusion from the sea.

In this study the investigation area covers 45 km2 of a coastal plain near Dörtyol in southern Turkey. Bounded by the Amanos Mountains to the East and the Mediterranean Sea to the west human activities are concentrated in this area. Agriculture as main land use, as well as the development of industry and the increasing importance of the geographical position as transition point between Europe and Middle East characterize this setting. It is threatened by saltwater intrusion due to high amounts of withdrawn water, as well as by anthropogenic compounds entering the aquifer. A detailed knowledge and understanding are essential to avoid destabilisation of such systems.

During a fieldwork in 2008 34 groundwater and 7 surface water samples were taken from wells and rivers. Physicochemical parameters, groundwater level measurements, and discharge loggings were done at various places in the study area. The water was analysed for major ions by inductively coupled plasma optical emission spectrometry and atomic absorption spectrometry. Studies in the field also included geological mapping of shallow geological layers and geometrical structures.
The impermeable basement of the coastal plain is composed of serpentinites and limestones from Mesozoic. Heterogenic tertiary and quaternary sediments composed of rocks from the Amanos Mountain formation cover the basement. This classification including observations of shallow permeable and impermeable layers as well as wetlands in the field allow the localisation of recharge and discharge zones. All sampled wells show similar water chemistry. However, areas of higher concentrations of nitrate (up to 45 mg/L) and sulphate (42 mg/L) can be distinguished, which is a hint of intensive agricultural influence including the use of fertiliser. Generally, the hydrochemistry of the groundwater is characterized by anthropogenic but also geological influence. Remarkable high magnesium concentrations (up to 81 mg/L) at several locations in the area show the influence of water-rock interaction. Ferromagnesian ions are dissolved from serpentinites while increased calcium concentrations result from limestone-dissolution.
Relatively low electrical conductivity values and chloride concentrations even in wells near the coast indicate that saltwater intrusion has not yet taken place. Anyway groundwater level measurements compared to former measurements suggest a future intrusion in case the water use remains constant at a high level.

This investigation enhances the understanding of the hydrogeological characteristics in this special area and of forthcoming problems in coastal areas in general. However, more emphasis and research is needed including long-term observation of ground- and surface water quality as well as a detailed investigation of hydraulic characteristics of the local aquifer to guarantee a sustainable groundwater use.