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Centre d'hydrogéologie et de géothermie

MSc in Hydrogeology and Geothermics
MSc Thesis Summary, **2020-2021**

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A groundwater model to evaluate the effects of pumping on the Kundelfingerhof spring

The Kundelfingerhof spring is the most productive spring in the canton of Thurgau. It is fed by the Buechbergschotter, a glacio-fluvial gravel aquifer. The water from the spring is used by a fish farm. To increase production and to improve water quality, wells were drilled in the vicinity of the spring. A long-term pumping test was started in 2018. In the following years decreasing hydraulic heads in a piezometer close to Kundelfingerhof and a decline of spring flow rate were observed. The goal of this thesis was to come up with a conceptual and numerical groundwater model of the aquifer. The model was then used to assess the influence of the two different stresses dry climate and pumping on the aquifer and to help defining extraction limits.

Previous studies and data from streamgages, weather stations and piezometers were analyzed. Groundwater recharge was estimated using the unsaturated zone model Hydrus 1D, a simpler soil box model and the water-table-fluctuation method. A conceptual model of the aquifer including a water balance was developed. From the conceptual model, a 2D steady-state and a 2D transient groundwater model of the aquifer were constructed in Feflow and calibrated.

The models were able to reproduce the general dynamic of the aquifer during the period 1990-2020. A simulation of the pumping test using the calibrated transient groundwater model showed that within the model 70-80% of the head difference between December 2017 and December 2020 at the closest piezometer to the spring was caused by the pumping test. An observed decrease of hydraulic head at a water supply well in Basadingen was reproduced by the model and was likely caused by the pumping test. The results showed a significant decrease of spring flow rate caused by the pumping wells, limiting the total output of groundwater available for the fish farm.

Because the modeled hydraulic heads during the pumping test were still higher than the observed hydraulic heads, only a comparison of different scenarios and resulting drawdowns within the model was possible. The conceptual and numerical model could be improved by collecting additional information on hydraulic head, neighboring aquifers, surface hydrology and hydrochemisty.

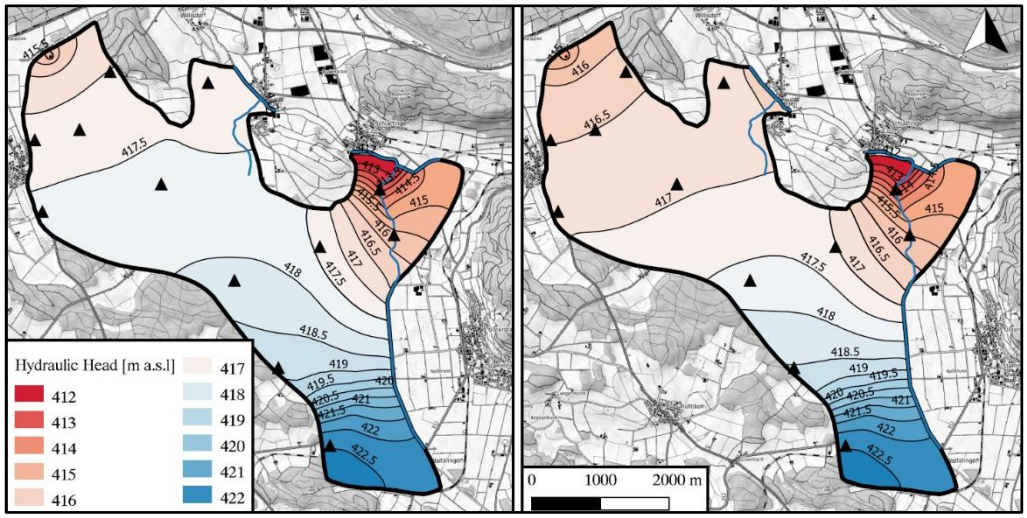

Figure 1: Modeled influence of pumping on the aquifer. Left: undisturbed hydraulic head in December 2020 (scenario SCU). Right: hydraulic head in December 2020 after simulated pumping test (scenario SC3). Background map: © OpenTopoMap