



# Mapping and modeling of the groundwater at the dam site in Bremen. A preliminary flow model

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## Abstract

Groundwater is of fundamental importance in water resources planning as it serves as storage/release entity. The hydrological characterization of the groundwater in Bremen area in the present work has been considered using two approaches.

- i) analysis of parameters collected during field campaign, i.e. piezometric head and electrical conductivity;
- ii) model elaboration and simulation with the forthcoming FREEWAT plugin for QGIS.

After straightened activities in Weser up to the North Sea, the Hemelingen barrier, the peculiarity of the study area, was built to maintain a constant flow in the upstream part. It strongly affects the groundwater movement: water flows from upstream towards downstream with semicircular movements around the dam. Tidal phenomena in Weser downstream cause tidal fluctuation in groundwater level up to 300 m from the river. As concern electrical conductivity, data provided from datalogger measurements and laboratory analyses connect salt concentration to natural sources, due to the geology of the area, and mainly to residual discharge into the river of compounds from mining activities from upstream. Model processing and set up required some input data, recovered from database, literature or previous studies and model calibration considered two aspects: the comparison modeled/measured values and the analysis of hydrological reasonableness. Several simulations were carried out to evaluate how the model responds to input variations. Changes both in input values (i.e. the thickness of the aquifer, the specific storage, the hydraulic conductivity) and in boundary conditions (performed through river, recharge and well packages) resulted in rather different model output. Uncertainty in some parameters created problems in the calibration, especially in the area affected by tidal fluctuations, demonstrating that, working with parameters totally or partly unknown, may make difficult the proper transposition of the natural system in a model scheme.



The thesis is written in English language.

The thesis can be consulted upon request.

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