

## **EFFECTS OF CLIMATE CHANGE ON THE FRESHWATER LENS OF THE GERMAN NORTH SEA ISLAND OF BORKUM**

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**Abstract.** *The German North Sea Island of Borkum is the westernmost and largest of the East Frisian Islands. It covers an area of about 31 km<sup>2</sup>. The drinking water supply of Borkum is based on two water works. The wells of water work I, located in the western part, reach down to a depth of 10 m and those of water work II, located in the eastern part, reach a depth of 40 m.*

*During 2008 to 2010 extensive geophysical surveys were carried out to obtain a database for a groundwater model. The database includes information from boreholes, a seismic survey, a helicopter-borne electromagnetic survey (HEM), monitoring of the freshwater-saltwater boundary by new developed vertical electrode chains in two boreholes, measurements of groundwater table, pumping and slug tests, as well as water sample analysis. Based on a statistical analysis of borehole columns, seismic sections and HEM, a geological model is set up leading to a groundwater model (FEFLOW) with density contrast between fresh and saltwater as driving force for groundwater motion.*

*This groundwater model is calibrated on the basis of hydraulic, hydrological and geophysical data, in particular spatial HEM and local monitoring data. Verification runs with the calibrated model show good agreement between measured and computed hydraulic heads. A good agreement is also obtained between measured and computed density or total dissolved solids (TDS) data for both the entire freshwater lens on a large scale and in the area of the well fields on a small scale.*

*The precipitation forecast from the IPCC climate scenario A2 for the German North Sea coast and an assumed sea level rise were used as input parameter for the groundwater model. The result is a changing salinization pattern in the aquifer beneath the well fields of the two waterworks. A relocation of the production wells is recommended to ensure the water supply of Borkum under the challenges of climate change (Sulzbacher et al. 2012).*

**Keywords:** *groundwater model, geophysics, helicopter-borne electromagnetic, climate change*

### **REFERENCES**

Sulzbacher, H., Wiederhold, H., Siemon, B., Grinat, M., Igel, J., Burschil, T., Günther, T., & Hinsby, K., 2012. Numerical modelling of climate change impacts on freshwater lenses on the North Sea Island of Borkum. *Hydrol. Earth Syst. Sci. Discuss.*, vol. 9, pp. 3473-3525.