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ABSTRACTS

30 years of geophysical data – one groundwater model structure

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Abstract

In Denmark, geophysical data and models are always stored in the national geophysical database, hereby making them broadly available to practitioners and researchers. This comprehensive dataset provides groundwater modellers with a unique possibility when working with regional scale hydrological models. These regional scale structures can be generated using boreholes to link between hydrostratigraphical classes and formation resistivity. Subsequently, they can form input to a groundwater model calibration or serve as a basis for further geological analysis.

We present the results of an automatic method for parameterization of a 3D model of the subsurface, integrating lithological information from boreholes with resistivity models. The objective is to create a direct input to regional groundwater models for sedimentary areas, where the sand/clay distribution governs the groundwater flow. The resistivity input is all-inclusive in the sense that we include data from a variety of instruments (DC and EM, ground-based and airborne), with a varying spatial density and varying ages and quality. The coupling between hydrological and geophysical parameters is managed using a translator function with spatially variable parameters, which is calibrated against observed lithological data. In other words, the translator function interprets the geophysical resistivities into a 3D clay fraction model and the 3D clay fraction model is then turned into a zonation for the hydrological model by a K-means clustering.

We present the methodology by show-casing a study were a regional groundwater model is constructed by including lithological information from 3100 boreholes over an 710 sqkm area. The geophysical models spans more than 30 years of data collection and includes approx. 225,000 DC models, and 35,000 airborne as well as groundbased transient electromagnetic models. The final model was calibrated to hydraulic data, and benchmarked to a model structure obtained from the National Water Resource model of Denmark. Finally, we show how this new model approach can be used to represent dynamic boundary conditions for more local scale models using the MODFLOW-USG.

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