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Efficiency of magnetic resonance soundings (MRS) for groundwater mapping and modelling in sedimentary aquifers in Denmark

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Intensive geophysical measurements (electromagnetic, electrical and seismic methods) are currently used in Denmark to comply with the Danish Government's environmental plans of dense hydrogeological mapping and modelling. These plans aim to ensure high quality non-treated drinking water supply based solely on groundwater. However, traditional geophysical methods cannot directly resolve variations of hydraulic parameters of the underground formations. They measure only physical variations, such as electrical resistivity and elastic properties, which can easily be hydraulically misinterpreted. Magnetic resonance soundings (MRS) is a recent geophysical technique designed specially for groundwater investigation. In order to evaluate the efficiency of MRS in the Danish context several MRS surveys were conducted in Denmark in different geological settings. Despite the generally high level of cultural electromagnetic noise around the country, which can often be a limiting factor for MRS application, it has been found that MRS provides reliable hydrogeological information about aquifers such as aquifer geometry and transmissivity. MRS quantitative characterization of different sedimentary aquifers reveals a good correlation with drilling results and pumping tests. For this characterization only limited number of boreholes is required for data calibration. Thus, MRS method has revealed to be a valuable complementary geophysical tool to enhance groundwater mapping with quantitative estimation of hydraulic parameters. Furthermore, MRS can significantly contribute to improvement of groundwater modelling by providing more dense spatial

coverage in the investigated areas than boreholes.