An analysis of the lithology to resistivity relationships using airborne EM and boreholes

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We present a study of the relationship between dense airborne skyTEM resistivity data and sparse lithological borehole data.

Understanding the resistivity structure of the subsurface is of great importance to hydrogeological surveys and to ensure a high standard for groundwater quality. Borehole data provides detailed lithological information in the vicinity of the borehole. Although, due to the sparse nature of boreholes they do not provide the sufficient information needed for local groundwater models. To counter this problem geophysical data is collected, but the integration of this data is subjective, un-documented and painstakingly manual.

This project presents a detailed research of the relationships between resistivity data and lithological borehole data. The purpose of this is to objectively understand the relationships between lithology and geophysical parameters and documenting the integration process.

The main focus was to utilize preexisting datasets from the Danish national borehole database (JUPITER) and national geophysical database (GERDA). The study presented here is from the Norsminde study area, situated in the municipality of Odder, Denmark. The Norsminde area contains a total of 758 boreholes and 106,770 skyTEM soundings. These large amounts of data make the Norsminde area ideal for coupling of geophysical and lithological data.

The coupling is made by dividing the subsurface into 20 cm horizontal sampling intervals. For each of these intervals a resistivity value is interpolated into the position of the boreholes. The lithology data from the boreholes are then used to categorize the interpolated resistivity values according to lithology. The end result of this coupling is resistivity distributions for different lithology categories. The distributions provide detailed objective information of the resistivity properties of the subsurface and are a documentation of the resistivity structure of the geological subsurface.

In conclusion we have studied the coupling between resistivity and lithology through a large scale geophysical study area. The end result is a set of resistivity distributions for different lithological categories, which serve as a documentation of the coupling between resistivity and lithology.