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# Geological modelling of AEM and borehole data – comparison of three different approaches

Anne-Sophie Høyer (1), Flemming Jørgensen (1), Nikolaj Foged (2), Xin He (1), and Anders Vest Christiansen (2)

(1) Geological Survey of Denmark and Greenland, GEUS, Denmark, (2) HydroGeophysics Group, Department of Geoscience, Aarhus University, Denmark

In the last decades, Airborne Electromagnetic (AEM) surveys have been used more and more in relation to groundwater mapping campaigns worldwide. AEM surveys provide information that is highly valuable when understanding the 3-D architecture of the structures in the subsurface. The airborne surveys provide huge datasets and thus, a degree of detail that is very time-consuming and sometimes even impossible to interpret manually in three dimensions. Recently, semi-automatic modelling approaches have therefore been developed and investigated, just as AEM data has been incorporated into stochastic modelling with the objective to utilize data in a more time-efficient way.
In this presentation, we will compare and evaluate the results of three different modelling approaches of AEM and borehole data in a study area in Denmark. This area consists of Quaternary clay tills and meltwater sands deposited on top of largely horizontal Pre-Quaternary sand and clay deposits. The modelling approaches are the following:
1) A manual 'cognitive' modelling approach based on the geological understanding of the area and including the knowledge of strengths and limitations of the AEM method.
2) A semi-automatic 'clay fraction model', in which borehole and AEM information are related through inversion to provide a 3-D model that shows the fraction of clay in each voxel
3) A statistical 'TPRoGS' model, where borehole information is used as 'hard information' and AEM data is used for soft conditioning. This model results in a binary voxel grid containing 'sand' and 'clay'
One of the challenges when comparing the models, are the different nature of the modelling approaches. Thus, while the cognitive and the clay fraction models both provide 'the best estimate' given the information available, the statistical model provides a range of realizations that are considered equally realistic. In the comparison we therefore need to use a single realization to represent the results of the statistical modelling. The results of the (1) and the (2) approach show many similarities, and resemble the structures in the geophysical data to a significantly higher degree than the (3) modelling approach. However, despite the similarities, the geologists understanding of the geological environment and the geophysical method results in noteworthy differences between the (1) and (2) approach.