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Correlations between topography and deep-seated structures in low-relief areas: Examples of subtle terrain features with high impact on geological interpretations of geophysical data

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Denmark has a low-relief topography with a maximum elevation at 170 m above sea level and a near-surface geology dominated by the effects of numerous glacier advances during the Pleistocene.

In 3D geological modelling of the Danish subsurface we combine near-surface geophysics, primarily AEM (Airborne ElectroMagnetic methods) with borehole data, seismic data etc. in order to model the groundwater-bearing sediments in the uppermost 300-400 m. The highly varied glacial succession and the underlying tertiary sediments require very dense data coverage in order to be able to perform modelling in sufficient detail.

Geomorphological data and observations are used for the interpretations alongside the other data. The overall geomorphology of Denmark is generally the product of the youngest glacial episodes and the subsequent periglacial and postglacial modifications where the effects of earlier ice advances are either obscured or removed. As such, the geomorphology will mainly contribute with geological information about the youngest events and the uppermost parts of the subsurface. However, in many parts of the Danish area we have found a correlation between surface features and deep seated structures. These structures can be old faults that have created weak and easily erodible zones in the sediments above and these erosional patterns have created trends that have survived over a long period of time. Some of these fault zones have been tectonically active as late as the Holocene thus deforming near-surface sediments and the topography.

Using geomorphological information such as lineament patterns, erosional patterns and variations in surface trends we are able to gain significant information about the deeper parts of the subsurface. This information is highly valuable when interpreting the geological setting from AEM data and seismic data.

In the presentation we will show examples from Denmark that link geomorphological features in the present day terrain with deep seated tectonic structures and buried erosional features mapped by geophysical data. The examples will include detailed observations of subtle geomorphological features in LiDAR-data that represent fingerprints of events that are not related to the formation of the surface sediments themselves.