SkyTEM

The SkyTEM method offers a high precision airborne method for mapping buried structures

The SkyTEM is an airborne electromagnetic method developed in Denmark with the purpose of offering a cost effective way of mapping the sub surface while preserving a precision similar to or better than ground based systems.

Data is gathered along flight lines with soundings per e.g. 30 m, thereby offering a densely covered dataset.

The SkyTEM method

The method is helicopter based with the equipment carried as a sling load.

Contrary to most other airborne methods the SkyTEM method was designed for groundwater purposes meaning that it offers a unique high resolution.

SkyTEM is the only airborne geophysical system capable of mapping shallow targets and those at depth simultaneously

SkyTEM offers a unique dual moment system capable of mapping the shallow and deep subsurface simultaneously. The system can be configured for different purposes and can offer penetration depths as high as 300 m.

Being an airborne system the method is independent on surface properties, e.g. soils.

With a high daily production the method is cost effective.

Relevant applications

Applying the SkyTEM method may be relevant in all cases where large scale information on the lithology of the subsurface is useful:

- Mapping of subsurface structures, e.g. paleo channels and fractures.
- Obtaining information on aquifers and hydrogeological properties, e.g. groundwater recharge or saltwater encroachment
- Localizing mineral deposits
- Mapping of water depths (Bathymetry)
- Mapping of landfills or soil contamination

Case example

In order to map the geological structures and to verify potential aquifers, a SkyTEM survey was carried out in a 250 km^2 area. The survey resulted in a total number of roughly 37,000 soundings or 150 soundings per km^2 providing a substantial data set for the following geological interpretation of the area.

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SkyTEM specifications:

- **Maximum penetration depth: Up to 300 m depending on geology, background noise and system setup**
- **Approximate resolution: Depending on system-setup, better resolution of low resistivity layers**
- **Field production per day: 100-200 line km – equaling approx. 7-15,000 soundings**
- **Strengths: Large scale structural mapping, independent of surface properties, high resolution and a densely covered dataset**
- **Weaknesses: Distance must be kept to all power lines (up to 200 m)**

The left part of the figure shows the mean resistivity at elevation -90 m to -100 m, and is characterized by large area with a resistivity below 10 ohmm, interpreted as heavy clay. In the western part of the area and in narrow structures from the central part to northeast and southeast the mean resistivity is above 60 ohmm, equivalent to more sandy layers. These areas are interpreted as areas with potential aquifers, and the narrow structures are interpreted as buried valleys in the paleocene clay. The paleocene clay has a very low hydraulic conductivity and is therefore often considered to be the lower boundary of potential aquifers.

The right part of the figure shows profile sections, where inverted SkyTEM soundings are shown with boreholes along the profile. A 3D grid made from the inverted soundings is shown as background image. The models and the 3D grid indicate that the area is characterized by a thick layer with high resistivity corresponding to an aquifer with a thickness of around 50 m. Above this high resistivity layer, a more or less homogeneous layer with a resistivity under 50 ohmm is seen. In this area, this layer provides a natural protective layer. Dense data coverage is important to map the lateral distribution of this layer, and to identify subareas where the protective layer is not present.