

Geophysical mapping

Obtain a deeper knowledge of the subsurface geology and gain important inputs to improve groundwater models

Intelligent mapping

At NIRAS, we are specialized in applying electromagnetic (EM) and direct current (DC) electrical investigations, particularly for groundwater mapping and exploration. We also combine geophysical and geotechnical investigations to provide crucial information for large-scale infrastructure projects and raw material mapping.

Depending on the purpose and goal, various methods can be used in the field of electromagnetism, ranging from near-surface to deep investigations with airborne EM systems. These methods are sensitive to variations in electrical resistivity. Since electrical resistivity is closely linked to soil lithology, these investigations can be used for indirect subsurface mapping. The methods described here are part of NIRAS' geophysical toolbox.

Sky high groundwater investigations

The SkyTEM system is a dual-moment time-domain Airborne ElectroMagnetic (AEM) method specifically designed for groundwater investigations in larger areas.

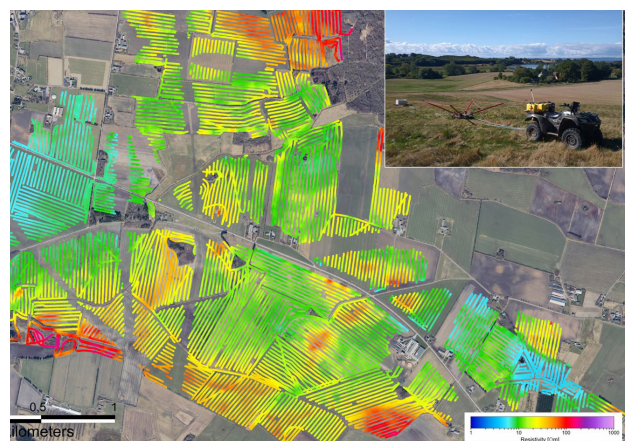
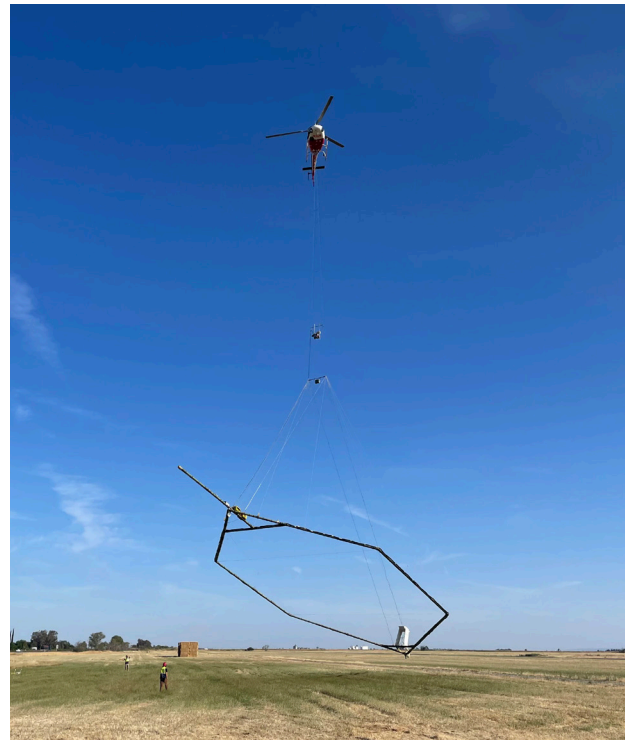
This system offers:

- Valuable insights into subsurface properties
- Can be designed for the actual purpose and area of interest
- Use survey line distances from 150 m to a few kilometers
- Depth of investigation varies between different system setups but can extend to 500 m

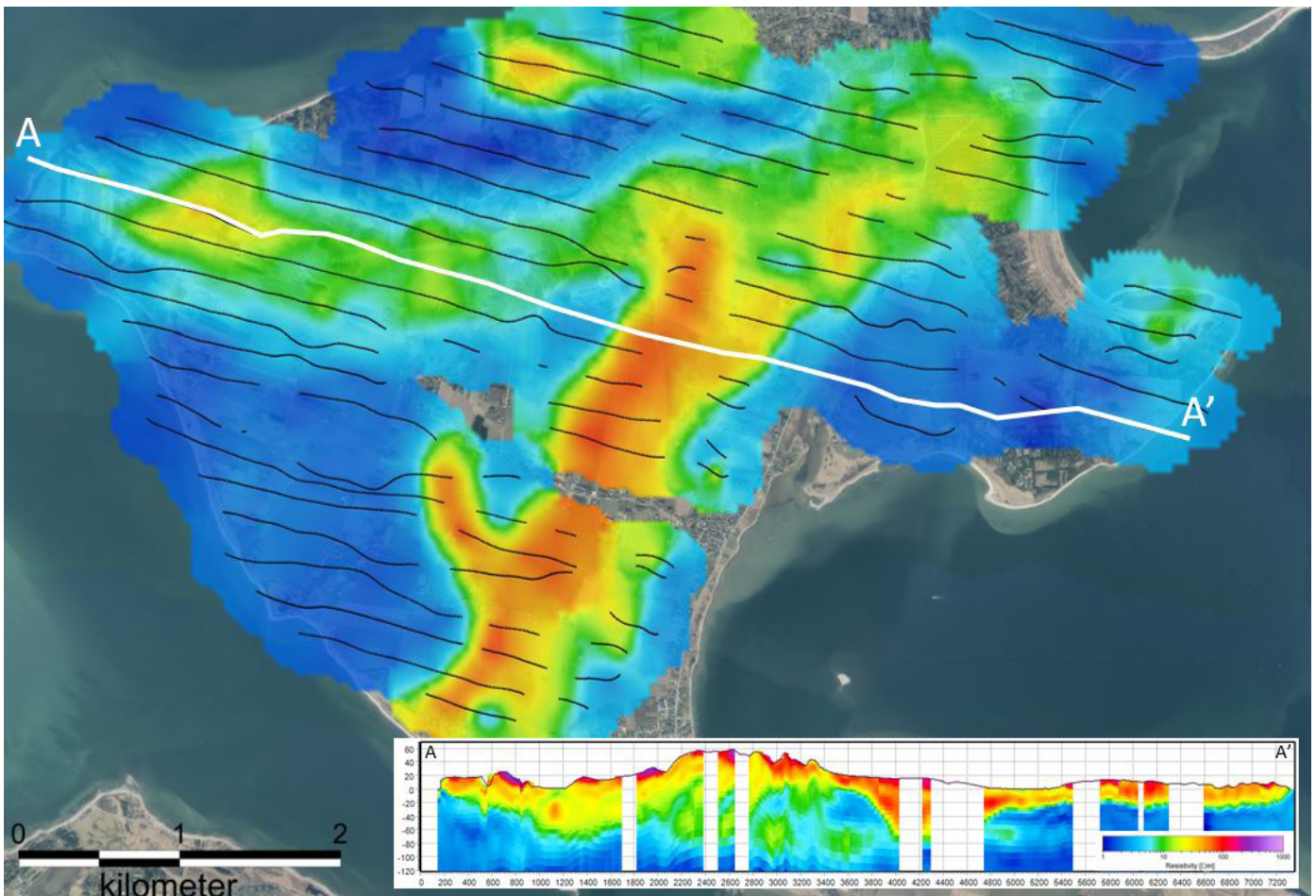
The SkyTEM system has proven its abilities within regional groundwater resource mapping and aquifer delineation. Notably, the Department of Water Resources in California selected it for the critical task of mapping all their high and medium-priority basins.

Ground-based system

The towed time domain electrical method (tTEM) is a ground-based electromagnetic system towed by an ATV where the resistivity is measured continuously in the time domain. The system is designed for efficient detailed 3D geophysical mapping of the subsurface. After geophysical processing and inversion, the resistivity is interpreted down to a depth of approximately 80-100 m depending on the geological setting.



tTEM is particularly suitable for mapping areas ranging from a few hectares in size to several hundreds of hectares. The transmitter coil is located 4 meters behind the ATV followed by the receiver coil another 7 meters behind.



The figure above shows the resistivity in elevation interval -40 to -30 m a.s.l. High resistivities (red colors) indicate sandy sediments, whereas low resistivities (blue and green colors) indicate more clayey sediments. The profile section shows the resistivity model from A to A'.

Other geophysical methods:

- The DualEM-421 system is a multi-configured Ground Conductivity Meter (GCM) applied for mapping the ground conditions by calculating the resistivity for the upper 6 meters of the subsurface. The instrument provides fast and detailed mapping for valuable geophysical and geotechnical assessments.
- For single-site deeper Time-Domain Electromagnetic (TDEM) investigations, the sTEM system excels. The resistivity is measured to a depth of approximately 200 meters in single soundings with the possibility of collecting a series of soundings in a grid over a larger area. The sTEM profiler is a semi-continuous system, where soundings are collected along a line, with an equidistance of e.g. 20 meters, and a depth of investigation of approximately 70-100 meters.
- Electrical Resistivity Tomography (ERT) is a widely used direct current (DC) method for groundwater mapping and geotechnical purposes. The ERT system consists of an electrode array that, depending on the electrode spacing, can measure the resistivity down to depths exceeding 100 meters.

NIRAS is a multiplanar consulting firm with offices in 30 countries, 3000 employees and 90 Danish experts within geology/hydrogeology.

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