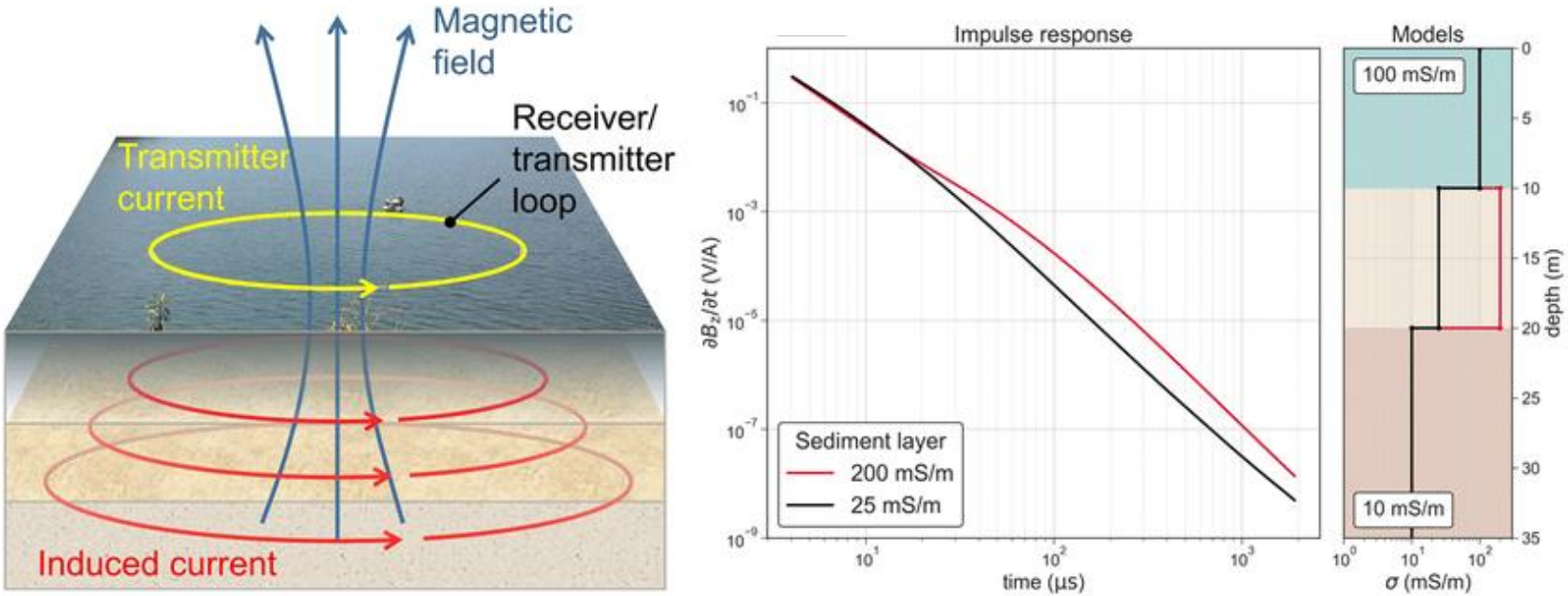
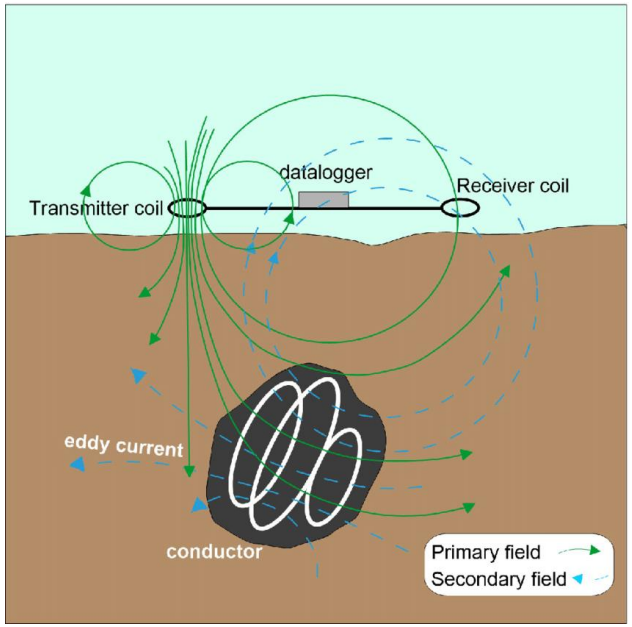
Electrical & Electromagnetic Methods

Electromagnetic methods refer to a set of techniques and principles that are used to study affect of electromagnetic fields which are generated by electric charges in motion and are characterized by their electric and magnetic field components. Electromagnetic methods play a significant role in geoscience and are employed in various applications to study the Earth's subsurface.



Electromagnetic (EM) Induction Methods:

These methods involve measuring variations in electromagnetic fields induced in the Earth's subsurface. By transmitting a time-varying electromagnetic field into the ground, it is possible to detect and analyze the responses to infer subsurface properties. This technique is used in electromagnetic geophysical surveys for mapping geological structures, detecting mineral deposits, and locating groundwater resources.



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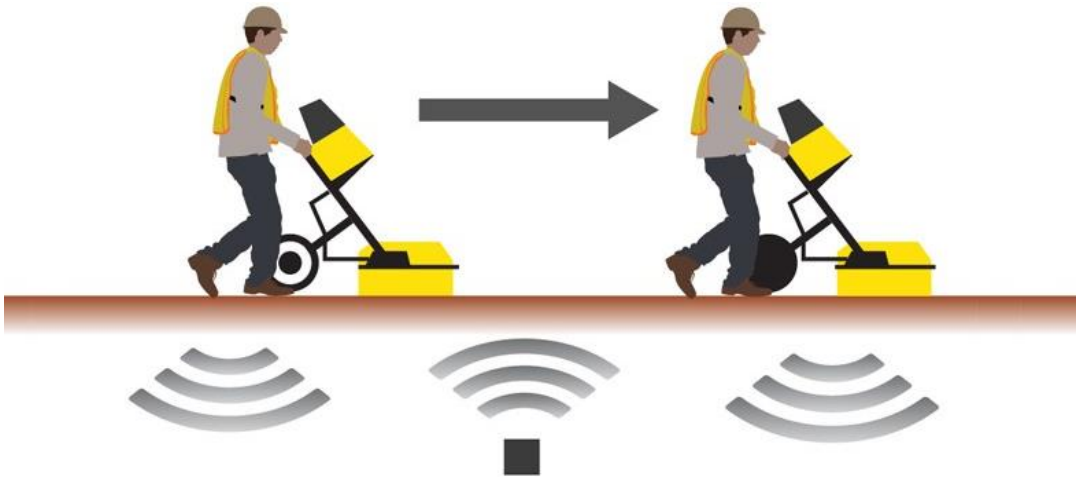
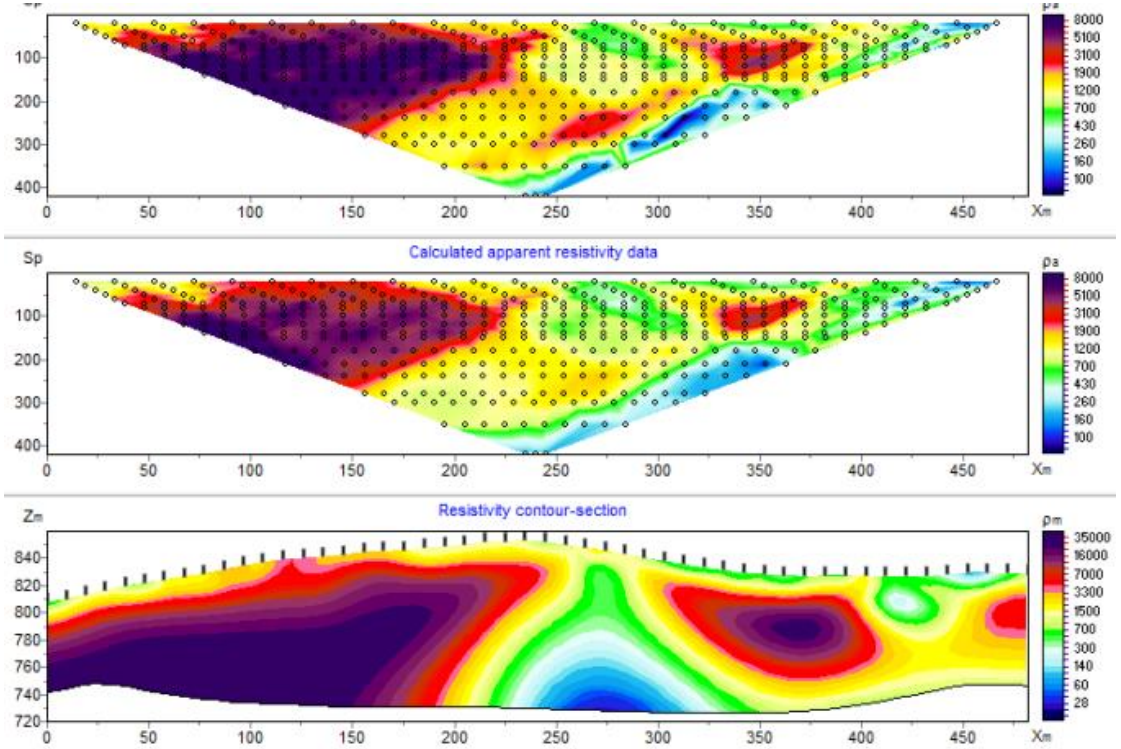
Ground Penetrating Radar (GPR):

GPR uses high-frequency electromagnetic waves to image subsurface features. A radar antenna is placed on or above the ground surface, and electromagnetic pulses are transmitted into the subsurface. The radar waves bounce back when they encounter subsurface interfaces with different electrical properties, such as soil layers, bedrock, or buried objects. GPR is used for subsurface mapping in a wide range of applications, including archaeology, environmental studies, and civil engineering.



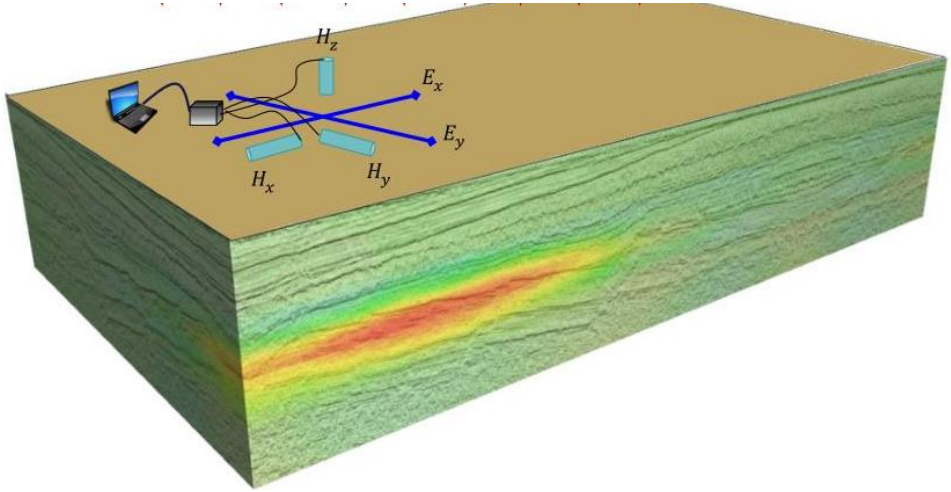
Electrical Resistivity Tomography (ERT):

ERT measures the electrical resistivity of the subsurface to infer the distribution of geological materials and fluids. By injecting controlled electrical currents into the ground and measuring the resulting voltage differences. ERT is used in groundwater exploration, mineral exploration, and geological mapping.



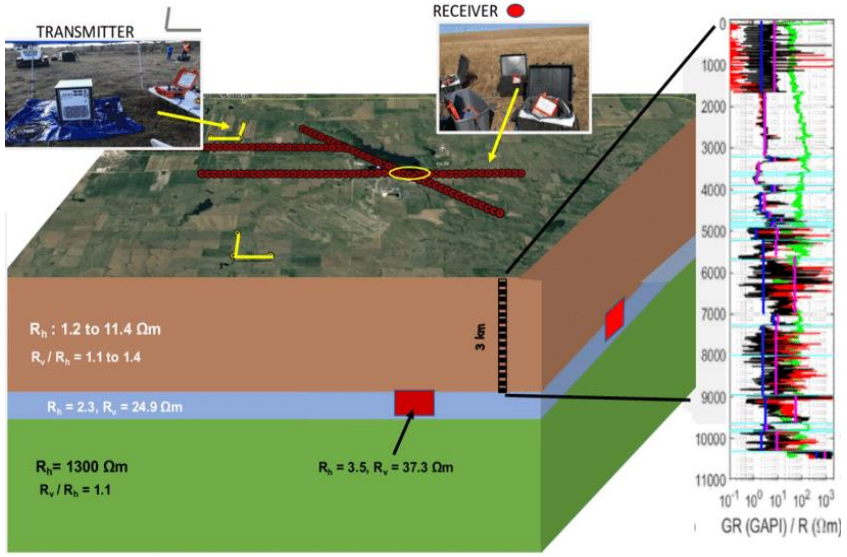
Magnetotellurics (MT):

MT measures natural variations in the Earth's electromagnetic field to obtain information about subsurface resistivity. It typically involves measuring the electric and magnetic fields induced by natural electromagnetic sources, such as variations in the Earth's magnetic field and solar-induced ionospheric currents. The data collected allows researchers to infer subsurface resistivity distribution, which is useful for studying crustal structures, geothermal resources, and hydrocarbon exploration.



Controlled-Source Electromagnetic (CSEM) Surveys:

CSEM surveys are used to investigate the subsurface properties of the Earth, it involves the controlled generation of electromagnetic fields and the measurement of the resulting electromagnetic responses. These measurements provide information about the electrical properties of the subsurface, such as the distribution of resistivity or conductivity. The surveys have several applications, including hydrocarbon exploration, mineral exploration, geothermal resource assessment and environmental and engineering applications.



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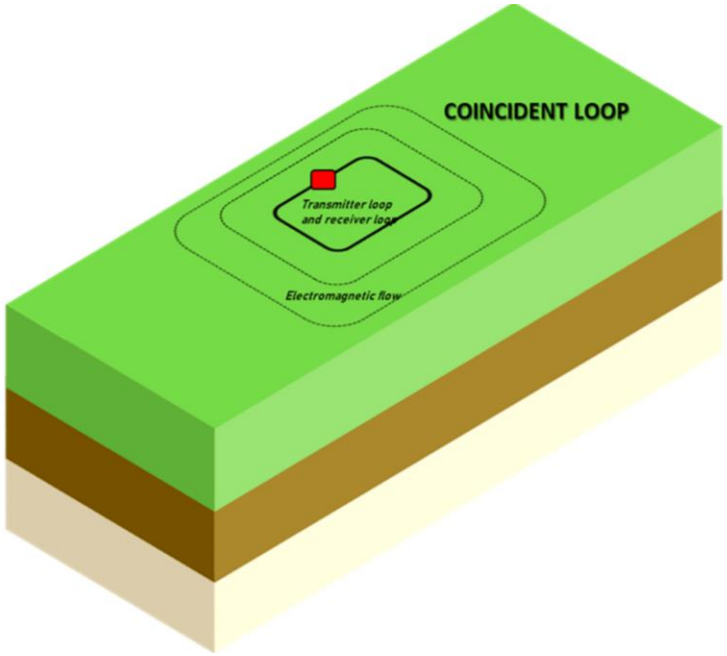
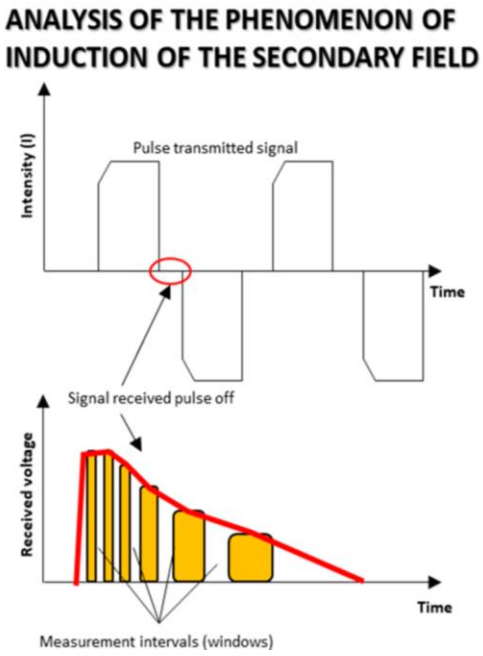
Time-Domain Electromagnetics (TDEM):

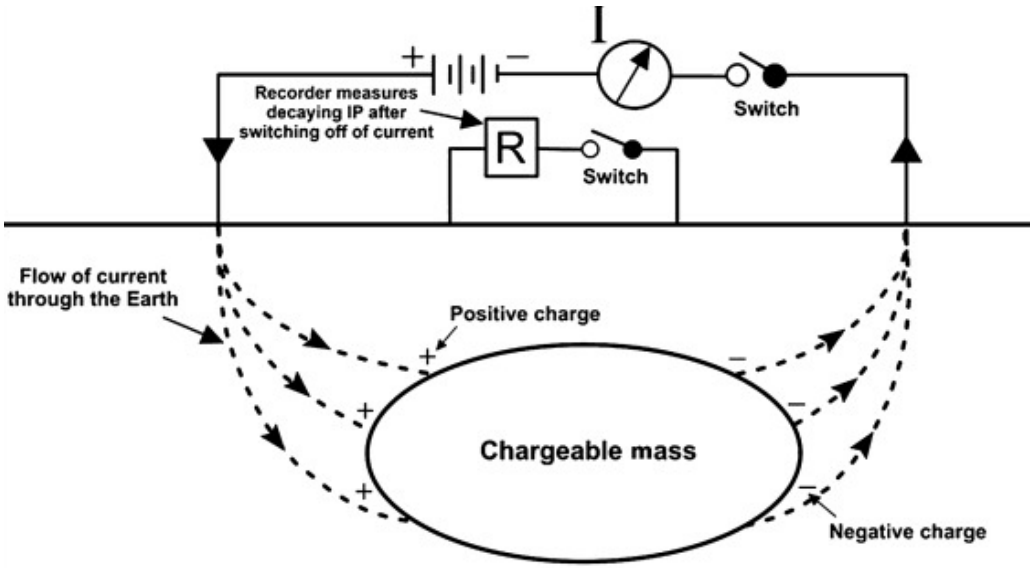
TDEM is a used for subsurface exploration and imaging. It involves the measurement and analysis of transient electromagnetic responses generated by introducing a time-varying electromagnetic field into the Earth's subsurface. TDEM surveys have various applications, including mineral exploration, groundwater studies, environmental studies and engineering and infrastructure assessment.





Induced Polarization (IP) Surveys:

IP surveys are a geophysical method used to investigate the electrical properties of the Earth's subsurface. IP surveys are often conducted in conjunction with resistivity surveys to provide additional information about the presence and characteristics of subsurface mineralization and fluid-bearing formations. IP surveys also have applications in environmental and engineering studies, mapping subsurface contamination, detecting and characterizing clay layers that affect soil stability.



Self-Potential (SP) Surveys:

SP is a passive method that measures naturally occurring electrical potentials on the Earth's surface. It relies on the fact that subsurface fluid flow and chemical reactions can generate electrical currents. SP measurements can help locate areas of fluid flow, such as groundwater, hydrothermal systems, and mineral deposits. SP surveys are also used in geothermal exploration, volcanic monitoring, and environmental studies.