

MT method

Magnetotelluric system (MT; AMT will define those working on frequencies $> 10\text{Hz}$) typologically belong to the group of EM surveys, and are used to detect the electrical impedance to the earth's surface using a series of simultaneous measurements of the fluctuations of the local electric and magnetic field.

These measurements are made for period of several minutes or hours depending on the frequency bands set that we used for instrumentation, ranging from 1 Hz to 40 KHz. Processing of the time series lead to a lecrical resistivity profile of the subsurface that for adjacent surveys, results in a 2D or 3D model of the subsurface to great depths (up to 1000-2000 m).

The data acquisition system has a receiver unit (Unit MT), two electromagnetic sensors, and four electrodes (Figure 3)

the placement of 4 electrodes arranged in a cross the disposition of the two orthogonal magnetic sensors at a distance of about 25 m from the instrument receiver.

The acquisition times are variable, but generally range from a minimum of 30 minutes to 12 hours for measuring point

Because data are acquired on a point (single sounding), to obtain a section is necessary to acquire more points along an alignment, with a spacing between points appropriate to the required resolution (normally between 50 and 100 m).

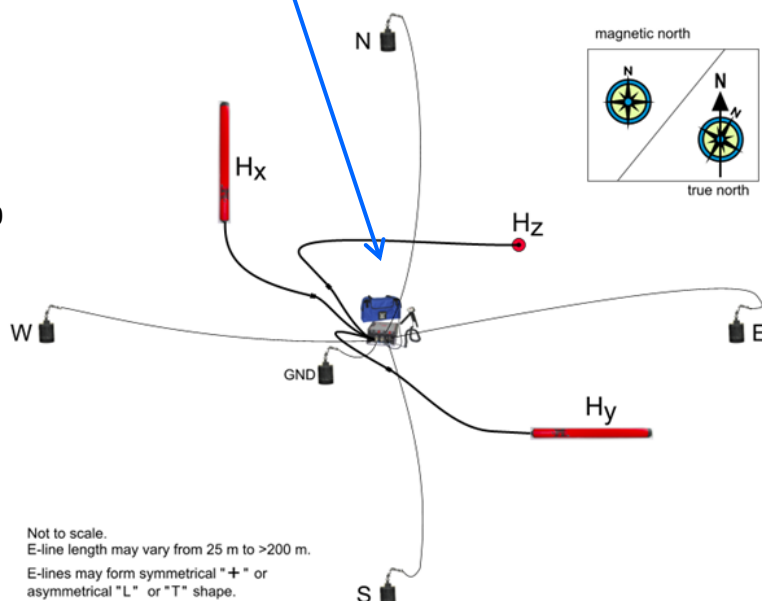
The interpolation between adjacent data allows the definition of a section of electrical resistivity (exactly as in the case of a geoelectric resistivity section).

The magnetotelluric surveys reach great depths in confined spaces.

They are used in general to define the geological and hydrogeological setting for the following applications:

- 1) Definition of structures of deep gravitational instability (deep landslide)
- 2) Definition of geological and tectonic structures for tunneling design
- 3) Definition of geothermal and hydro-geological models for the optimal location of wells

Receiver MTU-5



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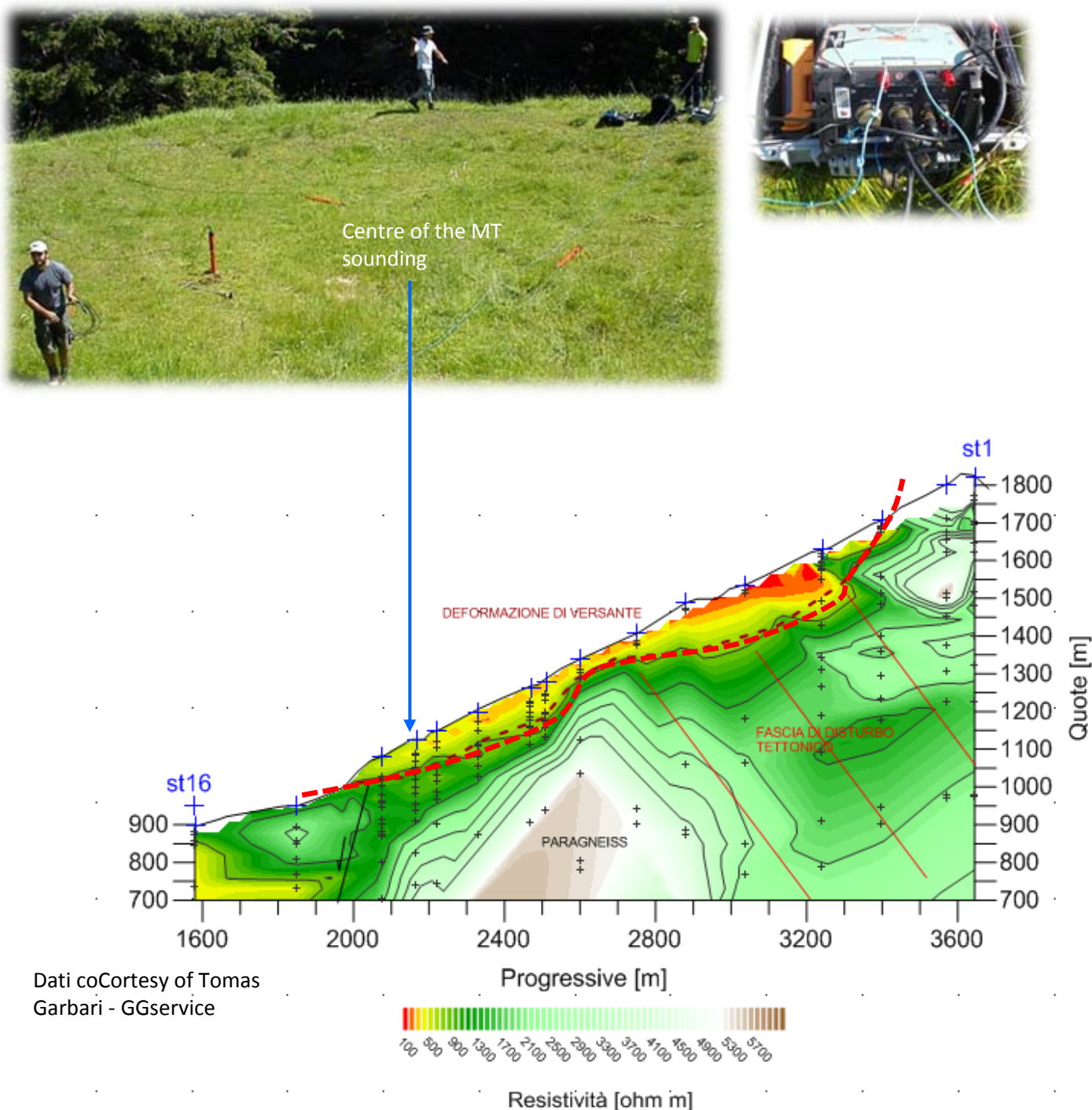
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Investigation in deep landslide areas

Magnetotelluric method can be used to investigate landslides in which the sliding surface is deeply located. Deep-seated landslides usually involve deep bedrock and include large slope failure associated with translational, rotational, or complex movement.

The MT survey of the case showed below has pointed out a vertical plane of weakness (fault zone)



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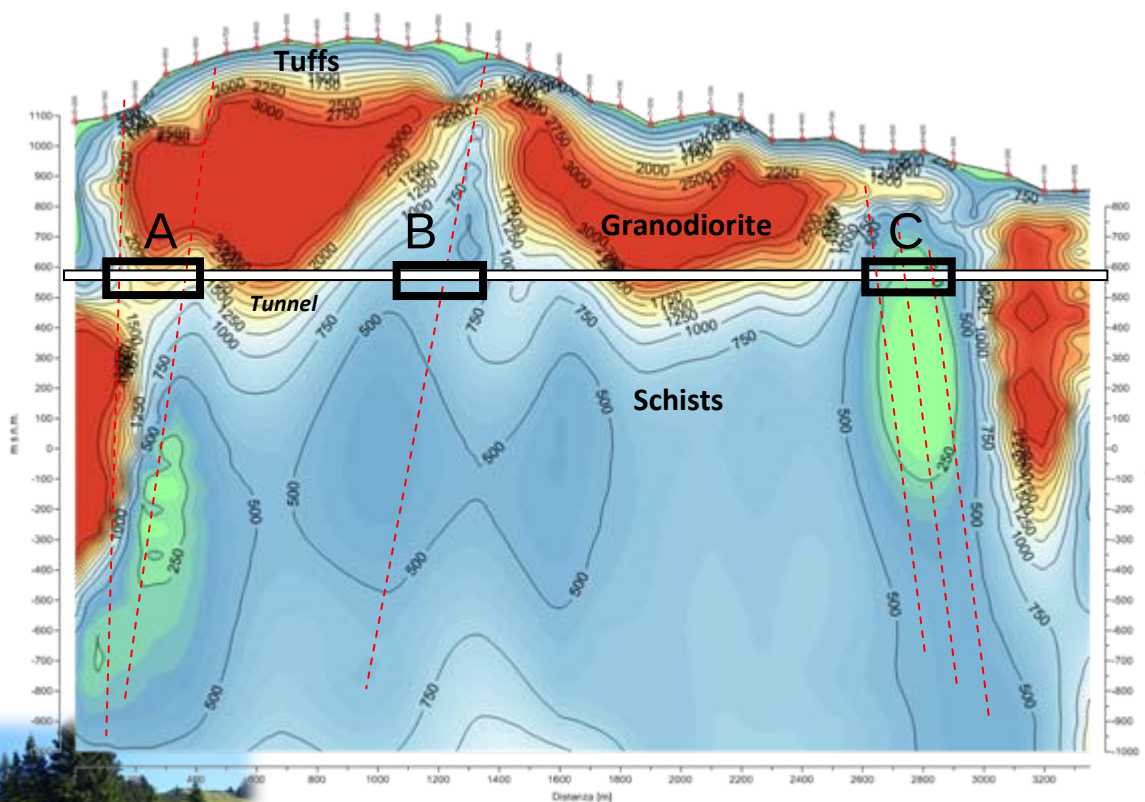
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AMT SURVEY FOR DEEP TUNNELING DESIGN

The geological prediction for the excavation of deep tunnels is of paramount importance, both for the choice of the method of excavation and also to identify the most critical areas (faults, weakness zones, ground water, etc).

The definition of a deep geological model requires high costs for drilling geognostic and generally very long time, particularly in difficult environments (mountainous areas, remote areas, etc..).

Among the techniques of deep geophysical survey, the method Audiomagnetotelluric (AMT) has proved particularly effective for predicting deep geology, particularly for the small size of the instrument (ease of transport and execution of surveys, with obvious economic advantages and reduction of time survey). The AMT method (like the other EM method) provides a model of electrical resistivity of the subsurface which, if properly calibrated with geological data from the survey or from borehole logs) can be used for geological prediction to great depths. This method (commonly used for oil prospection or geothermal purpose) has been applied successfully in several projects in Ecuador and Italy, with accessibility conditions prohibitive for other methods of investigation. The good results obtained allowed to outline the general geological framework up to great depths and to highlight the most critical areas for the mechanized excavation (eg, zones A, B and C in the electrical resistivity section , related to fault zones)



Resistivity section for AMT soundings (ohm.m)



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