



- ▶ Off-the-shelf, easy to install geoelectrical monitoring solution
- ▶ Remote monitoring, with data visualizations and configurations via Cloud software
- ▶ Energy autonomous system
- ▶ Soils' % water content calculation along the entire monitored profile
- ▶ Automatic alarm messages when thresholds are reached

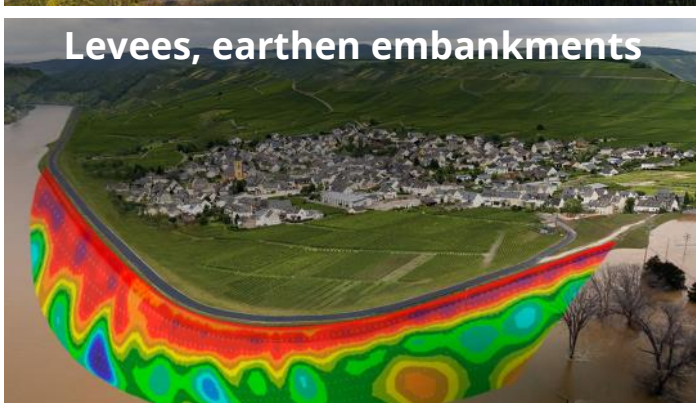
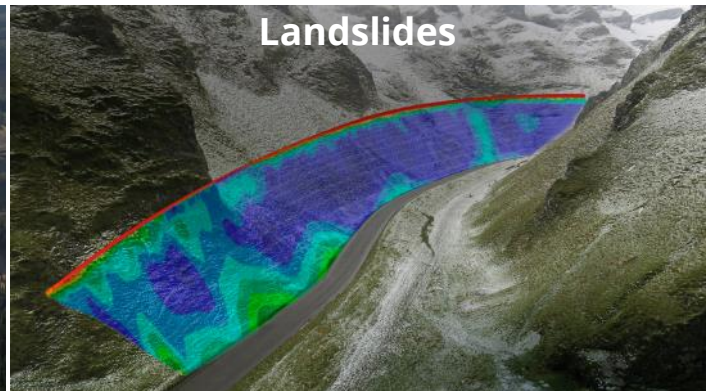
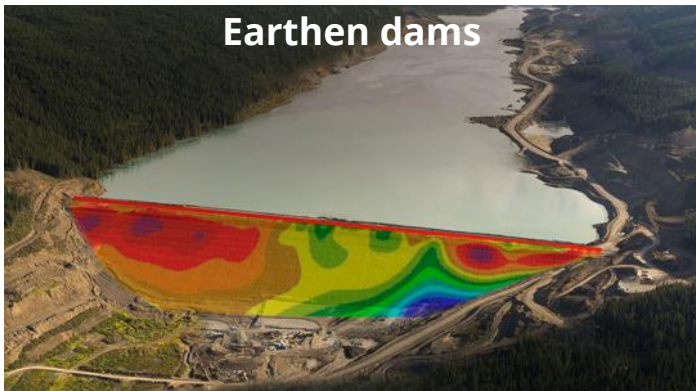
G.Re.T.A. is the most effective and innovative solution for Permanent Geoelectric Monitoring of the conditions of large sections of soil.

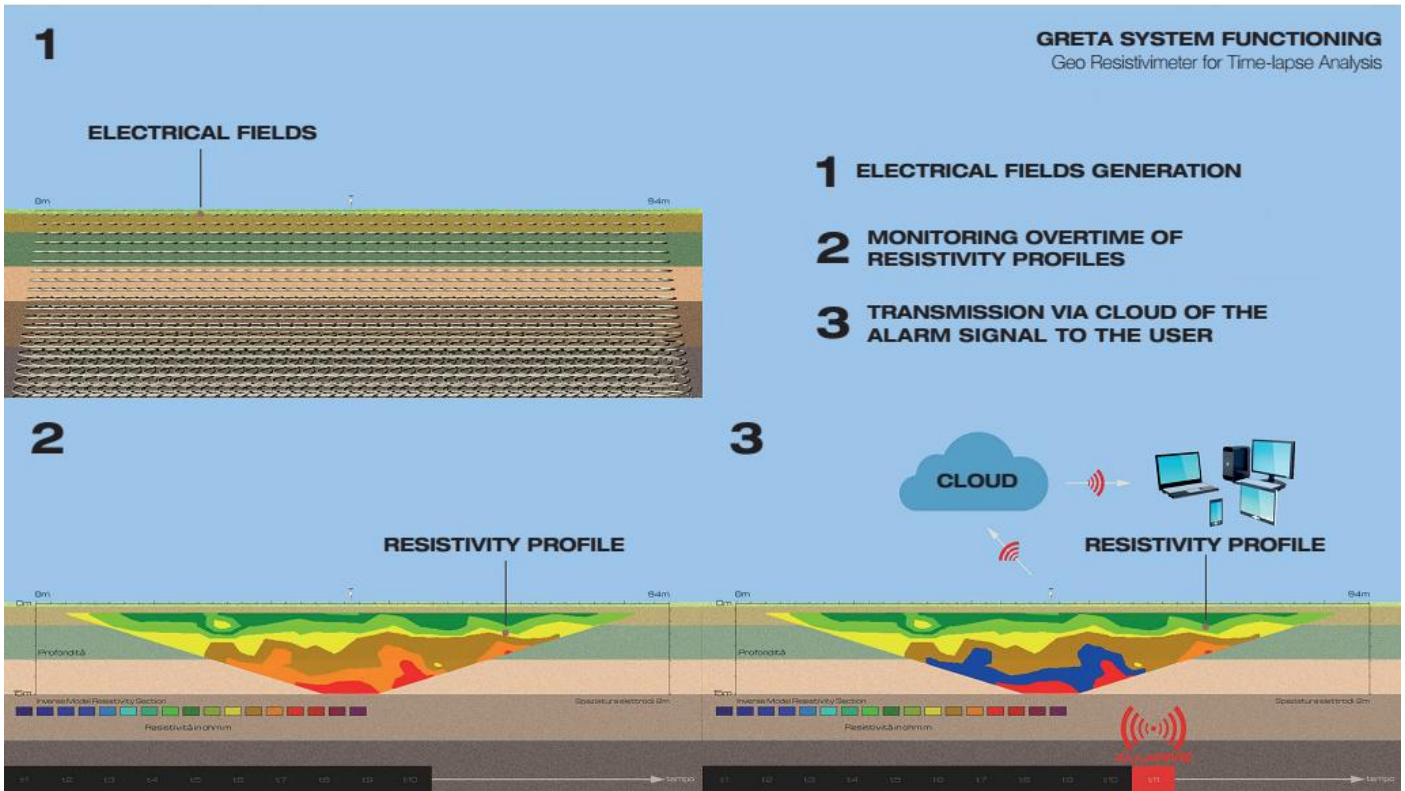
The device is an easy to install industrialized off-the-shelf solution for geoelectrical monitoring.

This instrument measures the alteration over time of the soil's resistivity section, functional to the characterization of the same in terms of water content, presence of pollutants, cavities and other anomalies.

## ▶ A consolidated technology

Electrical Resistivity Tomography (ERT) is based on the insertion of an electric field in the ground through electrodes (input electrodes), and the measurement of the voltage through other electrodes (measurement electrodes). From the measure of the voltage it is possible to obtain, through the second law of Ohm, the resistivity value, a peculiar characteristic of all materials.





### ► Main technical features

- Number of electrodes: 48
- Distance between the electrodes: depending on resolution and soil characteristics
- Measured profile length: up to 250 m
- Max measured profile depth: up to 37 m
- Measurement configuration: Wenner
- Power supply: solar panel or electric grid
- Additional battery pack available
- Modem or Router for automatic data transmission
- Remote control and programming via LSI LASTEM Cloud
- Alarm management based on pre-defined thresholds

### ► The heart of G.Re.T.A.

#### Energy efficiency

All components and operating logics have been designed to ensure the lowest energy consumption.

#### Filtration of any disturbing signals

The G.Re.T.A. system is able to recognize and exclude from the measurement any disturbing signals present in the ground.

#### Modular architecture

Each specific function of the system (current injection voltage measurement, signal switching, processing and data transmission) is implemented as an independent module; this favors possible maintenance activities.

### ► Main component of G.Re.T.A. GeoResistivimeter

- Measurement and communication Unit
- Energy supply Unit
- 48 electrodes cables in anti-rodent material
- Possibility of meteorological sensors integration



## ► Installation

The system can be installed in the field using one of the two types of electrodes available:

- **Plate electrodes:** the installation requires a shallow trench (30-50 cm deep) to house the two cables with plate electrodes. It allows the best adherence of the electrodes to the ground and the complete protection from possible interference with external agents (people, animals, etc.)
- **Rod electrodes:** recommended for short time installation, easy insertion of electrodes in the soil, with cables laid on the soil surface. Possible interaction with men, animals or means of transport



## ► Calibrated resistivity simulator

A useful accessory available to customers is the calibrated resistivity simulator. It allows the accuracy of resistivity measurements of the G.Re.T.A. system to be verified by comparing them with absolute values measured from a set of known resistances. The simulator is connected to the system via standard cable connectors and allows diagnostic measurements of resistivity and contact resistance to validate the system's perfect functionality. As with operational measurements, diagnostic measurements are visualised via the cloud.



## Technical Features

<b>Current injection circuit (transmitter)</b>	Number of channels	48 electrodes
	Current modulation	From 0.001 to 0.4 A. Resolution > 120 $\mu$ A
	Current measurement	<ul style="list-style-type: none"> <li>Resolution: 1 <math>\mu</math>A</li> <li>Stability: 0.0025% VM</li> <li>Accuracy: &gt; 60 <math>\mu</math>A</li> </ul>
<b>Measurement of electrode voltage (receiver)</b>	Measurement scale	N.2 with automatic scale change
	Protections	Automatic filtering at 50 and 60 Hz
	Input impedance	$1.6 * 10^{10} \Omega$
	Scale $\pm 0.47V$	<ul style="list-style-type: none"> <li>Resolution: 1 <math>\mu</math>V</li> <li>Stability &gt; 0,12% VM</li> <li>Accuracy: 70 <math>\mu</math>V</li> </ul>
	Scale $\pm 4.7 V$	<ul style="list-style-type: none"> <li>Resolution: 10 <math>\mu</math>V</li> <li>Stability: &gt; 0.03% VM</li> <li>Accuracy: 700 <math>\mu</math>V</li> </ul>
<b>Measurement of internal temperature</b>	Measurement points	N.2 on electronic board and on heat sink
	Range	-55...150 $^{\circ}C$
	Resolution	0.1 $^{\circ}C$
	Accuracy	$\pm 0.3 \text{ }^{\circ}C$
<b>Electrical safety</b>	Methodology	Automatic voltage disconnection after about 4" in case of system block
<b>Supply</b>	From PV module	50 Wp (optimized for one survey per day, performance site depending on latitude and insolation conditions)
	From main grid	115/230 V AC, 50/60 Hz
	Back-up battery	40 Ah
	Additional sources	Additional battery pack (on demand)
	Protection fuses	N. 6 of 12 V power lines
	Energy consumption	<ul style="list-style-type: none"> <li>150 mW low power mode, modem/router off</li> <li>5 W low power mode, modem/router active</li> <li>7 W standby, modem/router active</li> <li>115 W max during measurement at maximum power</li> </ul>
	Nominal energy autonomy	10 days, considering: <ul style="list-style-type: none"> <li>Using a fully charged 40 Ah battery</li> <li>Supplementary power module missing</li> <li>Complete absence of sun</li> <li>Low power mode enabled</li> <li>Execution of one survey per day lasting 40 minutes and with an average injection power of 60 W</li> </ul>

### Box, Cables and Electrodes Technical Features

<b>Box</b>	Material	Heat molded and glass fiber reinforced polyester
	Dimensions	730 x 530 x 270 mm (external connectors excluded)
	Weight (without battery)	13.5 kg
	Battery weight	13.5 kg
	Protection grade	IP66
<b>Cables</b>	Resistance to chemical agents	<ul style="list-style-type: none"> <li>solutions of ammonia and biogas</li> <li>ozone, UV rays and atmospheric agents according to EN 50396 and HD 605 S3</li> </ul>
	Usage environments	Industrial environments, in chemical, composting and purification plants
	Conformity	VDE 0250 / 0285, EN 50565-2 Norms
	Protection	Anti-rodents (according to part number)
	Nominal voltage	U0/U: 300/500 V
	Test voltage	4000 V
	Operative temperature	<ul style="list-style-type: none"> <li>Installation: -40...80 °C</li> <li>Fixed laying: -50...80 °C</li> </ul>
<b>Electrodes</b>	Material	Stainless steel AISI 316
	Dimensions	<ul style="list-style-type: none"> <li>Plate: 230 x 128 mm, width 1 mm</li> <li>Picket: length 400 mm, diameter 10 mm</li> </ul>

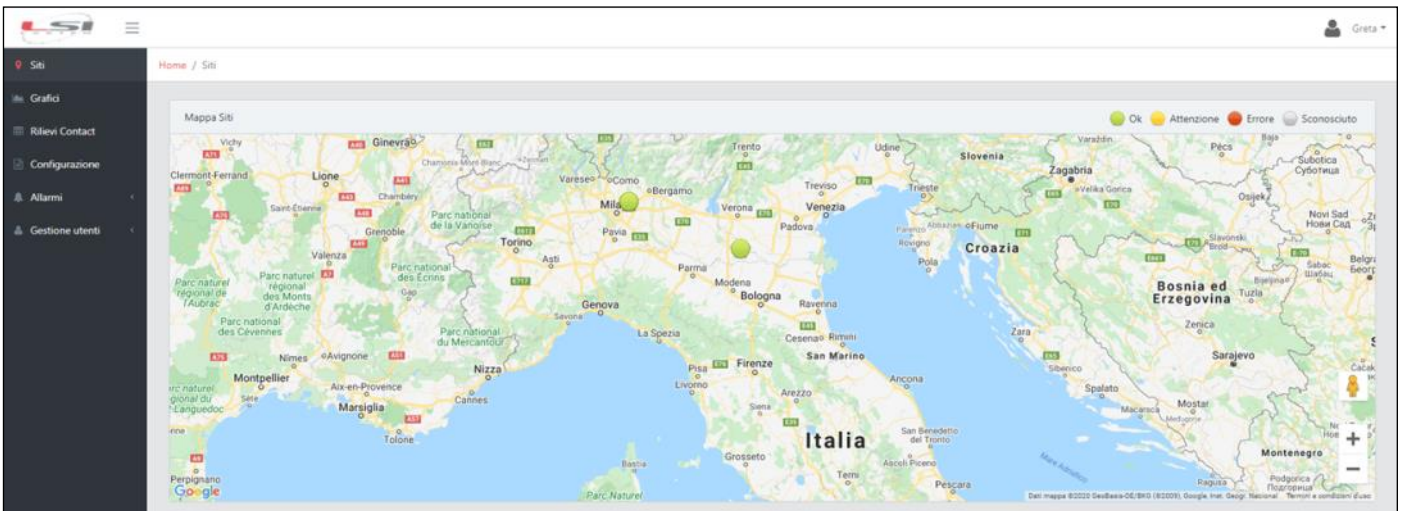
PN	CCECB0110	CCECB0210	CCECB0310	CCECB0510	CCECB0111	CCECB0211	CCECB0911	CCECB0311
<b>Electrode distance</b>	1.0 m	2.0 m	3.0 m	5.0 m	1.0 m	2.0 m	2.5 m	3.0 m
<b>Initial stretch length</b>	4.0 m	4.0 m	4.5 m	4.5 m	4.0 m	4.0 m	3.0 m	4.5 m
<b>Length EL 1-24</b>	23.0 m	46.0 m	69.0 m	115.0 m	23.0 m	46.0 m	57.5 m	69.0 m
<b>Cable total length</b>	27.1 m	50.1 m	73.3 m	119,5 m	27.1 m	50.1 m	60.5 m	73.3 m
<b>Monitored profile length (2 cables)</b>	47.0 m	94.0 m	141.0 m	235.0 m	47.0 m	94.0 m	117.5 m	141.0 m

► **Instrument settings and data management (see MW9006-ENG-14-GRETA CLOUD)**

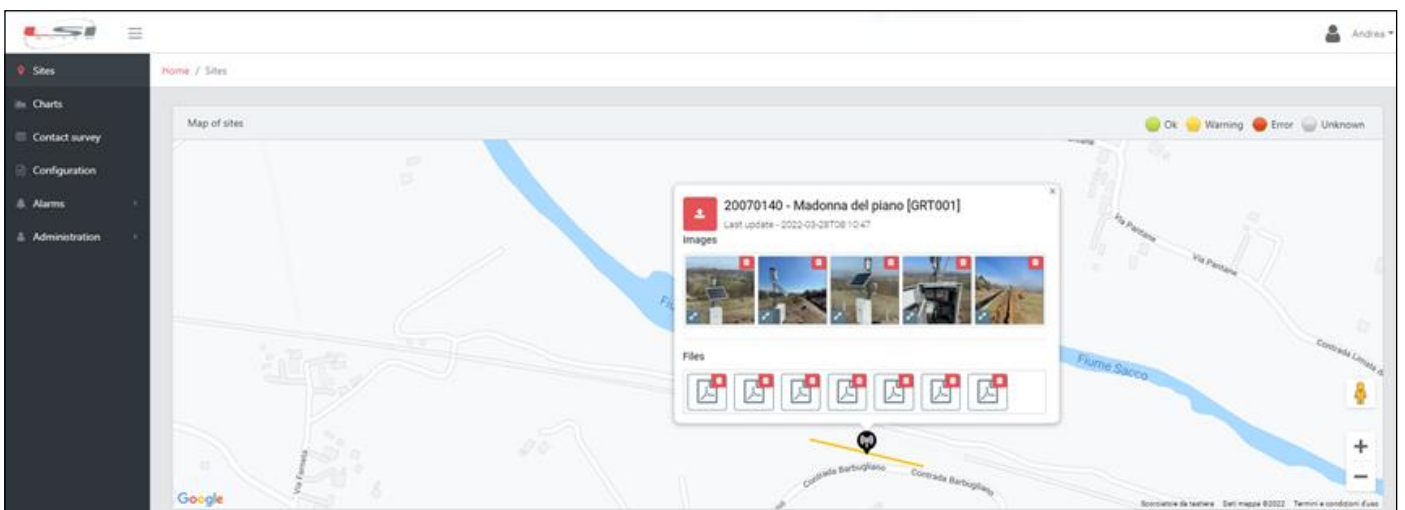
The Cloud software allows measurements visualization, data storage, instrument parameterization as well as the typical processing of raw data through inversion algorithms. For each single station it is possible to independently modify the measurement parameters and the parameters of the inversion algorithm.

It also allows:

- The geo-localization of the installed systems
- The comparison of measurements over different periods of time with simple and intuitive graphic models
- The display of additional environmental and piezometric data from an additional data logger inserted in the system box
- Water content Calculation in the soil according to the resistivity data and the soil characteristics (calibration)
- Automatic transmission of alarm messages when pre-set thresholds are exceeded
- Visualization and management possible also through mobile phone

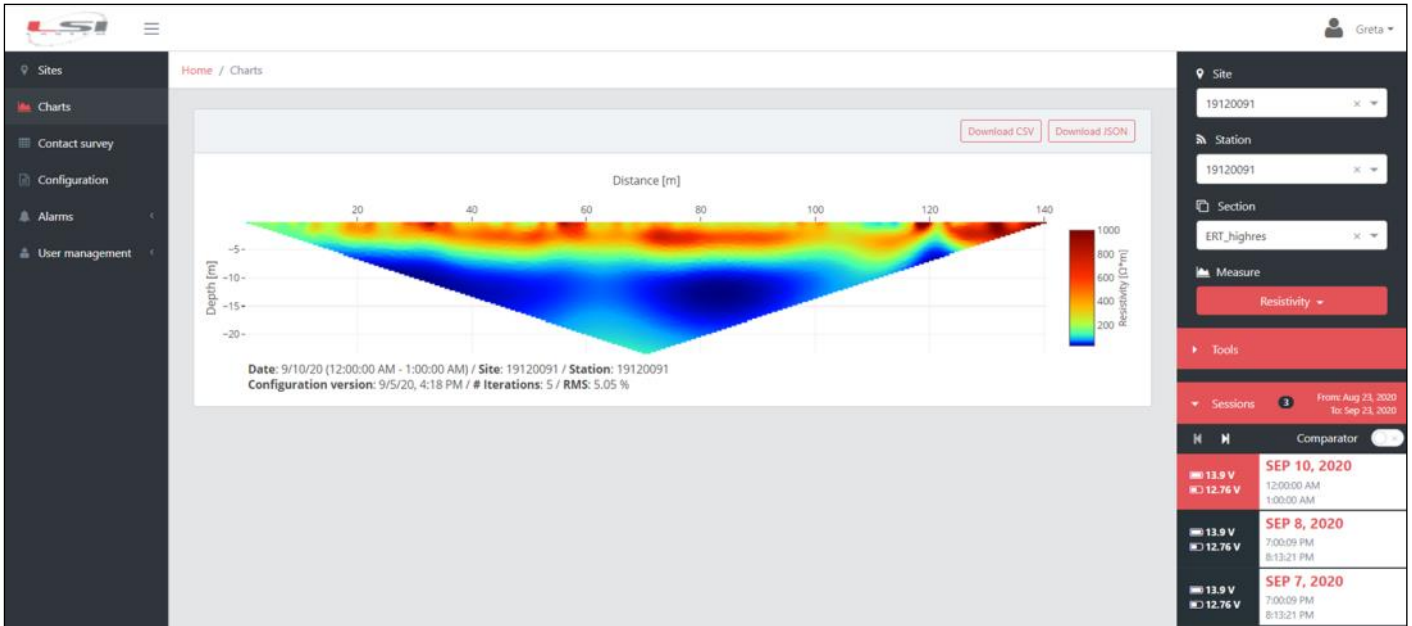


► **Geo-localization of the systems and first diagnostic indication of correct operation.**



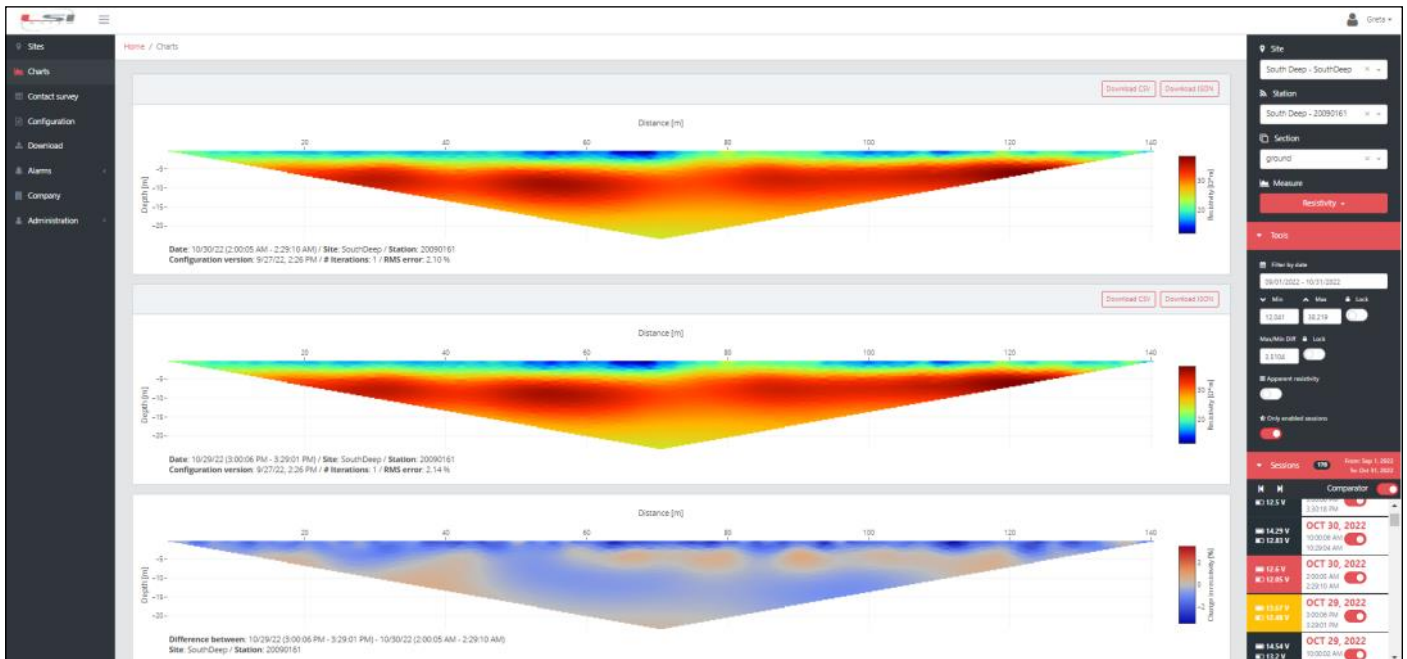
► **Visualization of the geoelectrical profiles on Google map and possibility of **uploading**, **downloading** and **viewing** images, **documents** and other metadata.**

▶ Instrument settings and data management

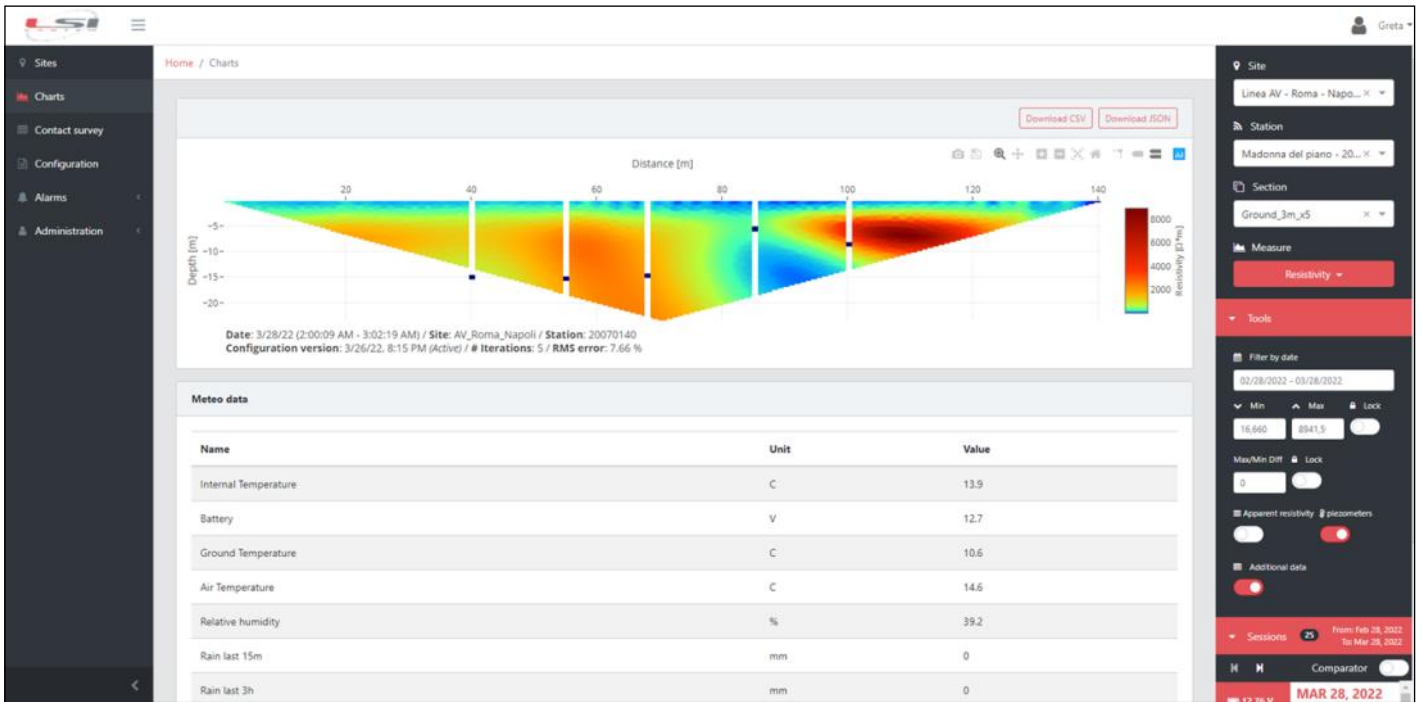


▶ **Visualization** of inverted resistivity, injected current, measured voltage, quality factor of measurements of different days  
**Data export:**

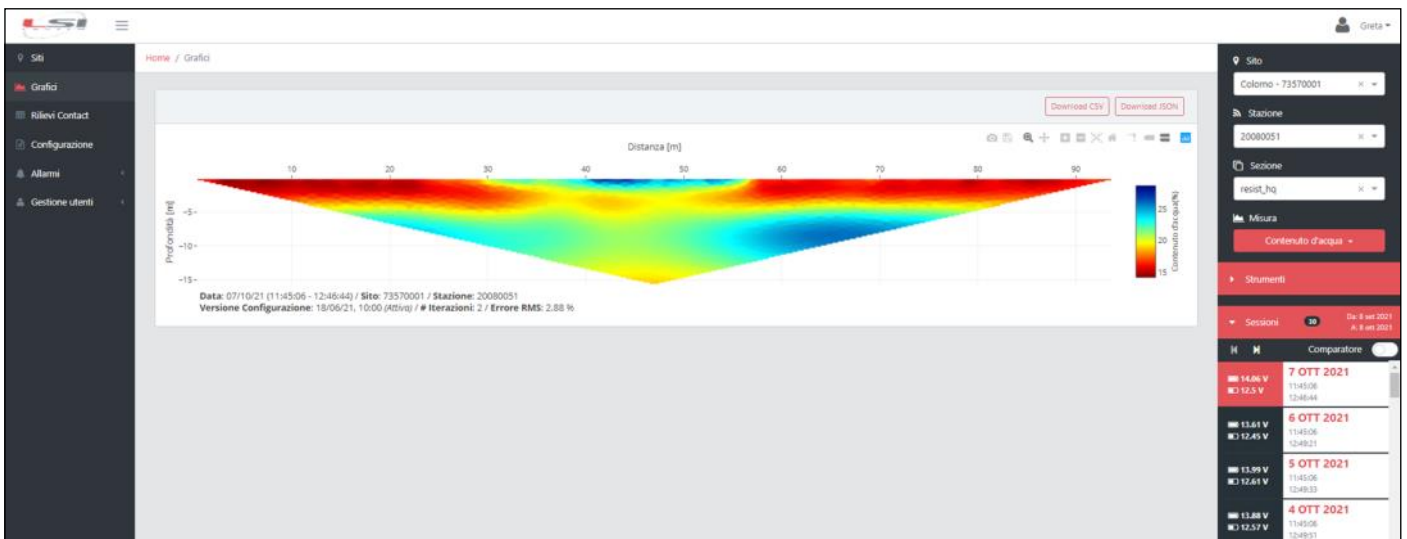
- manual download of single data or a period of data
- automatic export to any third-party software platforms.



▶ **Manual comparison** of measurements of different periods.  
Possibility of setting **automated comparisons and alert** thresholds on % of resistivity variations or absolute values.



▶ Display of **additional data**: piezometers and meteorological sensors can be integrated into the G.Re.T.A. system through an additional datalogger while related environmental and piezometric data displayed on the cloud software.



▶ Possibility of **soil water content calculation** based on a relationship derived from resistivity values and water content values of extracted core samples in the monitoring site.



## Part numbers and descriptions

G.Re.T.A. is composed of an acquisition unit, a power supply unit, cables and electrodes. The system is completed by web services on the Cloud platform.

Unit	Part number	Description
Acquisition and Power Supply	<b>GRT2A0100</b>	G.Re.T.A. ONE Geo-Resistivimeter, including MPU+SDU+PWR+SSU,+ 40Ah battery, 4G Global Modem/Router, IP66 box. Connection to optional additional battery pack available
	<b>GRT2A0110</b>	G.Re.T.A. ONE Geo-Resistivimeter, including MPU+SDU+PWR+SSU,+ 40Ah battery, 4G Global Modem/Router, IP66 box. Connection to optional additional battery pack available, complete with data logger for measurement of additional environmental quantities
Optional Battery pack	<b>GRT2A0200</b>	Additional Battery Pack with photovoltaic module input, battery included
	<b>EDPSA2190</b>	Additional Sealed 90 Ah Pb battery for GRT2A0200 battery pack, fastening strap included
Opt. Antenna	<b>TXANA3033</b>	(Optional) External Antenna SMA COMBO MIMO mobile / GNSS / WIFI ROOF
Solar Panel	<b>DYA101</b>	Solar panel 50 W
	<b>DYA064</b>	Mounting for solar pannel DYA101 on meteo pole Ø 50 mm
Pole & tie rods	<b>DYA010.1</b>	3m meteo pole (Stainless steel AISI304). Ø 5 cm.
	<b>DYA077</b>	Pole mounting arm (diam. 42...65 mm) for IP66 box
	<b>DYA021</b>	Base for meteo poles Ø 50 mm assembly on ground
	<b>DYA023</b>	Set of N.3 pickets for DYA021 or DYA021.1
	<b>DYA028</b>	Set of N.3 tie-rods for meteo poles
	<b>DYA026</b>	Set of N.3 pickets L=1 m
Cables (2 per system)	<b>CCECB0110</b>	Cable with 24 electrodes / 1 m electrodes distance / w-out anti-rodent sheath
	<b>CCECB0210</b>	Cable with 24 electrodes / 2 m electrodes distance / w-out anti-rodent sheath
	<b>CCECB0310</b>	Cable with 24 electrodes / 3 m electrodes distance / w-out anti-rodent sheath
	<b>CCECB0510</b>	Cable with 24 electrodes / 5 m electrodes distance / w-out anti-rodent sheath
	<b>CCECB0111</b>	Cable with 24 electrodes / 1 m electrodes distance / with anti-rodent sheath
	<b>CCECB0211</b>	Cable with 24 electrodes / 2 m electrodes distance / with anti-rodent sheath
	<b>CCECB0911</b>	Cable with 24 electrodes / 2.5 m electrodes distance / with anti-rodent sheath
	<b>CCECB0311</b>	Cable with 24 electrodes / 3 m electrodes distance / with anti-rodent sheath
Electrodes	<b>MAGEB1001</b>	Set of 50 stainless steel electrode fins - 230x128 mm - Plate type
	<b>MAGEB9221</b>	Set of 50 stainless steel electrode rods 400 mm with connection accessories
Installation	<b>DZZINST</b>	Installation and commissioning, per day, per person (travel expenses, board, lodging EXCL)
Web Services	<b>SWCLA1100</b>	G.Re.T.A. GeoResistivimetro Cloud - Software First Configuration
	<b>SWCLA1022</b>	G.Re.T.A. GeoResistivimetro Cloud - Software Annual License Fee
Accessories and spare parts	<b>SVSKA3001</b>	Calibrated resistivity simulator
	<b>MAGFA2005</b>	Fixing kit for environmental datalogger inside GRETA box
	<b>SDU001</b>	Signal Driving Unit
	<b>SSU001</b>	Signal Switching Unit
	<b>MPU001</b>	Main Processing Unit
	<b>PWR001</b>	Power Unit
	<b>MG0560.R</b>	Battery Pb 12 V/40 Ah
	<b>TXCRA2200</b>	Router 4G / LTE cat. 4 Global, Wi-Fi