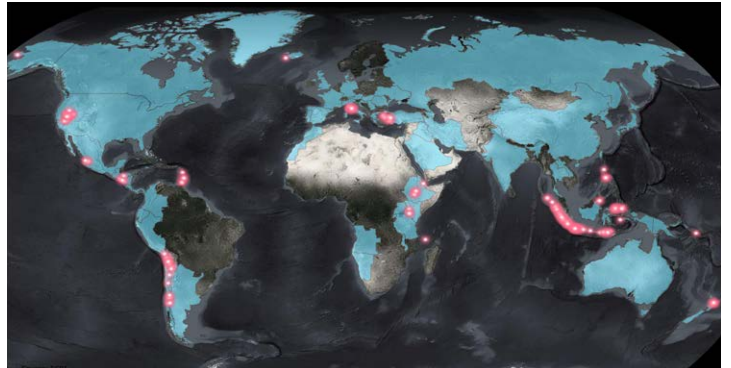


## Supporting the transition to a lower-carbon future

Understand and de-risk geothermal energy prospects, from exploration to production, with multi-disciplinary geoscience data, technology and expertise.

CGG's dedicated Geothermal Science group offers worldwide, multi-disciplinary geoscience data, technology, training and expertise to understand and de-risk geothermal prospects, from exploration to production. With a track record of over 150 targeted projects and two global resource assessments over the last two decades, we leverage significant exploration experience to provide valuable intelligence in global data and analytics, resource assessment, multiphysics imaging, reservoir characterization, production and monitoring. As a world leader in solving complex surface and subsurface challenges, CGG provides independent guidance, feasibility studies and risk assessment for geothermal exploration and development.



Highlighted countries indicate the CGG Geothermal team's regional experience with previous CGG project sites marked by pink dots.

Meet geothermal challenges with confidence, from exploration to production, with our comprehensive services, solutions and products:

Advanced data analytics	Global data integration, analytics and interpretation
Resource exploration and assessment	From global to prospect scale
Geothermal reservoir characterization	Characterization, reservoir monitoring and modeling
Geothermal value chain and techno-economic analysis	Including combined heat and power, cascade use, and co-production of fresh water and critical elements (e.g. lithium)
Satellite mapping and monitoring	Surface deformation monitoring, spectral analysis and mapping
Geomechanics	Comprehensive well and geomechanical studies, drilling prognosis and drilling analysis
Multiphysics imaging	Planning, processing and joint inversion of electromagnetics, gravity, magnetics, and seismic tomography
Seismic imaging and reprocessing	Planning, processing, noise reduction, integration and reprocessing of 2D and 3D data, interpretation and quantitative interpretation and characterization of seismic for geothermal
Data transformation	Dedicated team of specialists skilled in machine learning enabled digitalization, extraction and classification
GeoVerse™ multi-client products	Including the Global Geothermal Resource Assessment and Lithium Brine Screening study
Exploration and monitoring solutions	High-precision sensors, pressure/temperature gauges and distributed acoustic sensing (DAS) systems from Sercel

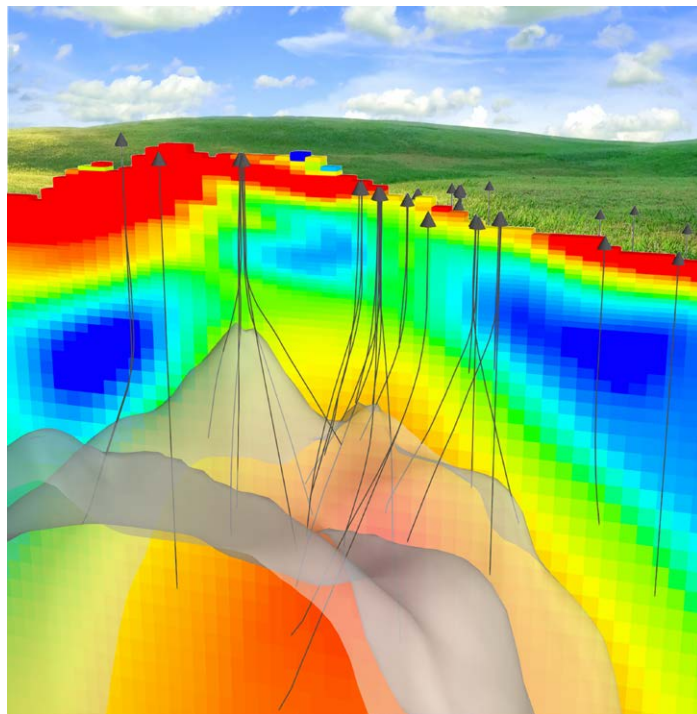
# GEO THERMAL SERVICES

## Level up to 3D for complete geothermal Earth modeling

Featuring CGG's electromagnetics and gravity-magnetics software development and interpretation groups, Multiphysics is a global team of geophysical and geological experts in data processing, depth inversion modeling and interpretation.

In-house algorithm and software development has produced the comprehensive range of industry-leading solutions – continuously maintained, upgraded and expanded – that both drive Multiphysics service projects and are licensed to companies and professionals across the natural resource E&P market. For example, **Geotools™**, which includes a 3D visualization capability, is a modern, interactive platform for 1D, 2D & 3D analysis of magnetotelluric data.

Generate high-quality 3D visualizations of your reservoir with our industry-leading interactive platform, Geotools.

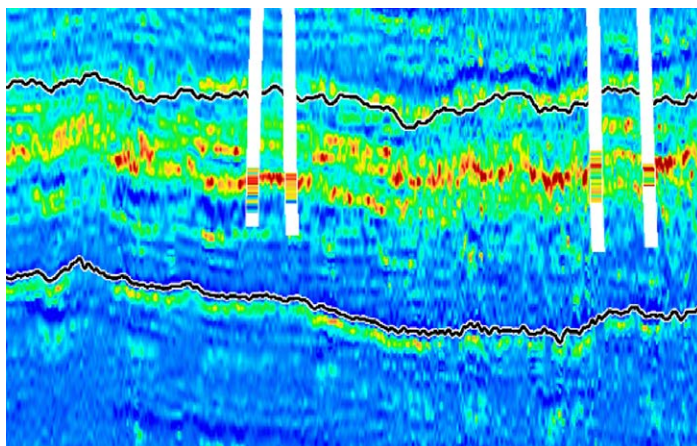


## Seismic characterization and machine learning for geothermal prospect evaluation

By integrating high-end seismic imaging technology within reservoir quantitative workflows, CGG provides detailed geothermal prospect evaluations that range from de-risking geothermal wells and production behavior using high-resolution fault area identification to improving geothermal quantitative interpretation in areas where reliable well information is limited or even absent.

CGG has a proven track record in providing this expertise in complex areas such as the Upper Rhine Graben in France where state-of-the-art survey design and subsurface imaging have provided key information for the interpretation of fault networks in deep crystalline rocks and the construction of a structural model that informed new production well trajectories.

In sedimentary strata lacking well information and high-resolution seismic data, the use of deep neural networks driven by rock physics knowledge has demonstrated the value of re-using legacy seismic data with often limited coverage in estimating key reservoir properties. Such advanced neural networks were successfully applied to seismic data across a carbonate geothermal reservoir located in the Dogger Formation north-east of Paris with the main objective of characterizing the extent of porous and permeable layers.



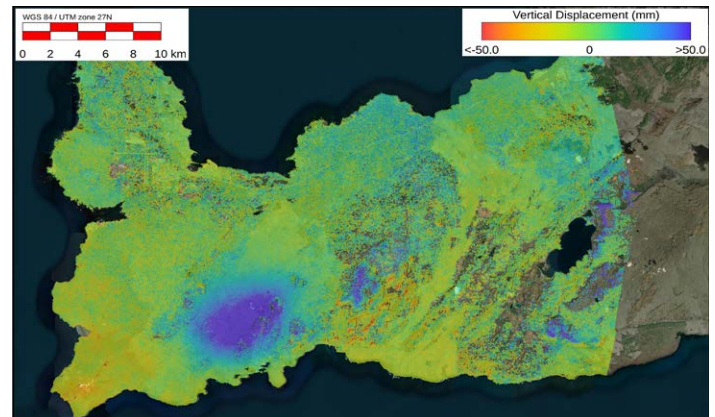
Geothermal reservoir seismic characterization with physics-guided deep neural networks (<http://dx.doi.org/10.1190/tle40100751.1>).

Rock physics data can be extracted and made analytics-ready using public and proprietary well databases using our machine learning-enabled data transformation and classification capabilities. These data, along with multiphysics expertise, can then be used to classify and characterize existing and reprocessed seismic data for geothermal purposes.

# GEOHERMAL SERVICES

## Earth observation for geothermal

CGG's Satellite Mapping team provide access to leading satellite imagery and elevation data, alongside innovative derived mapping and monitoring solutions. They combine deep remote sensing knowledge, advanced image processing, expert interpretation and complex analytics to deliver unique geological, environmental, geohazard and geotechnical insights. CGG's world-leading satellite InSAR solutions are deployed to detect, map and monitor surface deformation across geothermal fields to track reservoir dynamics and evolving hazards.



InSAR analysis showing vertical surface displacement of the Reykjanes Peninsula, Iceland in 2020.

## Sercel offers a comprehensive range of design and equipment solutions for the geothermal market

High-precision equipment is provided in both onshore and offshore environments for better characterization, evaluation, and monitoring of geothermal stimulation and production. It ensures stable technology solutions, products, and associated services, starting with design assistance and pilot survey execution to installation, maintenance, and upgrades of installed equipment.

Variable business models allow adaptation to customer needs and project-specific requirements. Working with CGG and other partners provides options for integrated and turnkey solutions, that are unique in the industry.

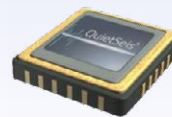
### Sercel equipment for geothermal applications includes:

- Geophone-based **SlimWave** – Slim (43-mm OD) system with up to 24 three-component shuttles which can be installed either on wireline or tubing or behind the casing, and the **GeoWave II** – High-temperature, high-pressure system with up to 120 three-component shuttles. These systems have industry-leading vector fidelity, sensitivity and field-proven reliability for short- and long-term installation in harsh environments and have been successfully used on many geothermal projects
- **WiNG** – A new fully integrated nodal land acquisition system designed with a single data collection platform to manage operations more easily and efficiently. It integrates Sercel's best-performing and most sensitive broadband sensor ever, **QuietSeis**<sup>®</sup>, to acquire high-precision seismic data

- **Q-SERIES** pressure and temperature permanent gauges provide the most accurate and reliable surveillance. Sercel-GRC's proprietary quartz transducer technology paired with a finely-tuned oscillator circuit offers superior accuracy, higher sensitivity, faster response and minimal drift over time
- **DAS** systems – Installed either on wireline, or permanently behind the casing, this range of fit-for-purpose cables are suitable for a variety of uses and installations, including the option of enhanced sensitivity fiber. The systems are connected on the surface to industry-leading recording systems, allowing high-resolution, high-fidelity, real-time data stream with integrated quality control features



WiNG<sup>NT</sup>



QuietSeis<sup>®</sup>



DAS

geothermal@cgg.com

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SEE THINGS DIFFERENTLY

