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ROTTERDAM, THE NETHERLANDS

GET2024

GEOTHERMAL ENERGY CONFERENCE

ACCELERATING DEEP GEOTHERMAL ENERGY DEVELOPMENT IN PARIS THROUGH NEW GEOPHYSICAL SURVEYS - GEOSCAN

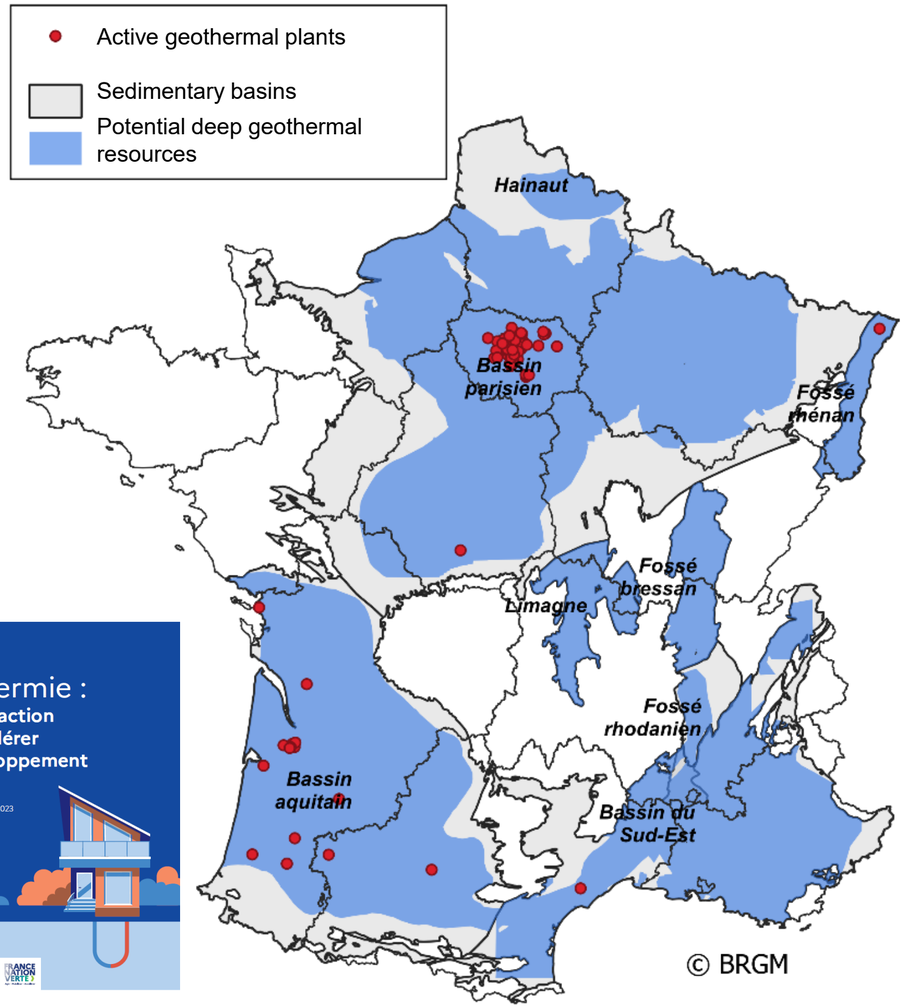
C. Maurel[1], A. Stopin[1], A. Bordenave[1], E. Lasseur[1], J. Briais[1], F. Branchu[1], J. Pwavodi[1], B. Isautier[1], L. Capar [1], S. Marc [1], N. Bommensatt[2], C. Laurent[3], N. Hebrard[2], B. Tayard[4]

[1] BRGM, [2] ADEME, [3] Conseil régional d'Île-de-France, [4] S3

THE GÉOSCAN'S PROGRAMS

Exploration of deep geothermal reservoirs

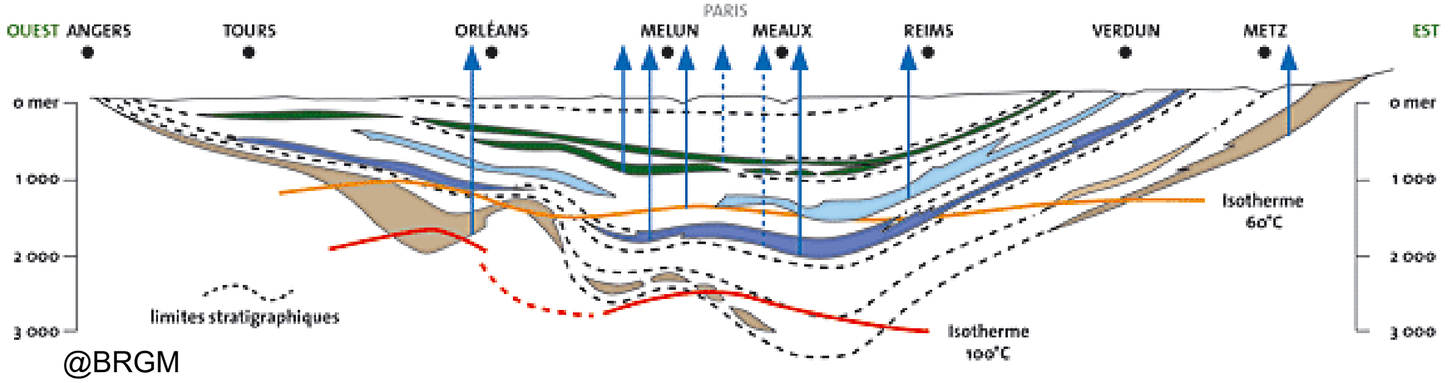
- Favorable context for geothermal exploration in France
- Pressing need to improve knowledge of the subsurface in unexplored areas
- Geophysical acquisitions and (re)processing plan launched and funded by ADEME
- Associated to 2 geoscientific programs
  - **West of Paris (BRGM, regional council)**
  - West of Marseille (BRGM, Aix Marseille metropole, regional council)
- 2 years projects
  - final results expected by T3/2025-T1/2026 for all audiences (public authorities, cities, experts, etc.)
  - first results published by the end of 2024 for experts
  - public access to results on the project website



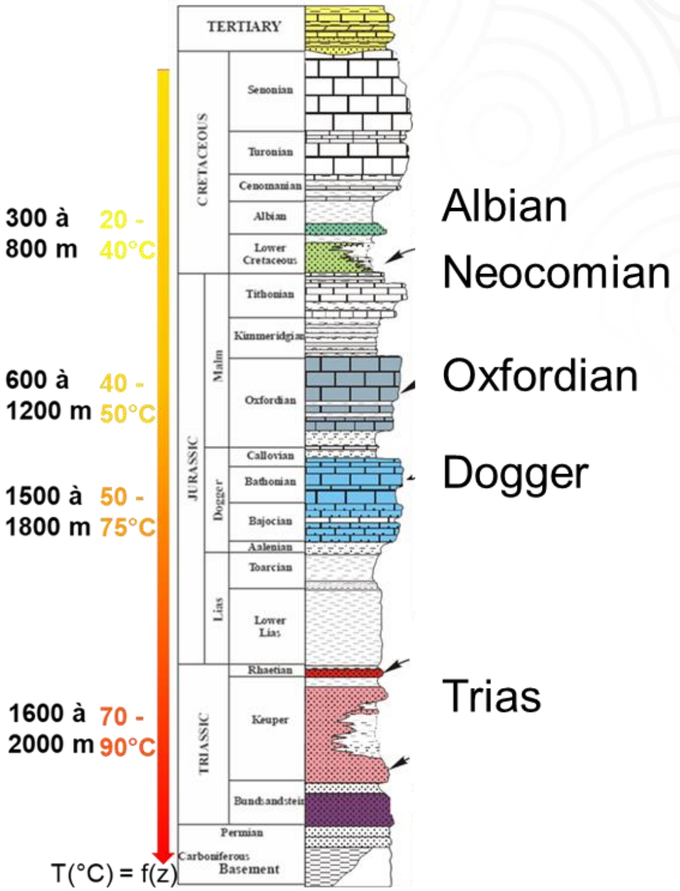
GÉOSCAN ÎLE-DE-FRANCE

In the IDF region, **58** doublets in 2022, **1M people** heated by geothermal energy with **1,69 TWh** of heat produced in 2022
Objective **X2** geothermal energy production by 2028 (PPE, SRCAE)

Context and location



- Sedimentary basin with **5 aquifers targeted** for the exploration
- Well known potential of the Dogger in the E & NE
- Expected degradation of the reservoir facies going west… and many other uncertainties to mitigate



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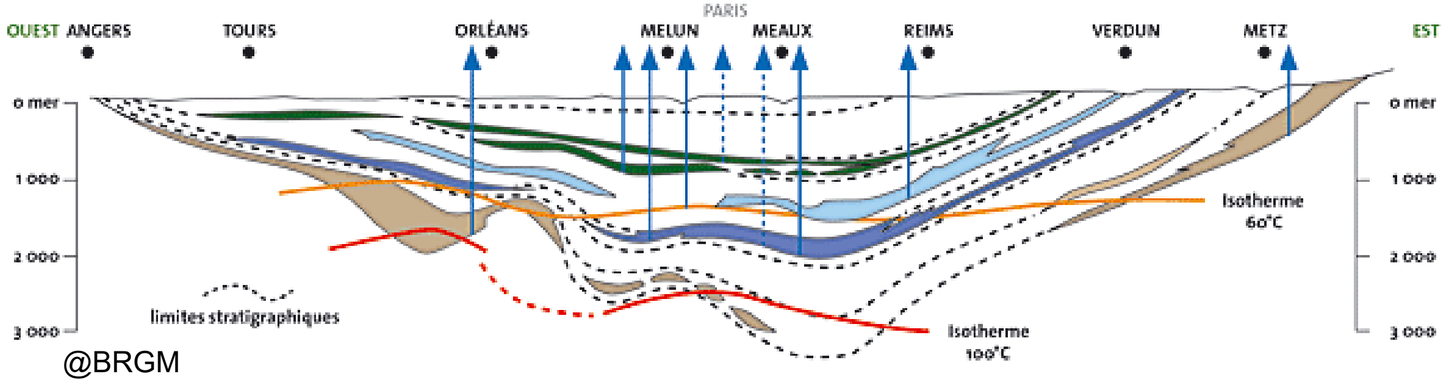

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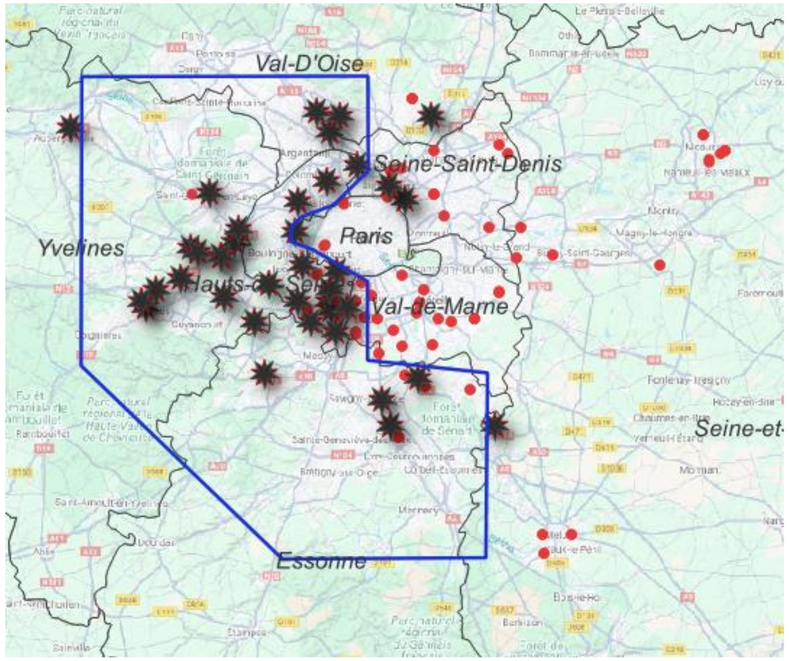
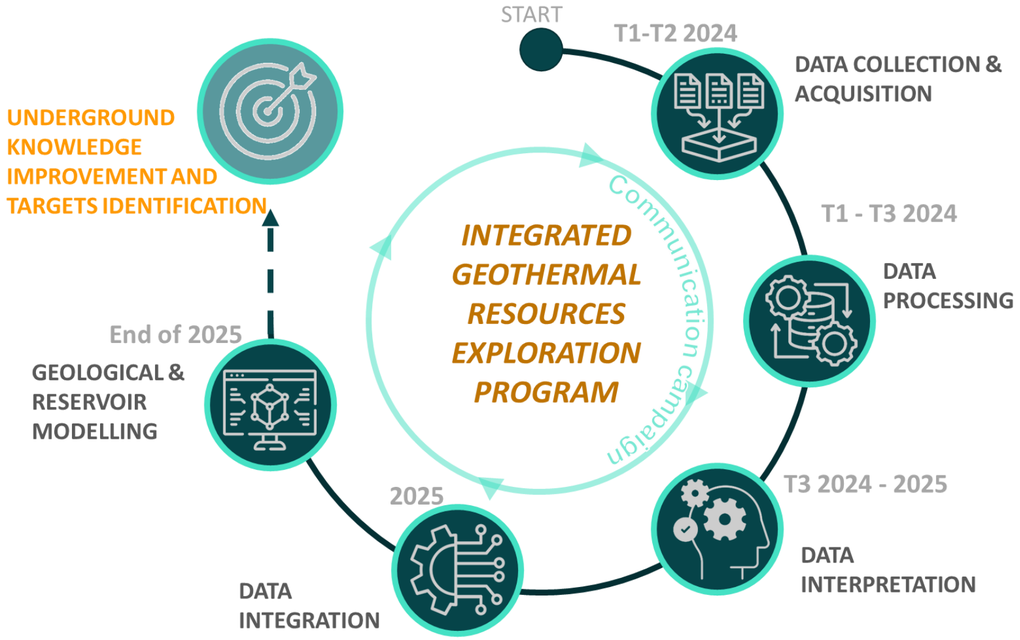
- 1900 km², more than 300 cities, about 4M inhabitants, >50% urban area



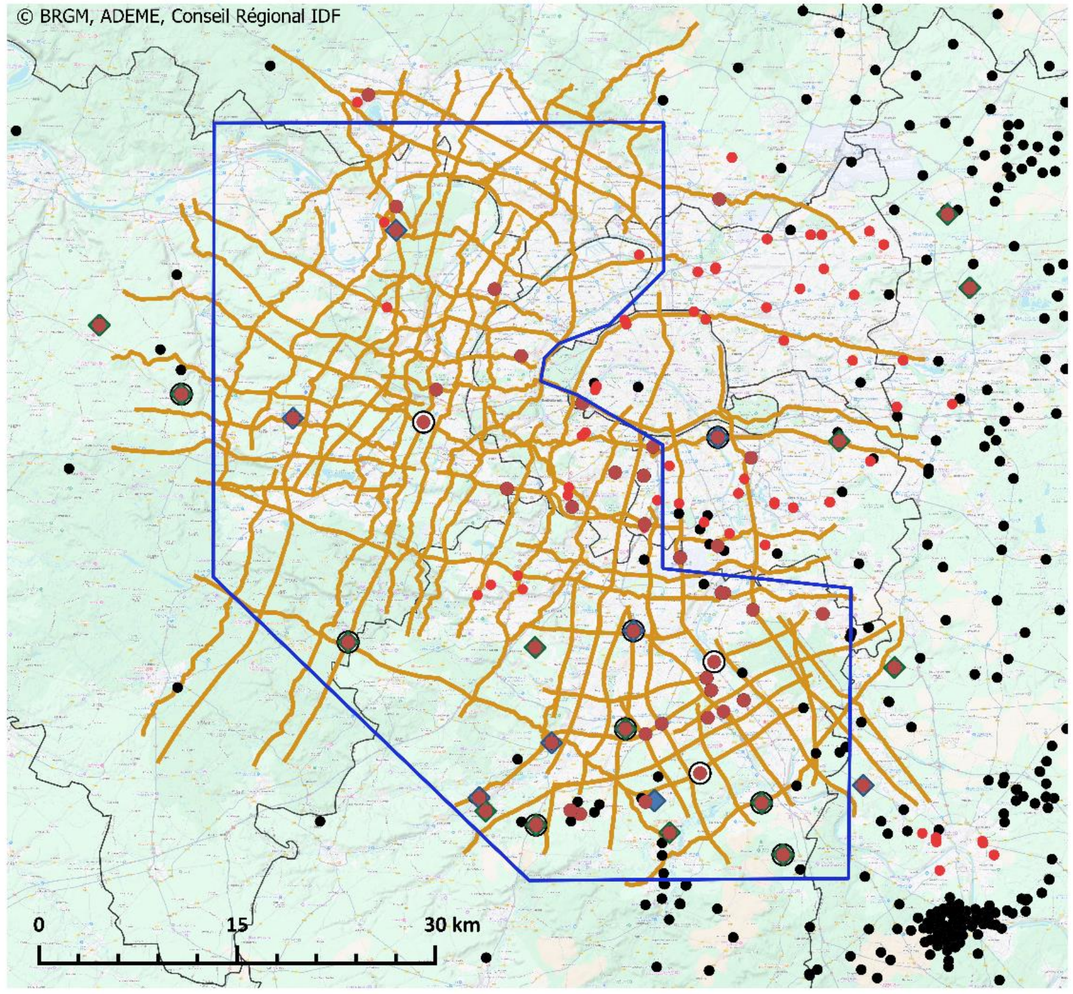
GÉOSCAN ÎLE-DE-FRANCE

Dataset available

- Numerous legacy data
- Integrated exploration program with geoscientific methods

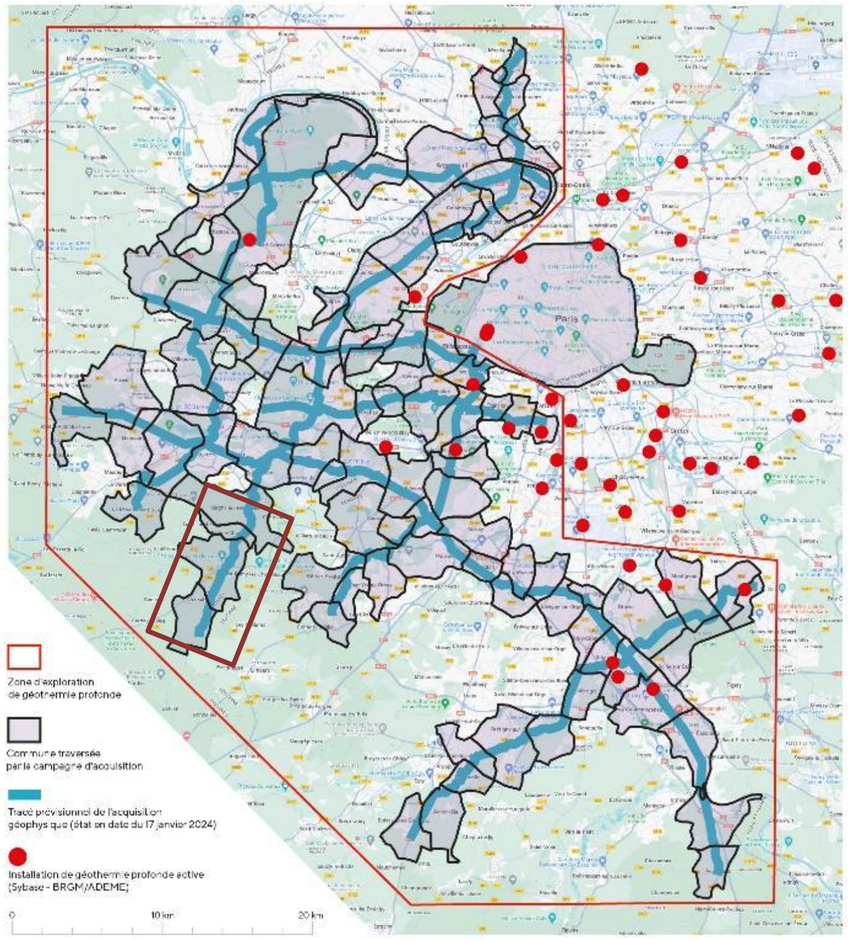


- Is legacy data enough to improve the knowledge of the subsurface?



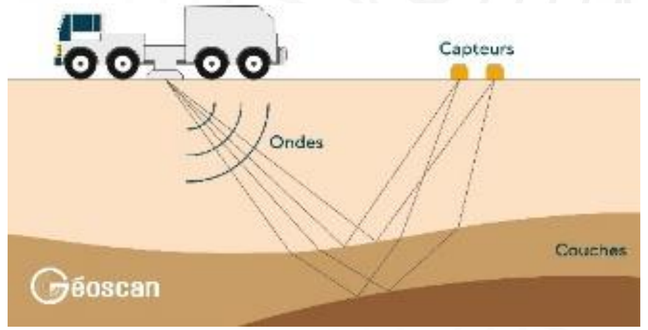
GÉOSCAN ÎLE-DE-FRANCE

Geophysical acquisition program



CSEM

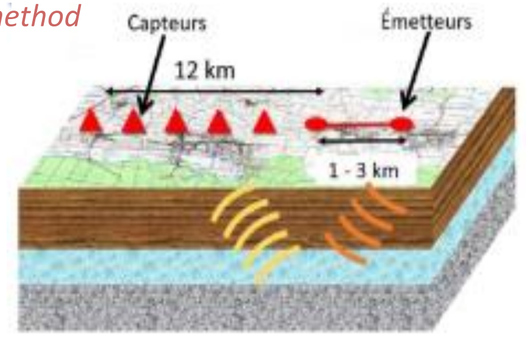
- 2D reflection seismic survey
  - 280 km
  - carried out by S³



Seismic reflection process

- CSEM survey
  - 12 km of acquisition along new seismic acquisition to compare the data
  - In rural area for deployment

Controlled sources electromagnetic method



2D SEISMIC SURVEY IN URBAN ZONES

How was it done ?

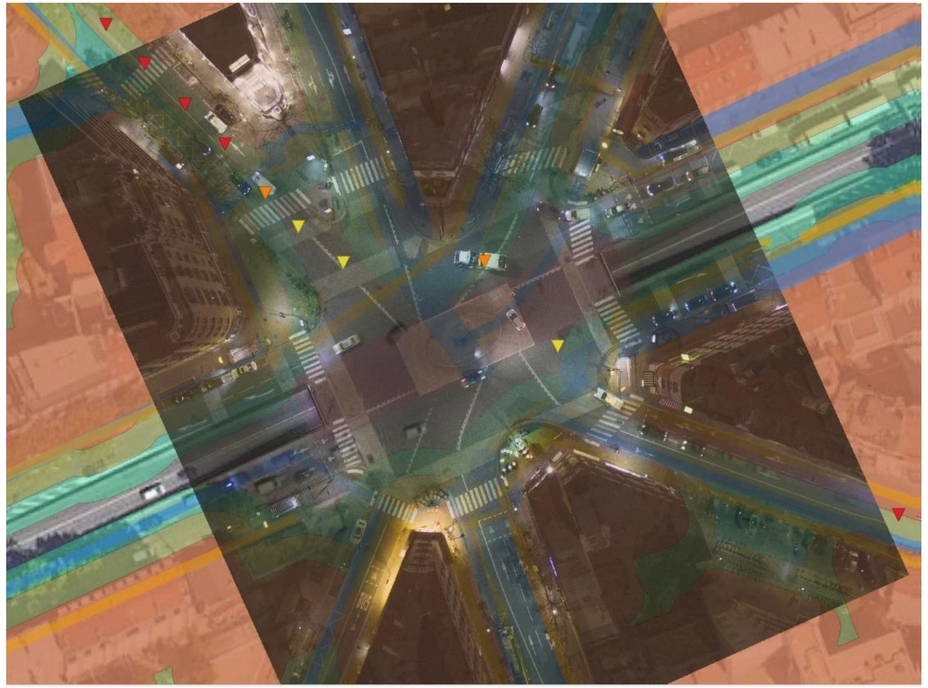
- Back and forth between **Pre-planning** and **Permitting** during 3 months

- A project on public roads: 98 cities involved, 7 departments in charge of main roads, several forests (National office of forest) and few private owners

- From first theoretical line…

… to refined outlines
… accounting for underground utilities networks
… infrastructures
… buildings
… vibrating strength

to final route



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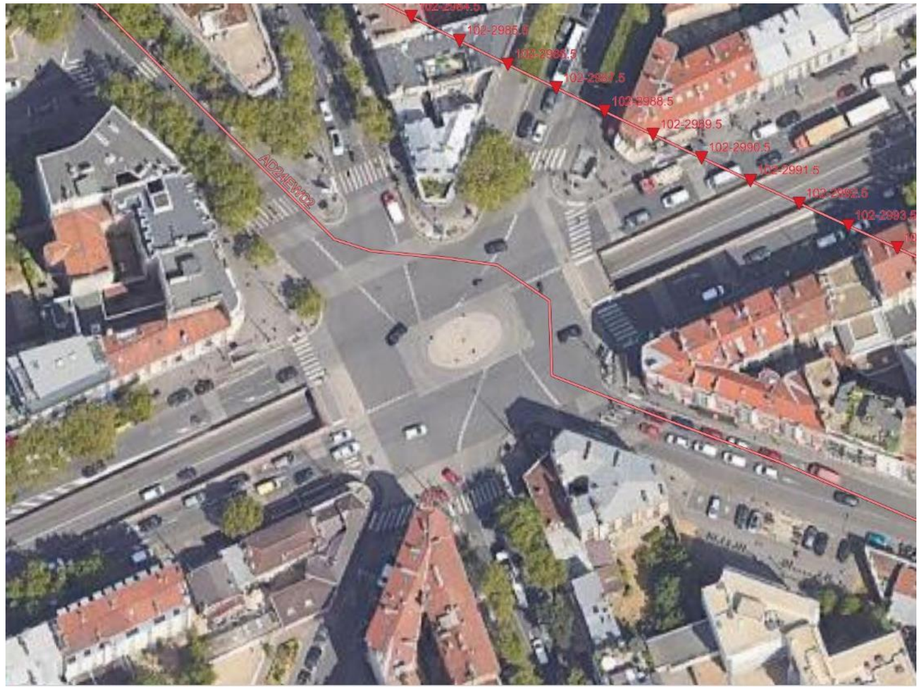

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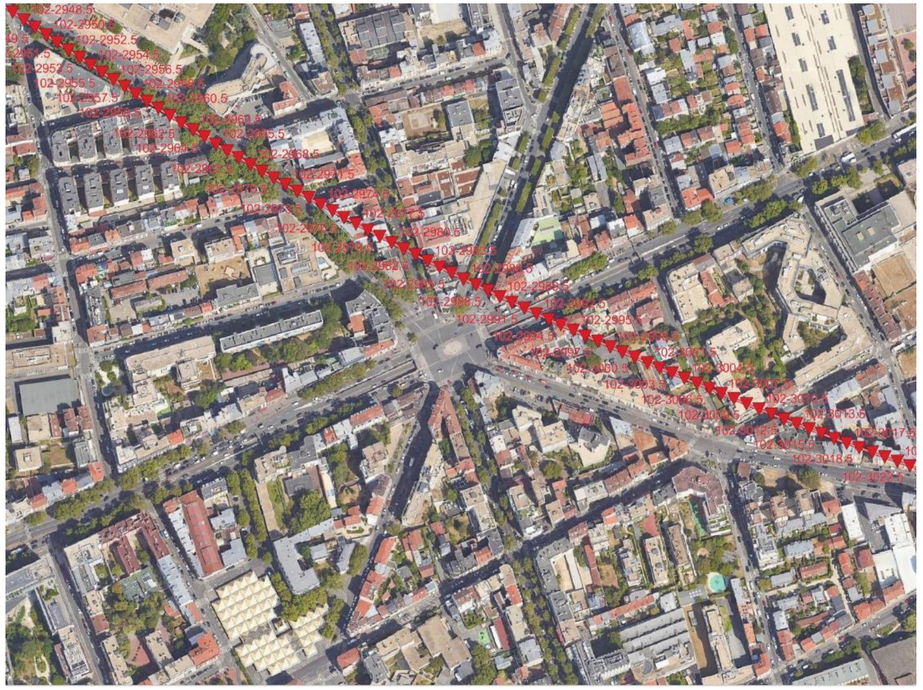

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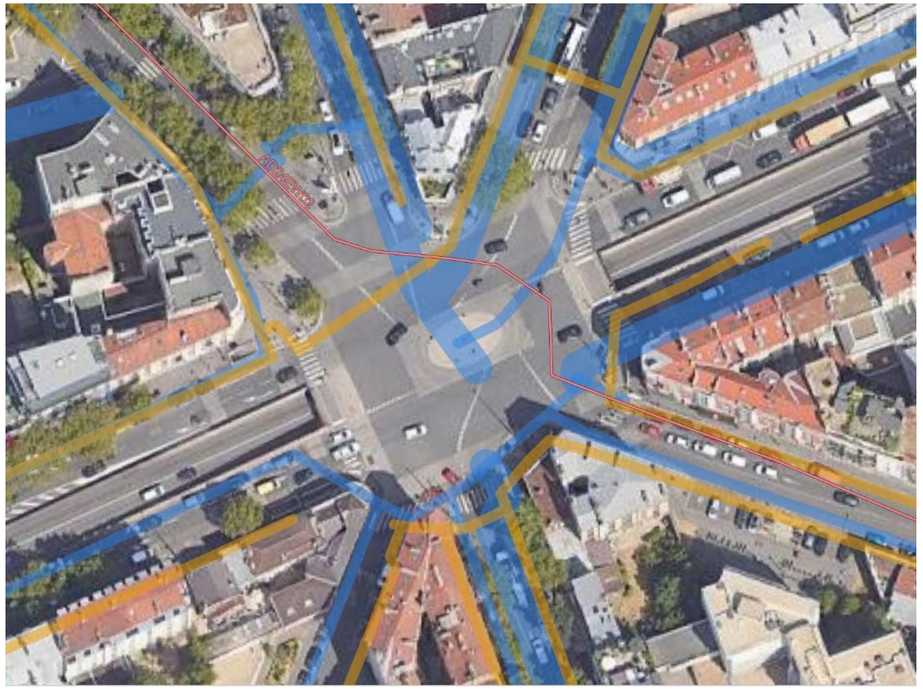

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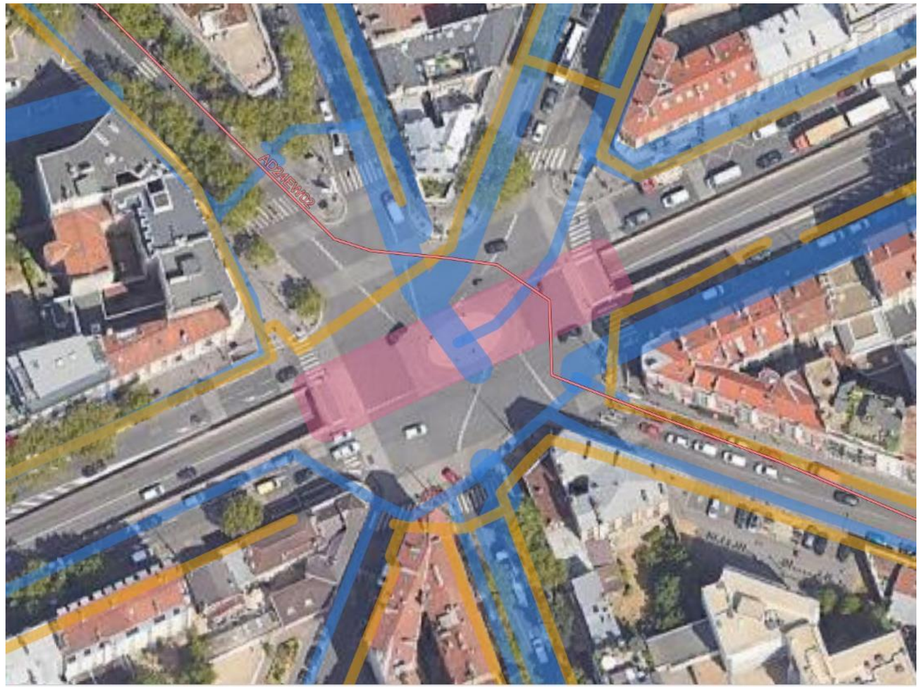

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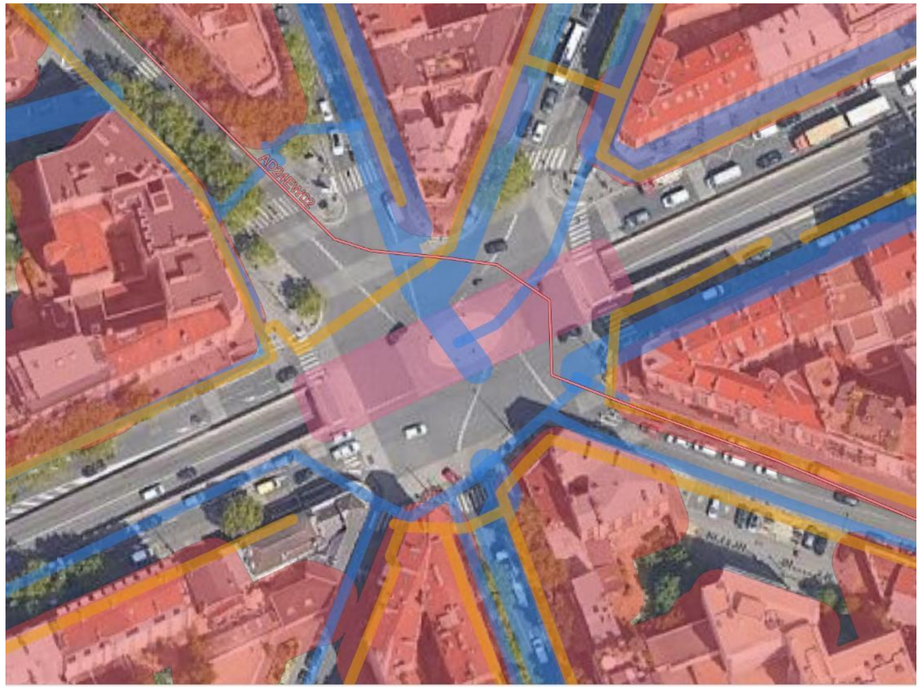

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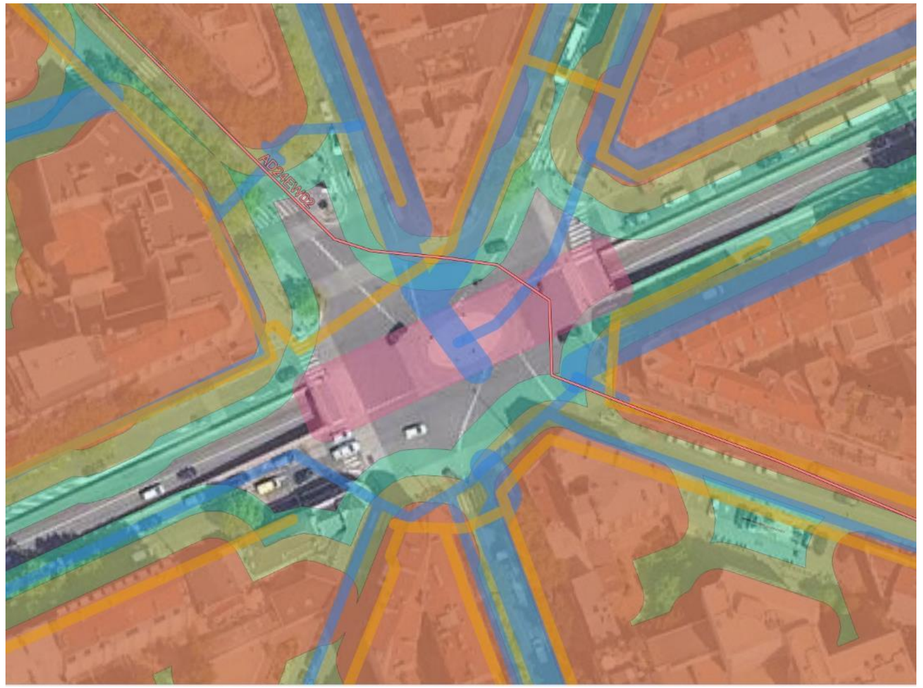

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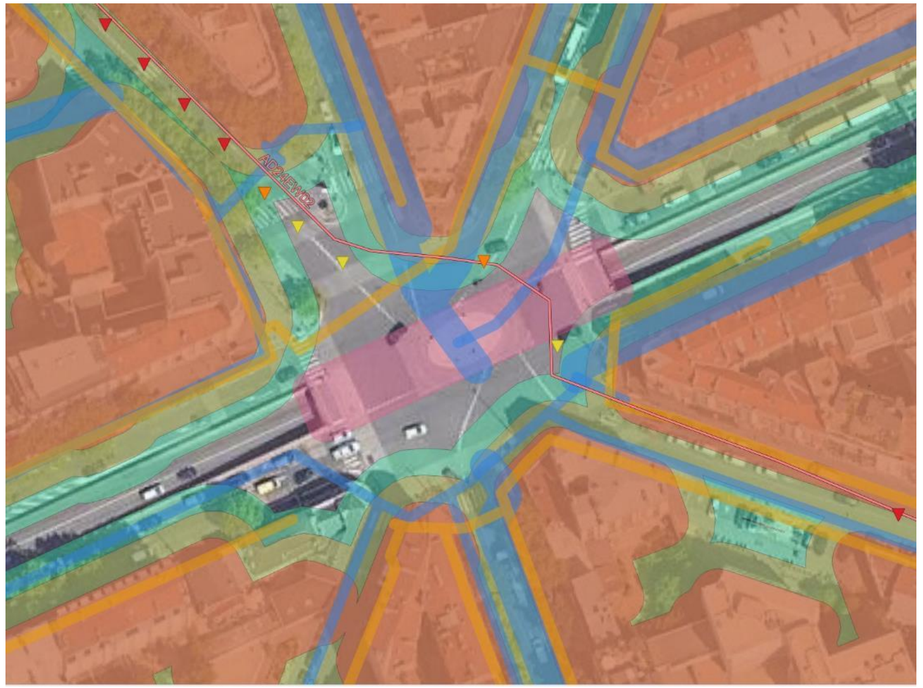

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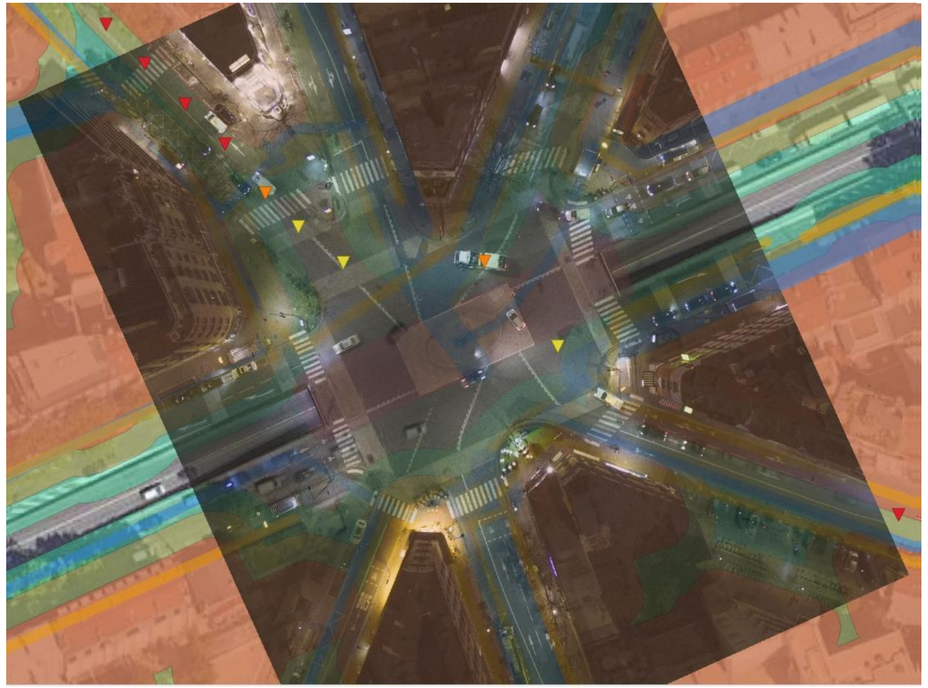


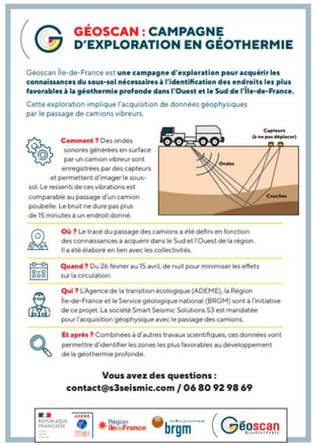
2D SEISMIC SURVEY IN URBAN ZONES

How was it done ?

- Communication campaign to:
  - help in the permitting process
  - allow smooth running of acquisition
  - engage potential end users
  - raise awareness about geothermal

- The tools used: a website, meetings with cities, open days, flyers in the mail boxes and poster campaign in buildings, press articles and tv interviews before and during the acquisition, information on sensors

https://www.geothermies.fr/geoscan-idf



2D SEISMIC SURVEY PARAMETERS

Vibrator trucks	3 Thomas of 32T
Sweep type	SRS
Frequency	2 to 96 Hz
Duration	48 sec
Number of sweep	1 per PV
Drive strength	80 to 20%
Receiver interval	20 m
Source interval	10 m
Offset max	9 km min

Duration

- from March 3rd to April 4th
- 10 p.m to 6 a.m to avoid road traffic disturbance and lower level of ambient noise

Sensors

- autonomous nodes with accelerometers
- remote quality control to detect disturbances

Vibration strength control

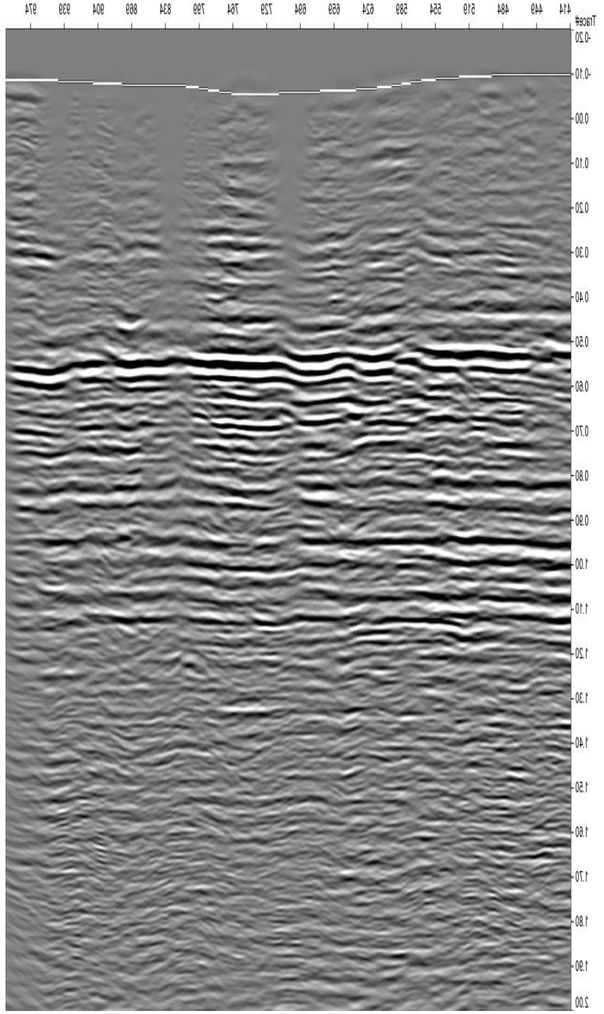
- regulatory limits for building exposure
- monitoring in real time and documented using PPV (adapt the drive, skeep VP, proof if complaints)

Photo : A. Stopin

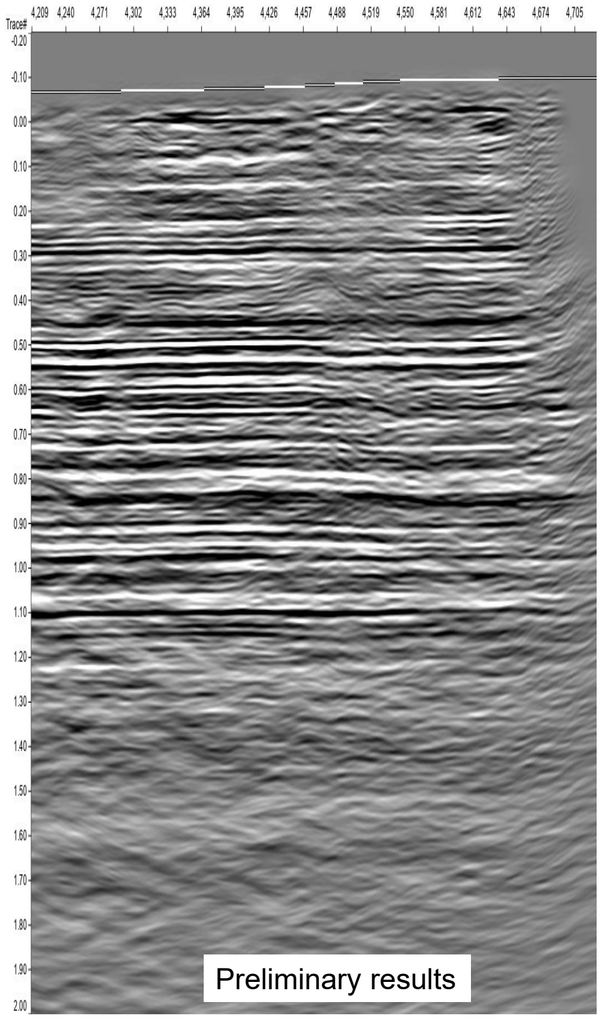
2D SEISMIC SURVEY IN URBAN ZONES

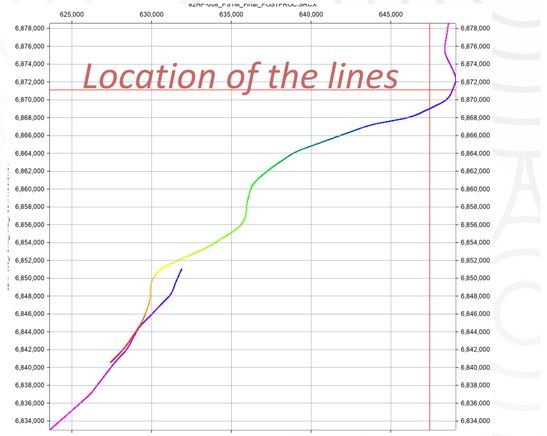
Was it worth it?

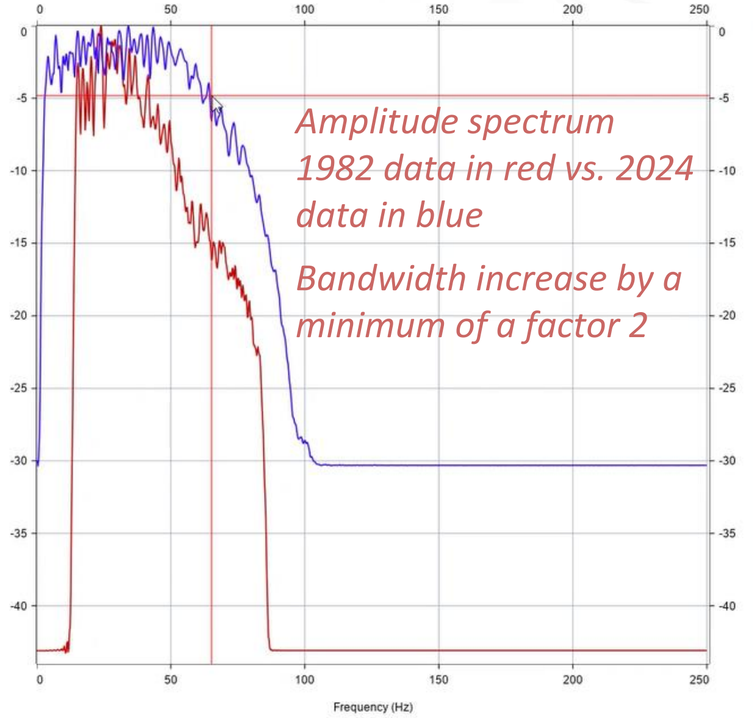
Line 82HP-008



Line 24IDF-002

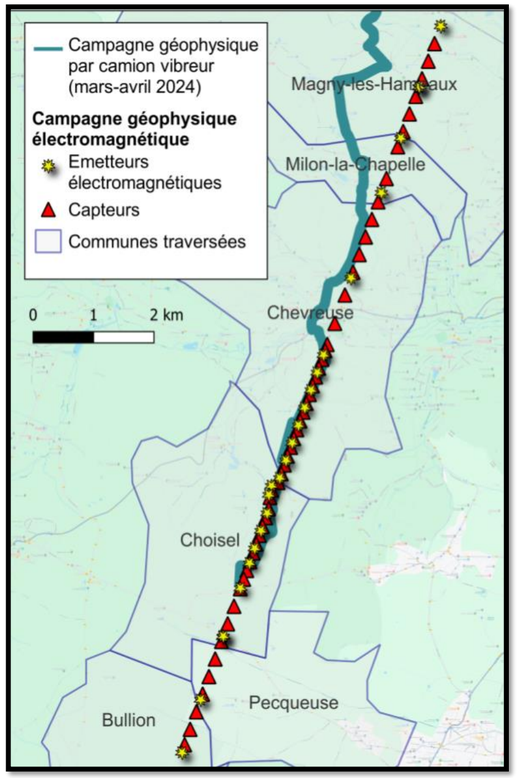






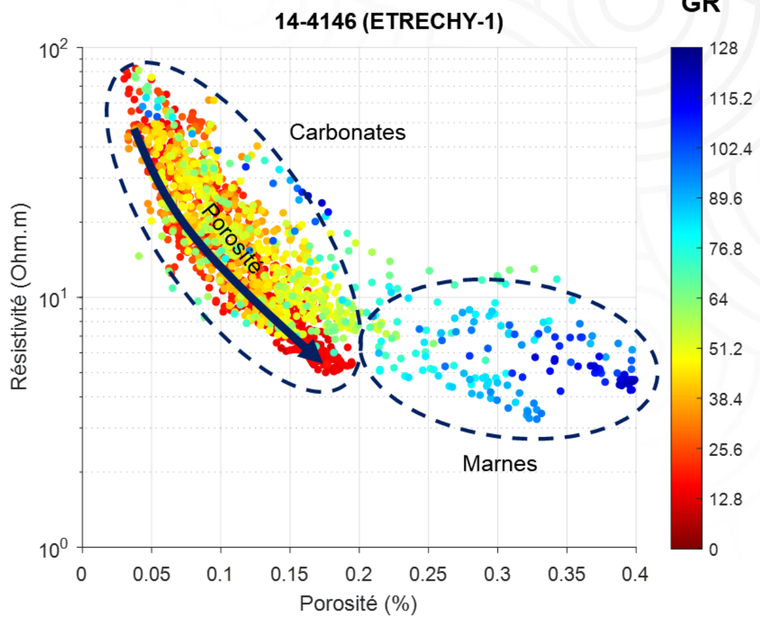
CSEM ACQUISITION

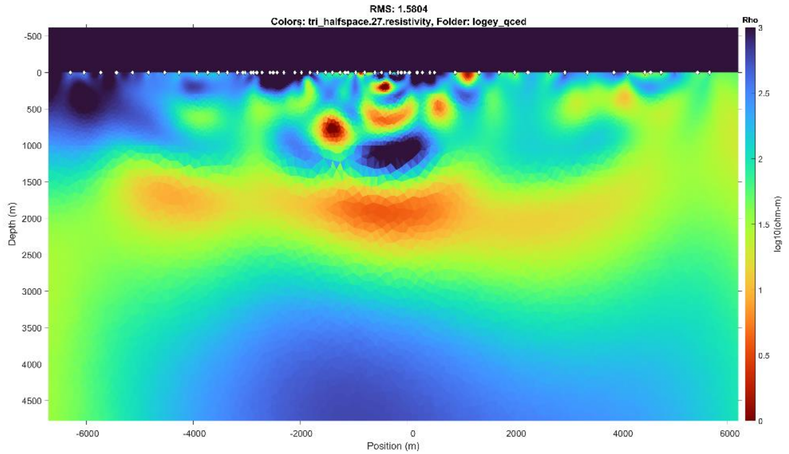
Testing other exploration methods in sedimentary basin



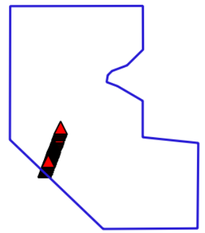
Location of the CSEM campaign

- 12 km along a new 2D survey in rural area to facilitate deployment
- Permitting over public roads and agricultural lands
- One week acquisition with test on S/R intervals





Preliminary CSEM processing



- Processing in progress, awaiting processed 2D seismic for cross interpretation

GÉOSCAN

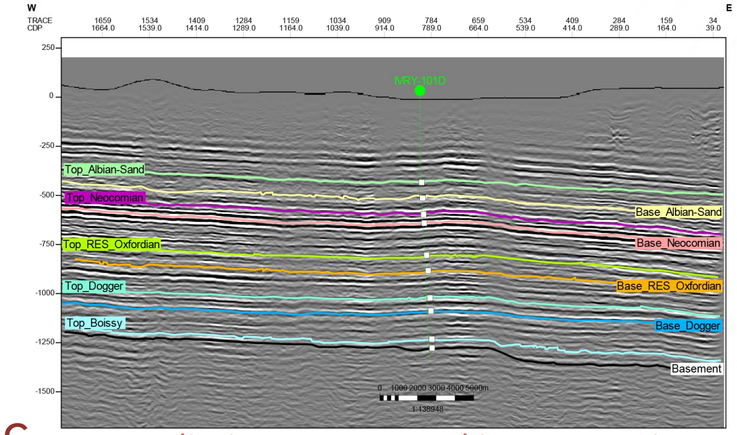
What’s next ?

GEOSCAN IDF

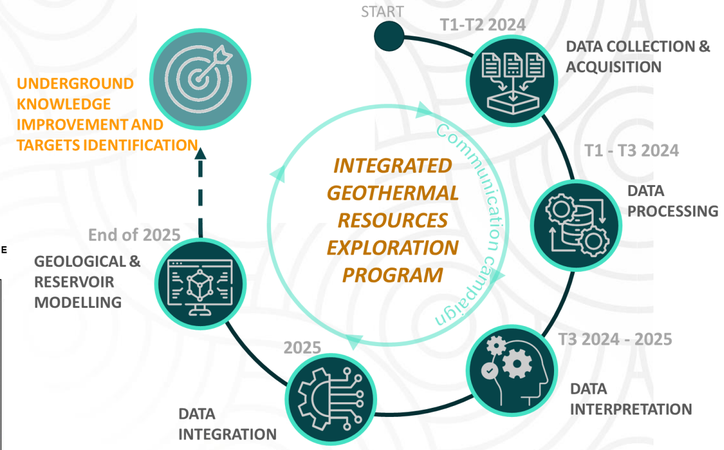
- (re)processing of legacy and new seismic data
- Structural interpretation
- Cross interpretation of new 2D seismic data and CSEM
- Quantitative analysis of seismic data
- …
- Geological & reservoir modeling

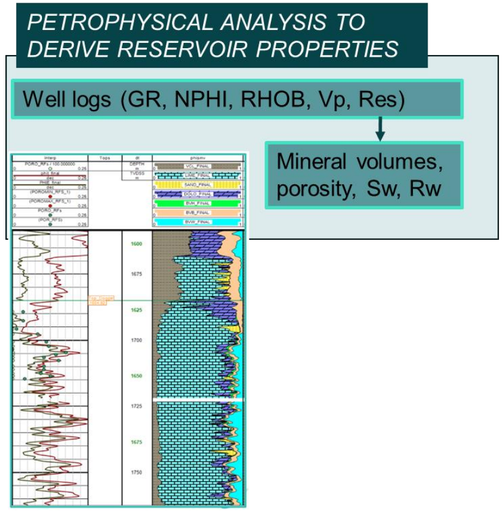
GEOSCAN ARC

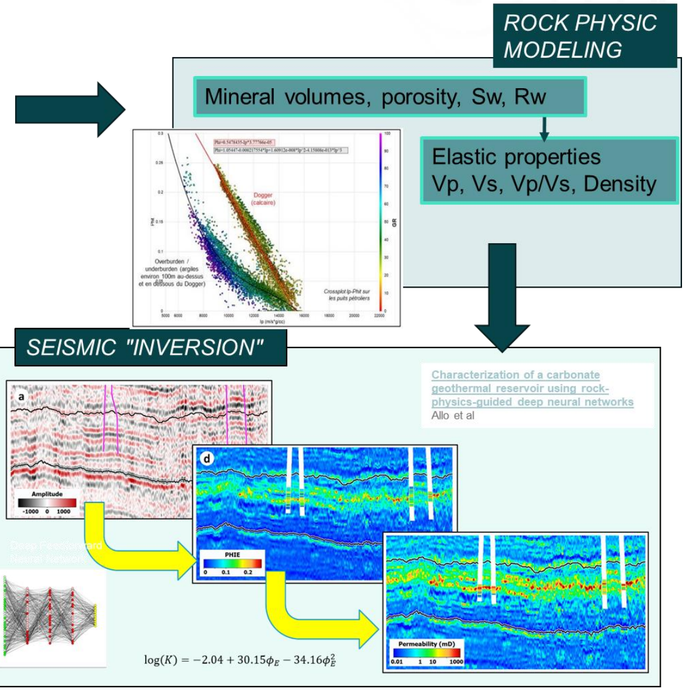
- Acquisition of 2D seismic reflection in Marseille from nov. to dec. 2024

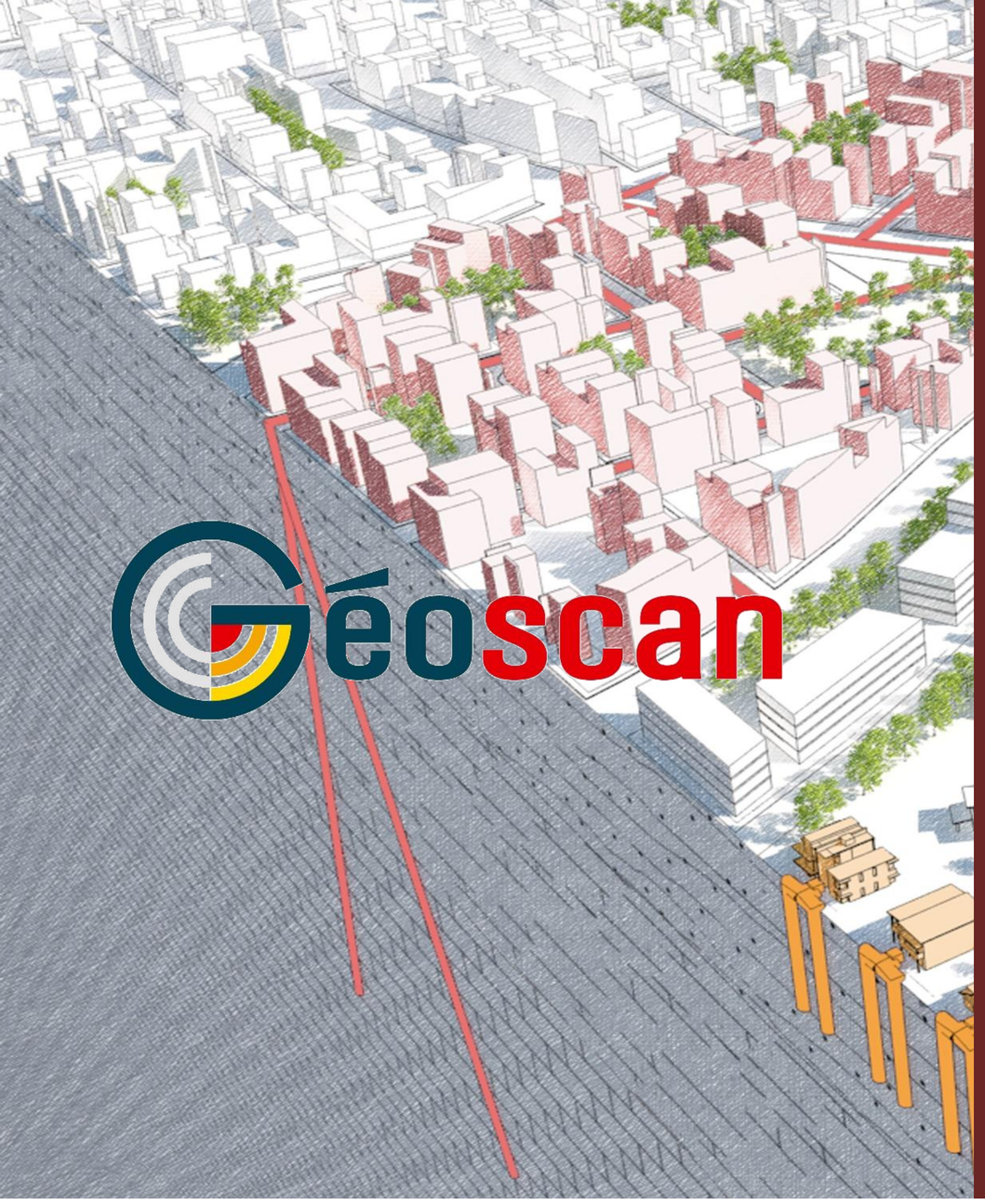


Preliminary structural interpretation









Thank you for your attention!

Follow the project on the Geoscan website and access the results of the project

Thank you to GSEU project, ADEME, CR IDF, BRGM

www.geothermies.fr/geoscan-idf

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