# Geophysical imaging studies for the EMR site: Early results from recent electrical resistivity tomography and gravity measurements
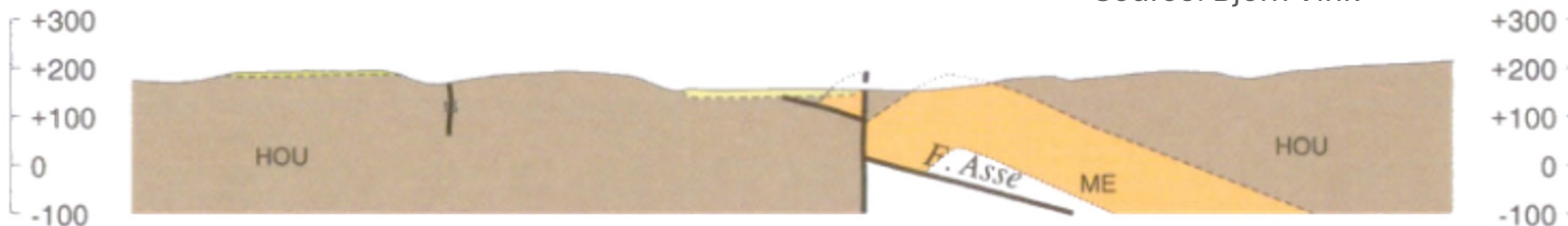
Y. Forth, H. Michel, F. Nguyen, D. Caterina, Q. Guillemoto, P. Orban

+ E-TEST team

Geologic context

- Largely folded and faulted geology

- Important for Newtonian noise estimation and for infrastructure positioning

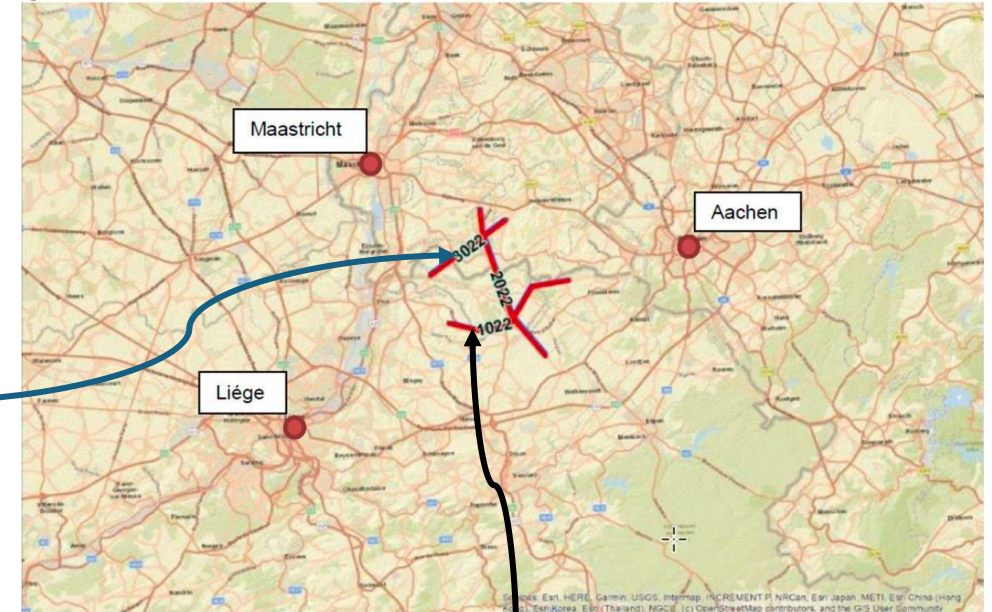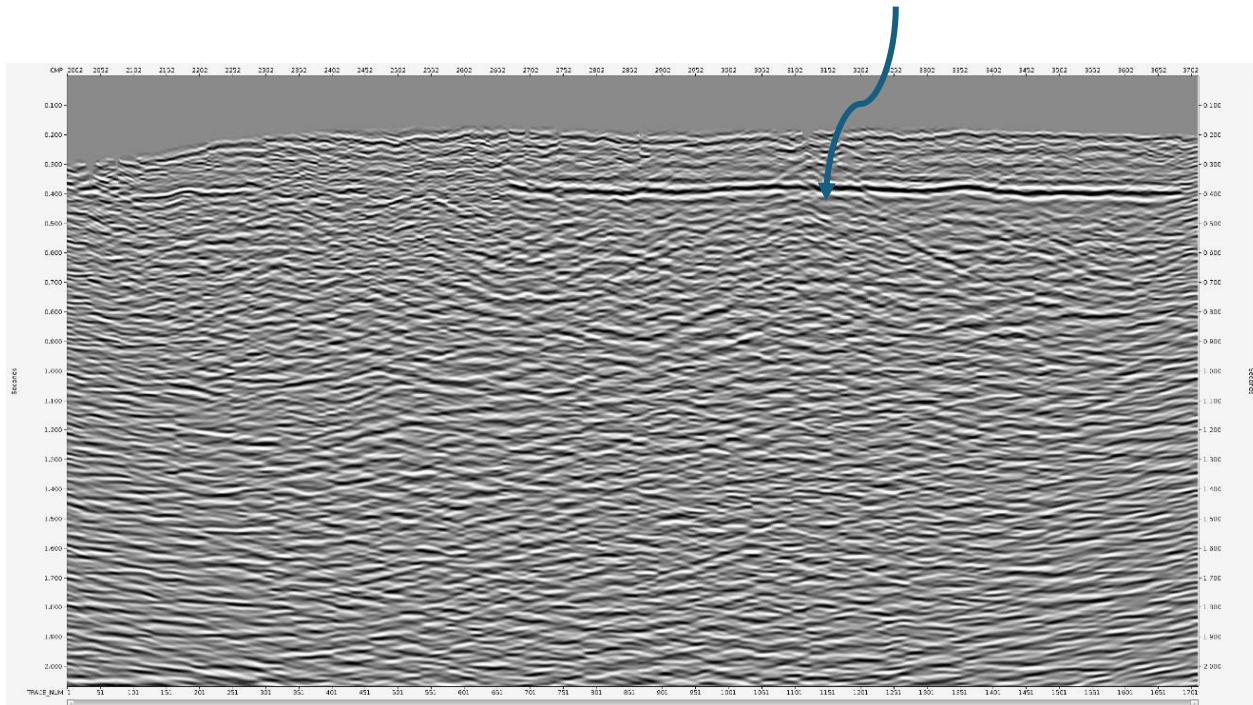- Target: Booze-Val-Dieu Block
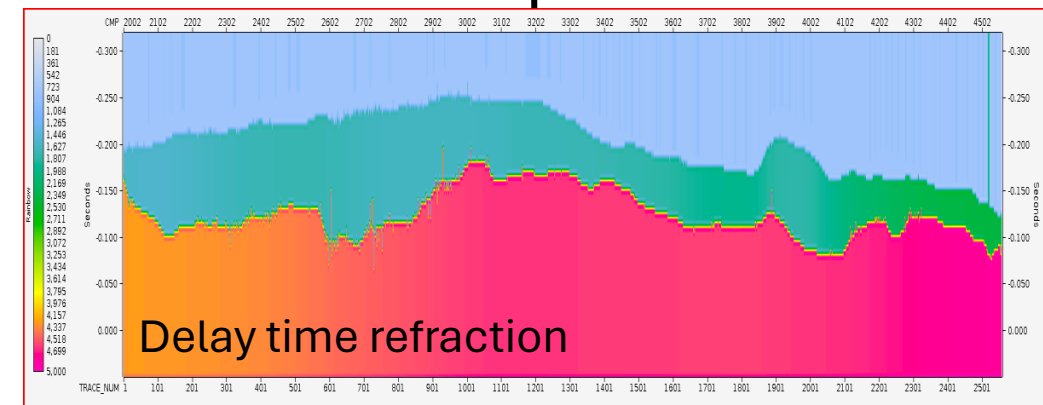 - mainly sandstone formation
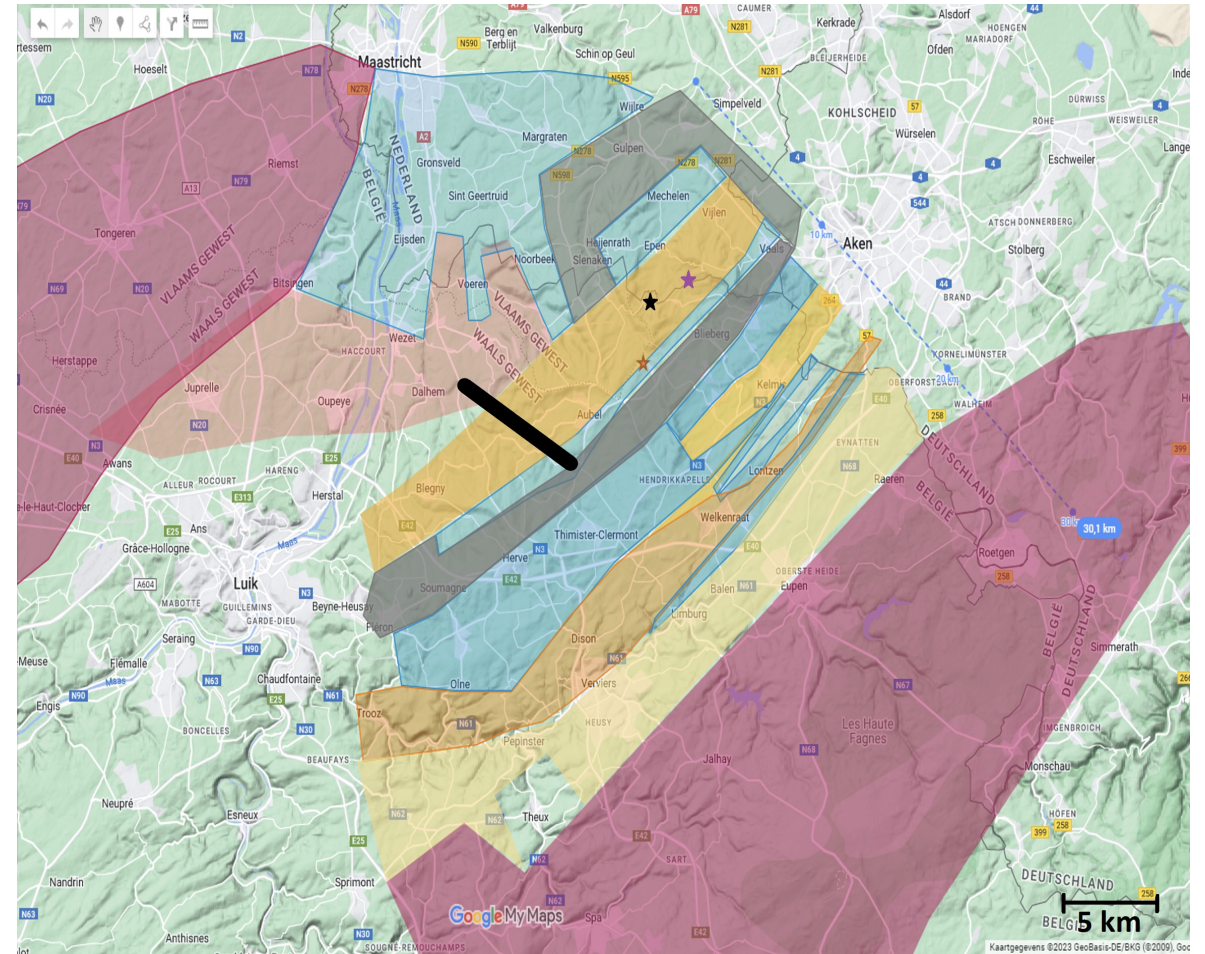
Source: Bjorn Vink

Source: geological map of Wallonia

E-TEST seismic results: importance of using multiple geophysical methods
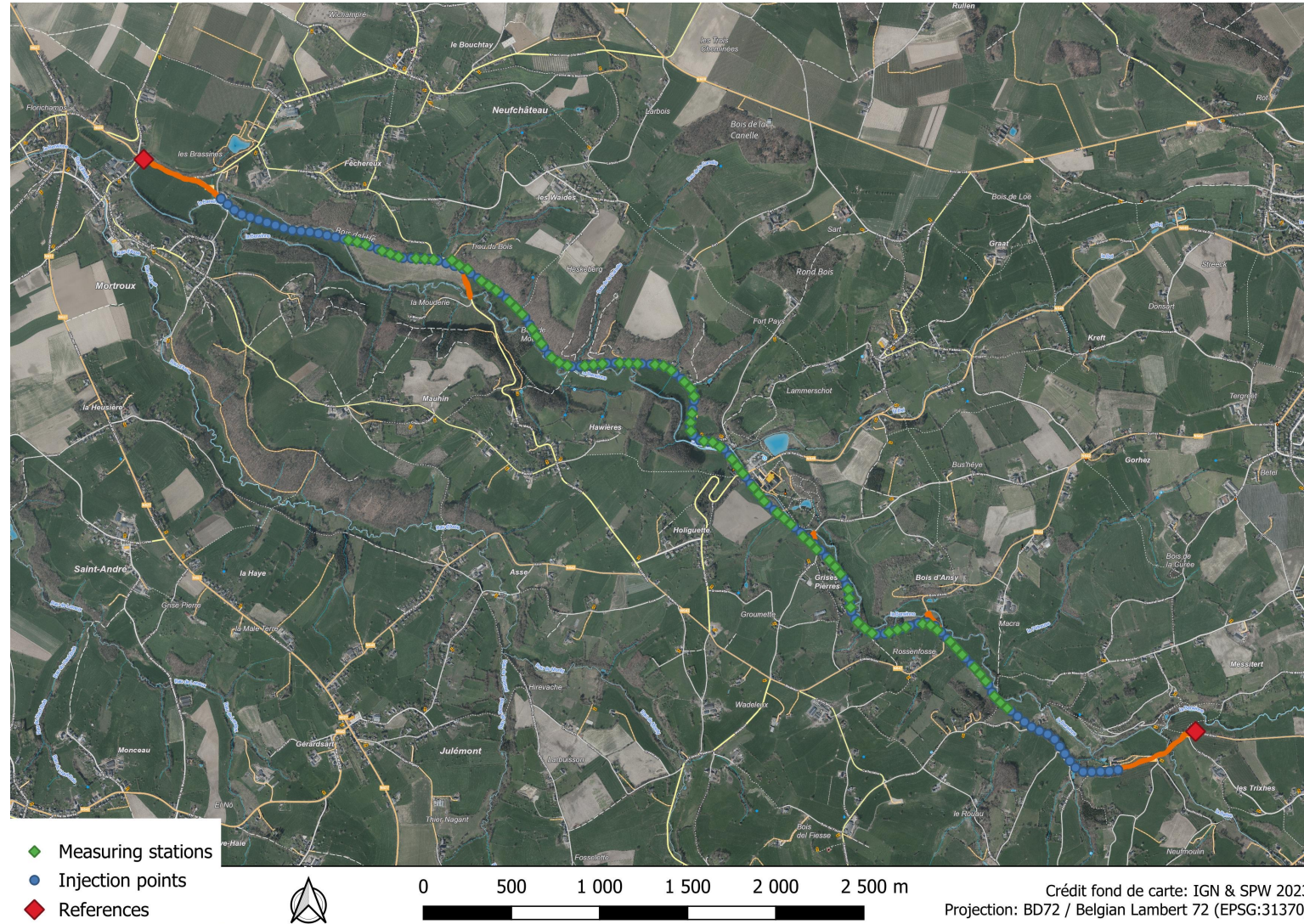
Shallow reflector screening deeper reflections

DT3.1.1 E-TEST PSTM image, see also Kiehn et al. (2023)

Delay time refraction

Deep ERT location

Measuring stations
Injection points
References

0   500   1 000   1 500   2 000   2 500 m

Crédit fond de carte: IGN & SPW 2023
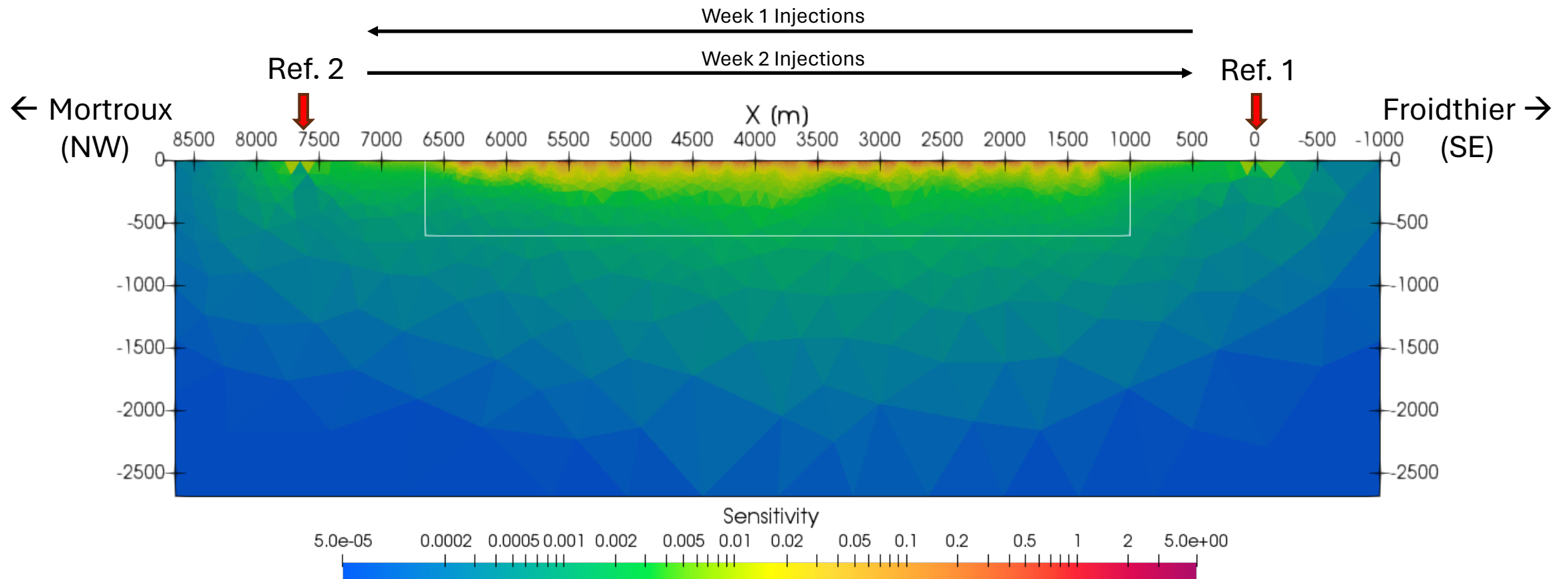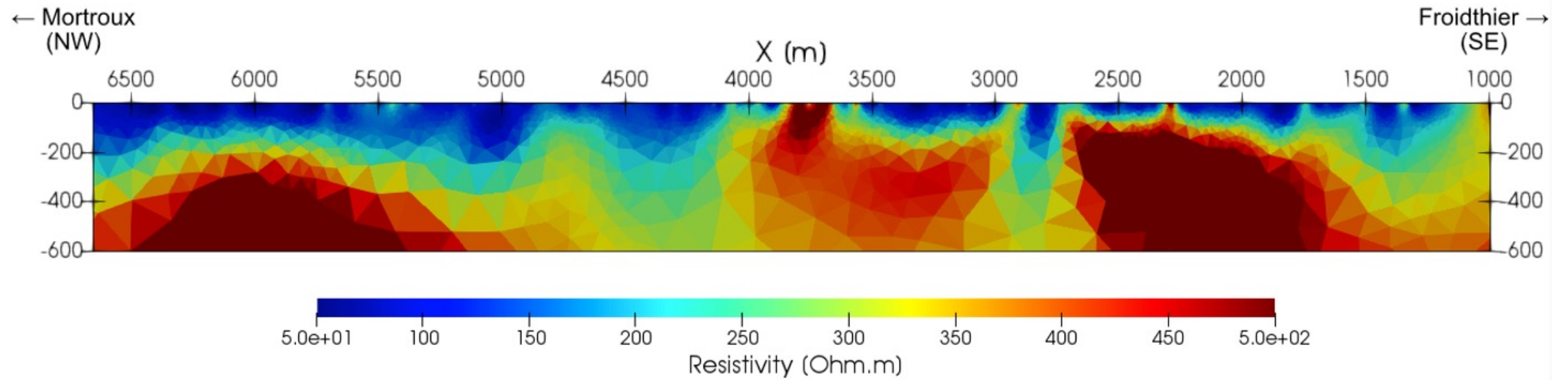Projection: BD72 / Belgian Lambert 72 (EPSG:31370)

Data

- 7.65 km line

- 134 Injection points

- 2 References Electrodes

- 26 V-Fullwavers – 2 channels each

- More than 300 injections

- Up to 4A injected at 1200V

- More than 6GB of raw data to process

- 12000 data points retreived out of 14500
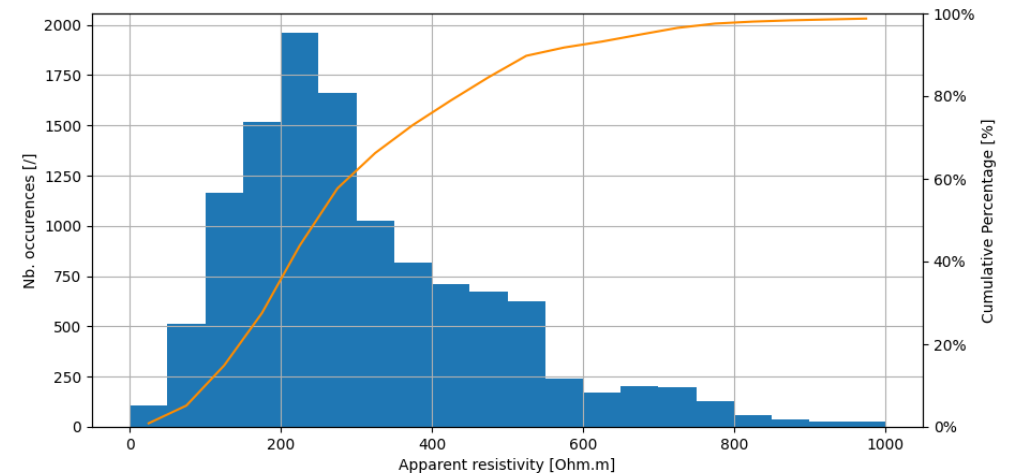
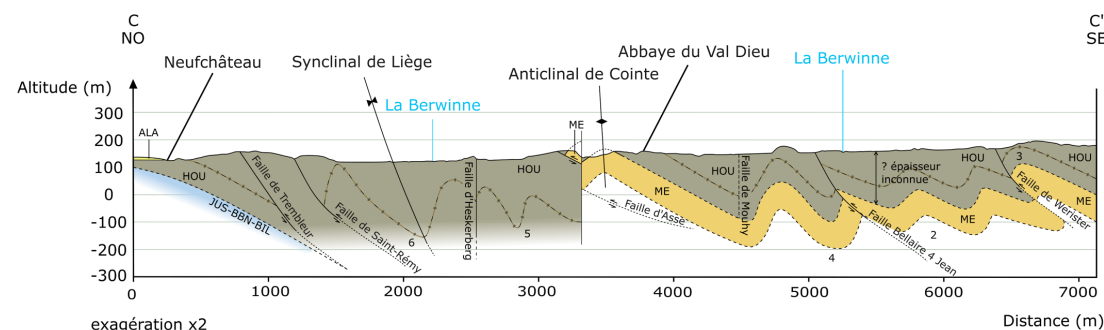# How deep can we image ? – Sensitivity

Results

Mortroux (NW) ← · · · → Froidthier (SE)

X (m)

Resistivity (Ohm.m)

This is not a straight line . . .

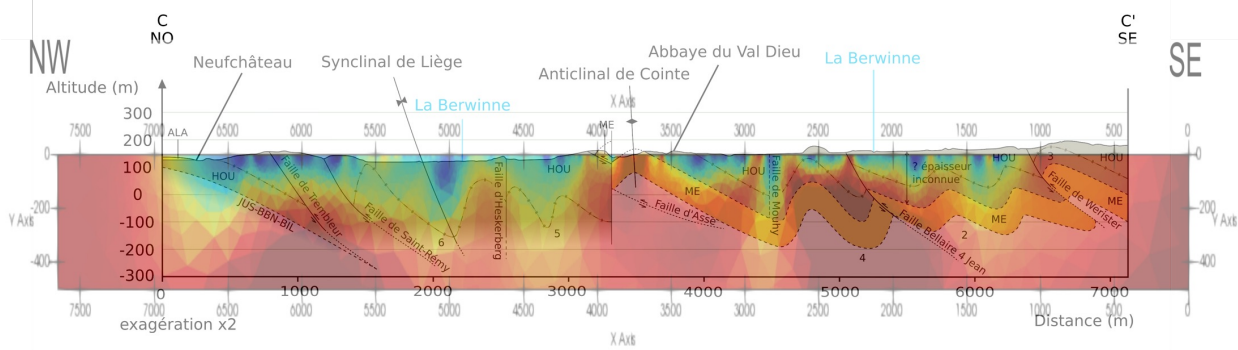# First interpretation

Low values likely correspond to Houiller formation (shales) where high values likely are limestone/sandstones
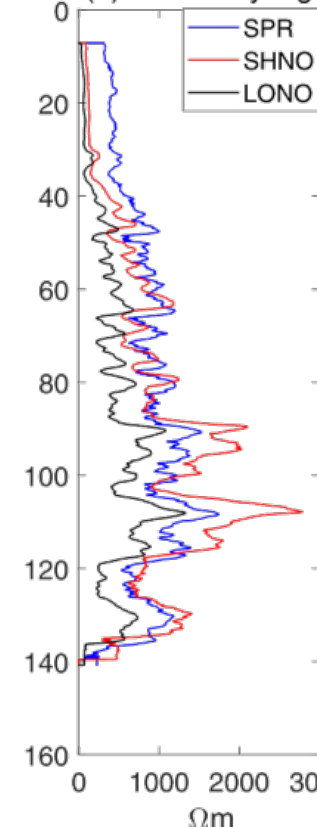

(modified from Koley et al., 2022)

M. potvin

Representing geophysical parameters in space

- Available are several 1D models based on boreholes (Terziet, Banholt, Cottessen, Aubel and more to come)

- 1D assumption breaks rapidly > 3D model

- Sensitivity of NN predictions wrt geological uncertainty

Bader et al. 2023
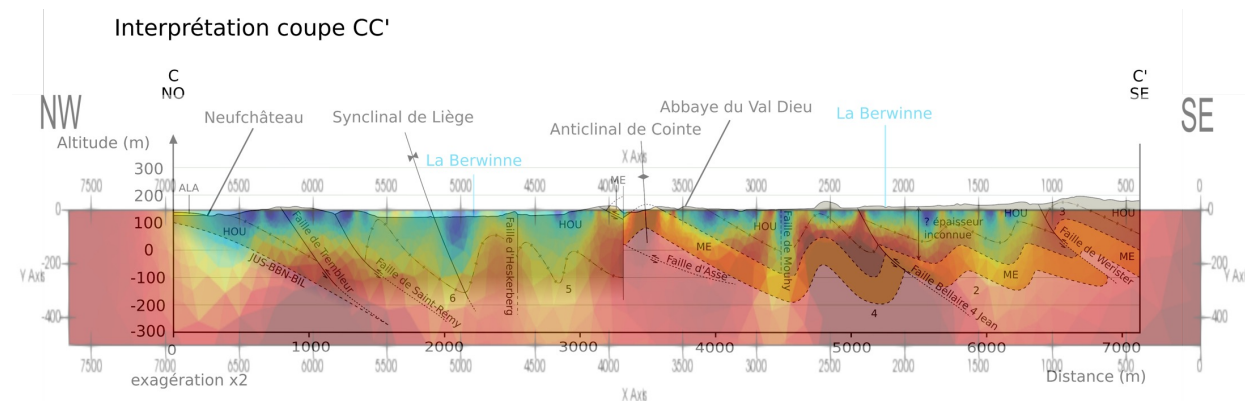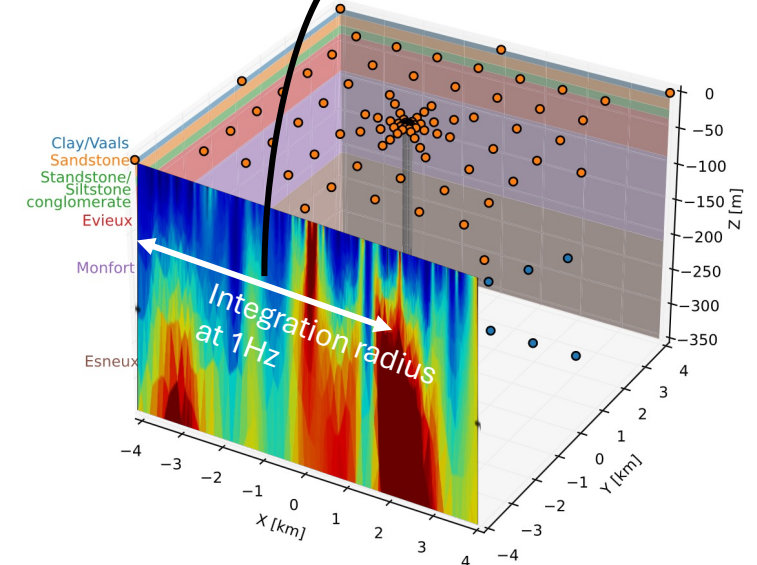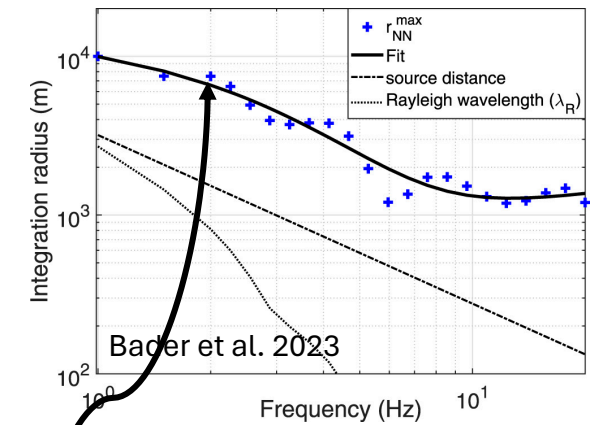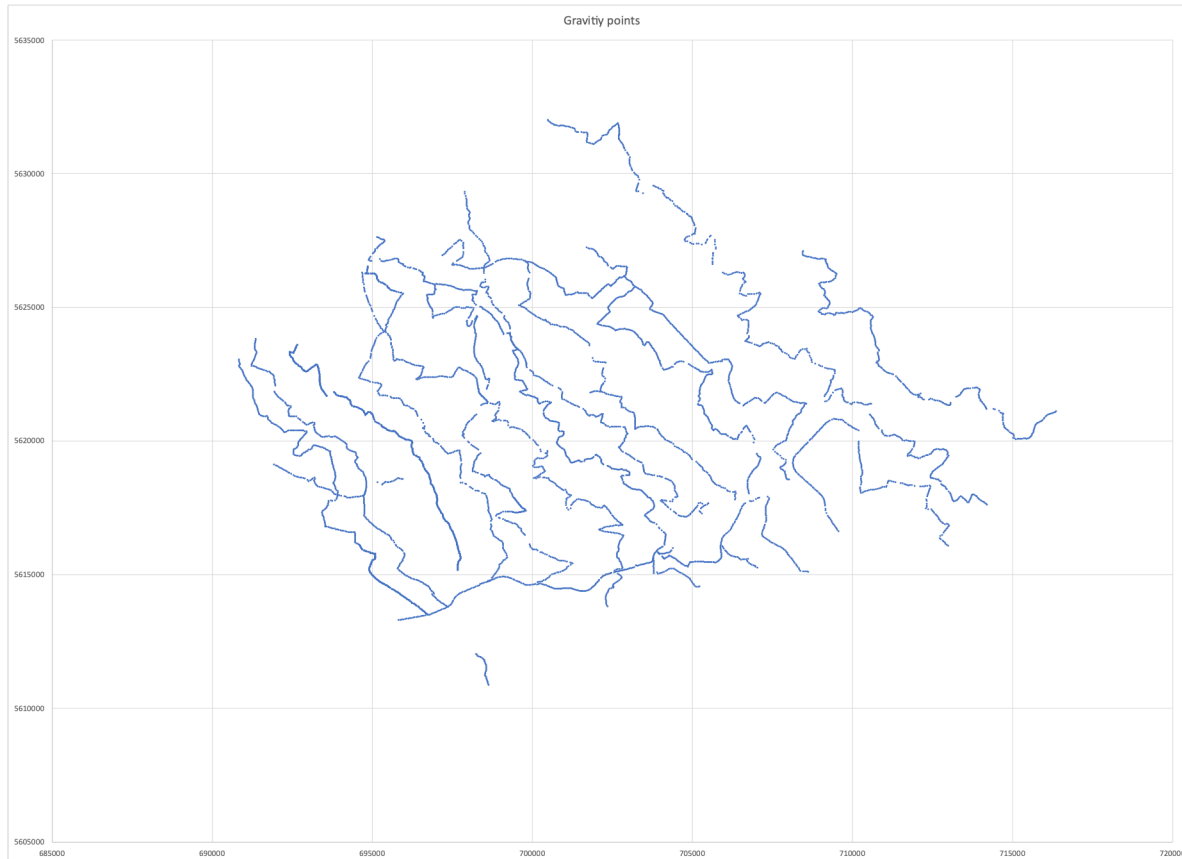

(modified from van Beveren et al., 2023)

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E-Test results – gravimetry survey

Lines of measurements

- Scintrex CG5 and CG6 instruments in // on the field
- Two to three crews (FREMEN GEO)
- Bouguer Gravity anomaly measured between november 2023 – march 2024
- Distance between points : roughly 50m
- Absolute measurement to be done by Christophe Collette
- Data shown processed by FREMEN GEO

E-Test results – gravimetry survey
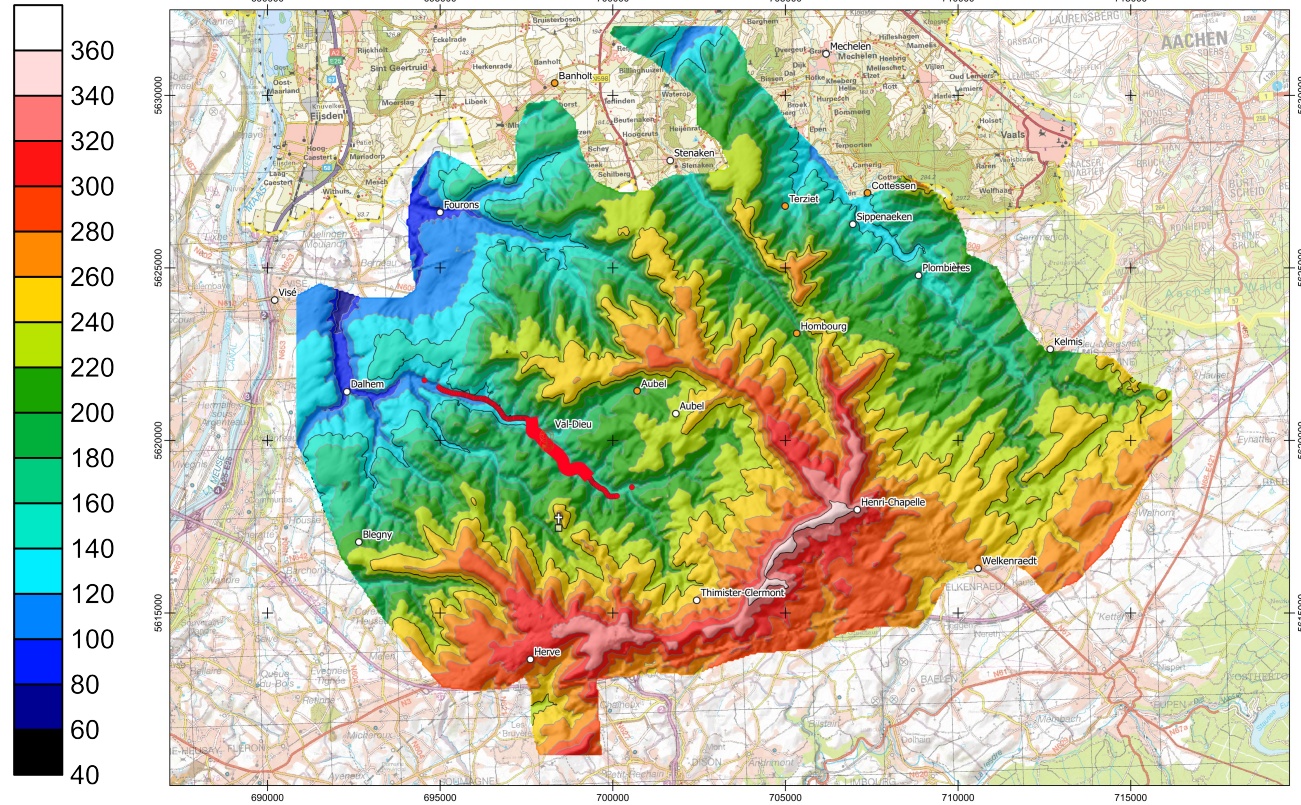
Topography of the area

- Scintrex CG5 and CG6 instruments in // on the field

- Two to three crews (FREMEN GEO)

- Bouguer Gravity anomaly measured between november 2023 – march 2024

- Absolute measurement to be done by Christophe Collette

- Data shown processed by FREMEN GEO

E-Test results – simple bouguer anomaly (d: 2.67)

Bouguer anomaly

µgal

Aubel Deep ERT line
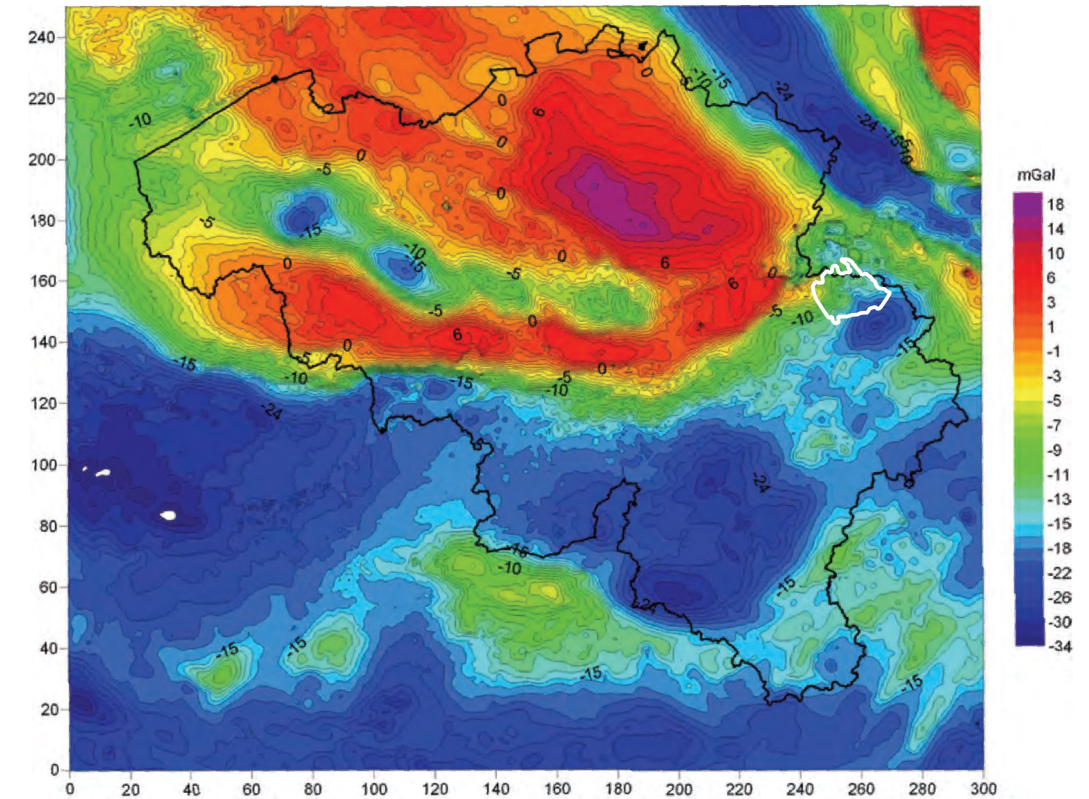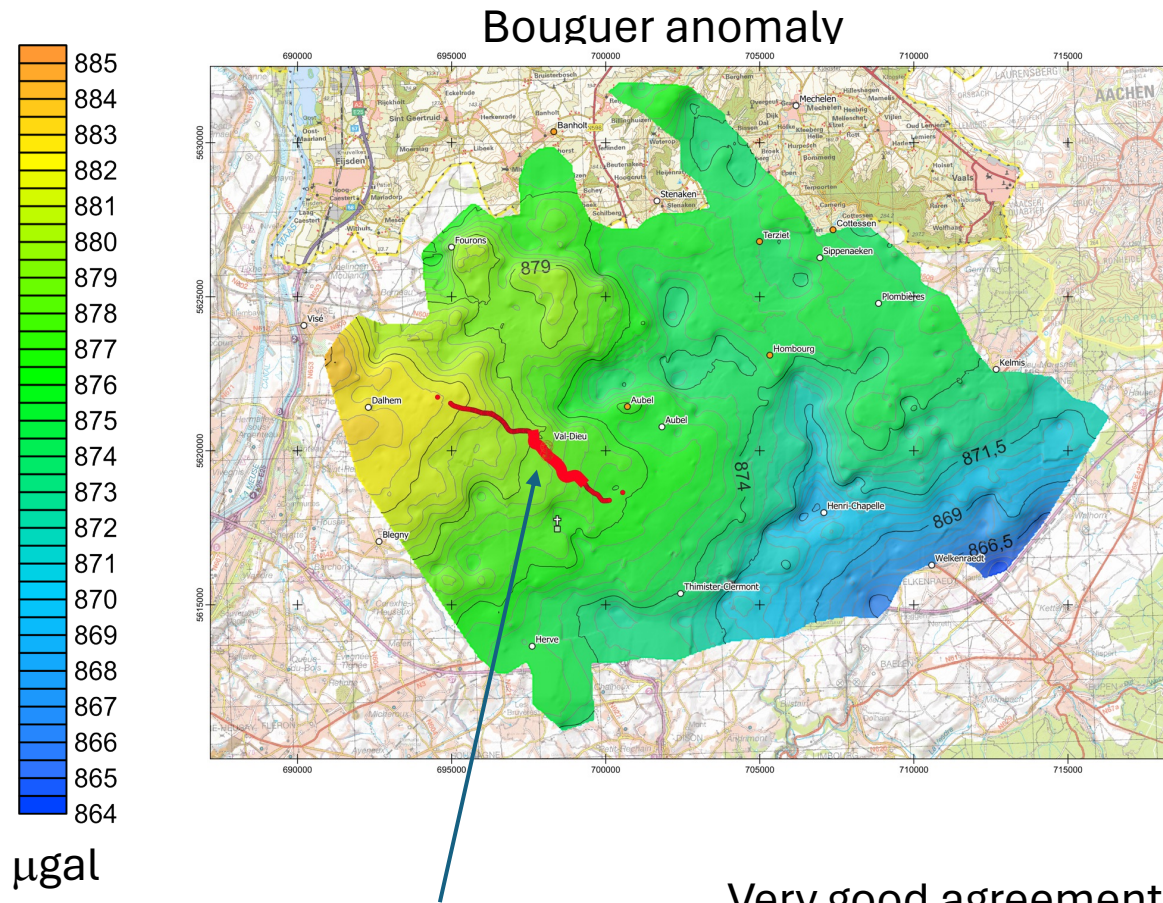
Very good agreement with previous maps

E-Test results – residual anomaly (complete bouguer and detrending d: 2.67)

mgal
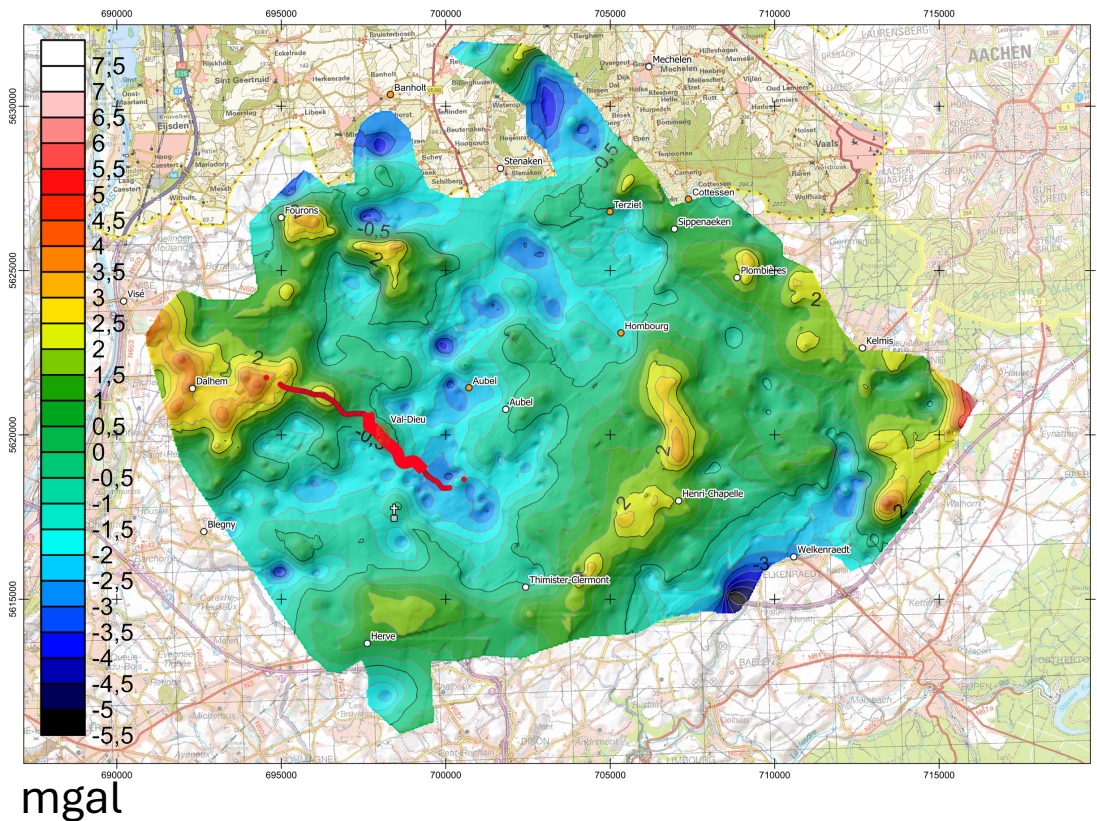
Interpolated residual anomaly (topography + detrending)

- Gravity anomaly measured between november 2023 – march 2024

- Requires own processing

- Coupled with the geological model (Chadulla, 2024) / other geophysics
  - Could lead to density model in 3D useful for NN
  - Mainly constraint lateral changes

Conclusions / perspectives

- Large scale geophysical methods allow recovering expected structures

- Multiple methods required given the challenging area

- Inform on lateral and vertical variations of physical properties of interests for Newtonian noise

- Low resolution requires coupling with constraints such as a geological model and/or seismic results (one model to rule them all)

- Further processing to be done with gravity data (still ongoing)

Thanks to the team

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- Simon Durieux
- Tom Debouny

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E-TEST is also co-funded by the own-fundings of all Partners:

Small ERT

Approximate tomo size

Resistivity model

Borehole data

Sand + Clay

Shale

Limestone