

Update Geo4All WP4

30 – 09 – 2025 Woerden

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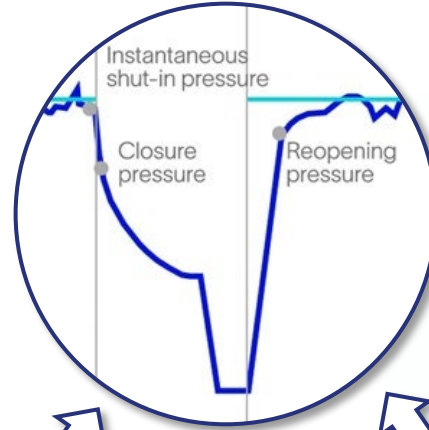
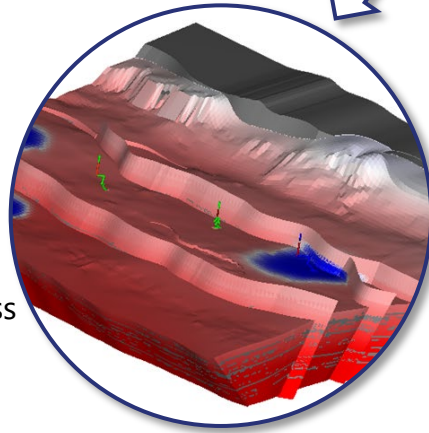
WP4

Where is cooling in the subsurface?
And does it cause seismicity?

Big 3Ms!

M

odeling
3D models, cooling, stress



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easuring
In-situ stress, permeability, velocity



M

onitoring
Deep geophones, surface networks, DAS

Evidence for lower injection temperatures and higher injection pressure within a safe and optimal production framework

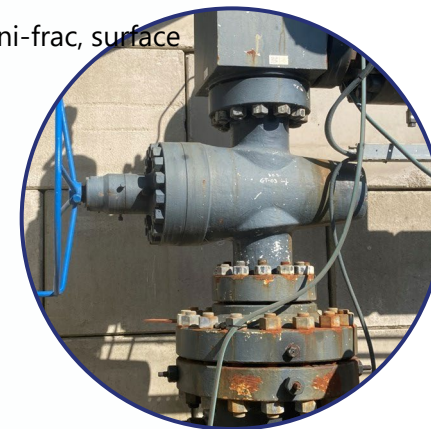
Kwintsheul

Surface network, active survey, modeling



Middenmeer

2.5 km deep toolstring, mini-frac, surface network



Bleiswijk

700 m deep geophones, XLOT, pulse surface network, modeling

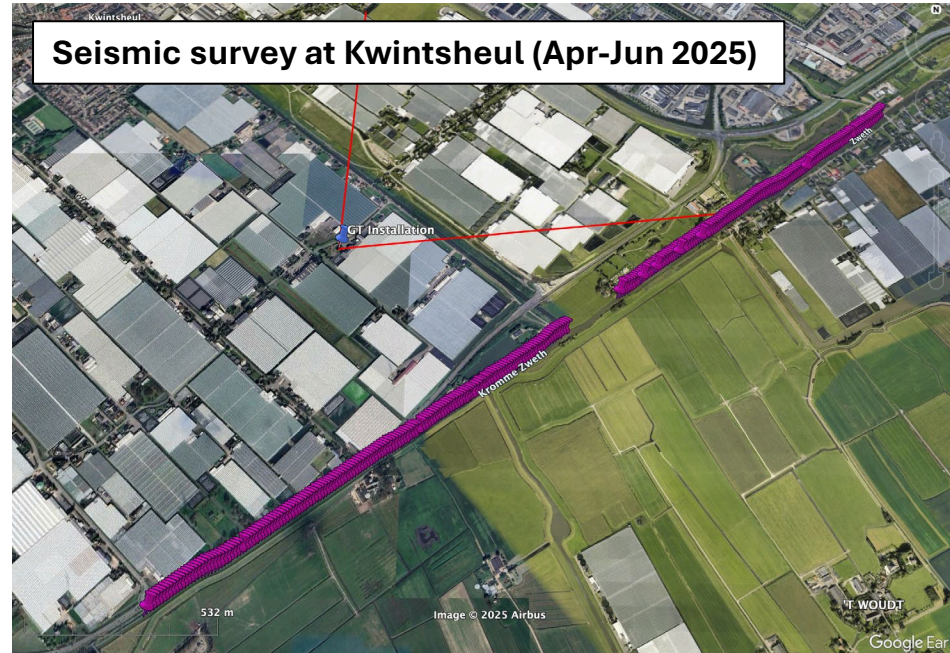


Summary main activities

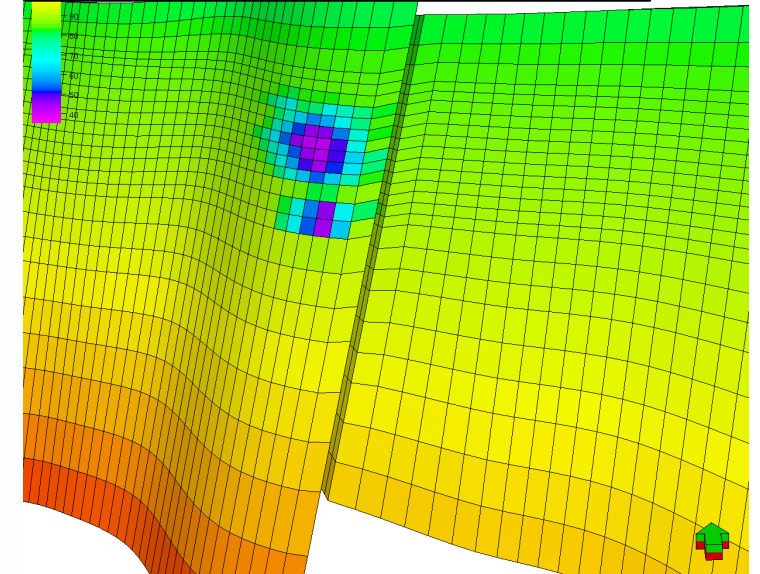
Stress & T at Middenmeer GT-11



Seismic survey at Kwintsheul (Apr-Jun 2025)



Modeling Kwintsheul (Jun-Dec 2025)



Temperature logging Bleiswijk



Progress Meetings WP4



10/03/2025

Procurement monitoring hardware

1. Buyer

1.1 Buyer

Official name: Nederlandse Organisatie voor toegepast-natuurwetenschappelijk

Legal type of the buyer: Body governed by public law

Activity of the contracting authority: General public services

2. Procedure

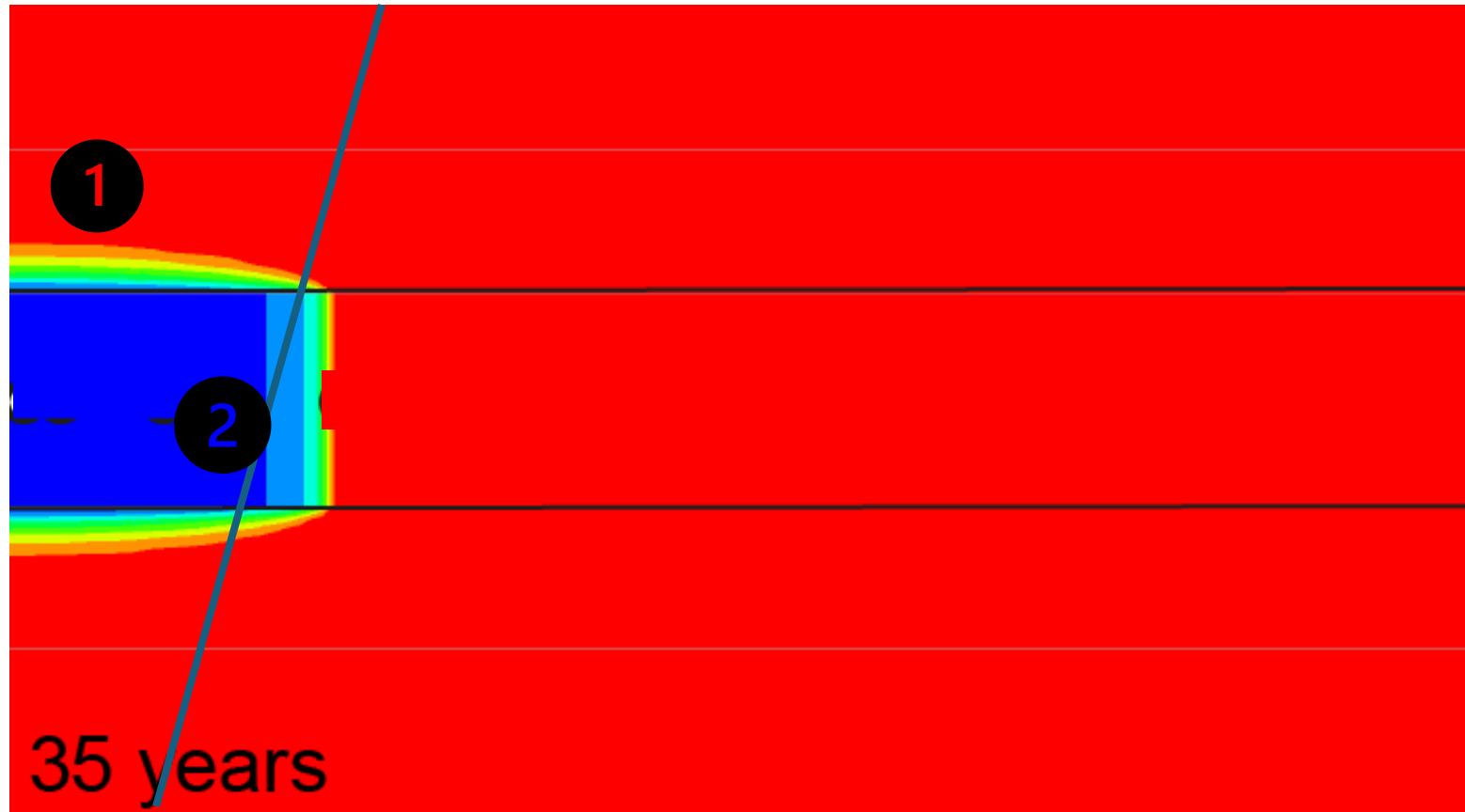
2.1 Procedure

Title: Design, delivery and deployment of 4 borehole monitoring string

Description: In the procurement guide we request a quotation for the design, setup, testing, calibration and maintenance of 4 borehole tool strings (geophones (and optionally, fiber optic cables) and their associated equipment, hereafter the 'design, delivery, and deployment' monitoring strings. These tool strings are to be deployed into formations at two locations in the Netherlands – the Middenmeer geothermal and Bleiswijk geothermal project. See: estimated value

GAS
ie

Cooling: why do we care?



- 1) Caprock integrity
 - 2) Fault reactivation
 - 3) Doublet lifetime
 - 4) License boundary
- Affects your production limits (TAS, SHRA)
- Field data lacking



SRIMA TAS & SHRA

WP4 Bleijswijk T logs

Measuring cooling at BLW-GT

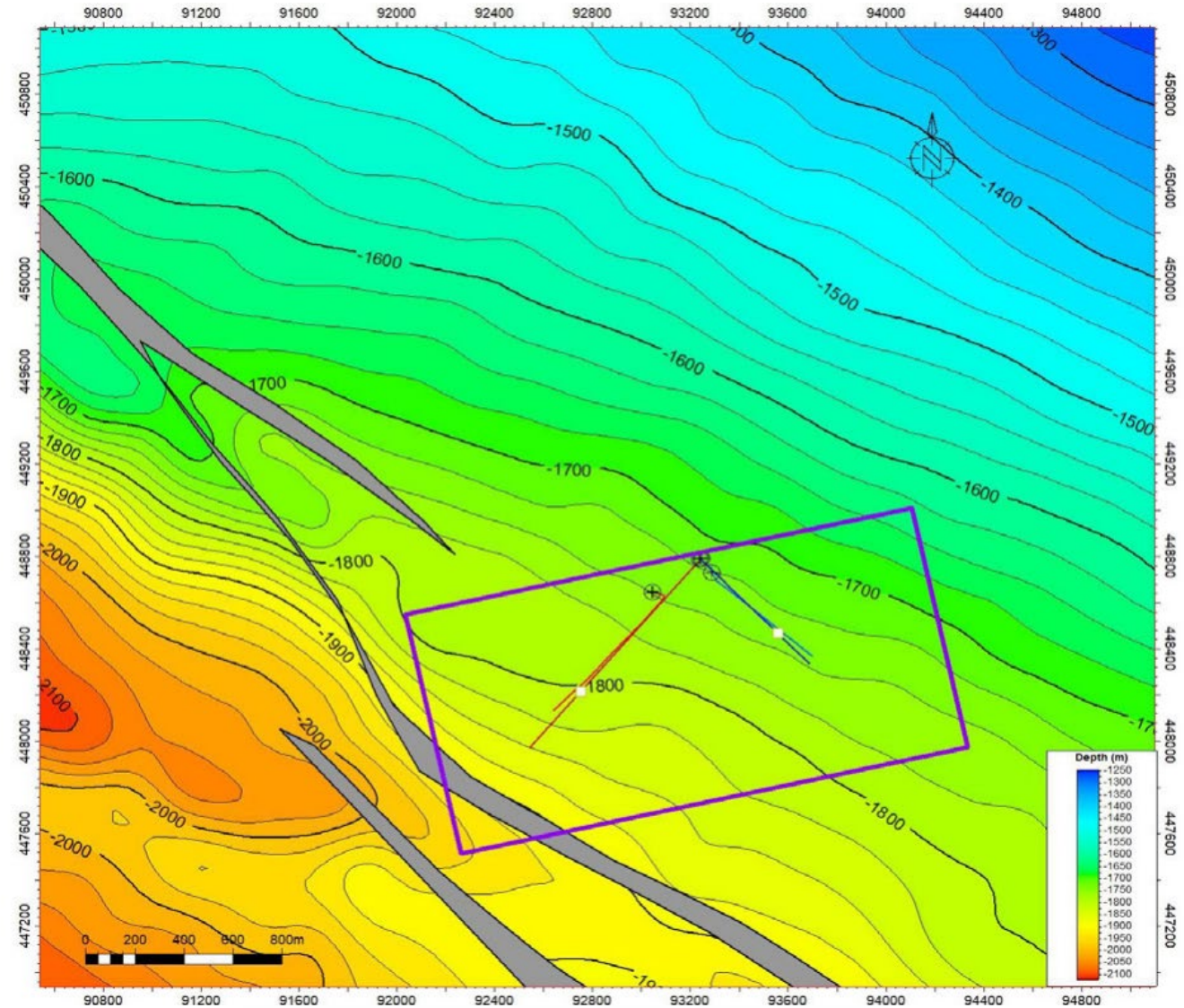
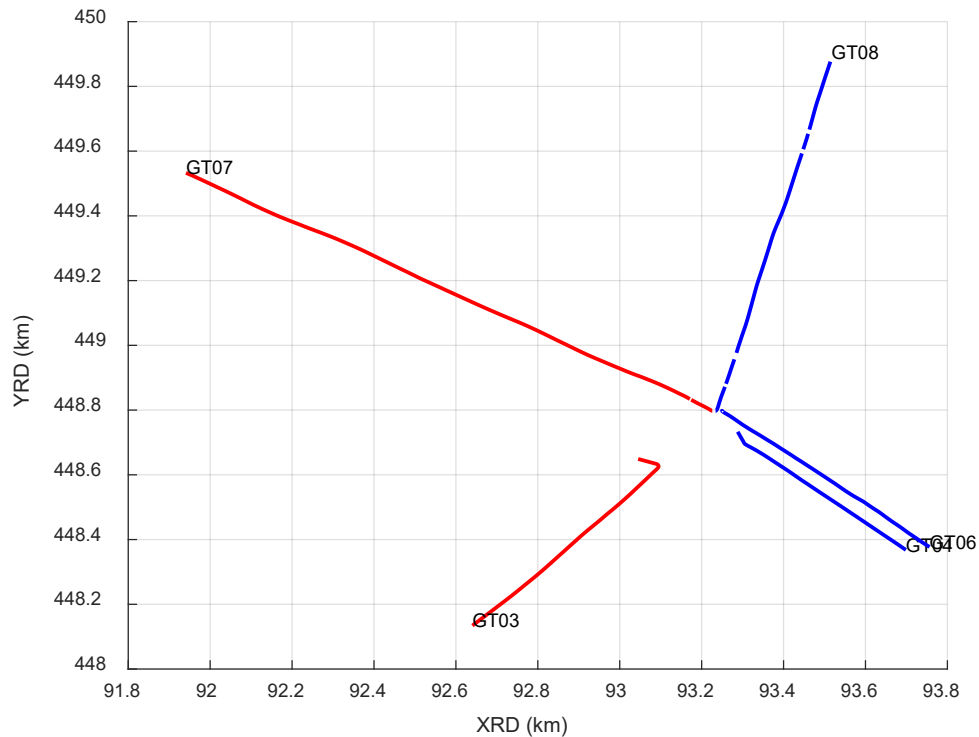
Loes Buijze, Hans Veldkamp



T logs BLW-GT

- VDB-GT-04 (old injector '07-'17)
- VDB-GT-06 (new injector)
- VDB-GT-08 (virgin state)

Another opportunity to measure cooling!







Toolstring: slickline with jar, PT memore gauge, bull nose.

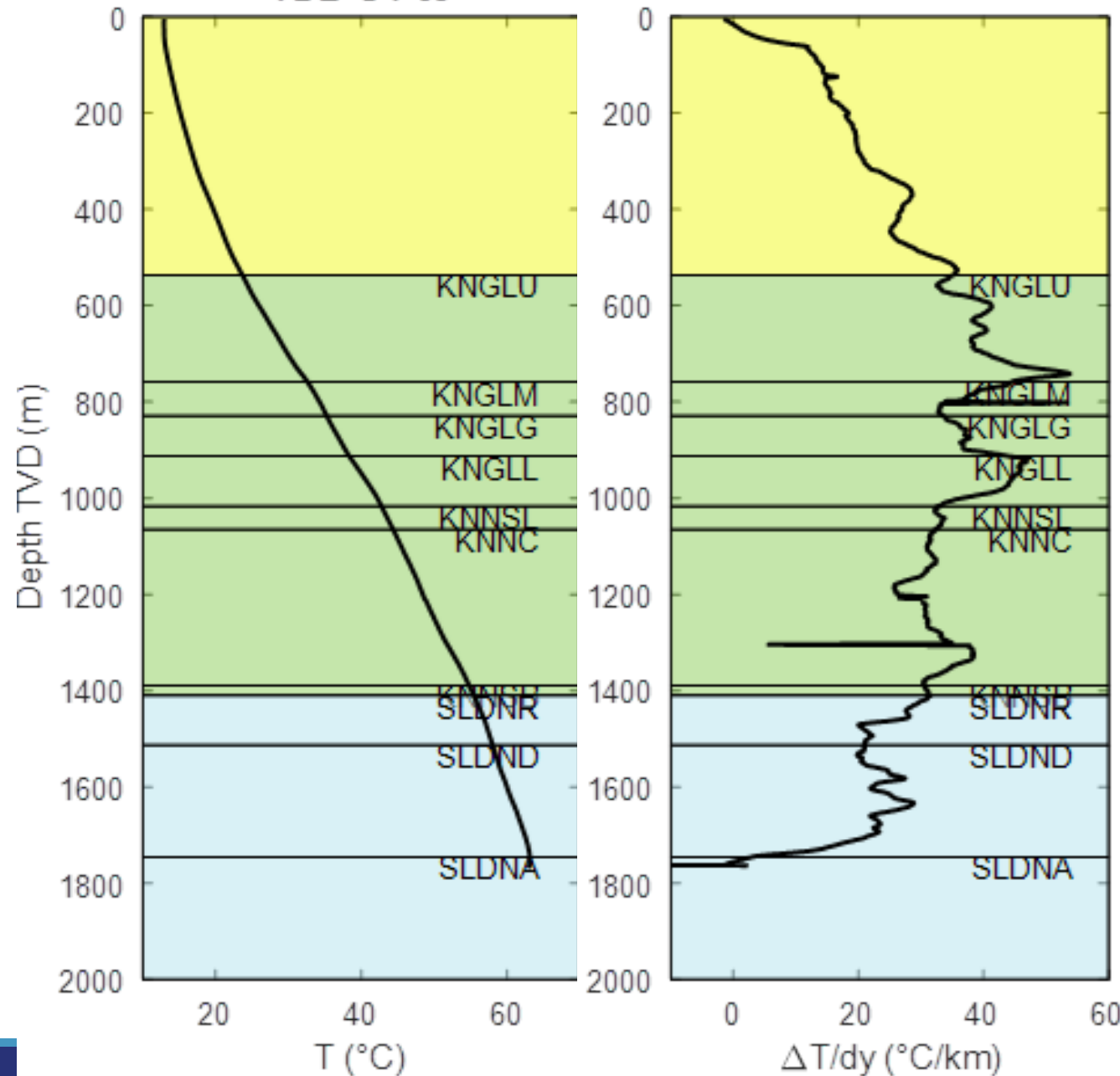


Run down fast
Run up 5 m/min





VDB-GT-08

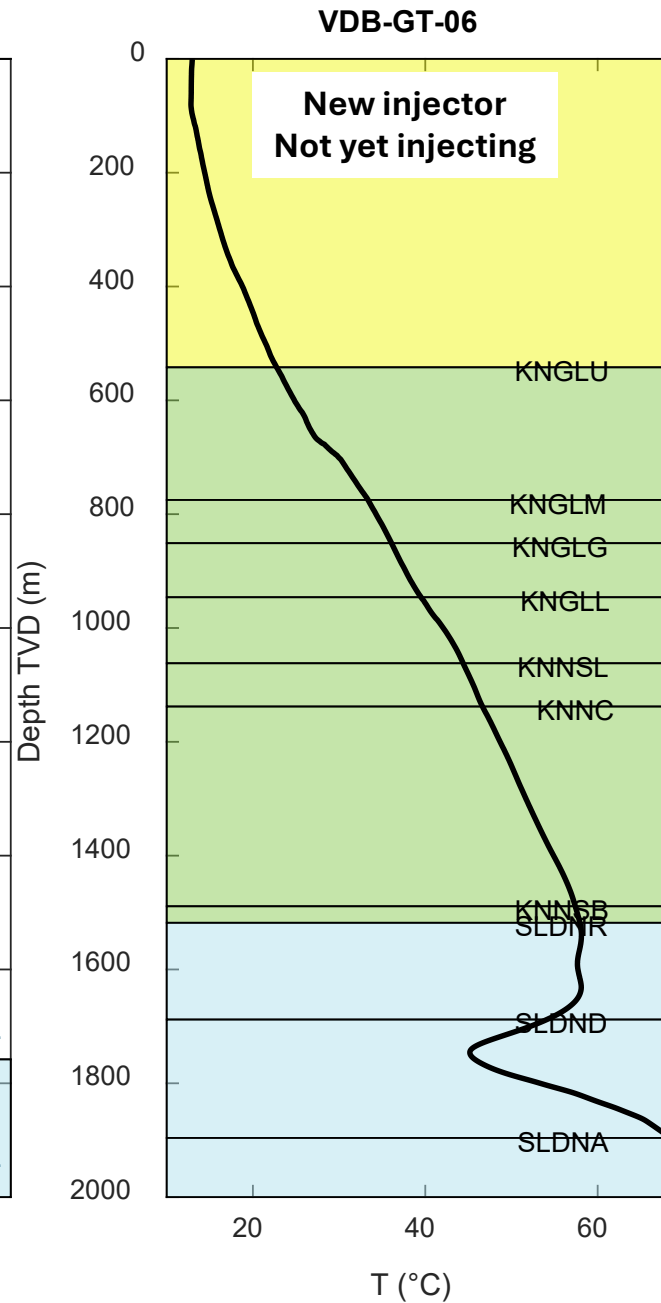
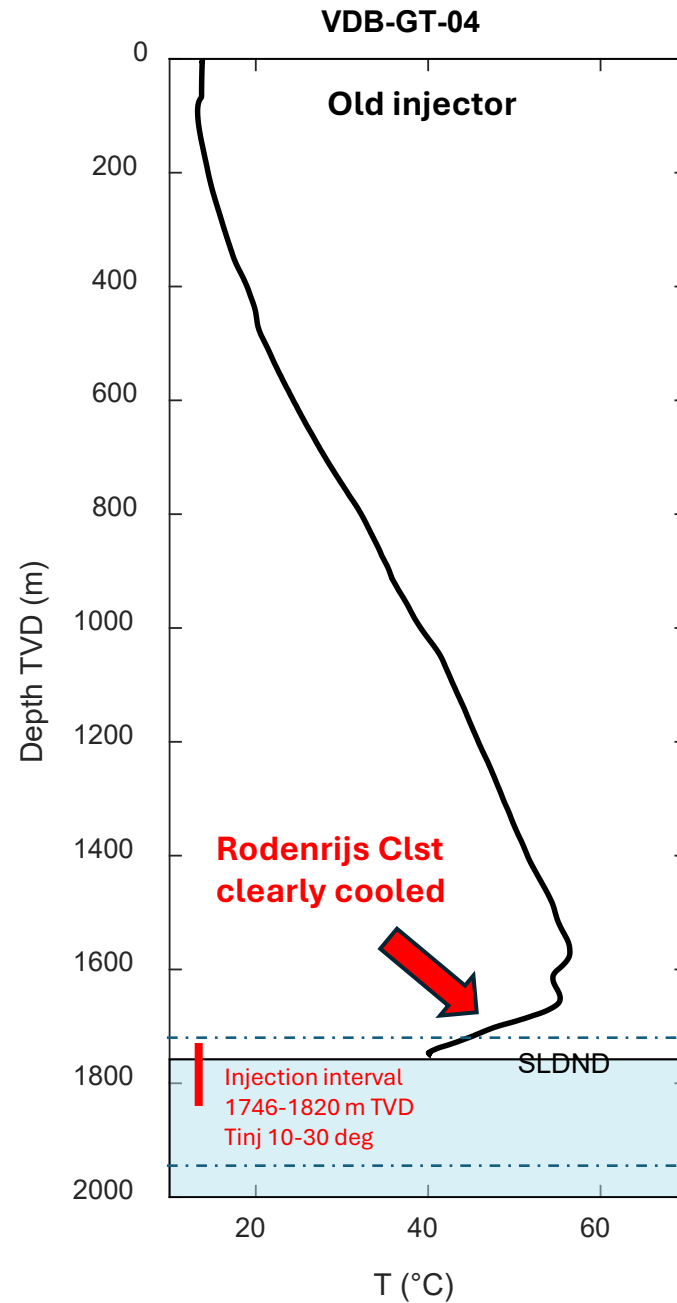


Results: unperturbed T profile

- Average T gradient 30 °C/km ($T_{y=0}$ 10 °C)
- High local T gradients in marls, clays
- Lower T gradients in sands

Cooling

- Clear cooling top reservoir
- Relation with good poro-perm
- No vertical flow

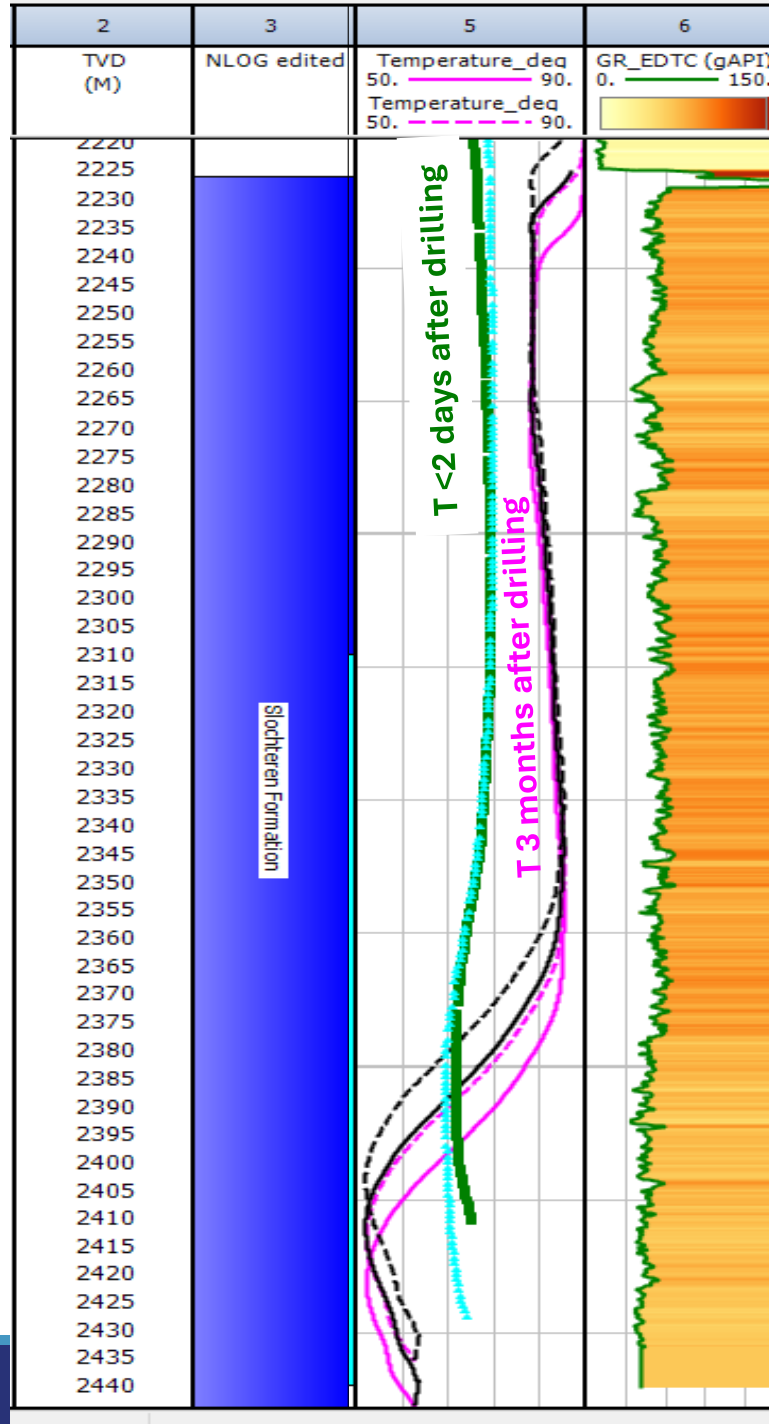
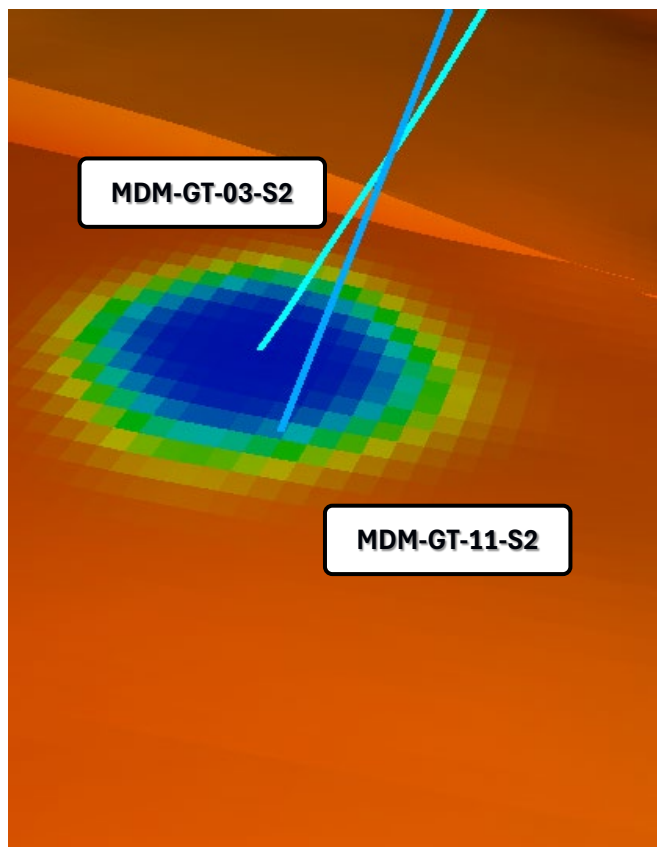


**Cooling observed in GT-06 top half reservoir
Less than modelled in SRIMA**

WP4 Middenmeer Temperature

Temperature logs during the stress test and 3 months after drilling





Cooling MDM-GT-11-S2

- Clear cooling bottom reservoir
- Relation with good poro-perm

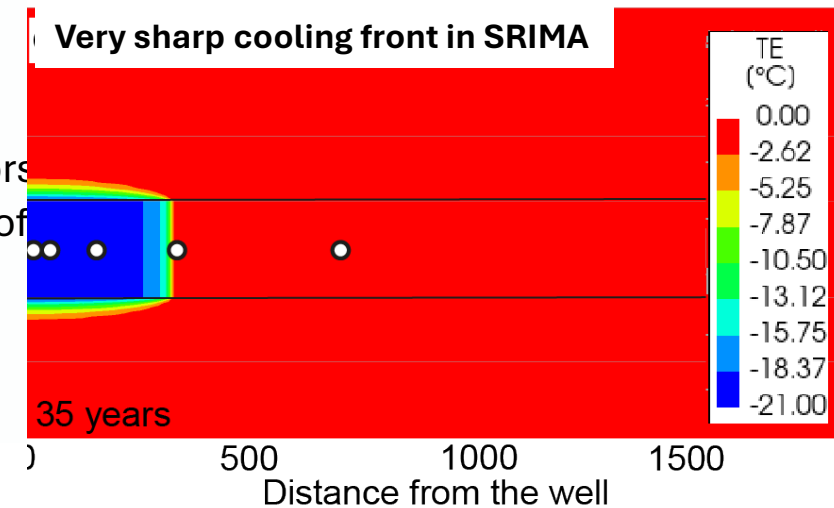
ennatuurlijk aardwarmte

Comparison T in BLW and MDM & next steps

- Cooling is less than predicted in SRIMA and more heterogeneous
 - Smearing due to horizontal conduction? Reheating
 - Effects of heterogeneous poro-perm
- Implications: Fault reactivation and caprock integrity issues may be less severe than modelled in SRIMA
- Now, we have field data to substantiate modifications/improvements!
- Results also show the importance of good logging

- **Next steps @TNO**

- cap rock integrity predictions should consider reservoir poro-perm
- SRIMA PT calculations should be evaluated against more complex simulators
- WGC article: simulate vertical heterogeneity. Can we explain the cooling profile



Read more on our LinkedIn posts and upcoming EGC articles, Geo4All website, EAGE GET session, etc



184

6 comments



8,730 impressions

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Loes Buijze • You
Geomechanics | Scientific Lead Induced Seismicity
6mo • Edited

Day 2/3 Stress Test: Rig Up... and Break Down! #geo4all 🔥

With the log data of the first day and this morning coming in (and ...more



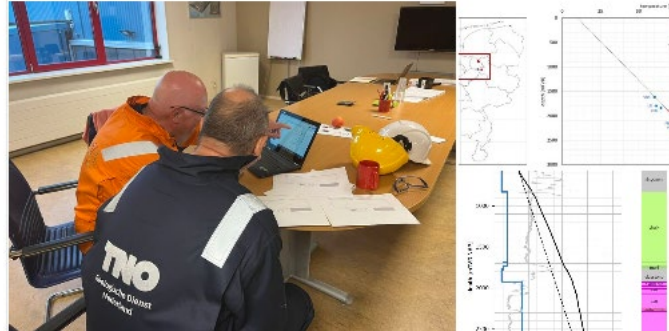
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8 comments



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2w •

T in the Dutch subsurface 2/5: Some formations are hotter than others...
...more



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3w • Edited

T in the Dutch subsurface 1/5: How hot is it below your feet?

Temperature is one of the most important subsurface parameters ...more



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