



The Dutch SCAN Geothermal Seismic Exploration Program – Current Status & Future Plans

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Ministerie van Economische Zaken
en Klimaat



TNO

Interreg 
North-West Europe
DGE-ROLLOUT

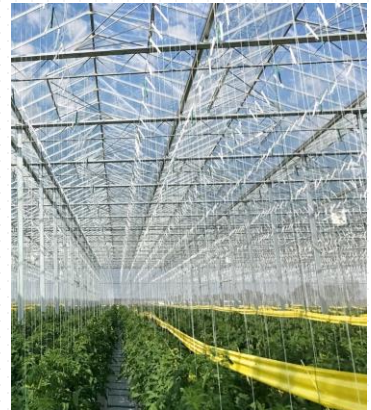
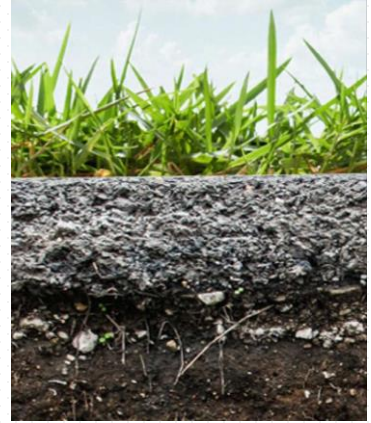
Agenda

- Introduction to EBN B.V. and the SCAN program
- 2D seismic acquisition & processing
- PreSTM processing example
- Cross-spread acquisition & processing test
- 2D reprocessing status & examples
- Conclusions
- Acknowledgements



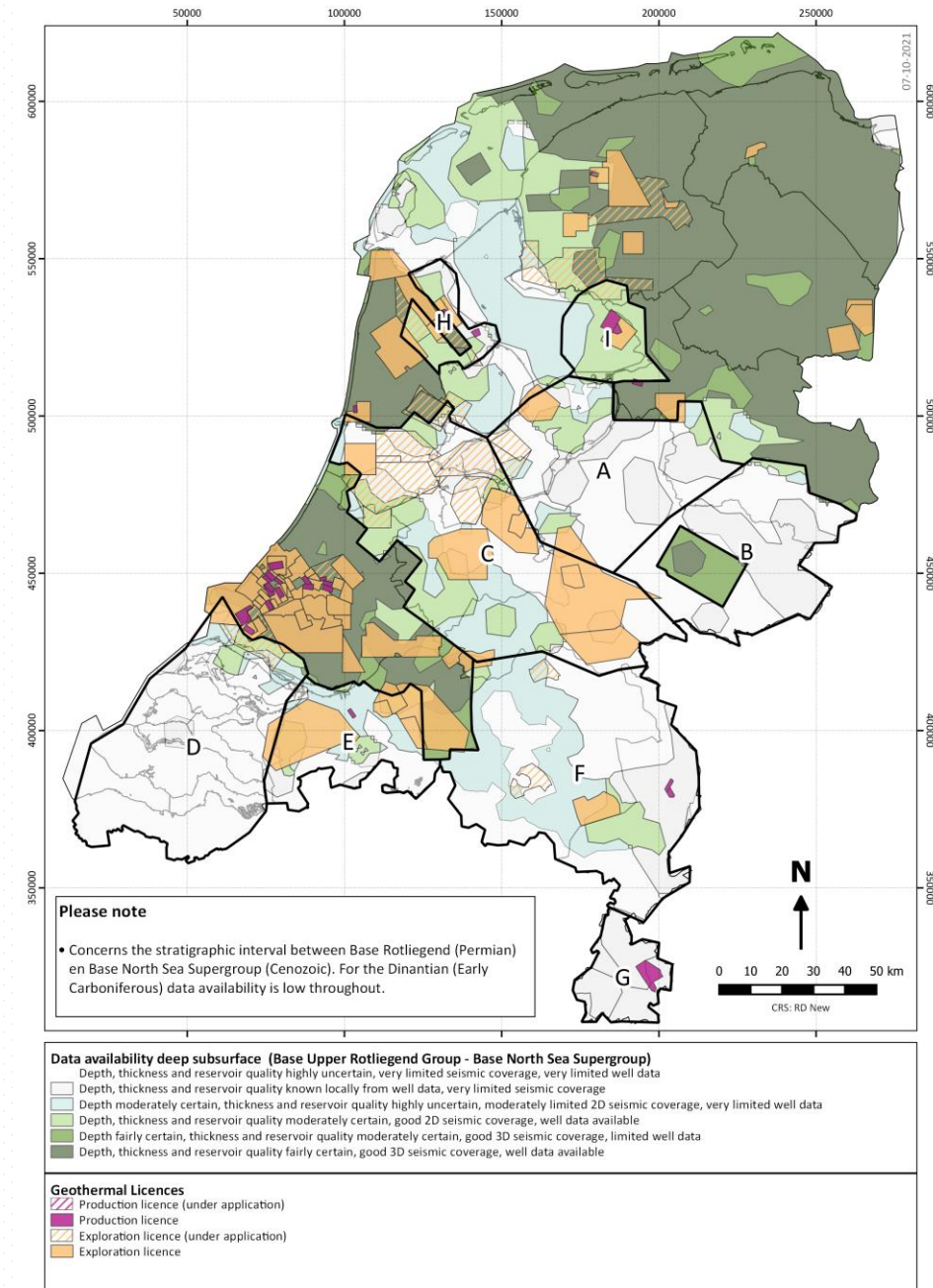
Introduction to EBN B.V.

- EBN B.V. (Energie Beheer Nederland) was founded 58 years ago and is a 100% state-owned company with some 160 employees, based in Utrecht, the Netherlands
- Our mission: EBN creates economic and societal value from geological energy sources in the Dutch subsurface
- Three strategic pillars:
 - 🔥 Our Dutch Gas
 - ♻️ Return to Nature
 - 💧 New Energy
- New Energy: EBN builds partnerships for the efficient exploitation of geothermal energy and may become a financial partner in future geothermal projects



Introduction to SCAN

- SCAN stands for
Seismische **C**ampagne **A**ardwarmte **N**ederland
- SCAN accelerates the development of geothermal energy by filling in subsurface data gaps
- The SCAN target depth for geothermal projects is ranging from 500 to 4000 m depth
- The new 2D seismic acquisition also targets the Ultra Deep Geothermal (UDG) depth > 4000 m
- Funded by the Ministry of Economic Affairs and Climate and executed by EBN and TNO. Part of the seismic acquisition is subsidised by the EU Interreg program DGE-ROLLOUT



The 3 key components of the SCAN program

1. Acquisition of new 2D seismic data

- Started in February 2019 with the EBN test line and the regional campaign commenced in September 2019

2. Reprocessing of existing 2D seismic data

- The reprocessing effort started in October 2018

3. Data well campaign

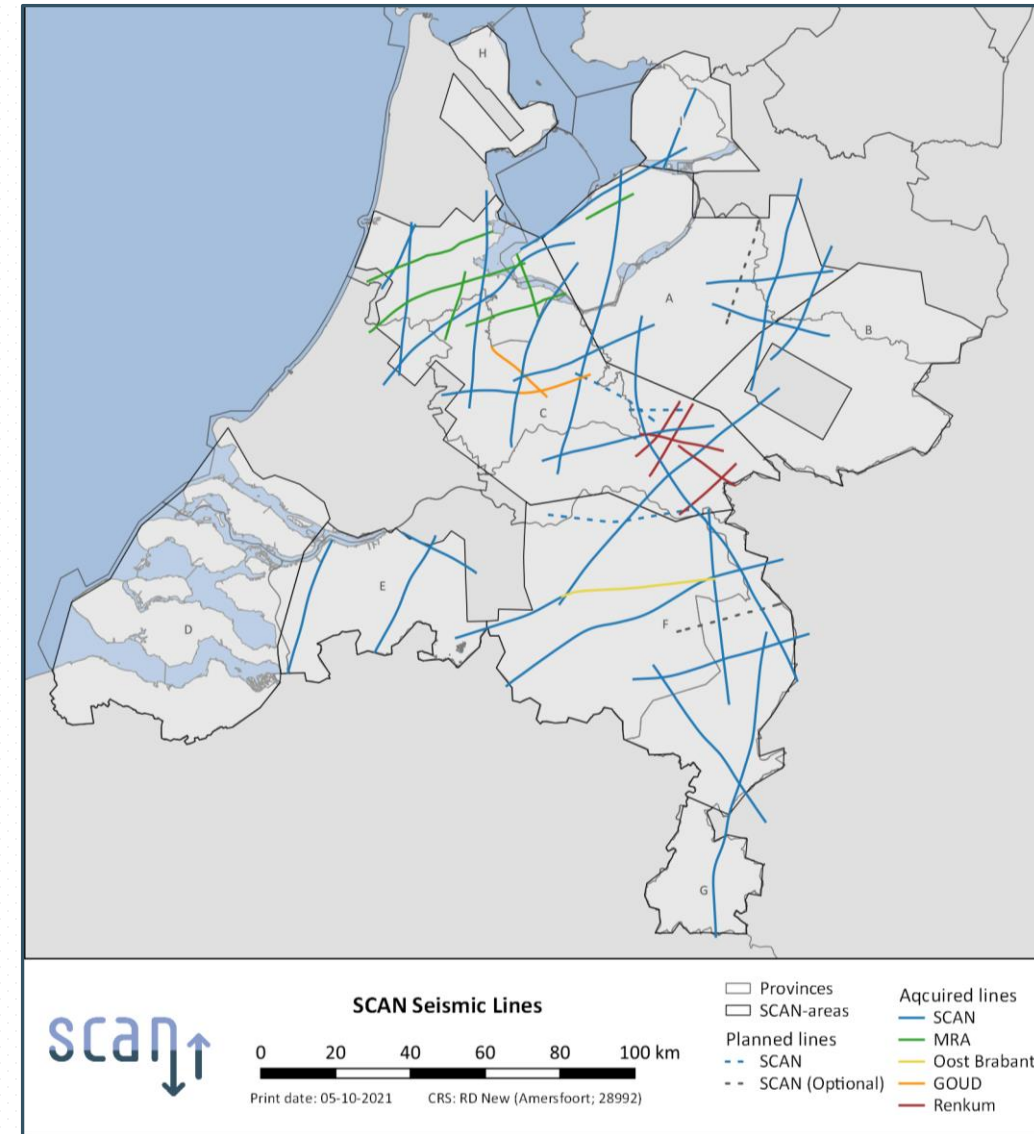
- The budget for the data well campaign has been awarded in early 2021 and first spud date planned for Q1.2023

All data and study results are immediately released to the public domain at completion and published on the websites scanaardwarmte.nl and nlog.nl/scan

SCAN seismic acquisition & processing status

- To date > 1680 line km of new 2D seismic data has been acquired with zero LTIs
- SCAN acquisition is combined with local seismic acquisition programs for UDG and MRA
- Visited > 165 municipalities, distributed > 115.000 letters into the neighbourhoods prior to acquisition
- Currently processed data of 31 lines (1197 line km) are available on the NLOG website
- New 2D data usually available at NLOG within 6 months of data being available for processing

MRA = Metropoolregio Amsterdam



SCAN seismic acquisition

Key acquisition parameter:

- Shot spacing: 60 m
- Shot depth: Nominally 20 m
- Shot type: Seismic explosives
- Receiver spacing: 5 m
- Receiver type: Wireless nodes
- Spread type: Split-spread
- Maximum offset: 7 km
- Recording length: 10 seconds

Key SCAN HSE numbers (30.09.2021):

- Zero LTIs
- Manhours worked: 790.699
- KMs driven: 2.283.474



Land drill tractor, usually 5 tractors deployed, up to 100 shot points/day



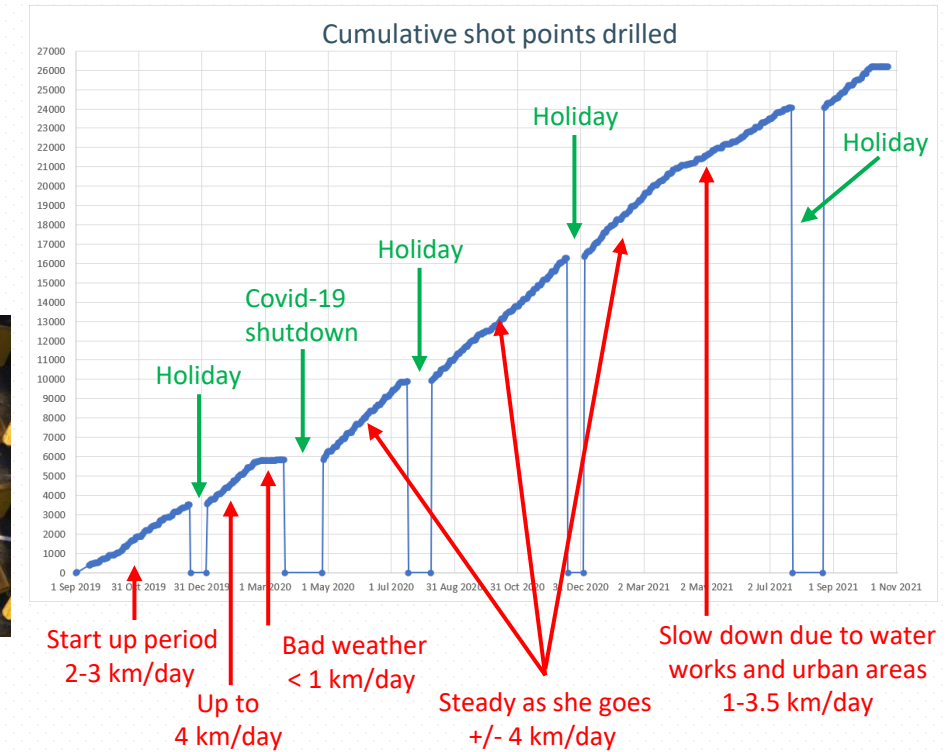
Geophones



Shooting crew, up to 160 shot points/day, usually 1 crew deployed

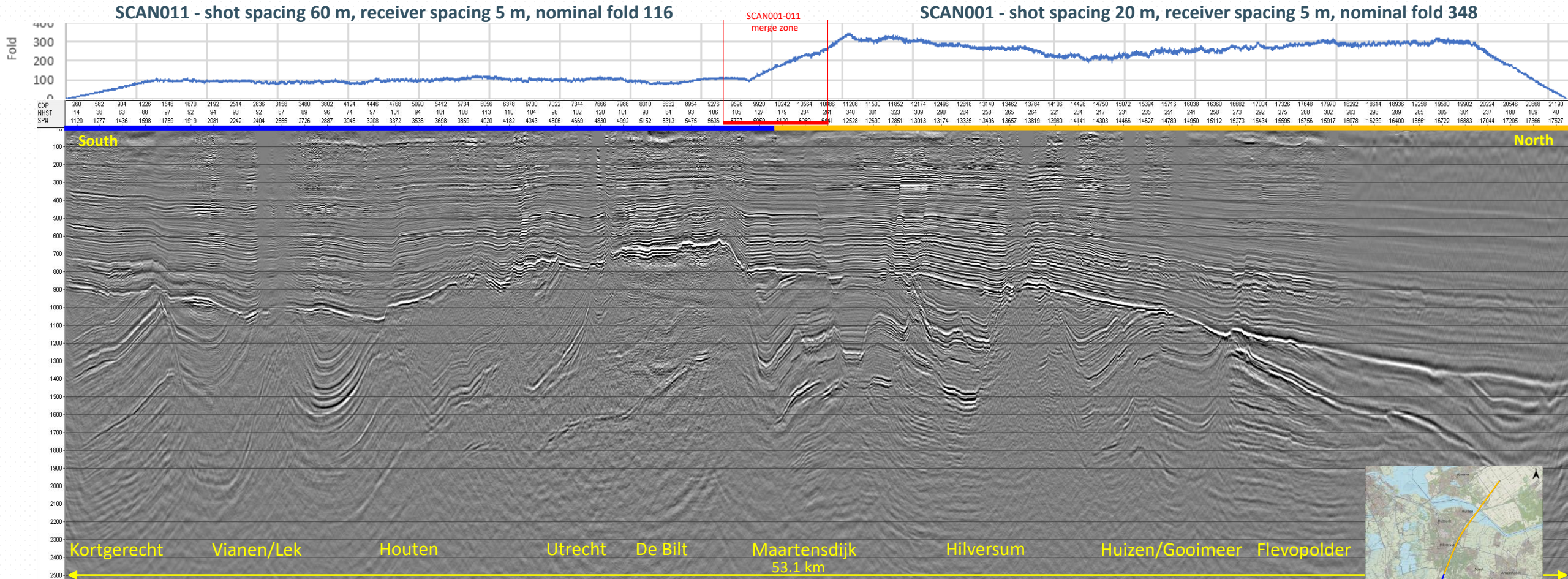


Barge/pontoon mounted drill tractor, usually 3 barges and 1 pontoon deployed, up to 58 shot points/day



Average shot point drilling since acquisition start (428 days of shot point drilling) is 3.7 km/day.

SCAN PreSTM processing - SCAN011 & SCAN001



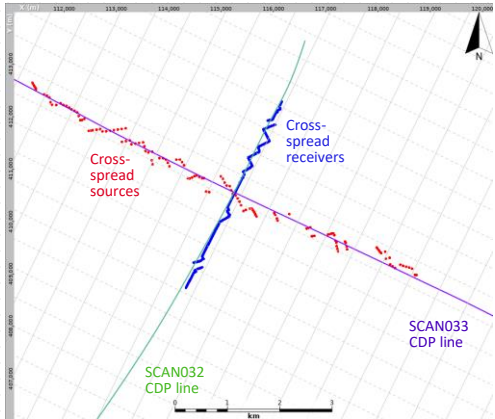
- Shot spacing of 60 m shot & 5 m receiver spacing provide adequate data quality for 2D regional seismic interpretation
- No significant data quality reduction compared to 2019 test line that would compromise seismic interpretability

SCAN cross-spread acquisition & processing test

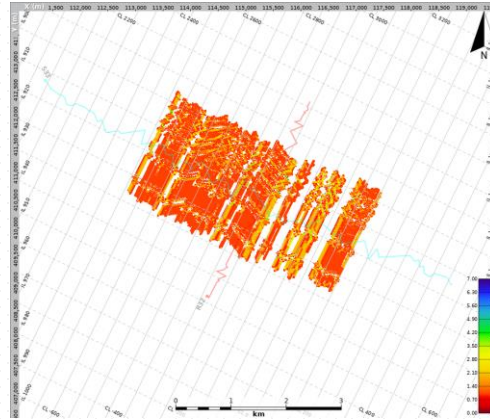
- Shots of SCAN033 being recorded into 4km geophone spread of SCAN032



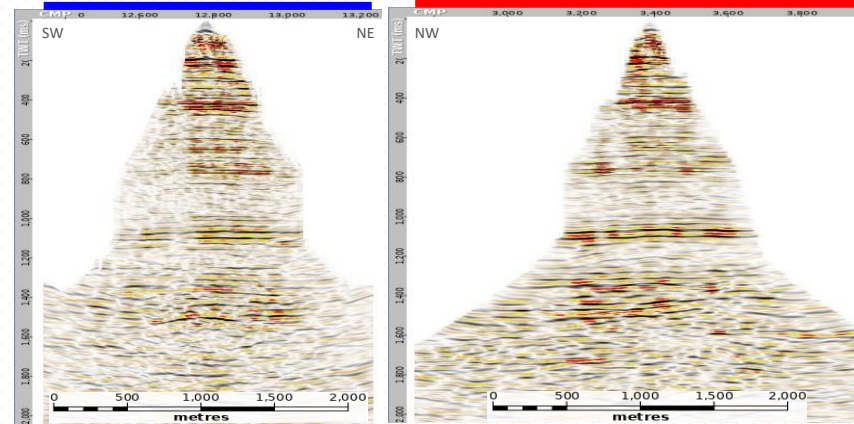
- Cross-spread acquisition allows for limited sparse 3D coverage
- Ideally, shots from both lines to be recorded into both geophone spreads
- Usefulness for seismic interpretation still to be fully evaluated
- Data will also be made available through NLOG



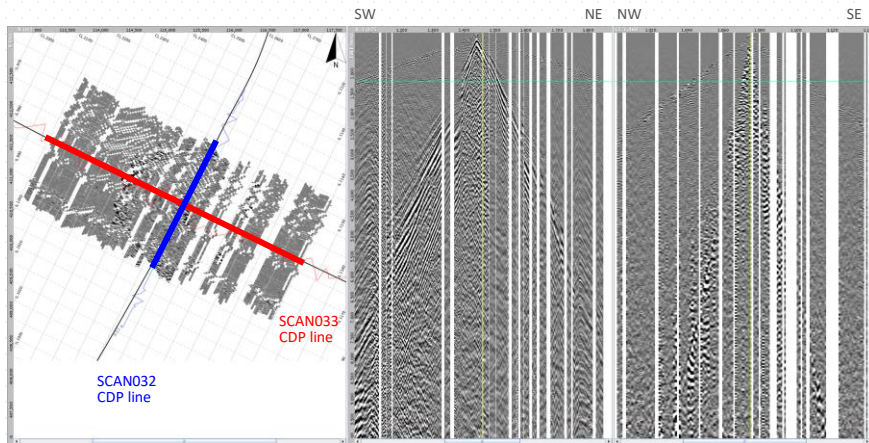
Acquisition layout



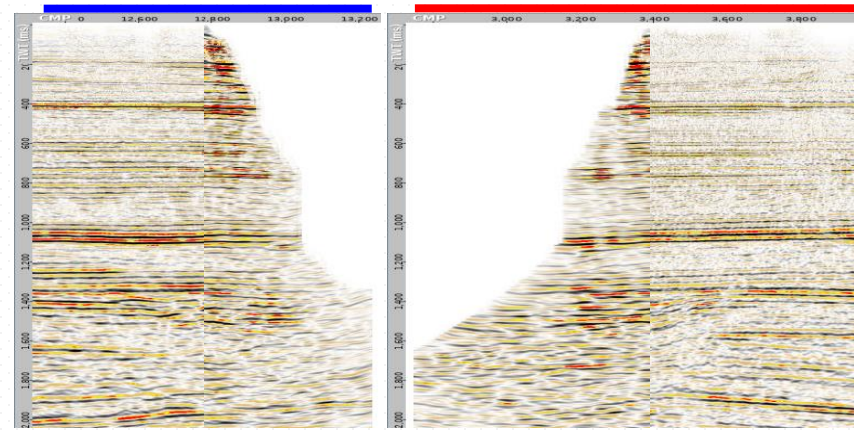
Cross-spread fold map



Cross-spreads – PoSTM



Cross-spread – raw data



SCAN032

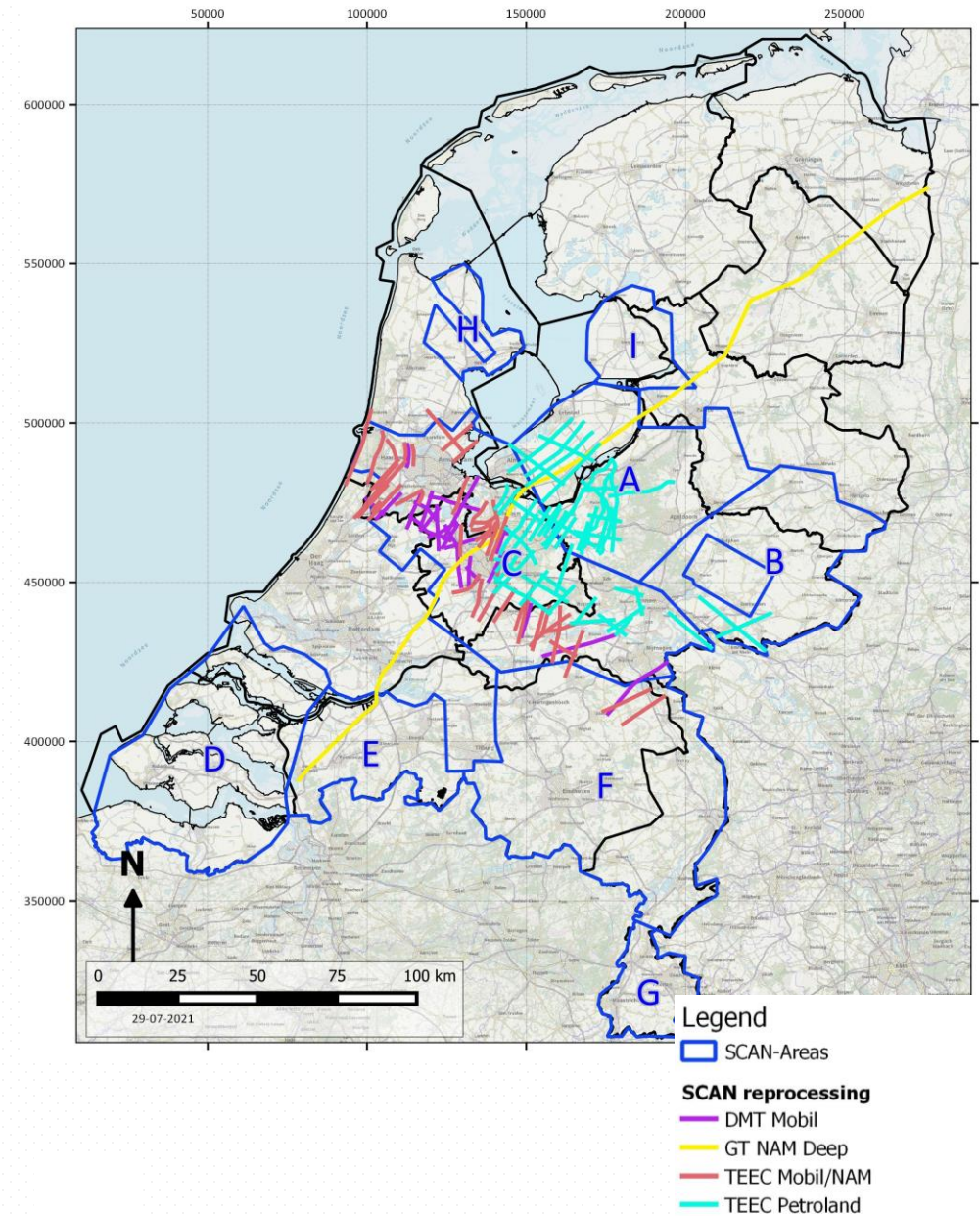
X-spread

X-spread

SCAN033

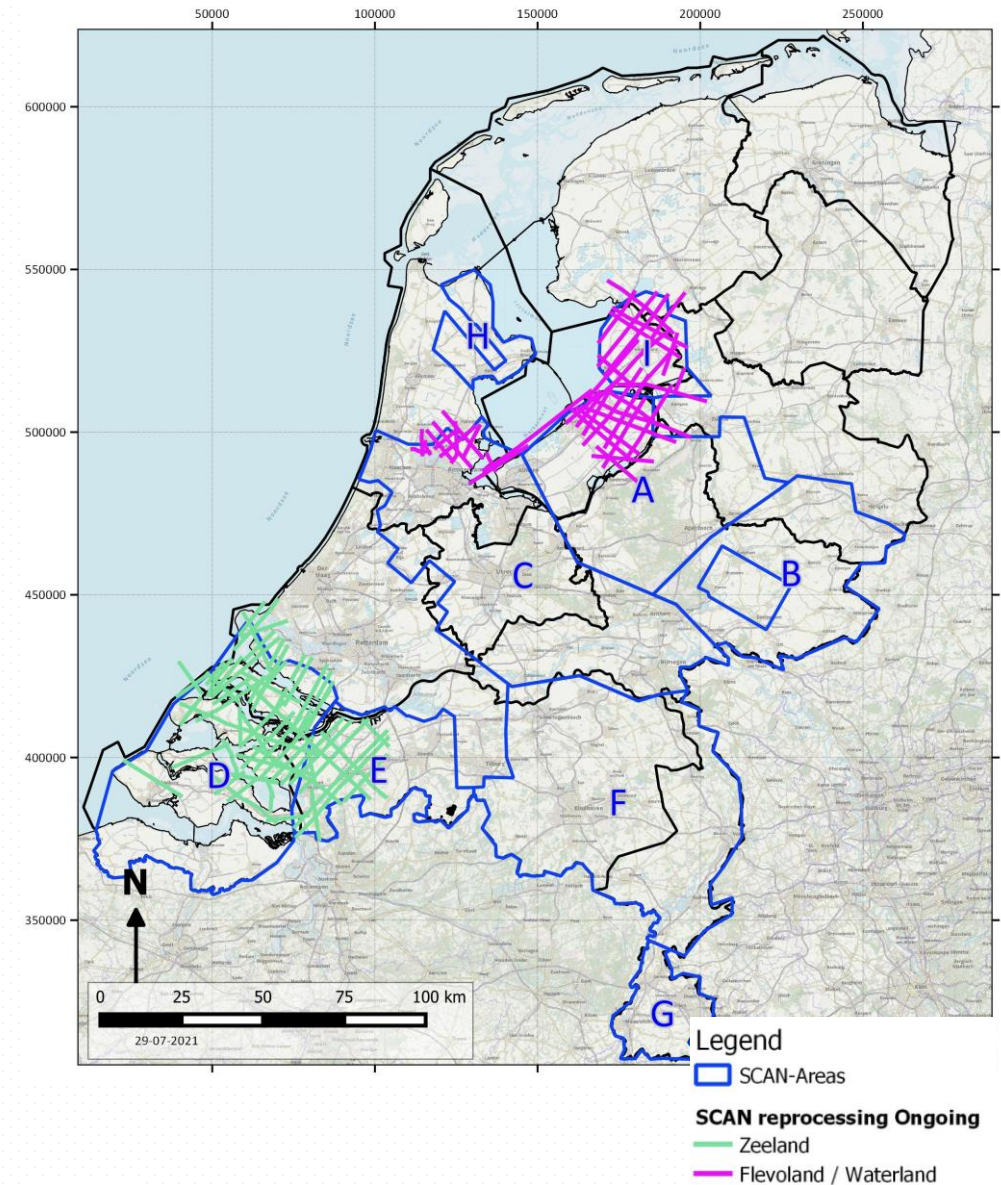
SCAN 2D reprocessing

- 2D seismic data, acquired from the early 70s to early 90s, is reprocessed through a broad-band PreSTM sequence
- To date results of 4 reprocessing projects have been released, which amounts to more than 1850 line km (120 lines)
- Reprocessing nearly always resulted in an improved quality of the data



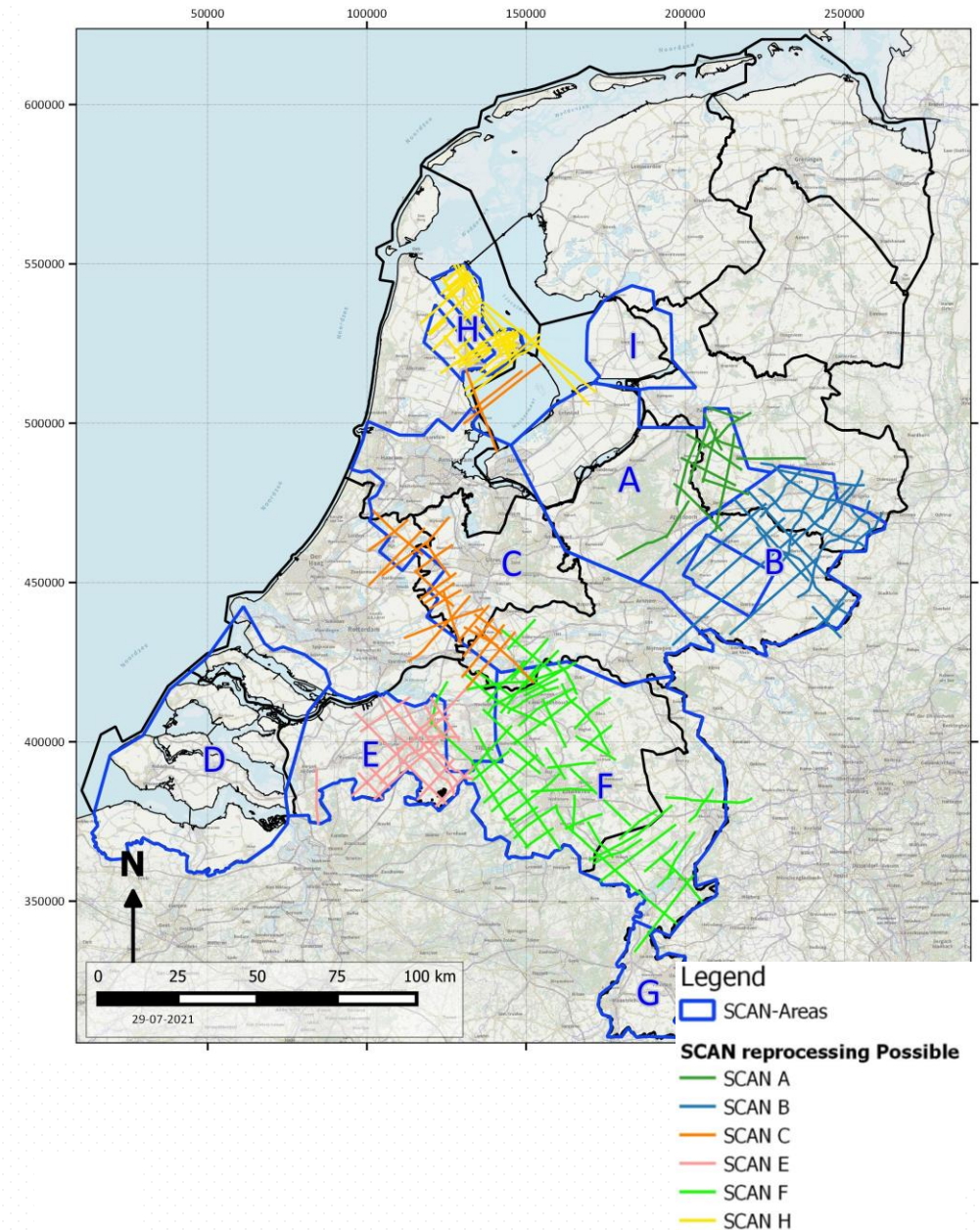
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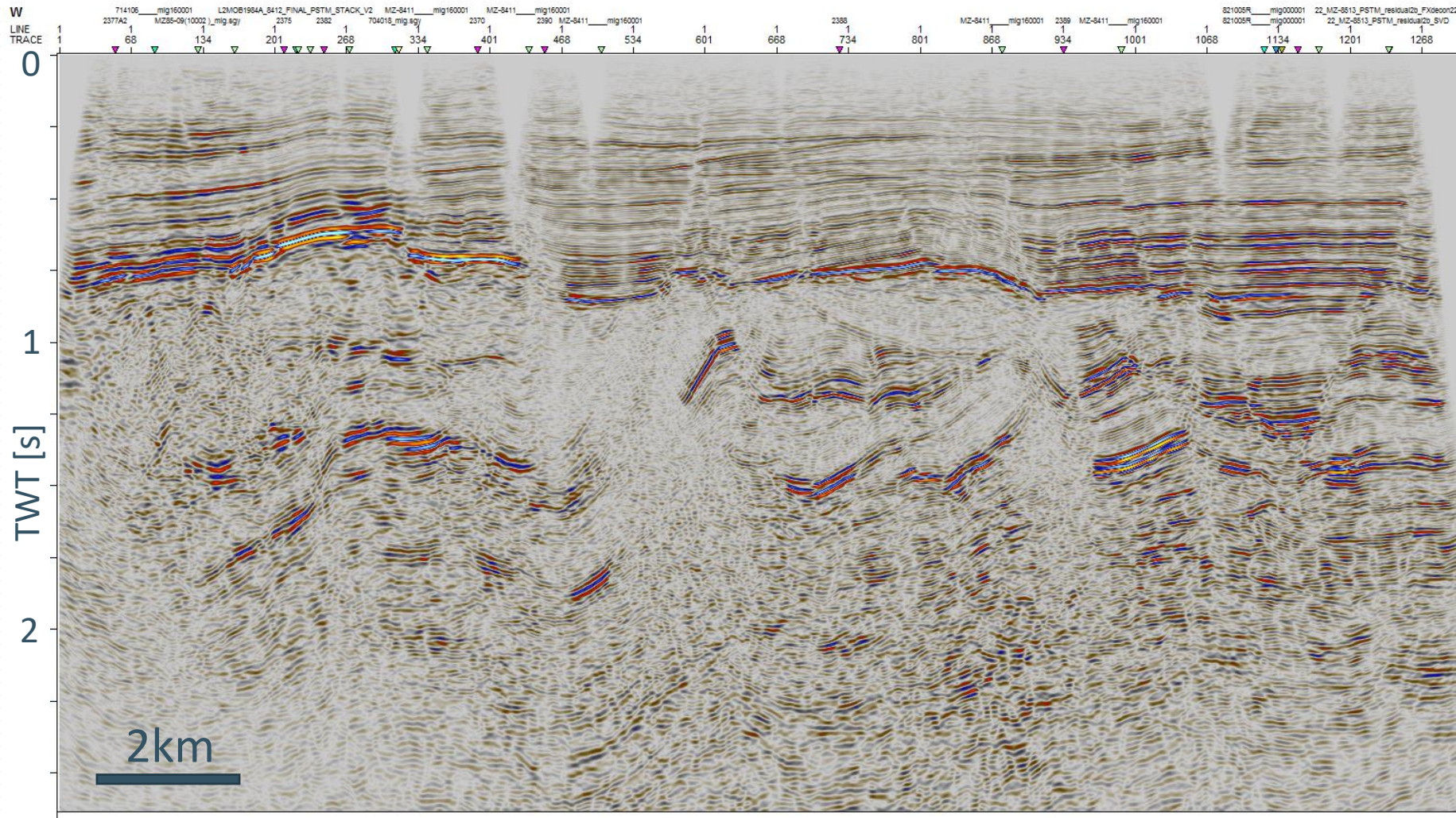


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- Further reprocessing scope in remaining SCAN areas is up to **2450** line km

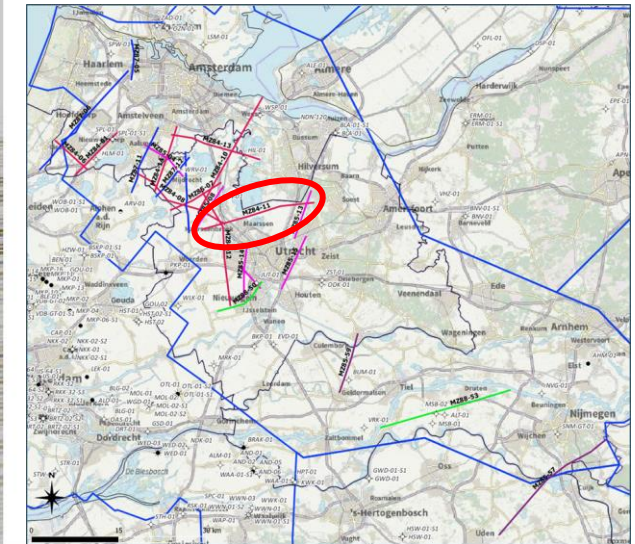


SCAN 2D reprocessing – “New” digital vintage line

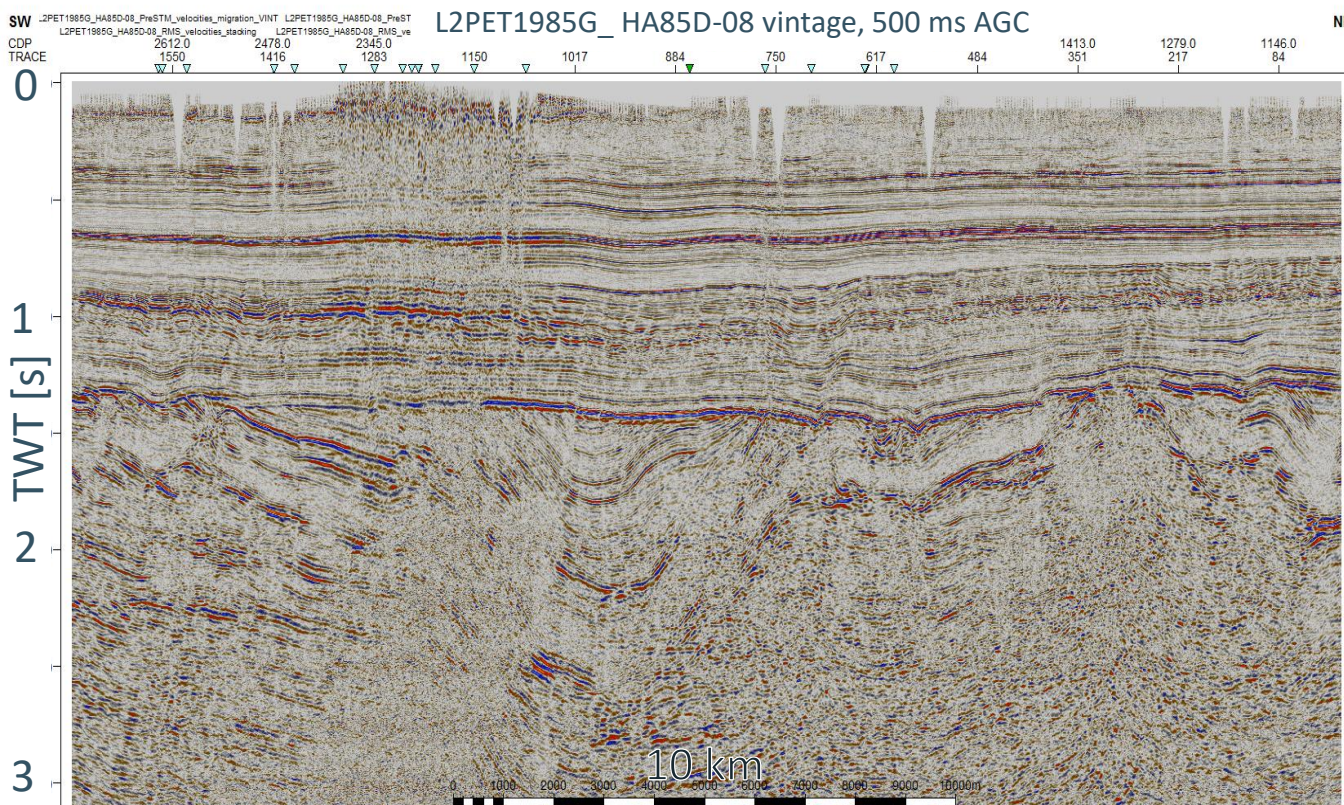


- No digital or paper section present in TNO archive for this line.
- Used vintage field data to create a “new” line

North of Utrecht

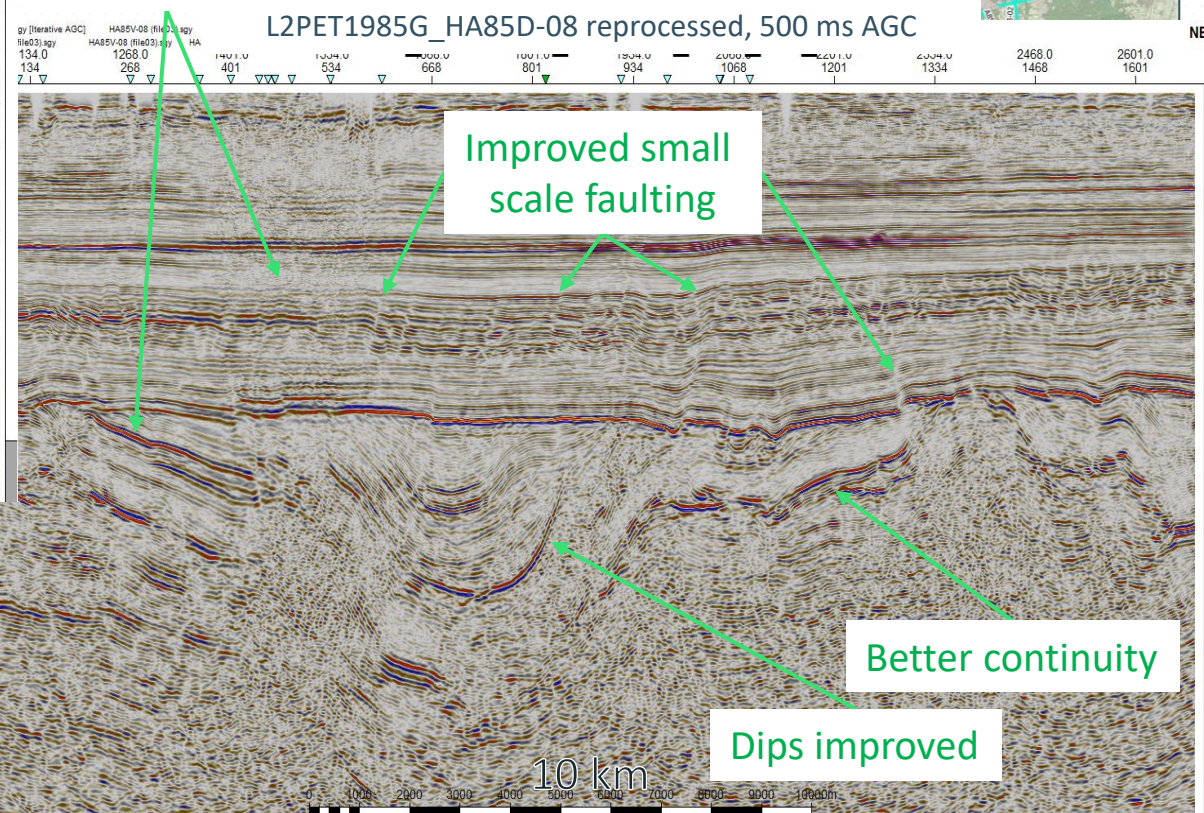
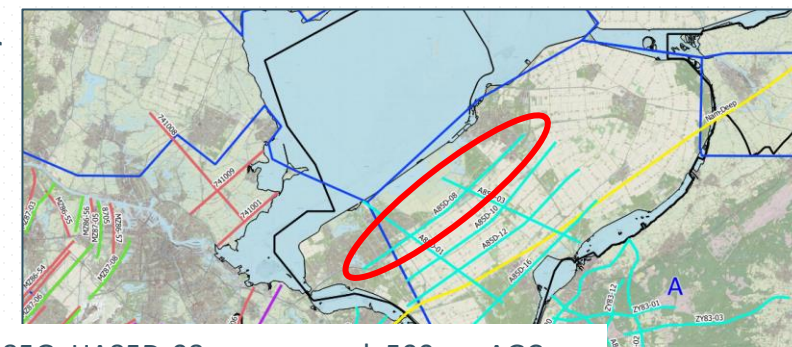


SCAN 2D reprocessing - Old digital vs. new digital



Flevopolder
Almere-Lelystad

Better S/N



- Reprocessing usually improves Signal-to-Noise, event continuity as well as fault & dip imaging

Conclusions

- The SCAN program is providing a wealth of new and improved subsurface data:
 - Approximately 1800 line km of newly acquired high quality broad-band 2D seismic in areas with low seismic coverage
 - Up to 5500 line km of reprocessed vintage 2D seismic
 - A data well campaign will follow to focus on data acquisition of all potentially attractive geothermal reservoirs
- Expected completion:
 - Seismic acquisition: Q1 2022 (delivery final products Q3 2022) with some additional local seismic covering potential SCAN well locations
 - Seismic reprocessing: Q1 2023
 - Data well campaign: Mid 2025
- All data is released for free at completion and ready for use for further geothermal exploration and development

Acknowledgements

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