Geoelectrical and seismic investigation of a subsidence geohazard zone in Neckendorf, Saxony-Anhalt, Germany

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Supplementary material

Geology of the study area

- The study area near Neckendorf is located at the edge of the „Mansfelder Mulde“ (german for trough)
- This region is characterized by the outcropping of the “Zechstein”
- The “Zechstein” marks the beginning of the copper shale deposit and is characterized here by anhydrite and gypsum

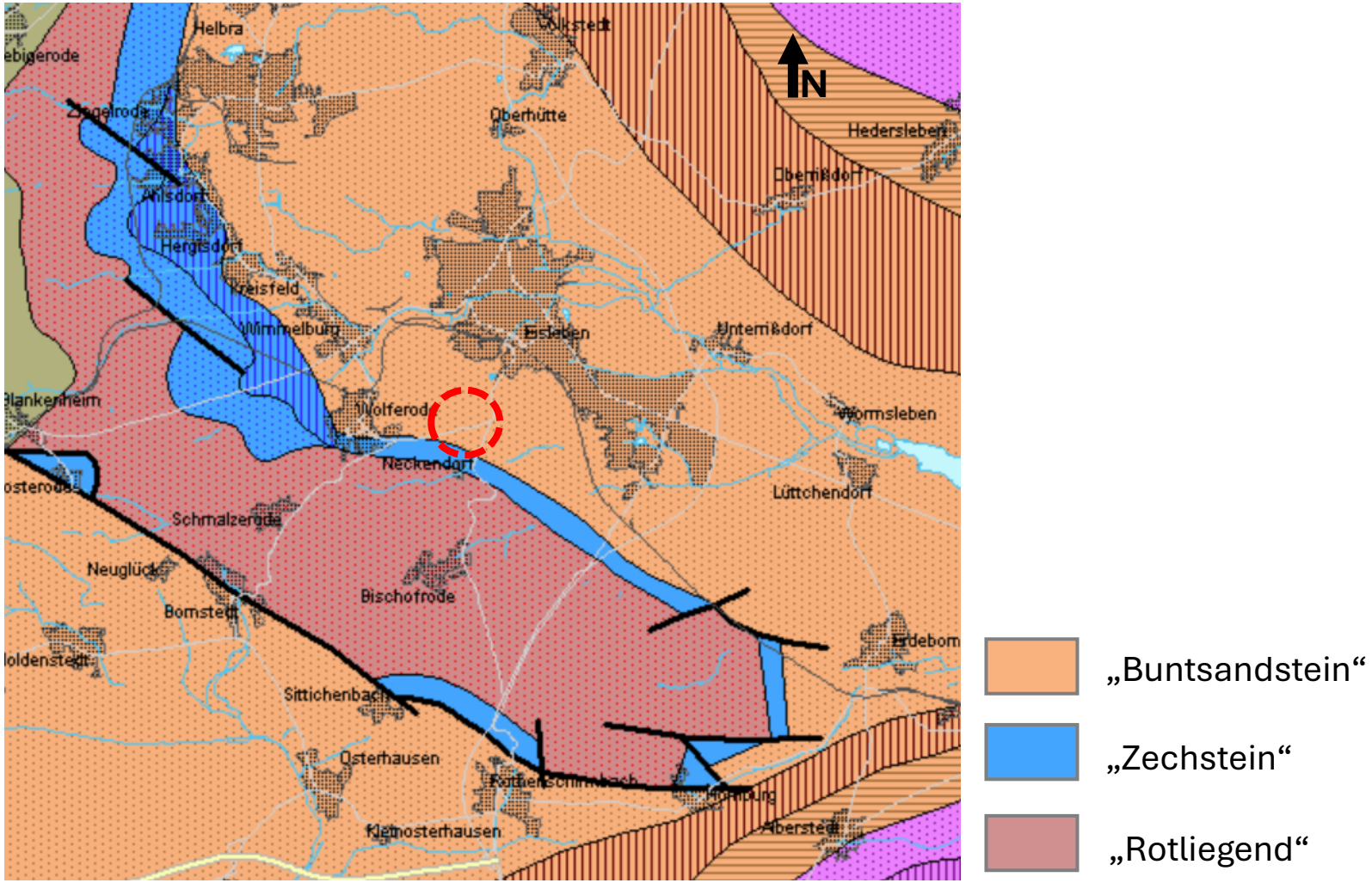


Figure 1: Section of the interactive geological overview map (without Cenozoic) of the Saxony-Anhalt State Office for Geology and Mining. (© LAGB)
https://webs.idu.de/lagb/lagb-default.asp?thm=guekok400&tk=C4734

Geology of the study area

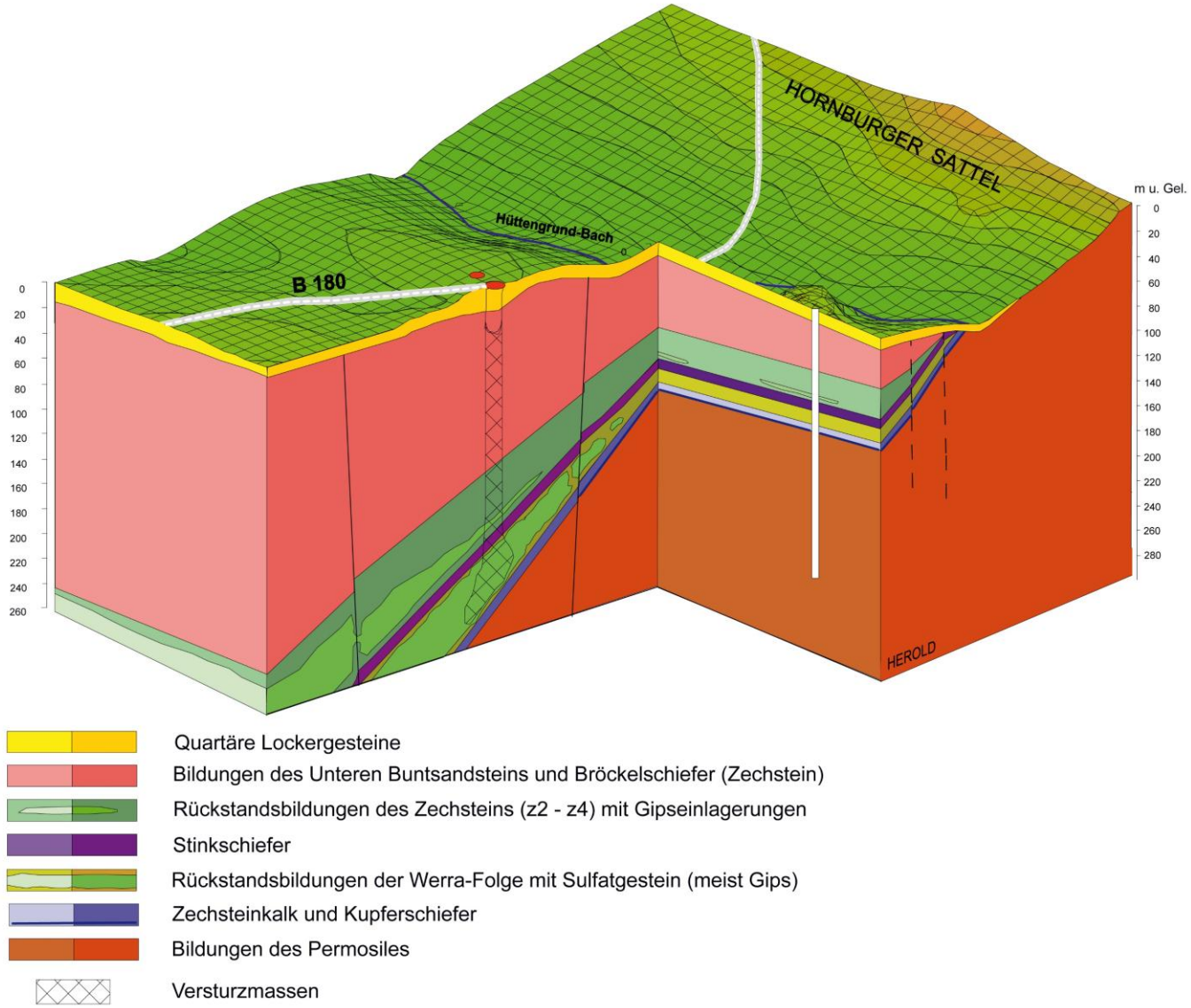


Figure 2: Generalized geological model showing the two major sinkholes around the Neckendorf allotment garden site and the former B180 (© LAGB) *https://lagb.sachsen-anhalt.de/geologie/georisiken/aktuelle-informationen-zur-l-224-im-kreuzungsbereich-k-2319-zwischen-neckendorf-und-wolferode-gelaendeeinsenkungen*

Figure 3:Sinkhole in the allotment garden site early 2000s (© LAGB)

Figure 4: Sinkhole on the federal road B180 in 2001 (© LAGB)

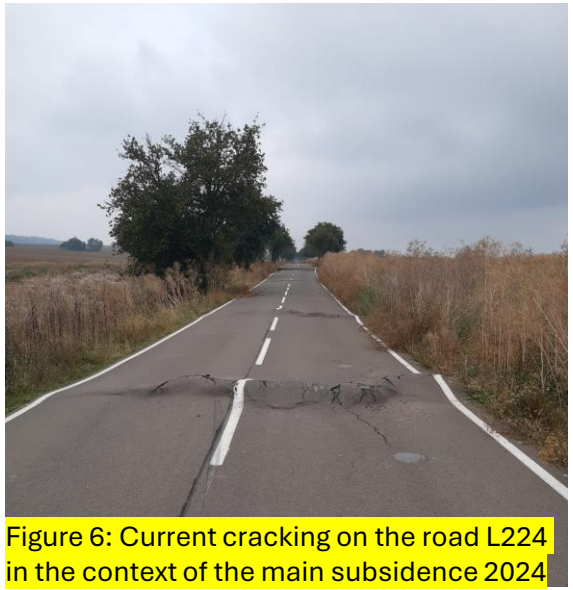
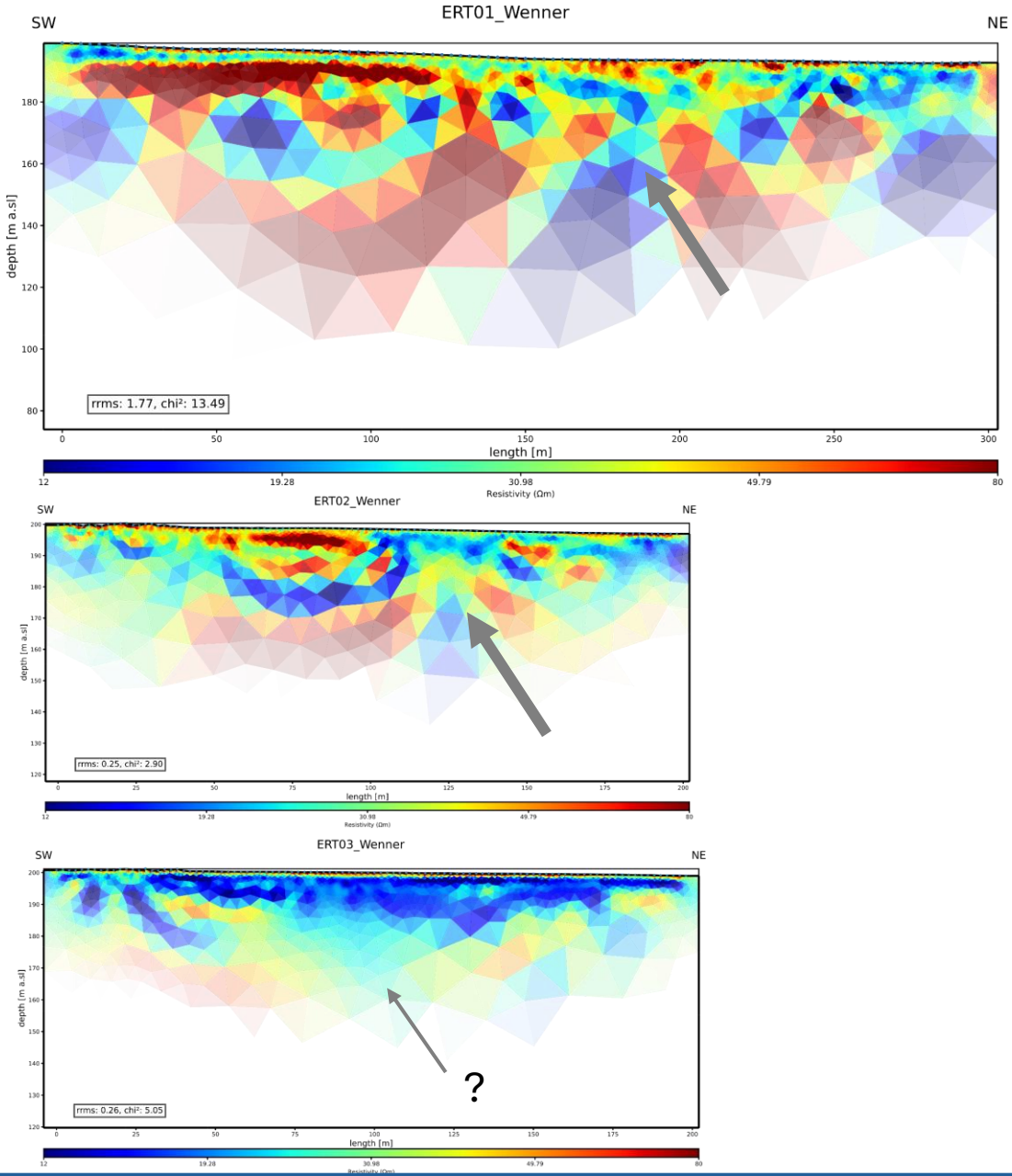


Figure 6: Current cracking on the road L224 in the context of the main subsidence 2024

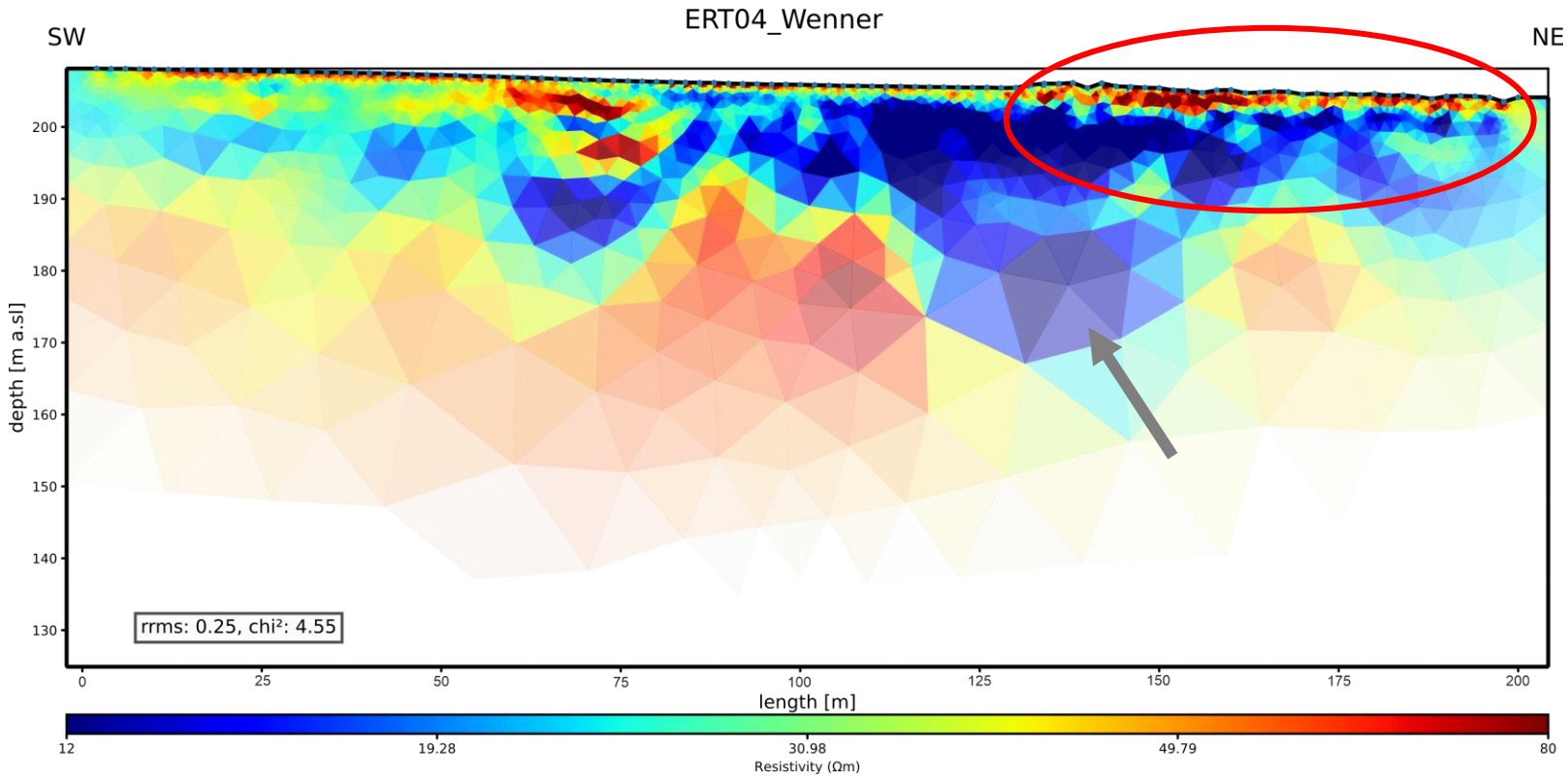
Figure 6: Large offset in the road L224 due to the main subsidence 2024

ERT results

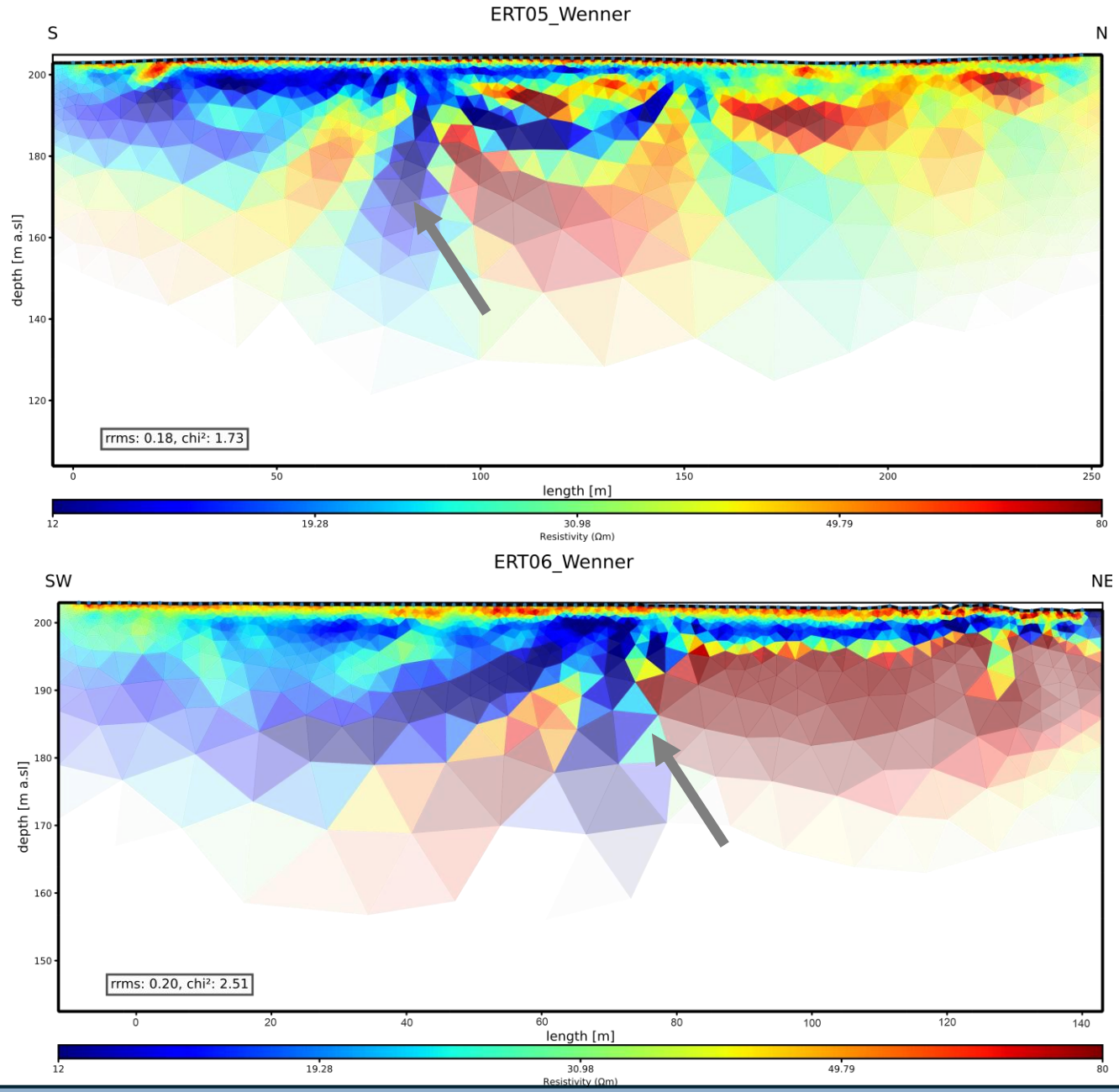
- Near-vertical structures of low resistance (blue) at great depth, which break through higher-resistance (red) structures
- Clearly visible in ERT01 and ERT02



- Big low resistivity anomaly due to a broken water pipe
- Higher resistance in the topsoil near surface cracks



- ERT05 and ERT06 also show the conspicuous vertical low-resistance structures

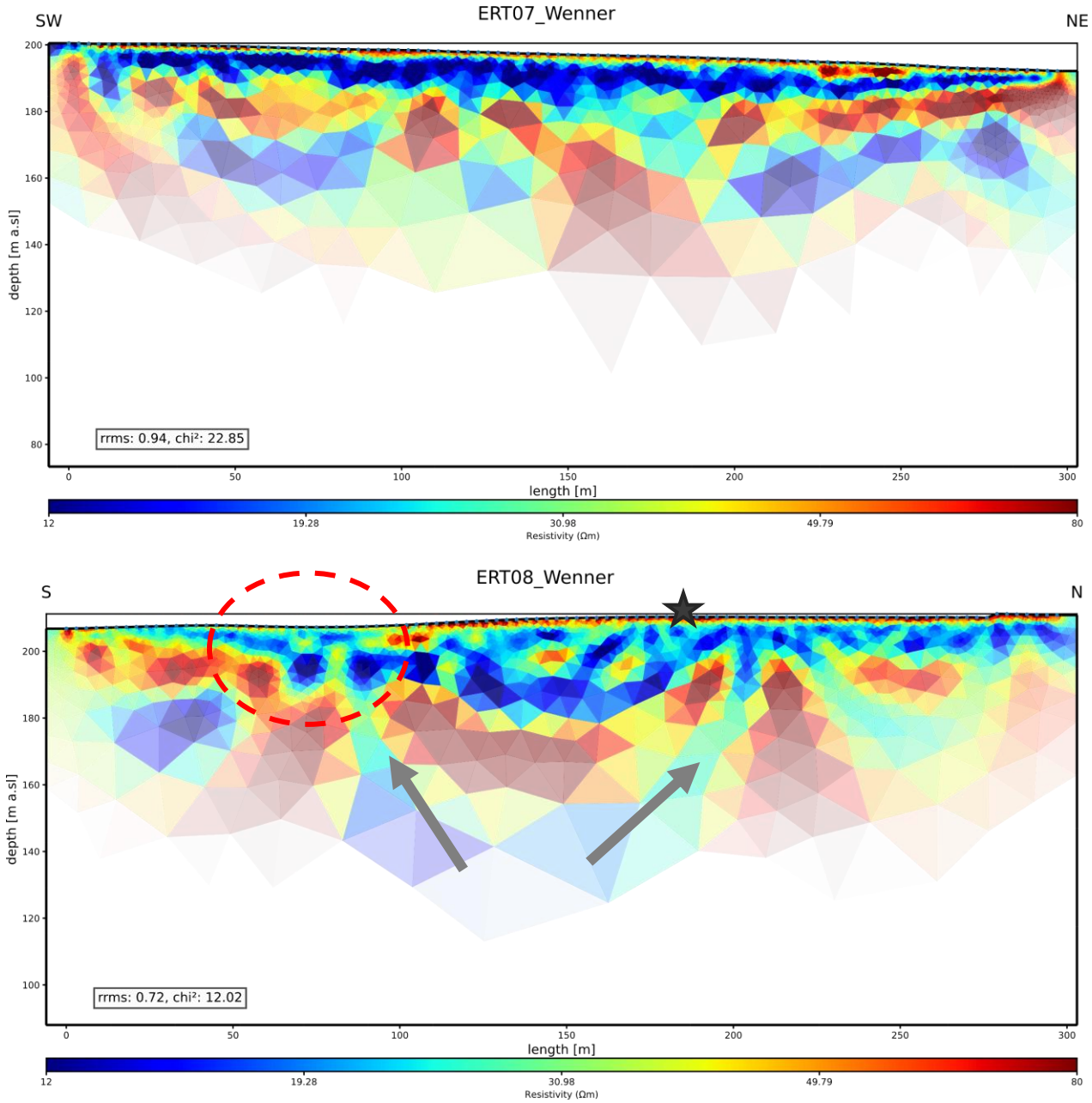


- Like ERT03, ERT07 shows a relatively homogeneous low-resistance topsoil compared to the other profiles

- ERT08, on the other hand, again shows signs of low-resistance vertical structures, but not as distinct as in ERT05 or ERT02

- The “old” sinkhole, recognizable in gravimetry and in the DEM, cannot be clearly identified in ERT08

- The old “Rißdorf” mining shaft can also not be recorded with the profile layout selected in ERT08



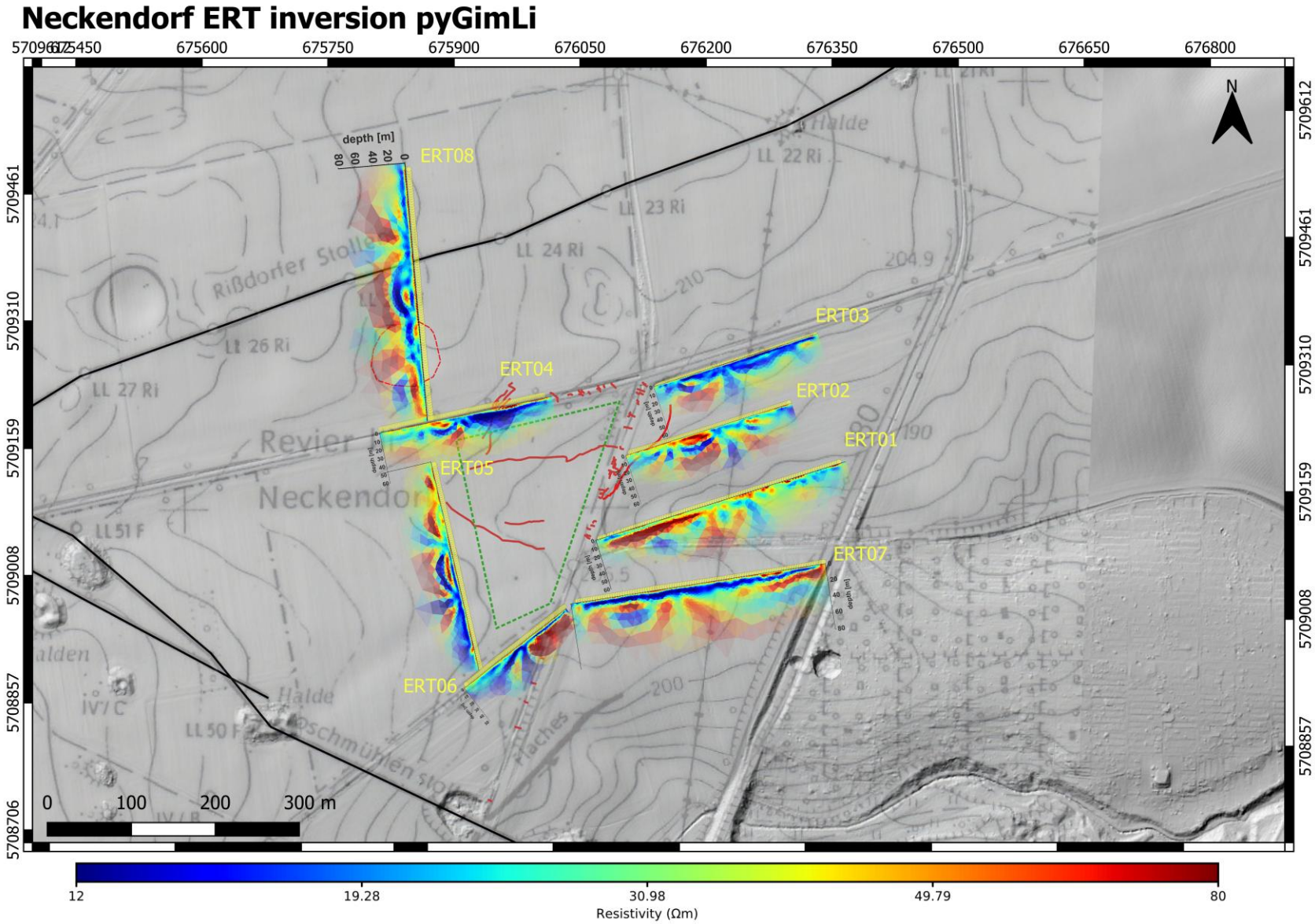


Figure 7: Different inversion parameter $\Lambda = 200$.

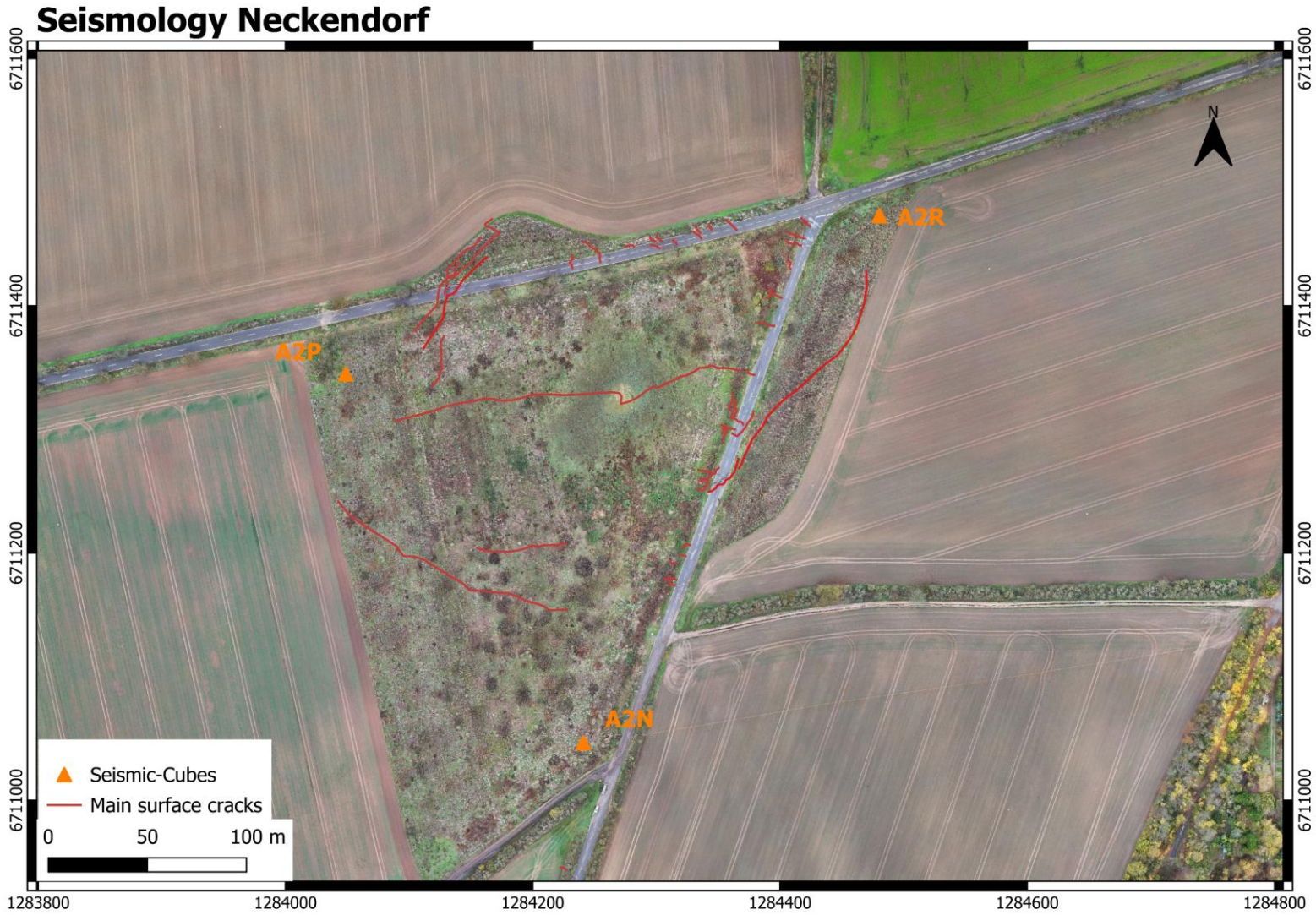
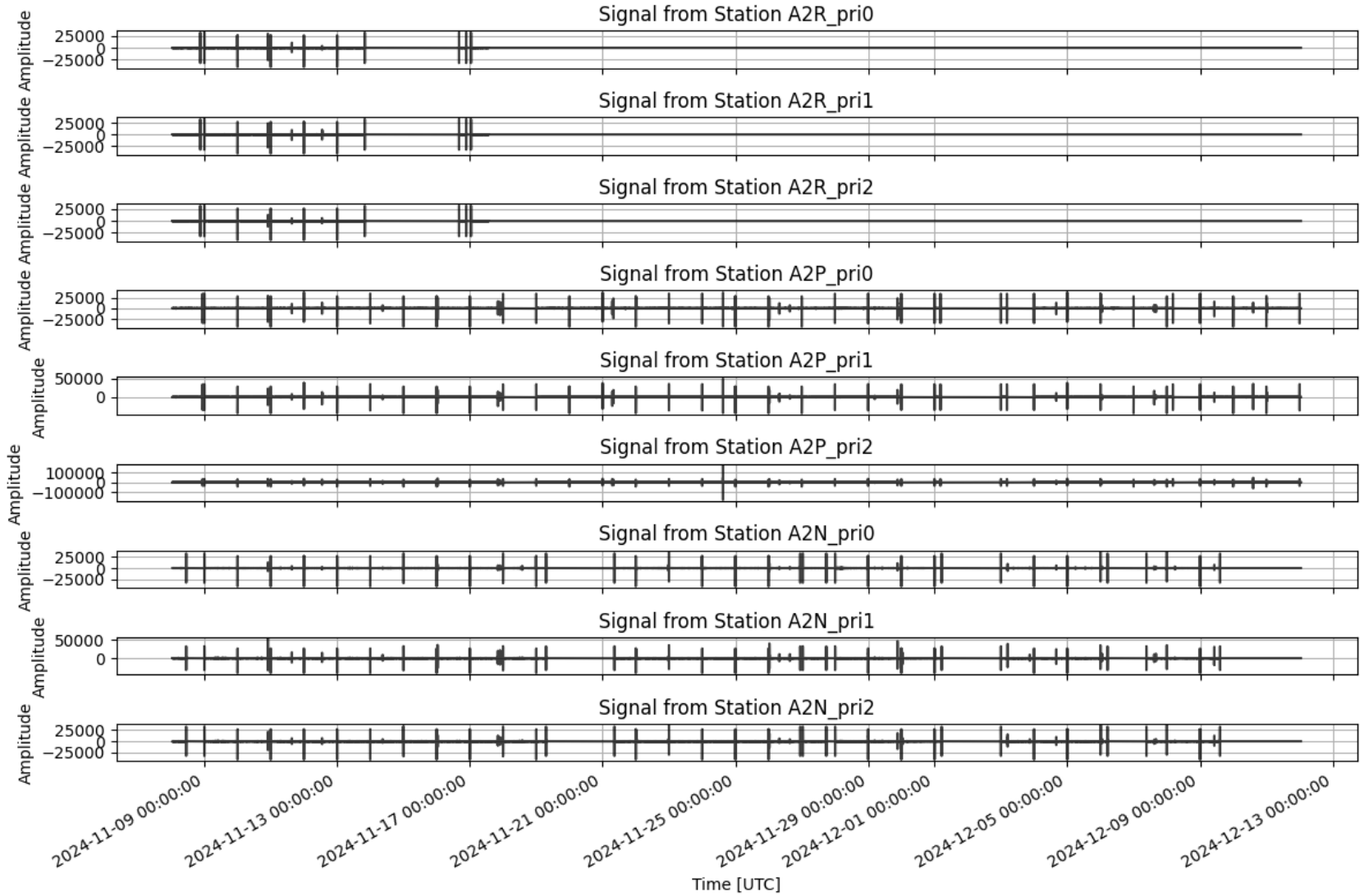


Figure 8: Positions of the three seismic stations distributed around the main depression.

Seismological results

- Signals from all three stations over one month period
- Every station has three components



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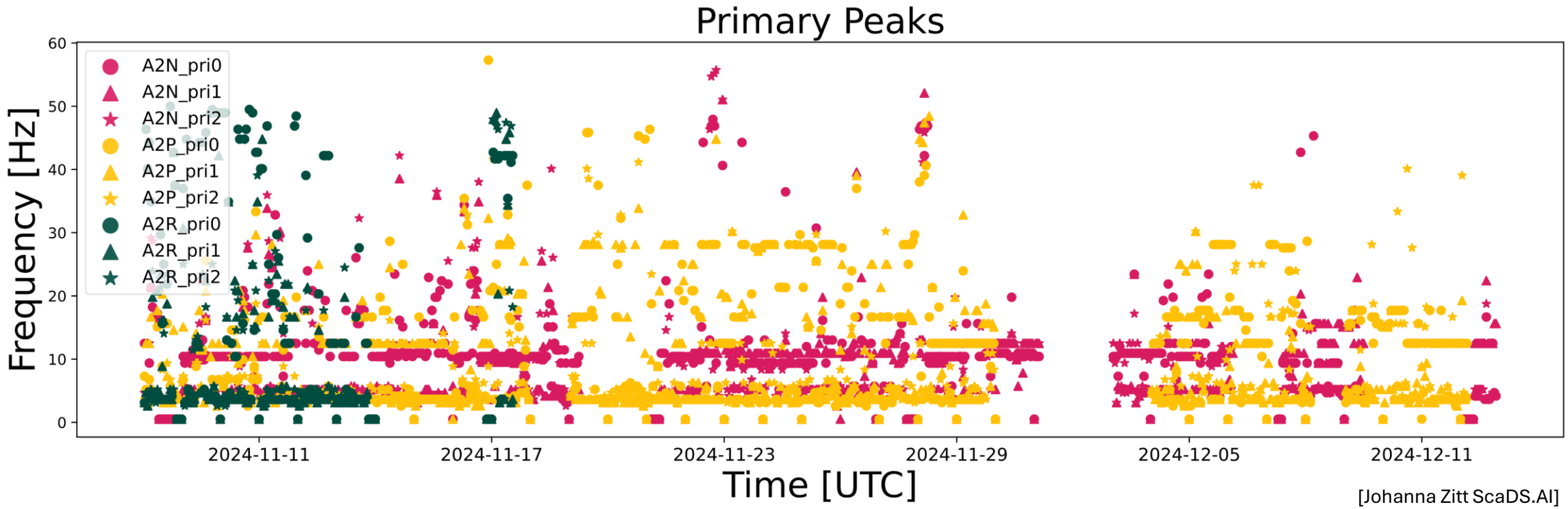
Frequency range 0.1 – 60 Hz
full period



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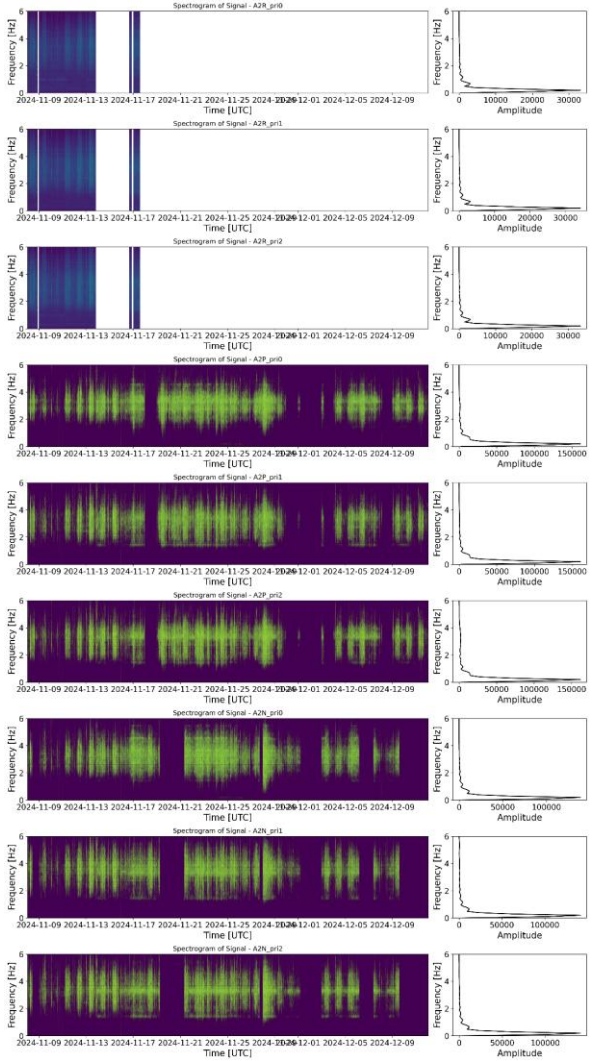
Frequency range 0.1 – 4 Hz full period



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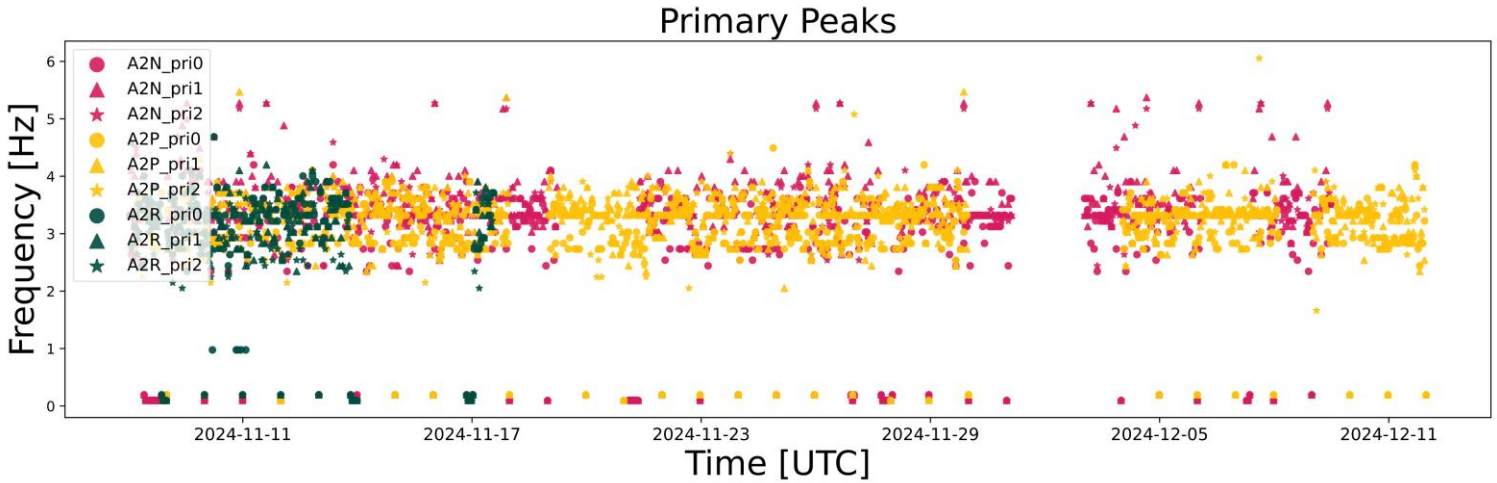

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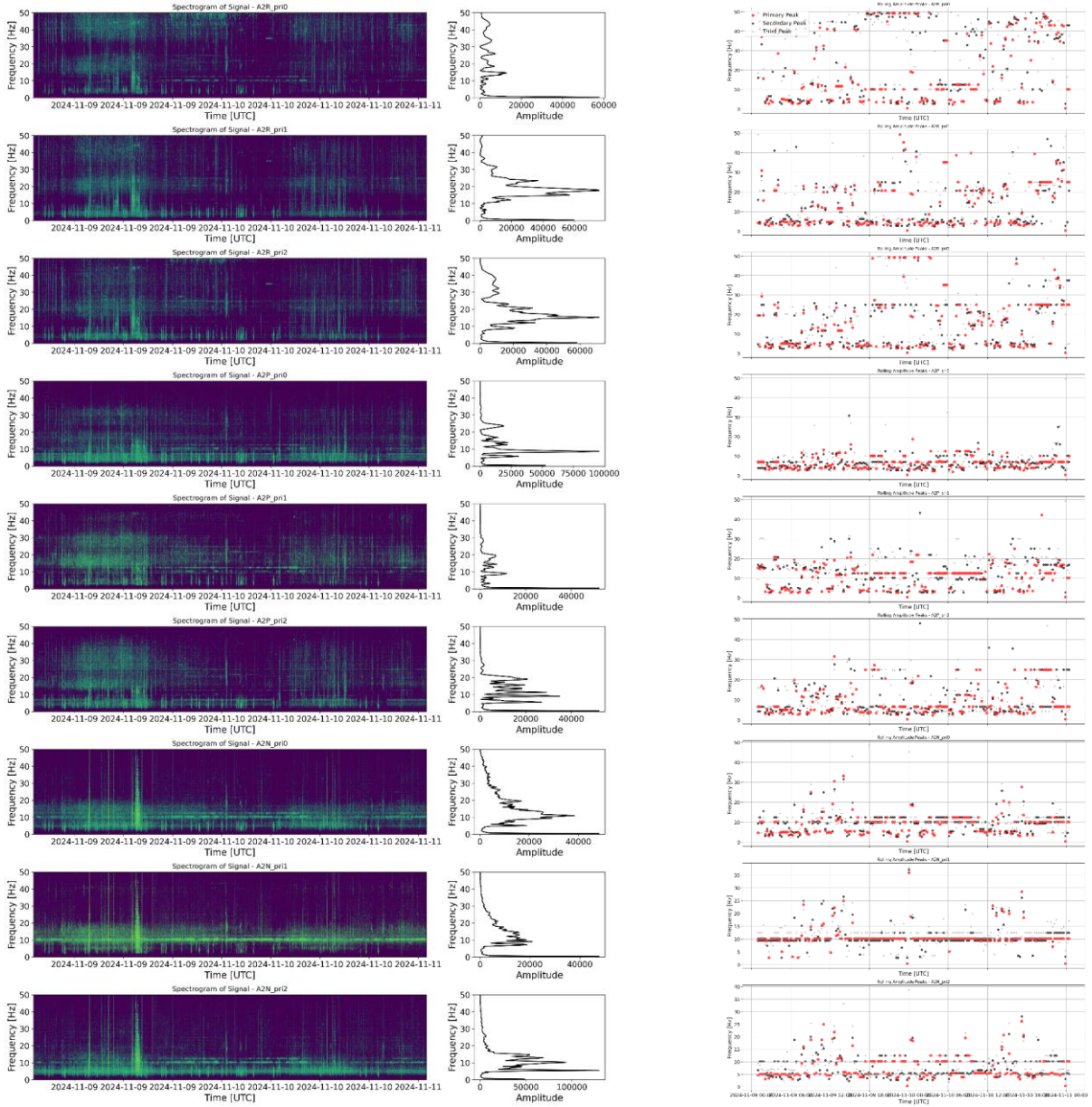
Frequency range 0.1 – 60 Hz two days

- During daytime clearly visible noise peaks, possibly from nearby road and agriculture



[Johanna Zitt ScaDS.AI]

ERT results LAGB

- ERT profile across the main subsidence shows large vertical anomalies of low resistances down to a depth of over 60 m
- These structures can be water-saturated loosening zones in the context of subsidence

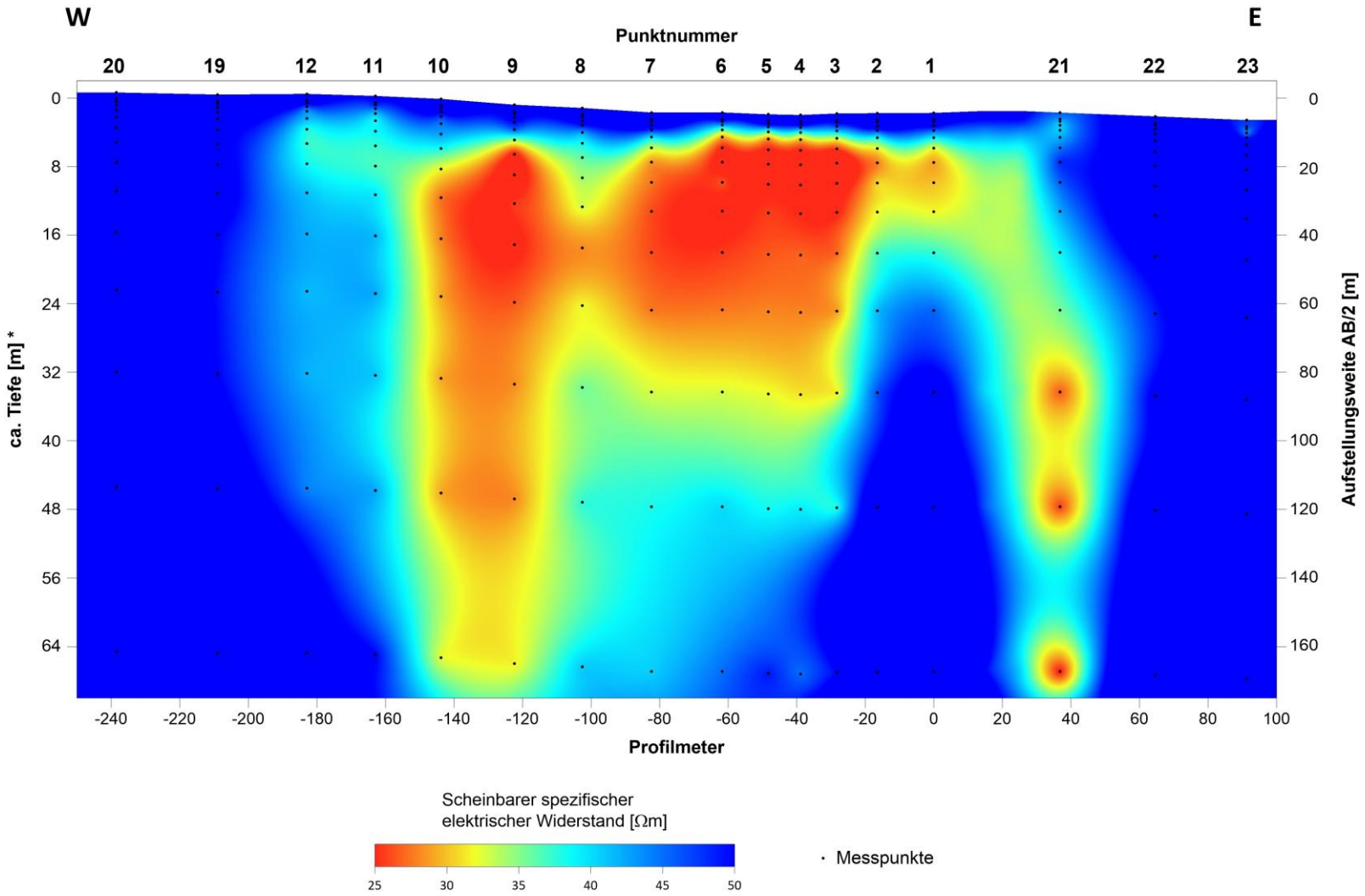


Figure 9: ERT results of the LAGB measurements (© LAGB)

Model of the geological situation in the subsidence area [LAGB]