Geologischer Dienst NRW

Geologischer Dienst
Nordrhein-Westfalen
– Landesbetrieb –

PROJEKTTREFFEN
DB MISS
17. OKTOBER 2025

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Fachbereich 34: Geophysik, Landeserdbebendienst

dbmiss

Projektträger Jülich
Forschungszentrum Jülich

GESCHWINDIGKEITSMODELL

DURCHGEFÜHRTE ARBEITEN

Datengrundlage Lithologie:

Vereinfachung der Lithologien aus dem Geothermieportal NRW:

- für oberflächennahe Geothermie (bis 100 m)
- für mitteltiefe Geothermie (100 – 1000 m)

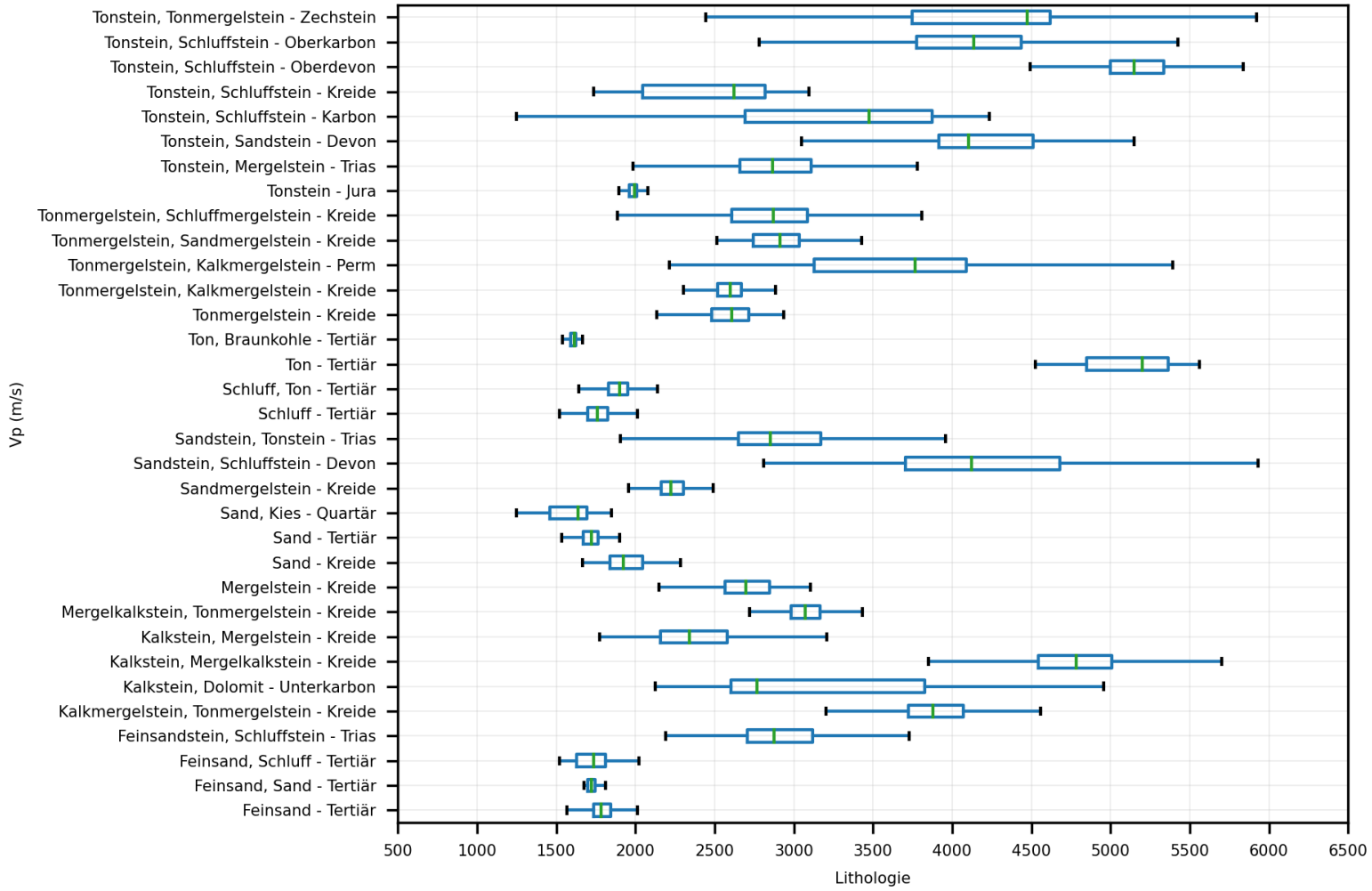
DURCHGEFÜHRTE ARBEITEN

Datengrundlage Geschwindigkeiten:

Digitalisierte Bohrlochlogs (Sonic):

- Messungen der Intervallgeschwindigkeiten an ausgewählten Standorten in NRW
- Übertragung der Geschwindigkeiten auf Schichtäquivalente in ganz NRW

DURCHGEFÜHRTE ARBEITEN



DURCHGEFÜHRTE ARBEITEN

Beispiel Nörvenich:

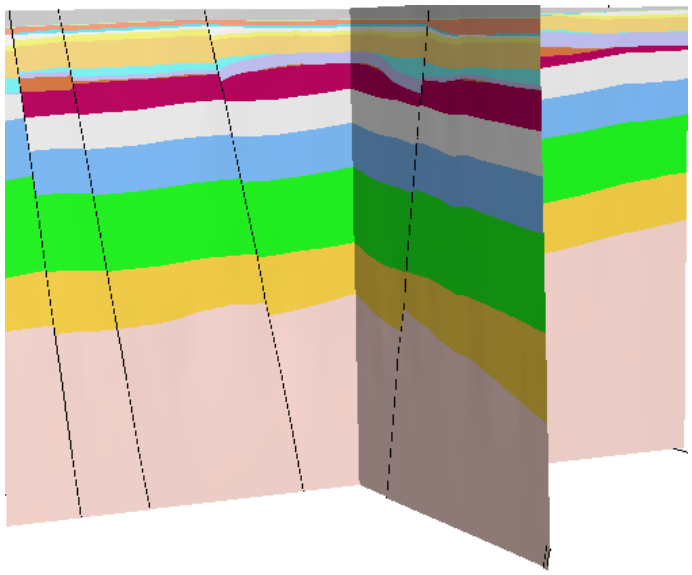
Digitalisierte Bohrlochlogs (Sonic):

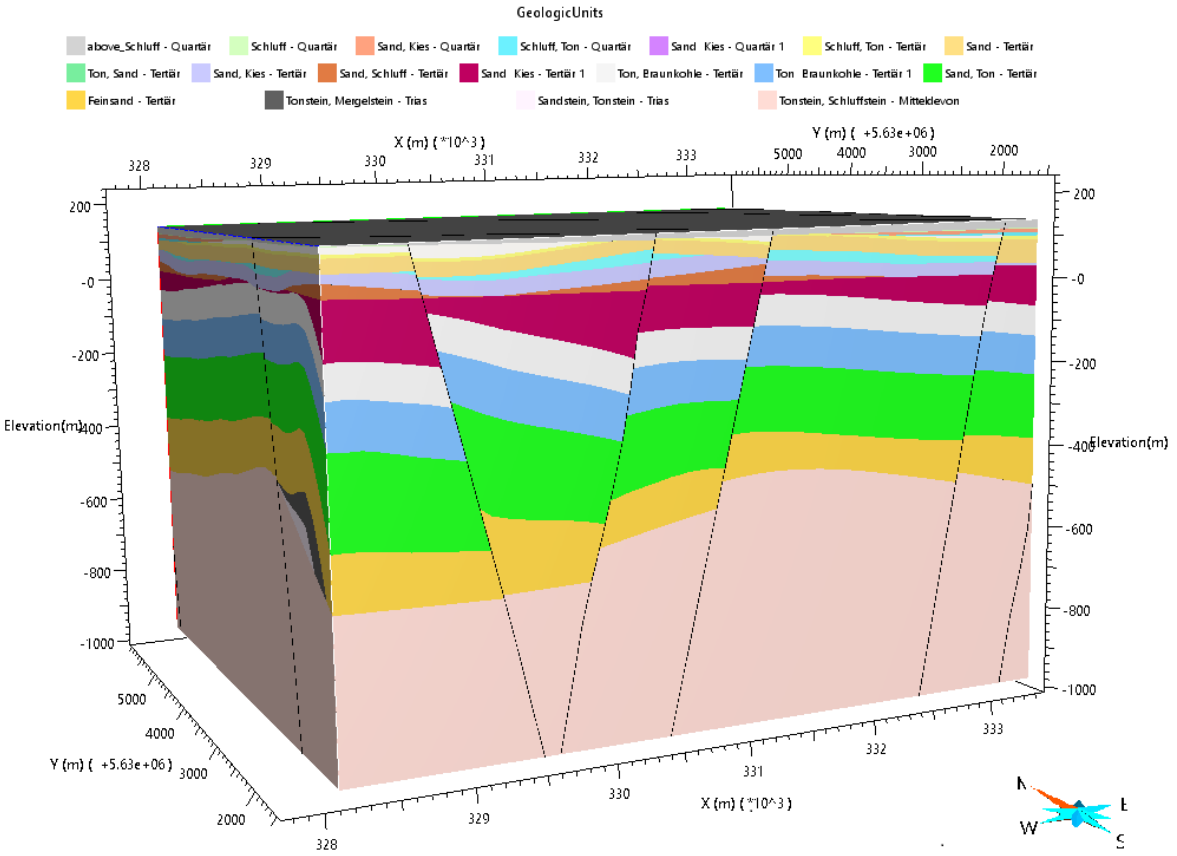
- 3D-Störungsmodelle der Erft-Scholle
- Aspen SKUA - Geological Modeling Software
  - SKUA Wrokflows der Structure & Stratigraphy

3D-lithologisches Modell

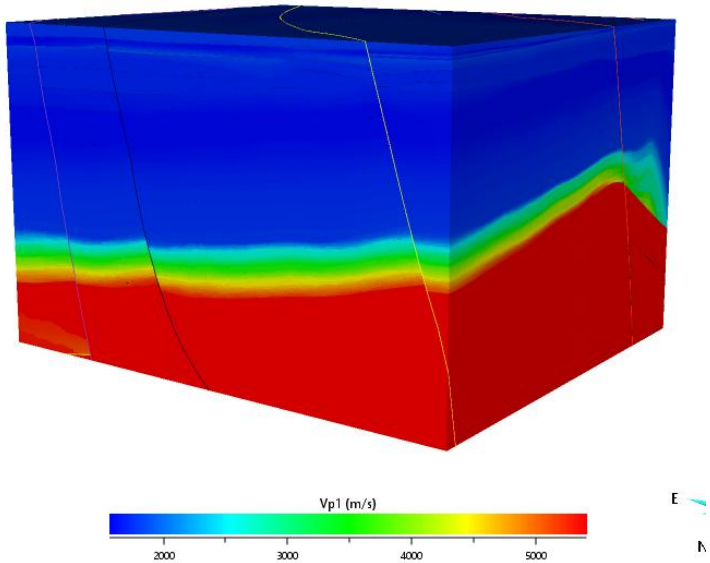
Fläche ≈ 27km²

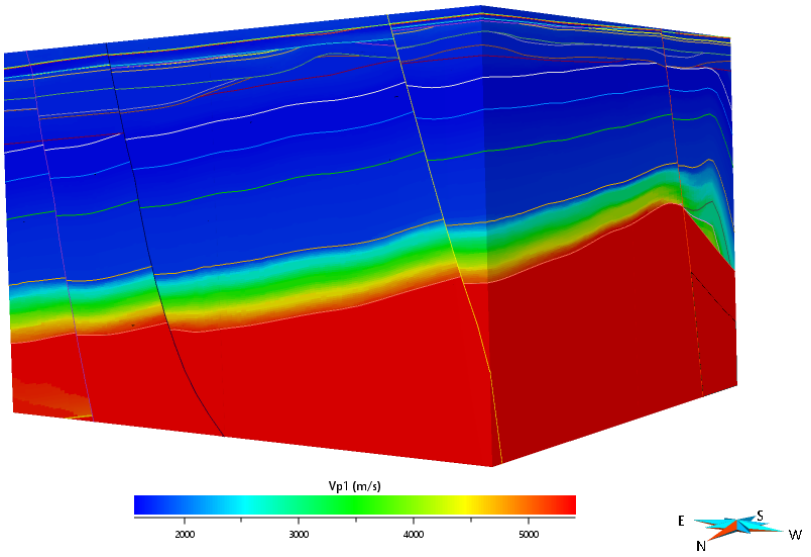
Tiefe = 1000m

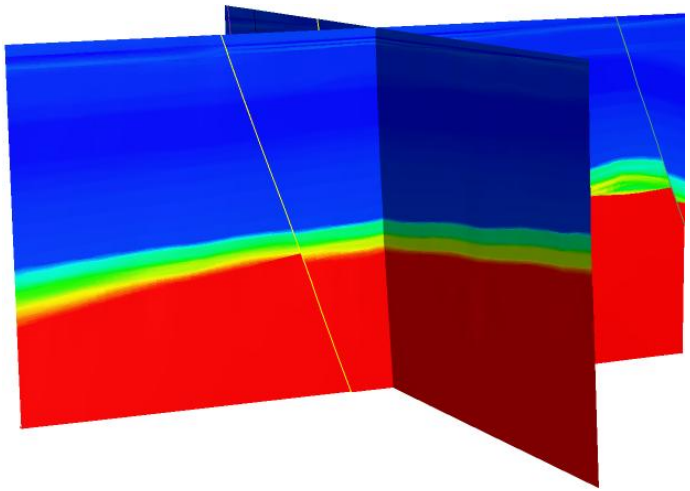


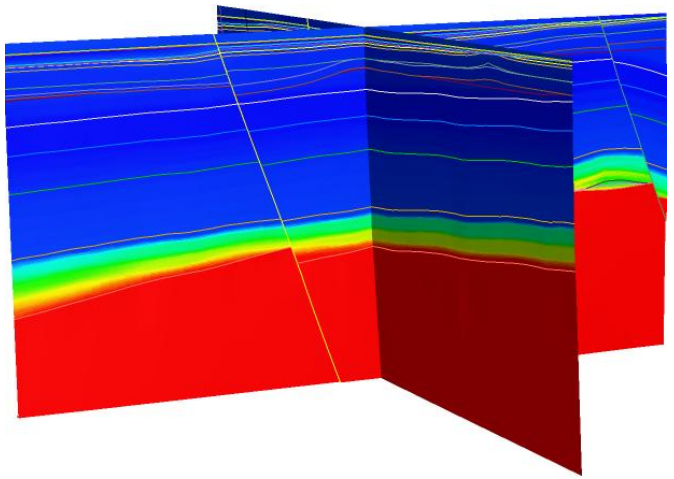


- V_P aus Δt-Logs

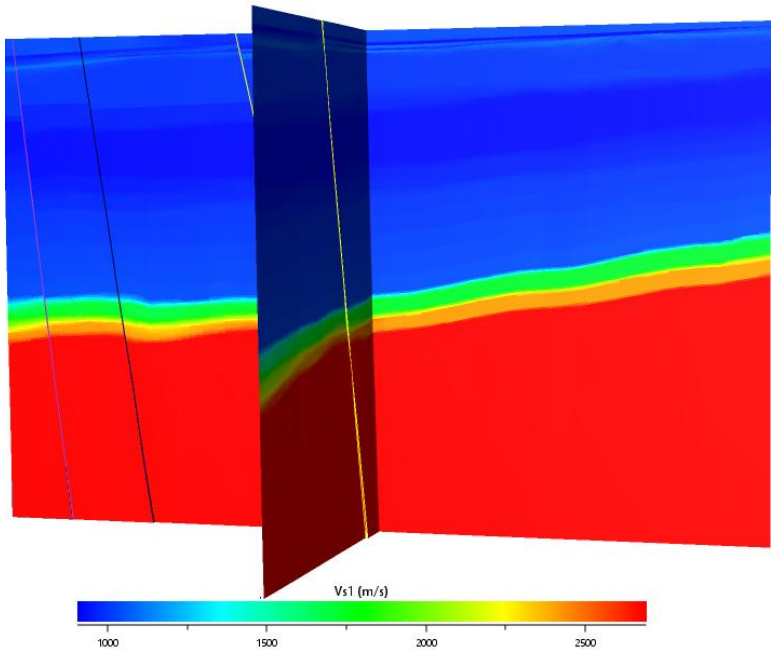


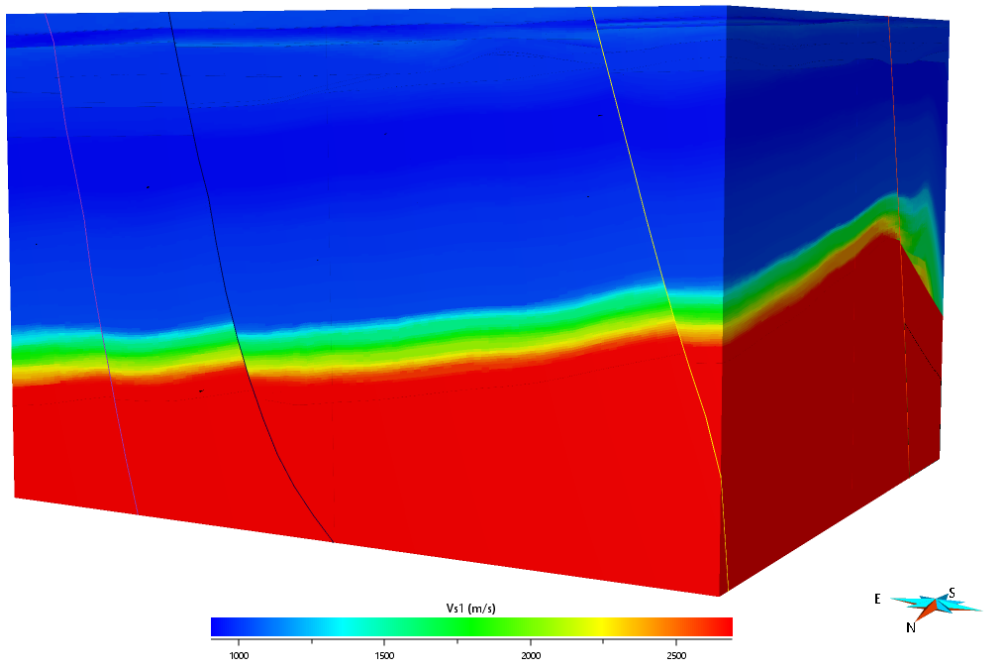




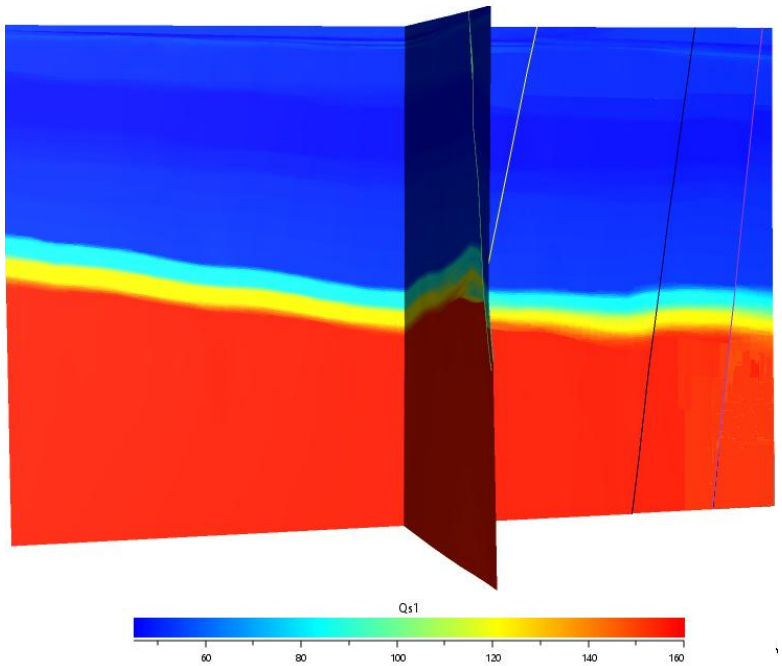


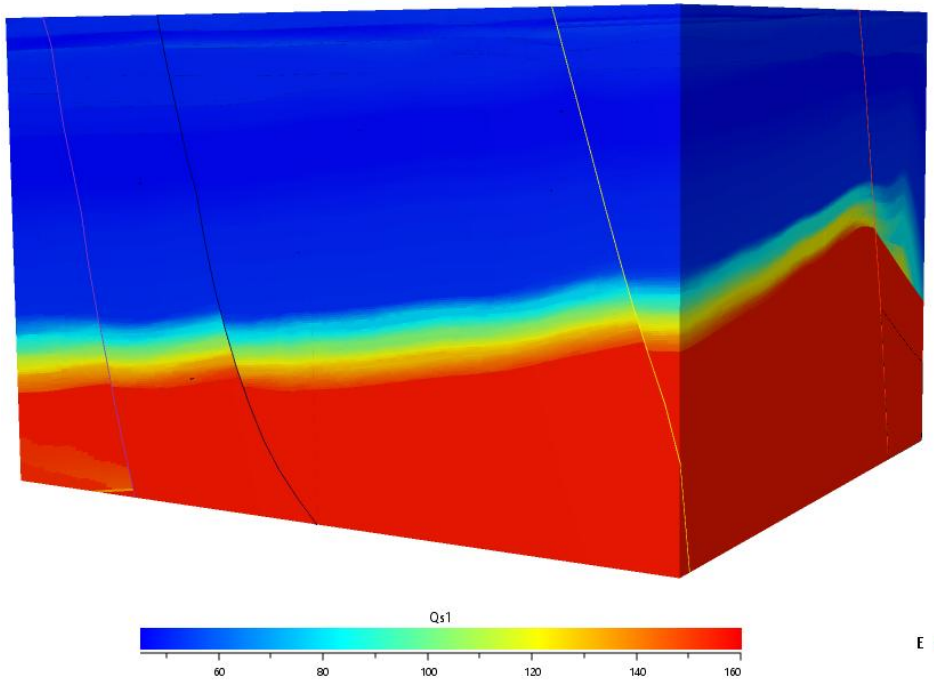
- $V_s = Vp/\sqrt{3}$



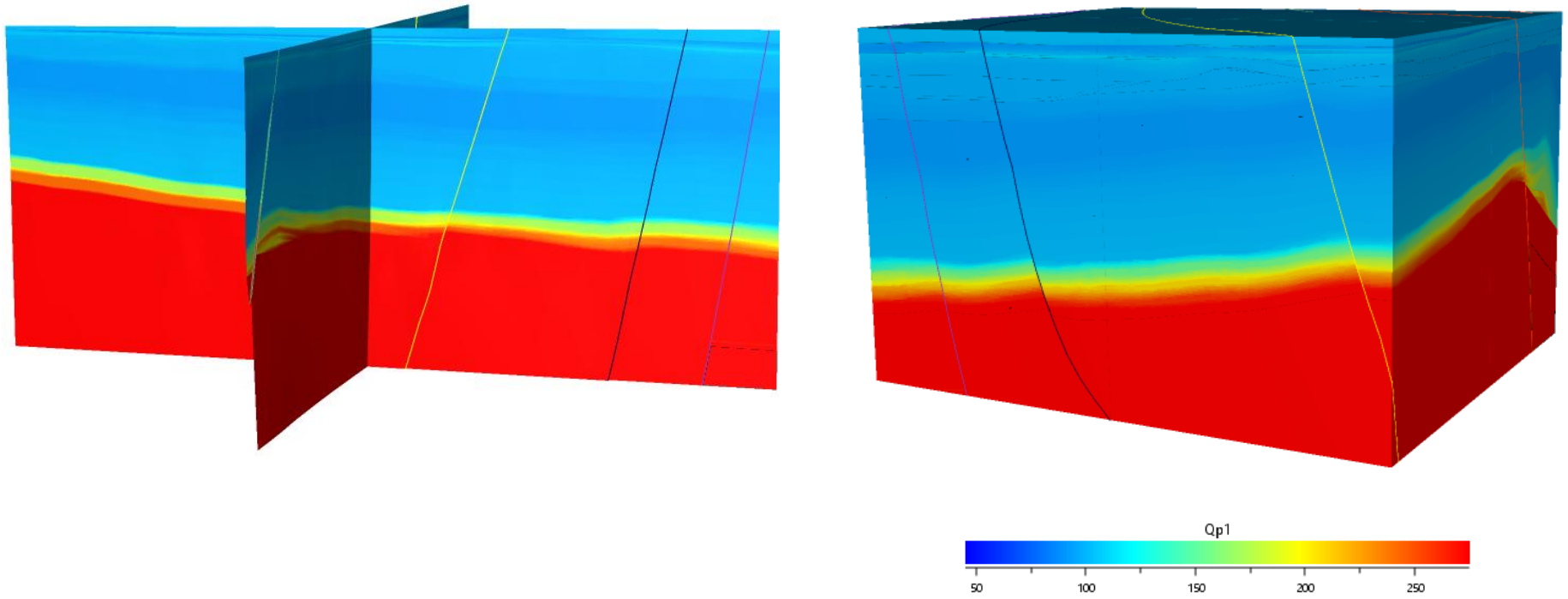


- $Q_S = 50 * V_S$ *(Bielak et al. (2010), Cui et al. (2010), Graves et al. (2011))*





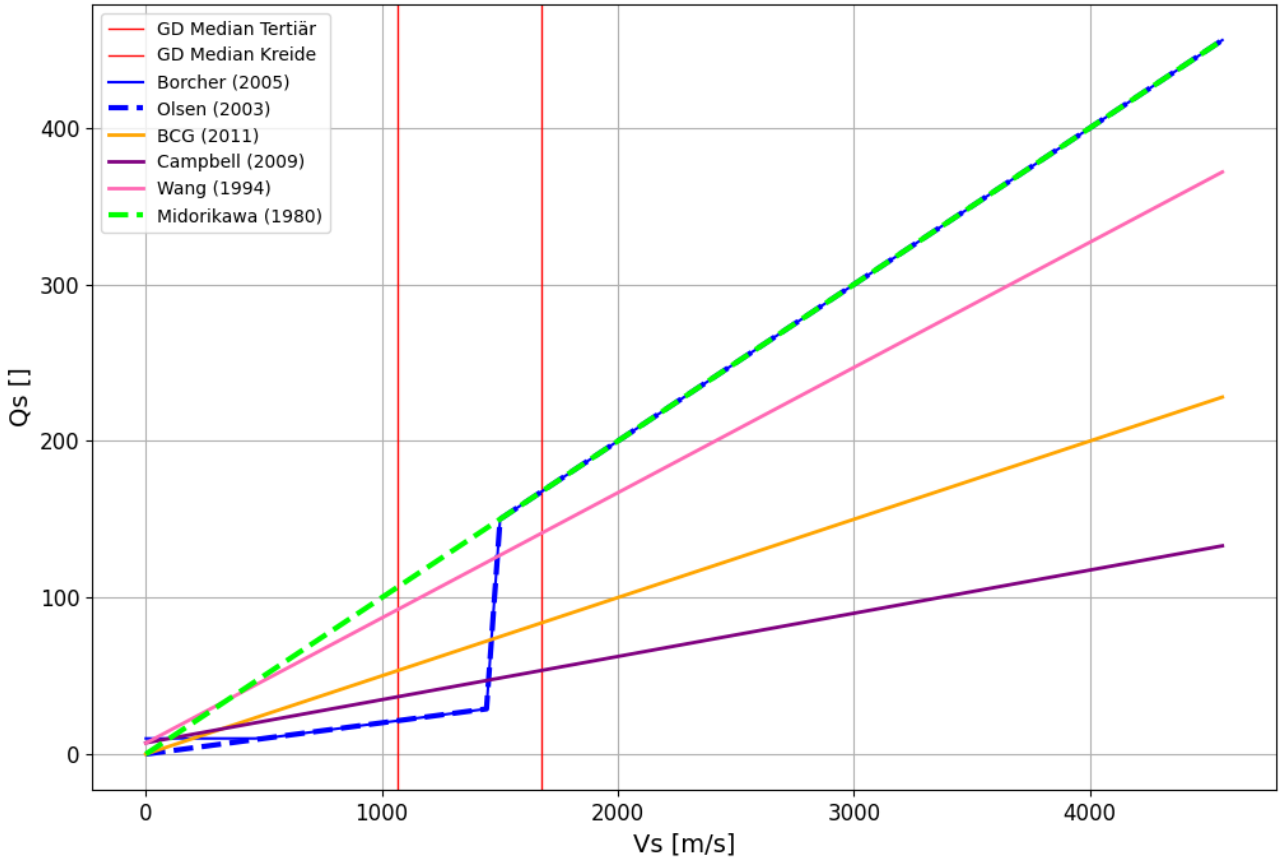
- $Q_P = 2 * Q_S$ *(Bielak et al. (2010), Cui et al. (2010), Graves et al. (2011))*



EMPIRISCHE BEZIEHUNGEN FÜR Q

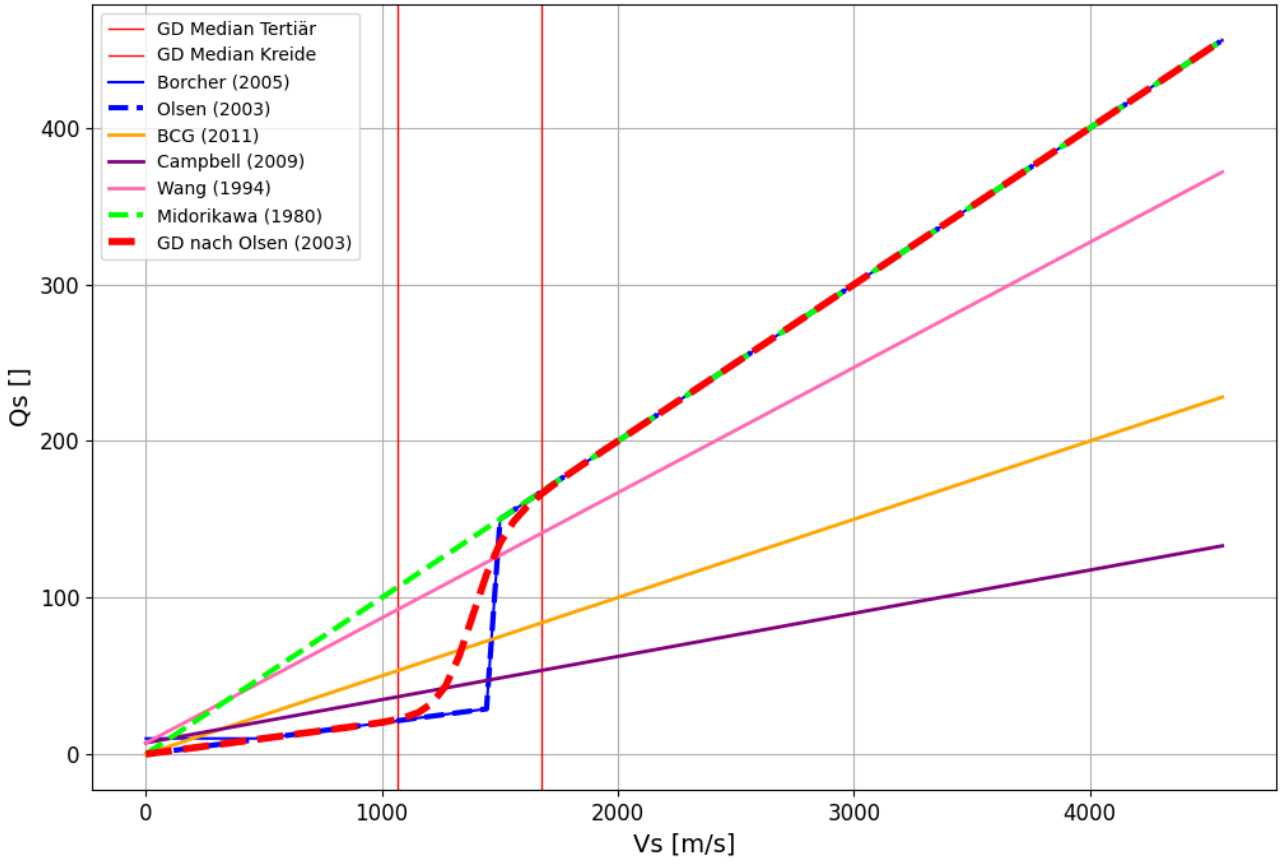
DURCHGEFÜHRTE ARBEITEN

Anpassung der Qs-Beziehung nach Olsen (2003)

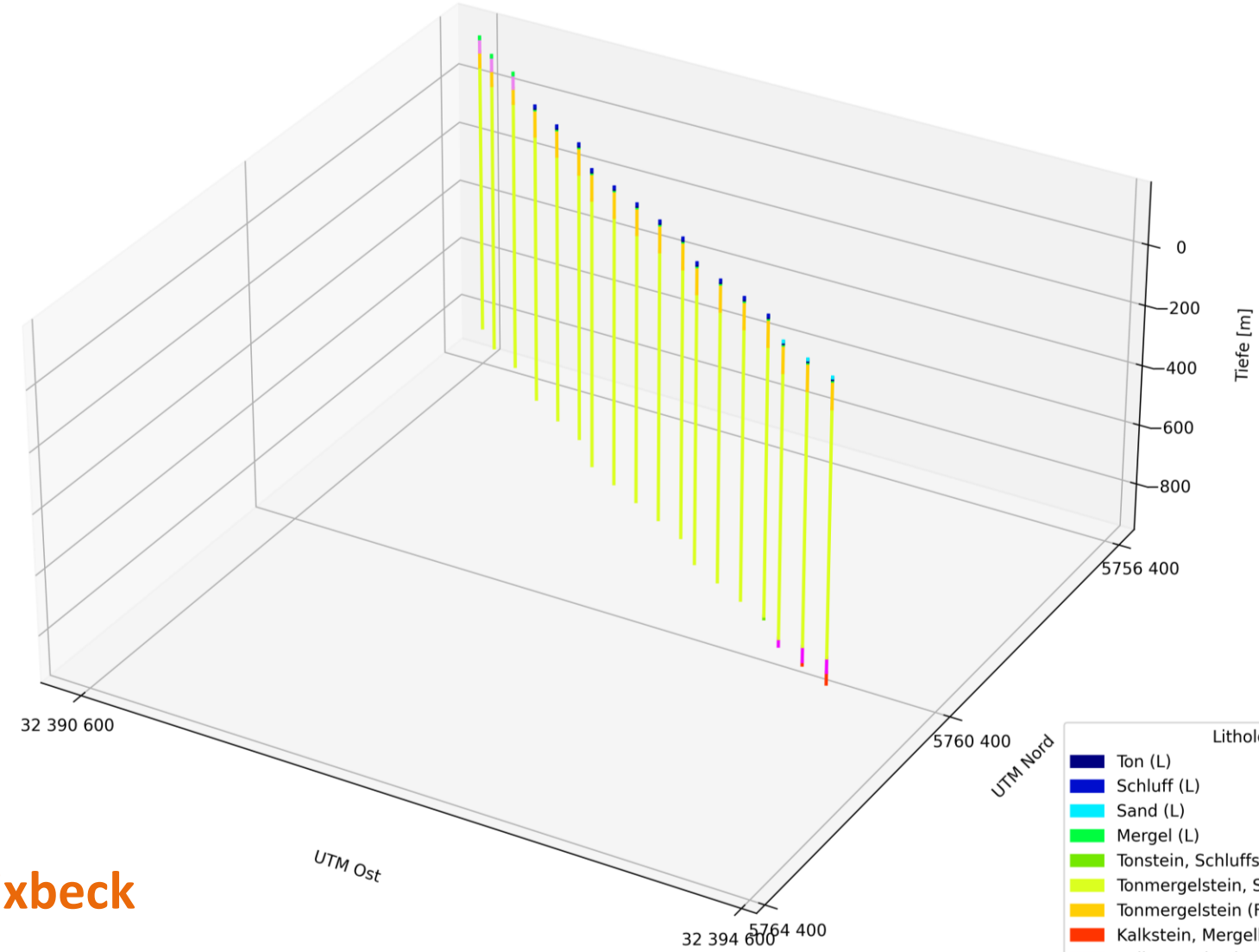


DURCHGEFÜHRTE ARBEITEN

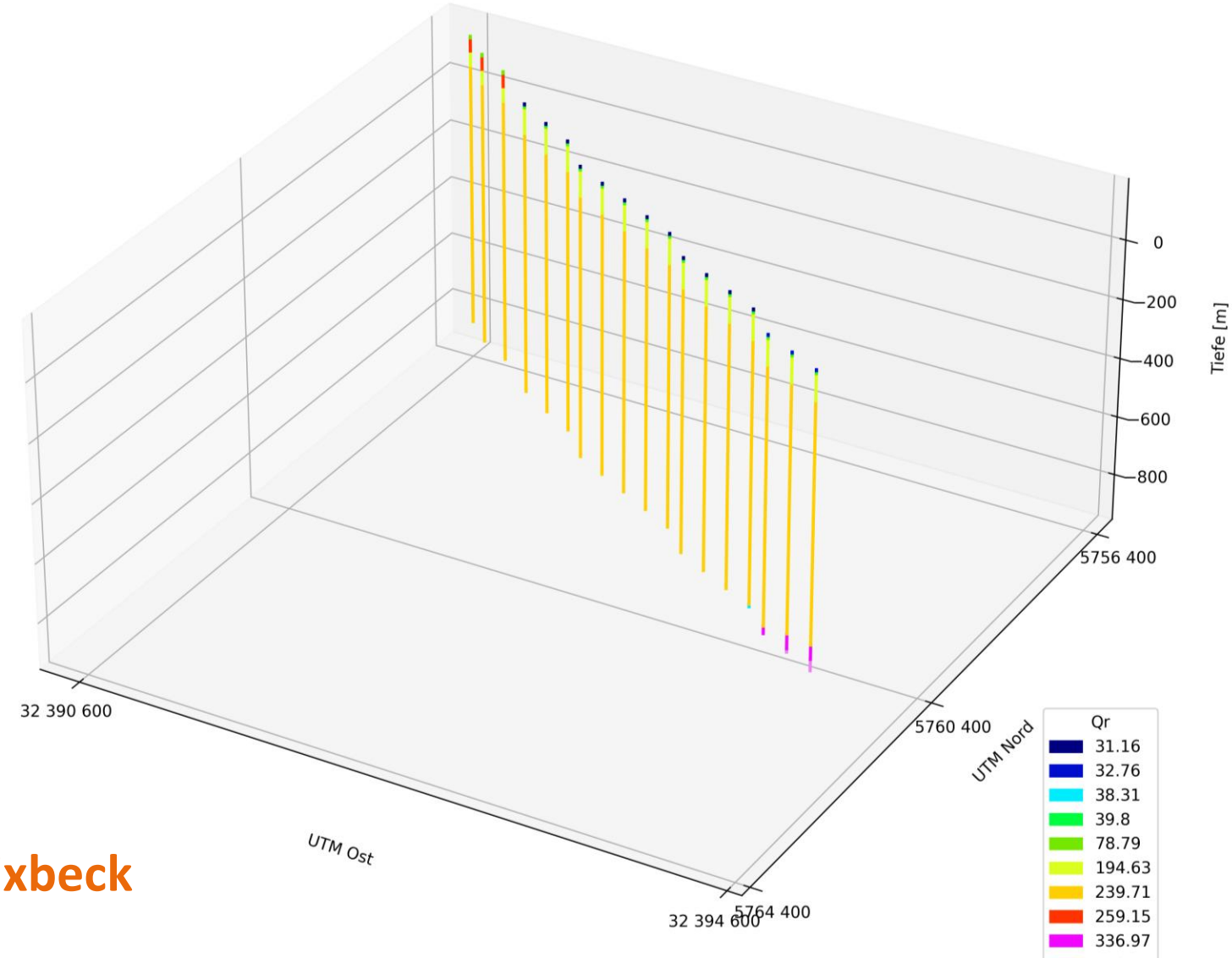
Anpassung der Qs-Beziehung nach Olsen (2003)



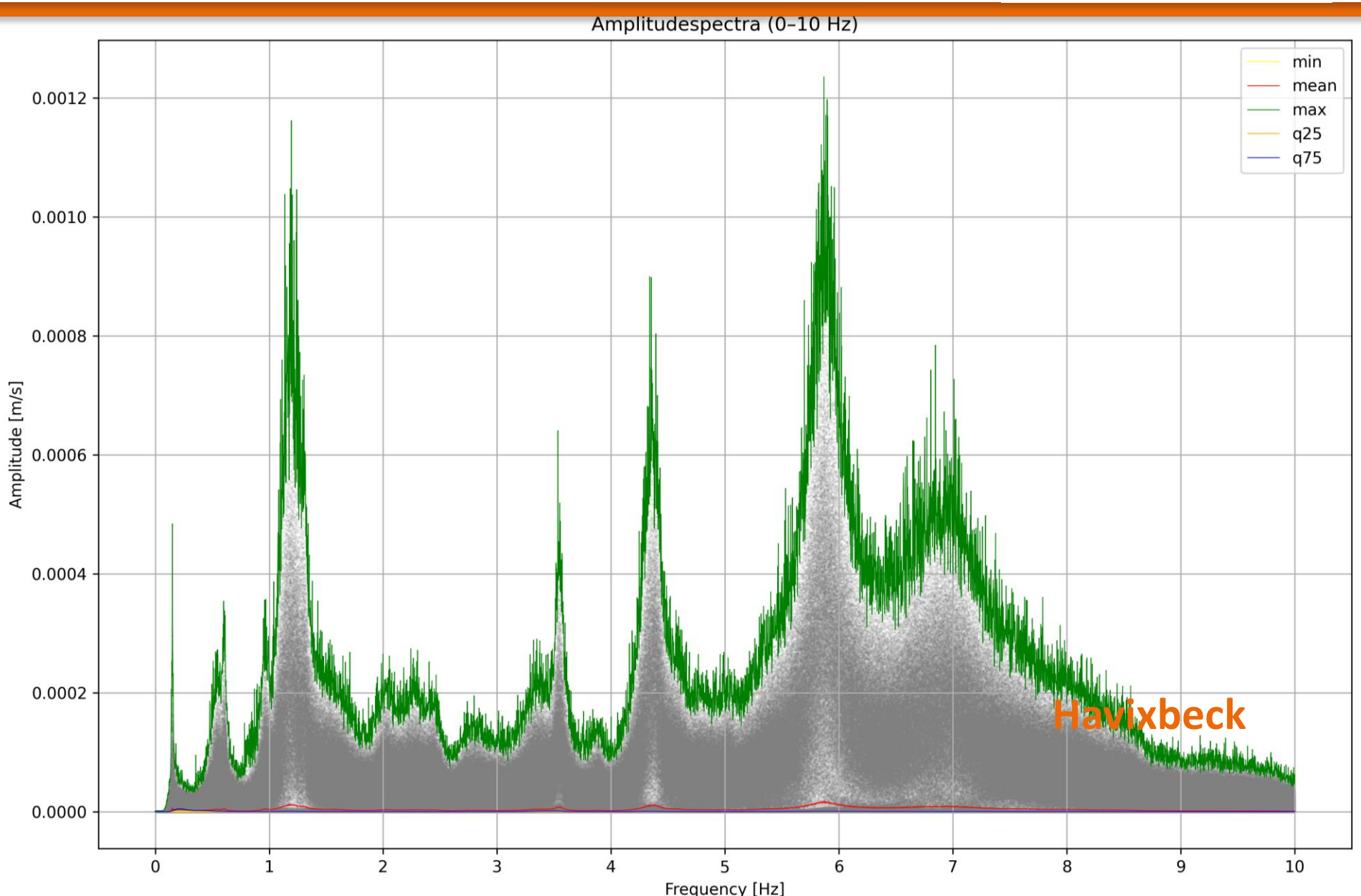
MESSSTANDORTE DES KIT
-
AMPLITUDENABNAHME IN ABHÄNGIGKEIT VON V_R UND Q_R

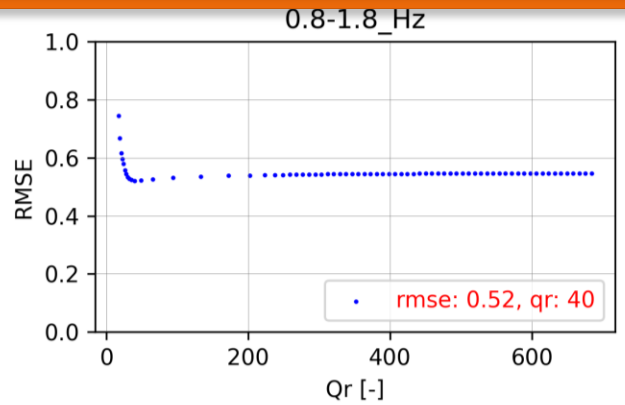

0
200
400
600
800
Tiefe [m]
5756 400
5760 400
UTM Nord
32 390 600
UTM Ost
32 394 600
5764 400
Lithologie
Ton (L)
Schluff (L)
Sand (L)
Mergel (L)
Tonstein, Schluffstein (F)
Tonmergelstein, Schluffmergelstein
Tonmergelstein (F)
Kalkstein, Mergelkalkstein (F)
Kalkmergelstein, Tonmergelstein (F)

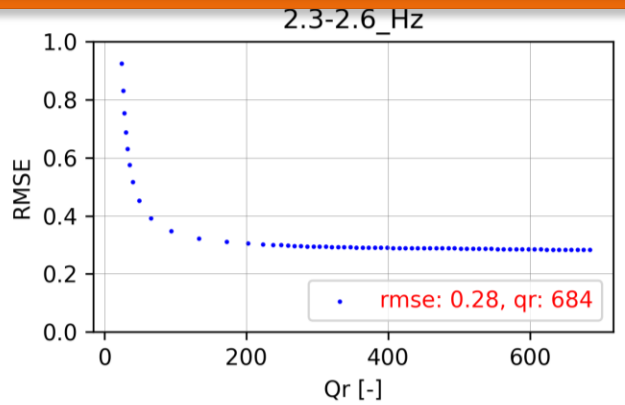
Havixbeck

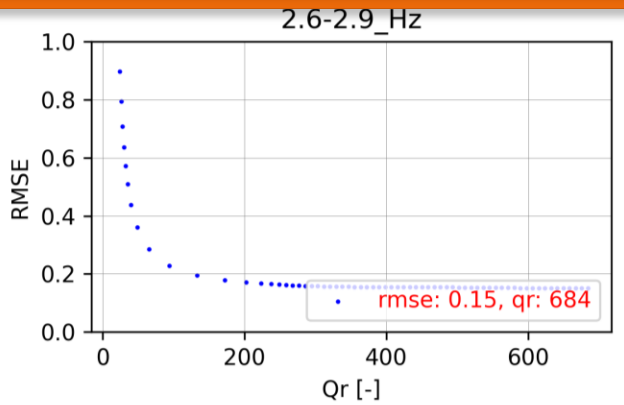

0
200
400
600
800
Tiefe [m]
5756 400
5760 400
UTM Nord
32 390 600
UTM Ost
32 394 600
5764 400
Qr
31.16
32.76
38.31
39.8
78.79
194.63
239.71
259.15
336.97

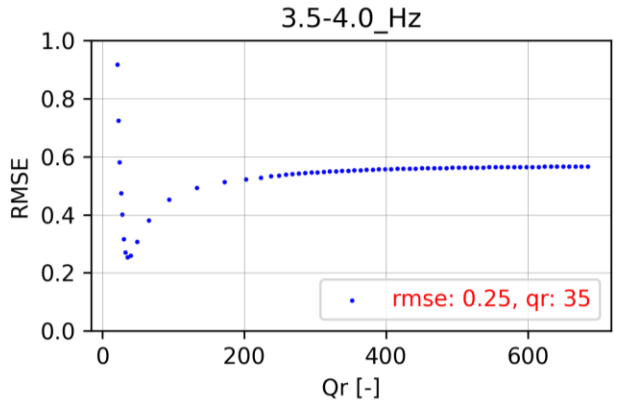
Havixbeck

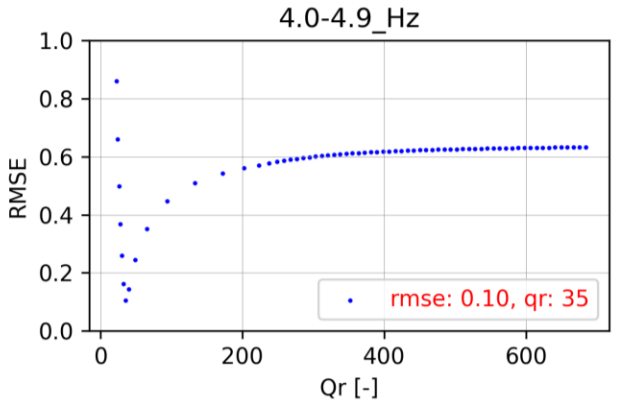

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
0
1
2
3
4
5
6
7
8
9
10
Frequency [Hz]
Havixbeck

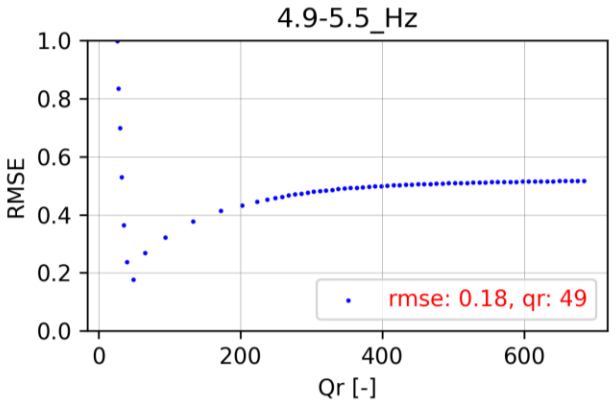


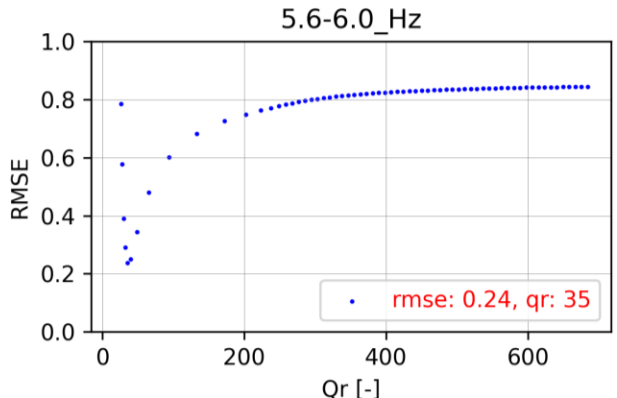


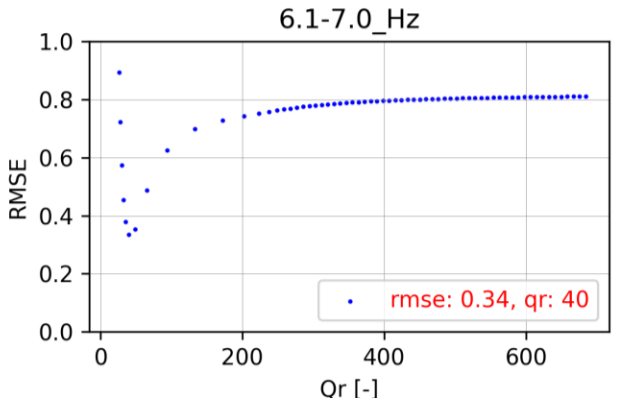






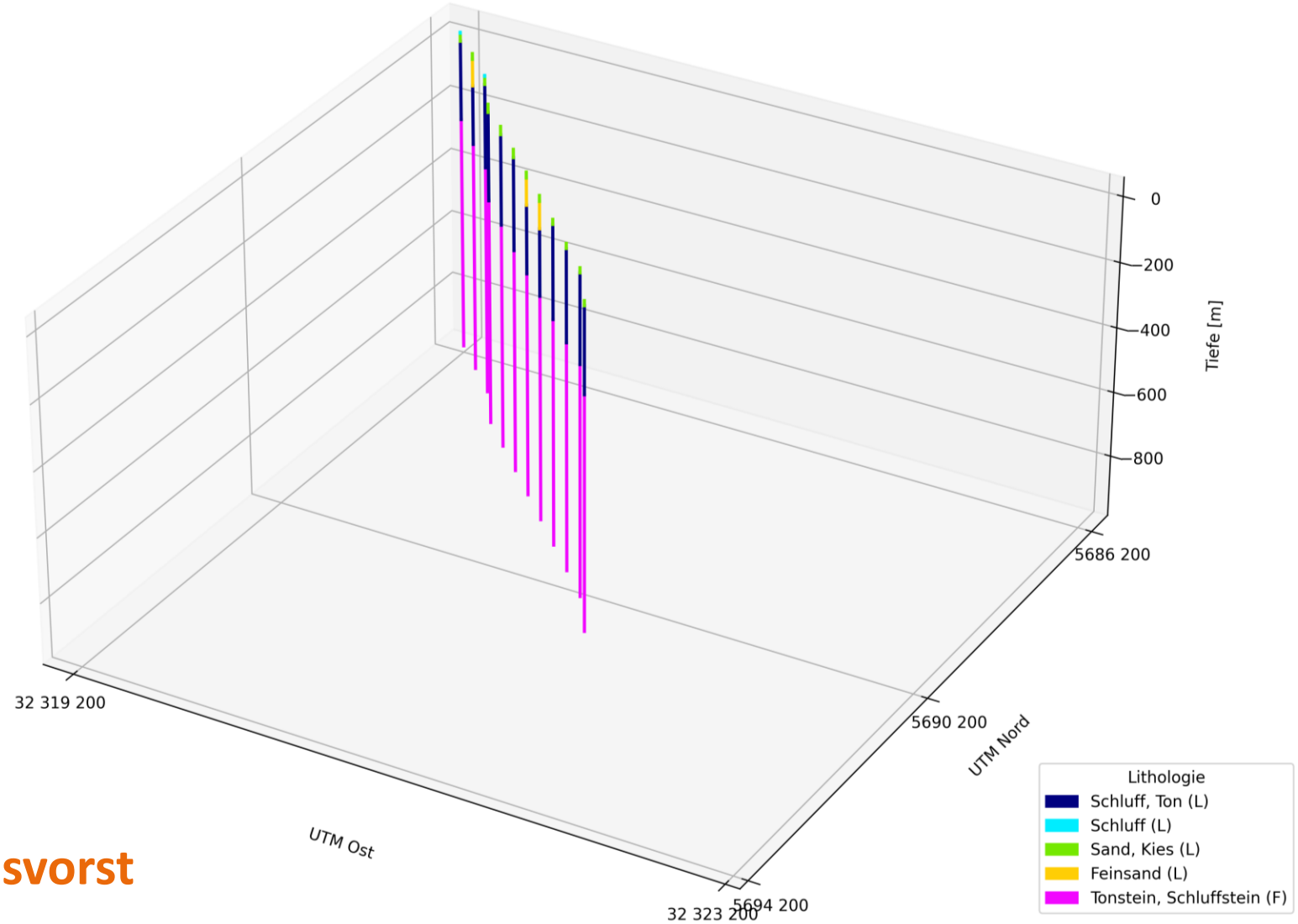




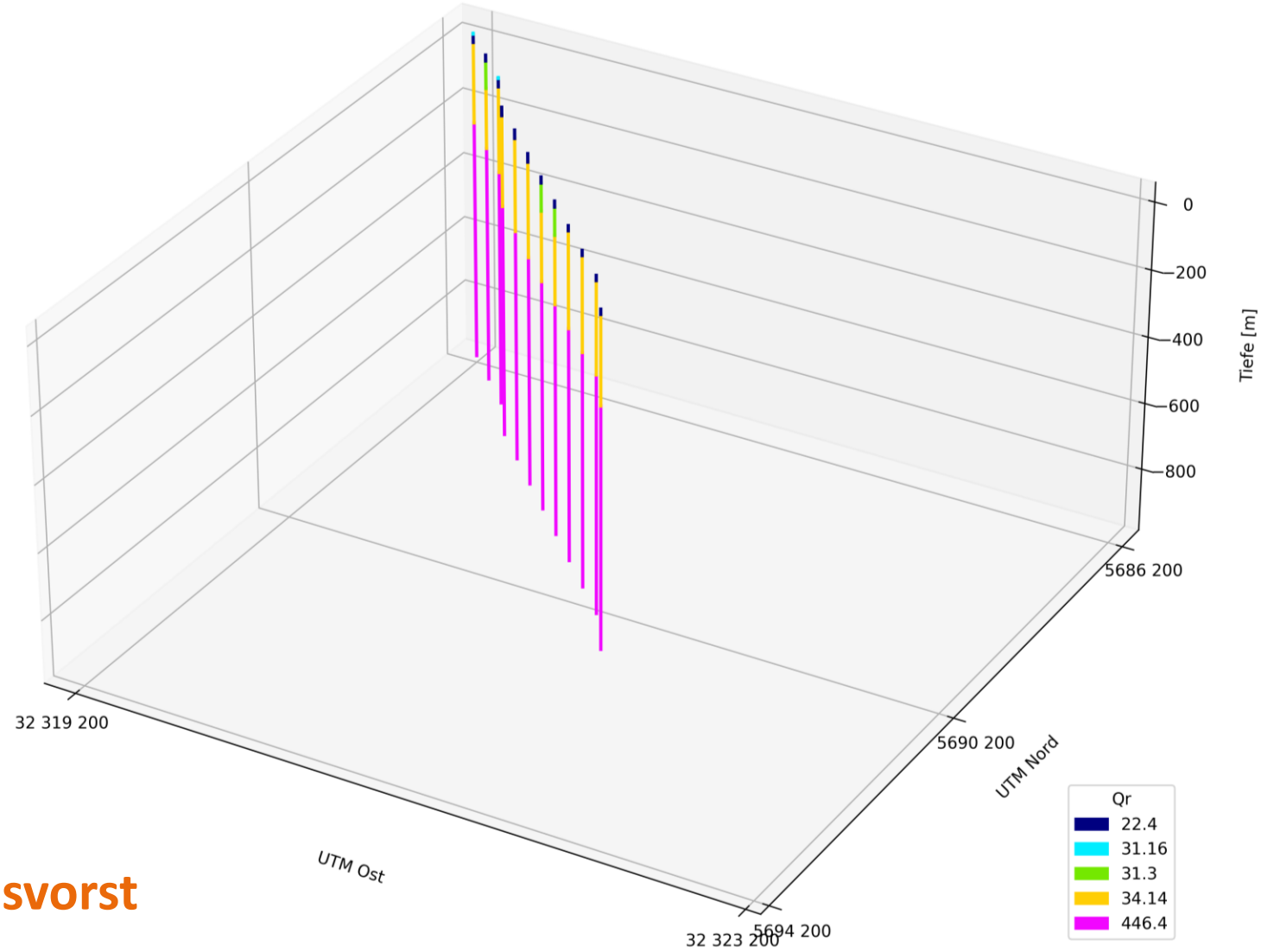


Havixbeck

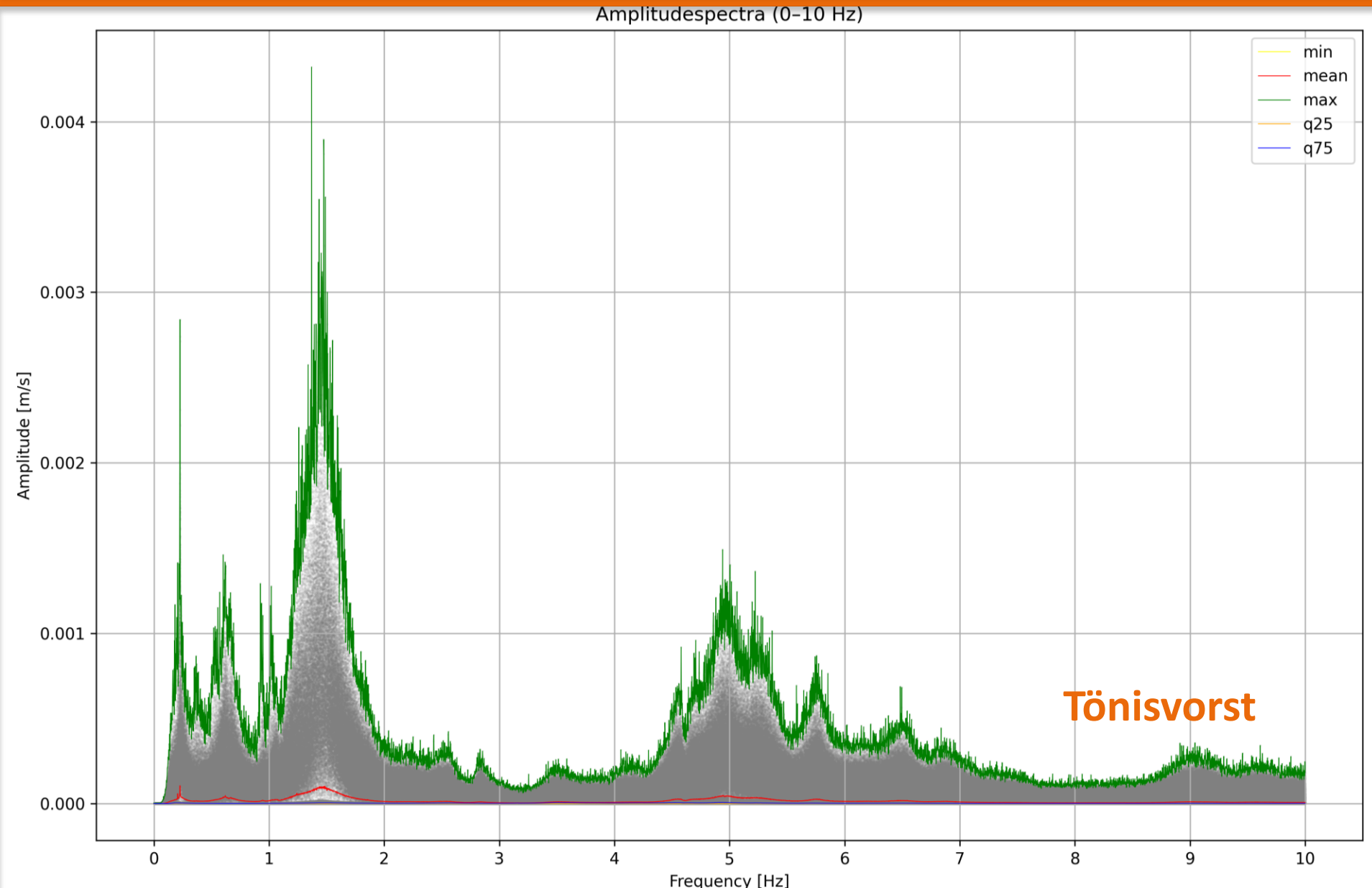
Qr = 40 – 49

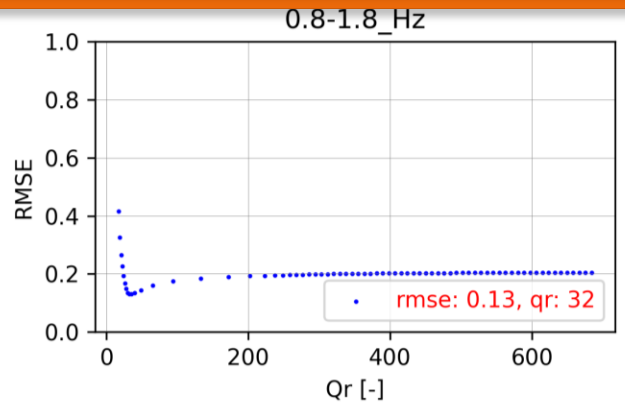

0
200
400
600
800
Tiefe [m]
5686 200
5690 200
UTM Nord
5694 200
32 319 200
UTM Ost
32 323 200
Lithologie
Schluff, Ton (L)
Schluff (L)
Sand, Kies (L)
Feinsand (L)
Tonstein, Schluffstein (F)

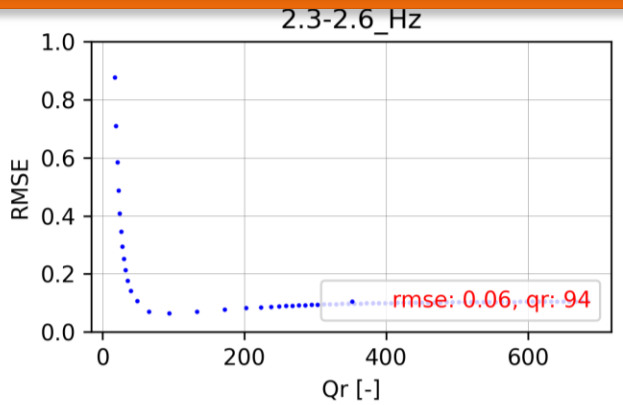
Tönisvorst

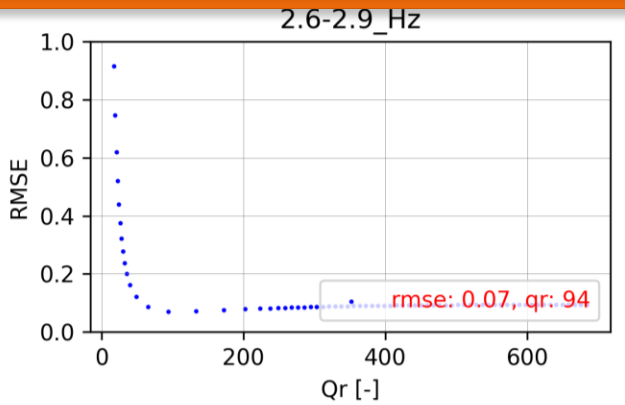

0
200
400
600
800
Tiefe [m]
5686 200
5690 200
5694 200
UTM Nord
32 319 200
32 323 200
UTM Ost
Qr
22.4
31.16
31.3
34.14
446.4

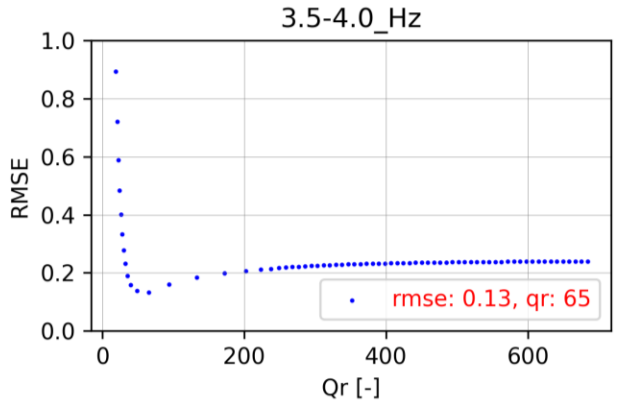
Tönisvorst

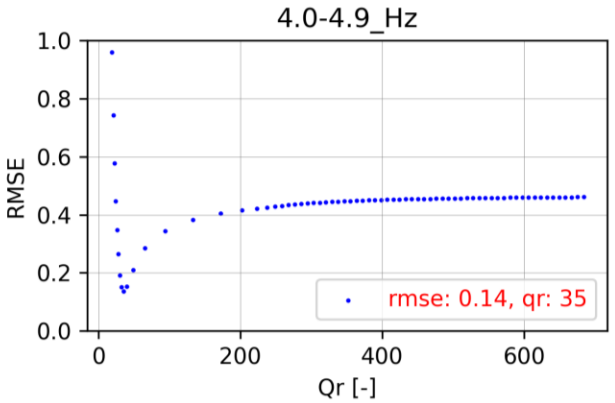

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.000
0.001
0.002
0.003
0.004
0
1
2
3
4
5
6
7
8
9
10
Frequency [Hz]
Tönisvorst

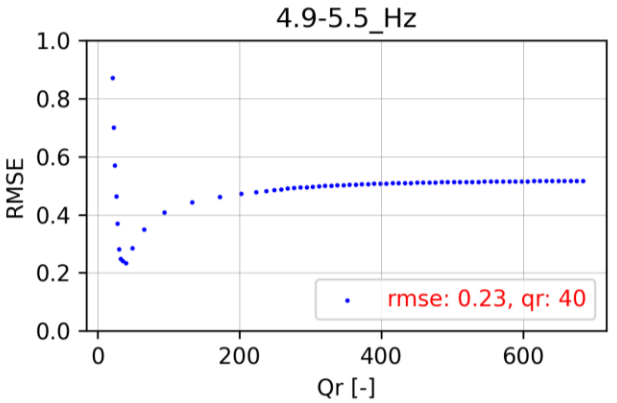


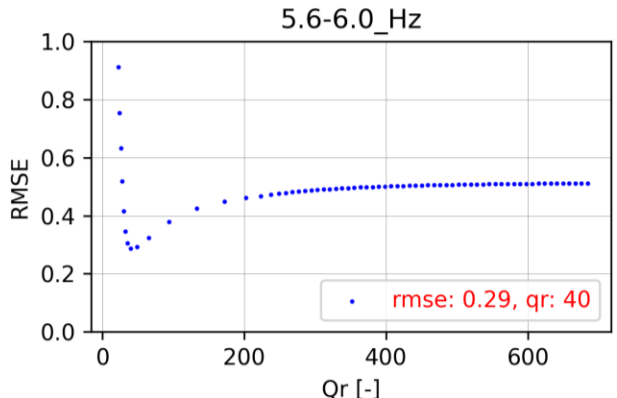


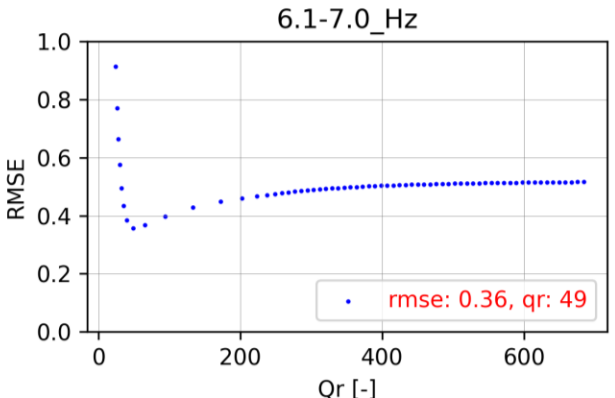






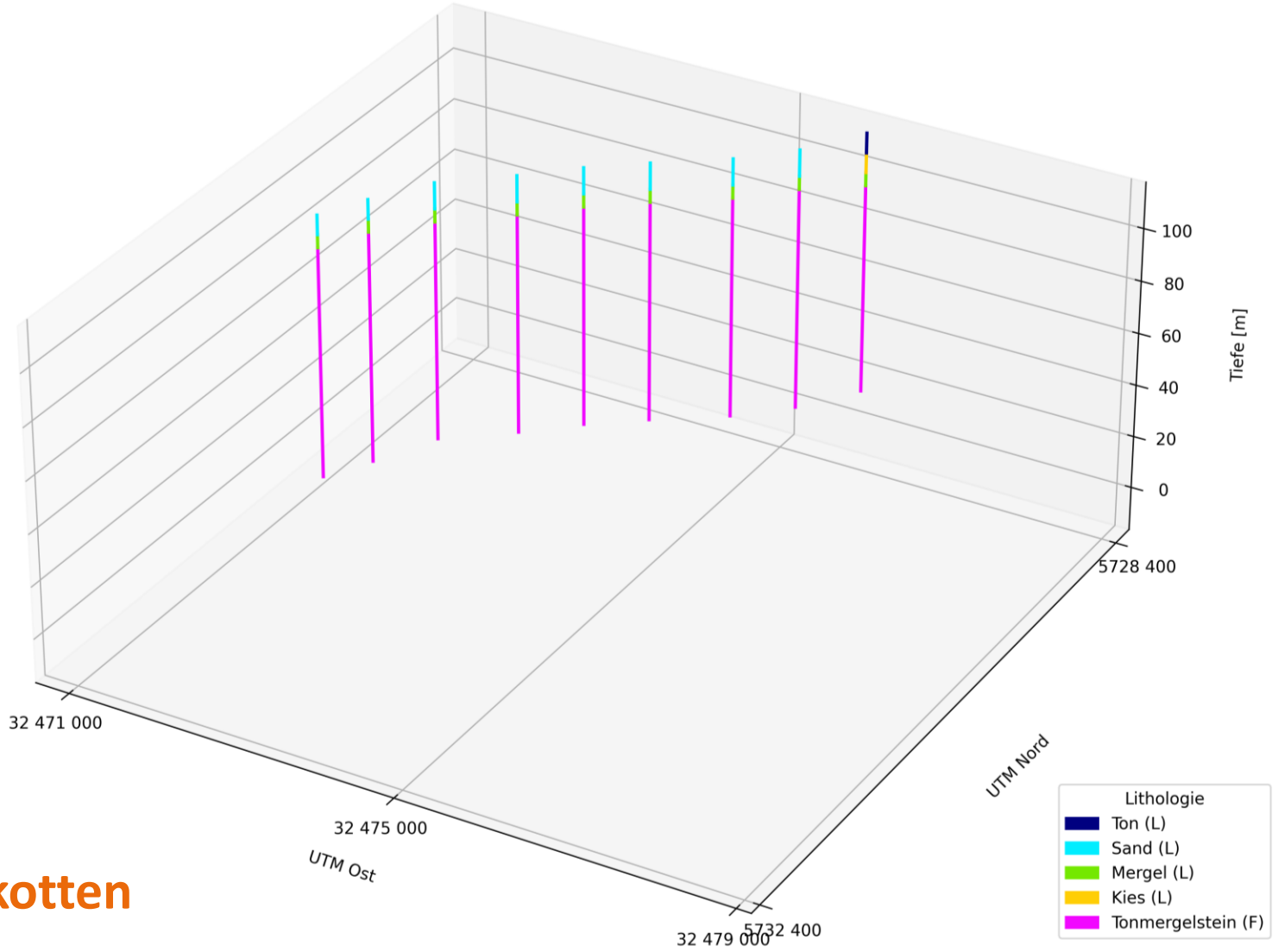




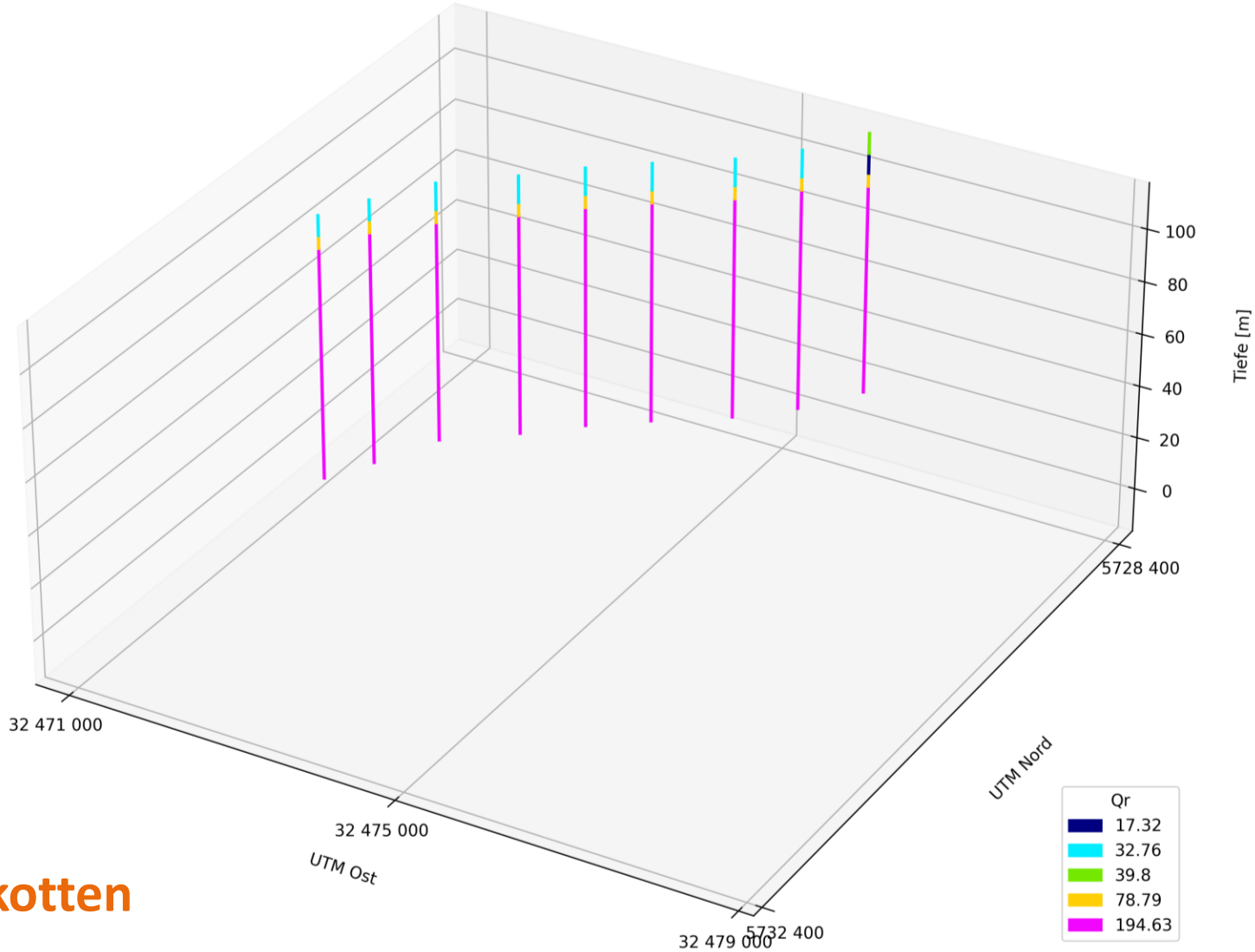


Tönisvorst

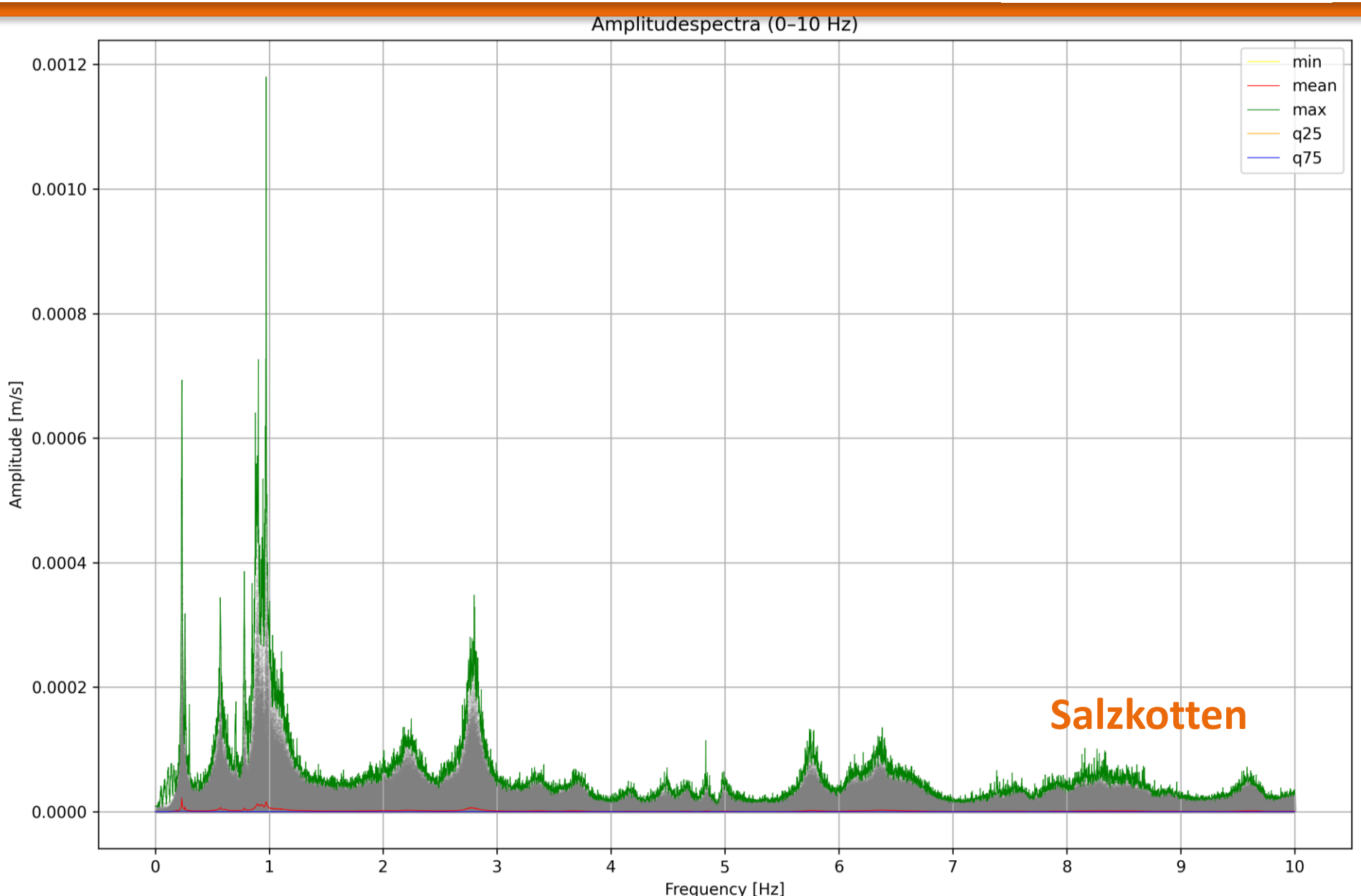
Qr = 32 - 94

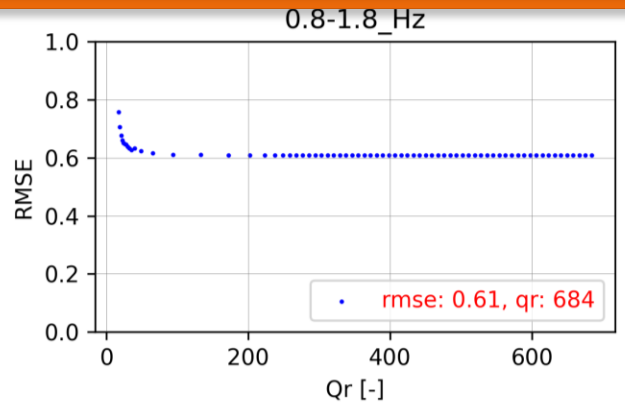

100
80
60
40
20
0
Tiefe [m]
5728 400
UTM Nord
32 471 000
32 475 000
32 479 000
UTM Ost
5732 400
Lithologie
Ton (L)
Sand (L)
Mergel (L)
Kies (L)
Tonmergelstein (F)

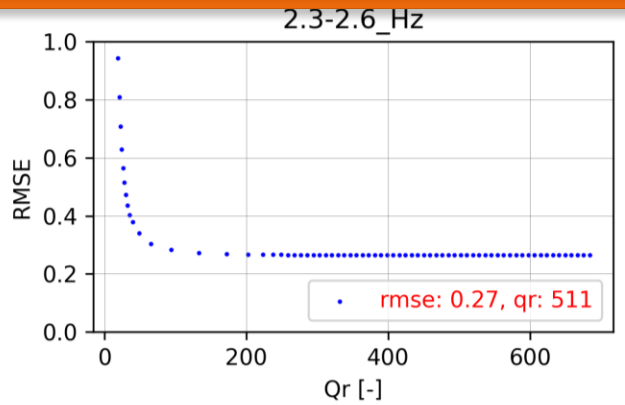
Salzkotten

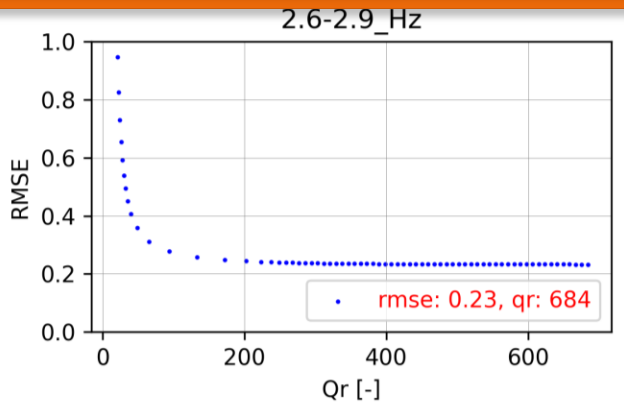

100
80
60
40
20
0
Tiefe [m]
5728 400
UTM Nord
32 471 000
32 475 000
32 479 000
UTM Ost
5732 400
Qr
17.32
32.76
39.8
78.79
194.63

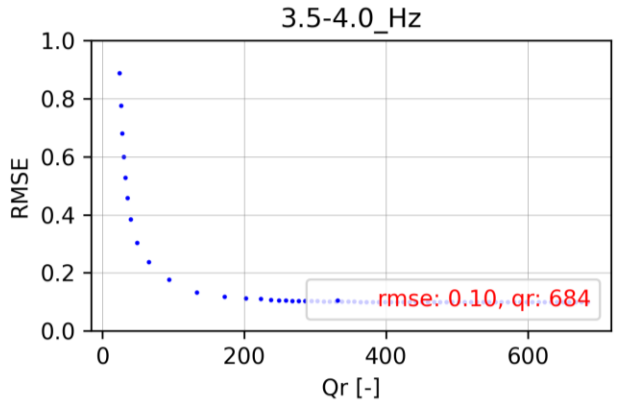
Salzkotten

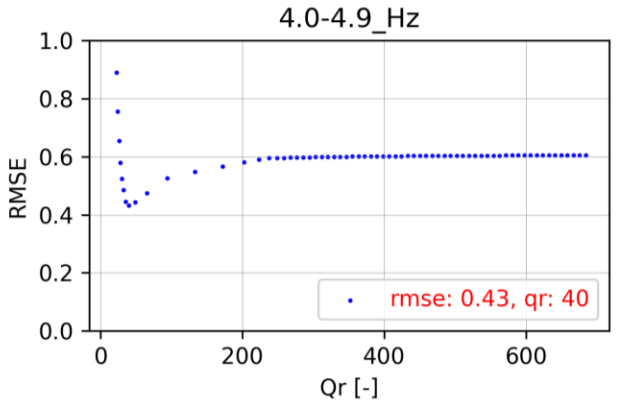

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
0
1
2
3
4
5
6
7
8
9
10
Frequency [Hz]
Salzkotten

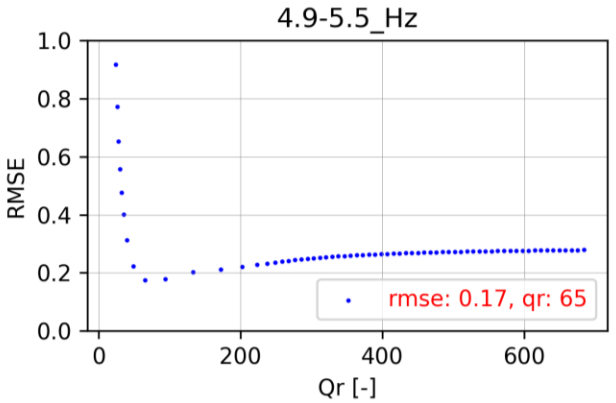


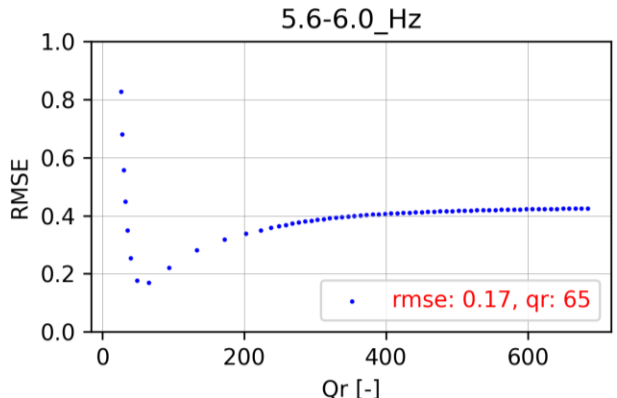


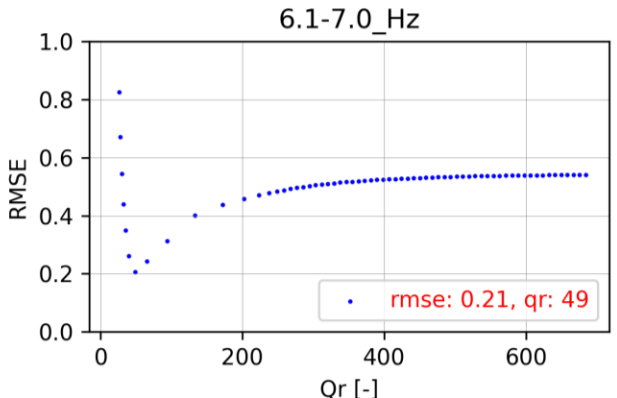




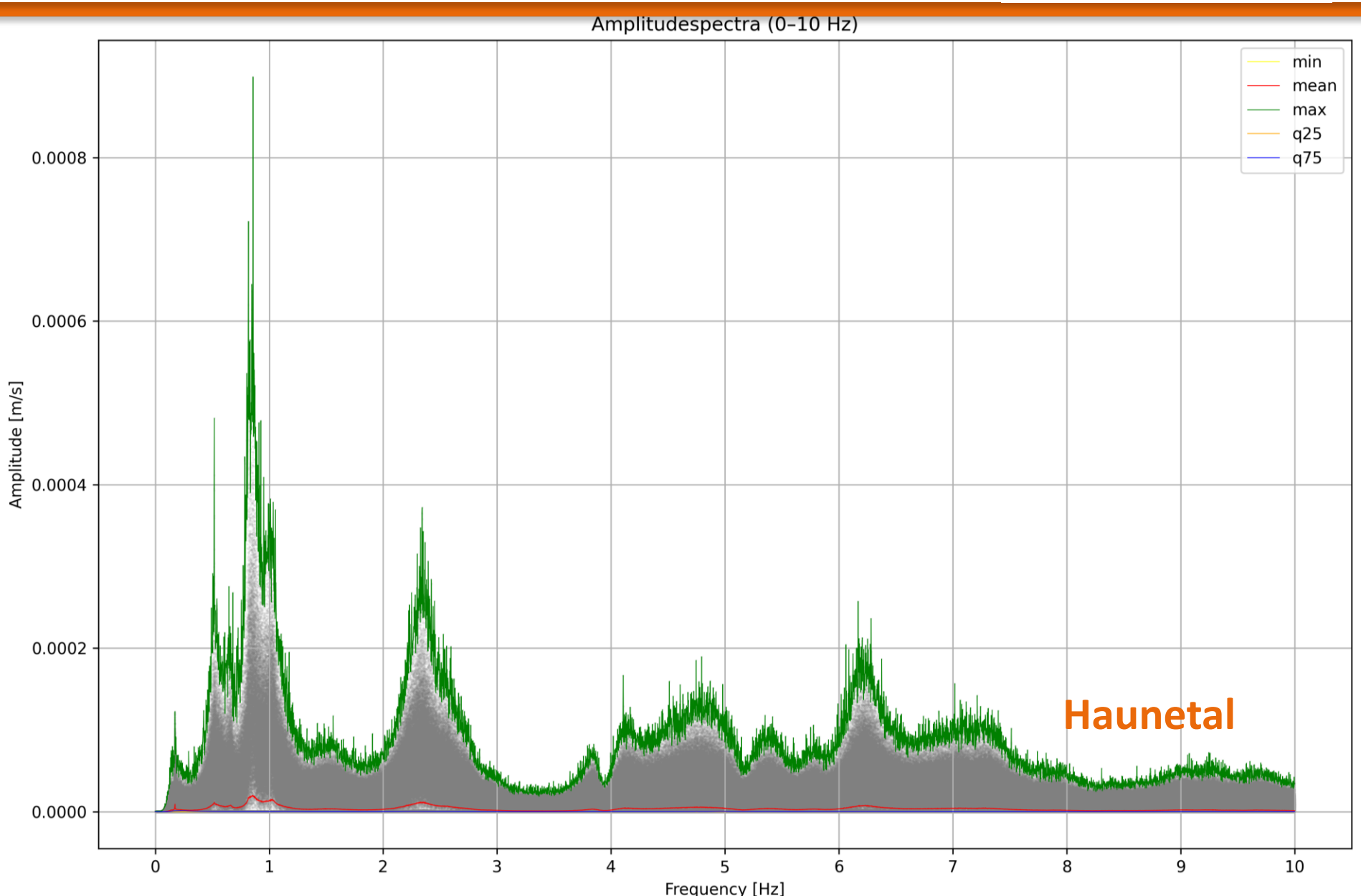


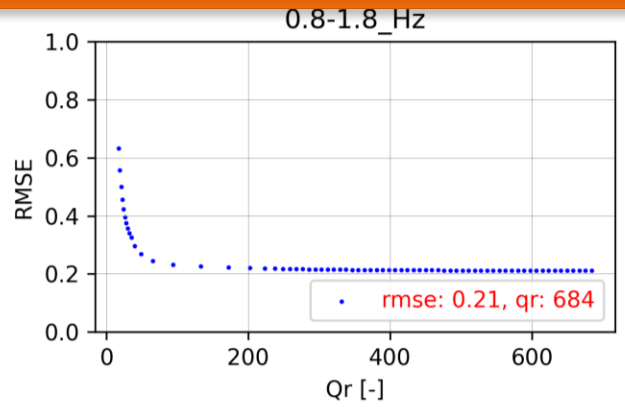


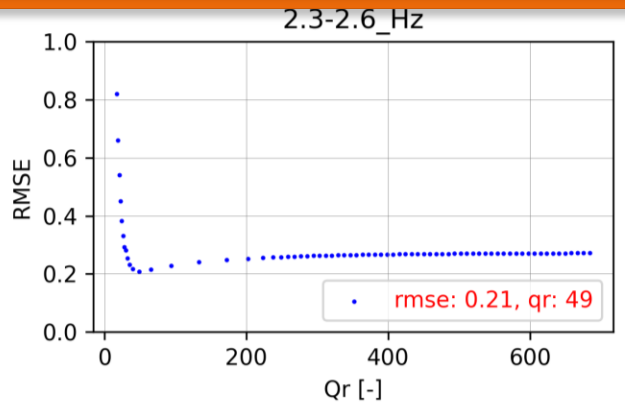


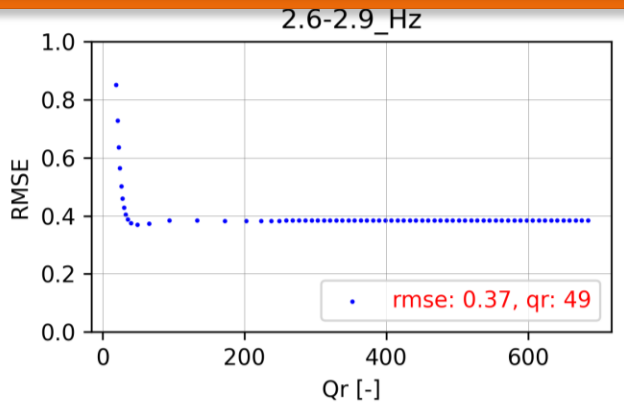


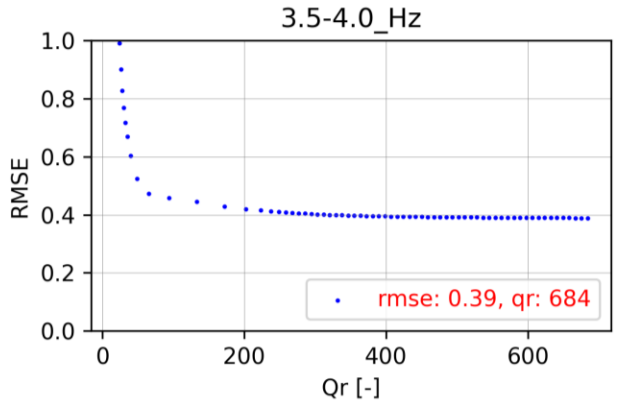
Salzkotten
Qr = 40 – 65

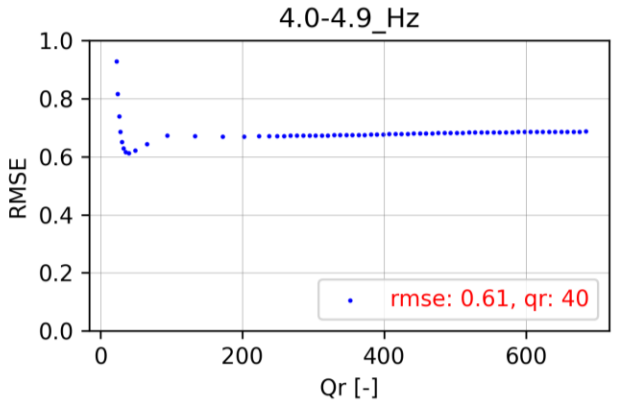

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.0000
0.0002
0.0004
0.0006
0.0008
0
1
2
3
4
5
6
7
8
9
10
Frequency [Hz]
Haunetal

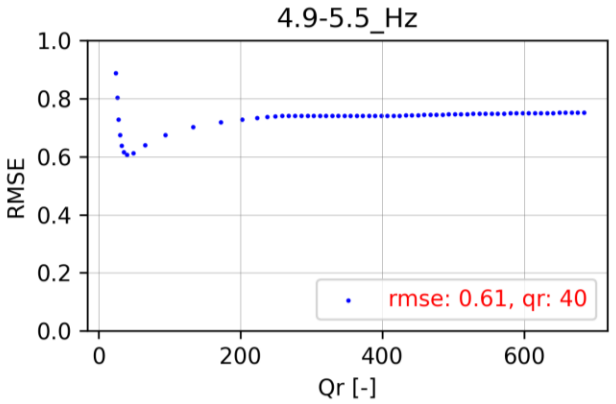


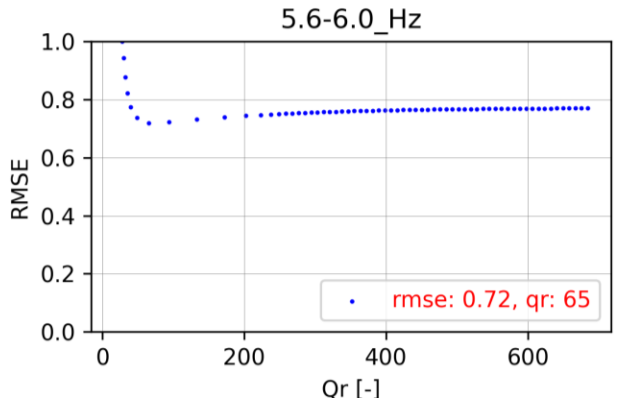


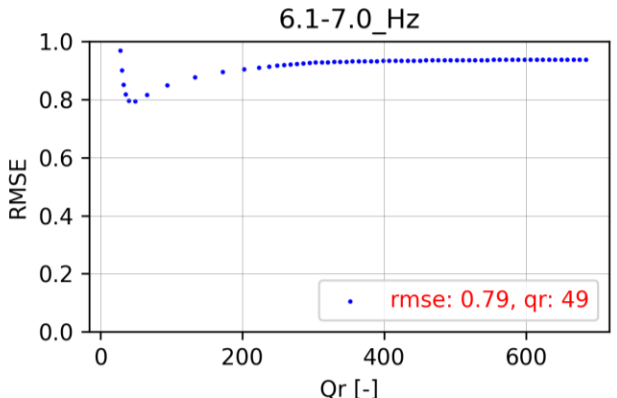






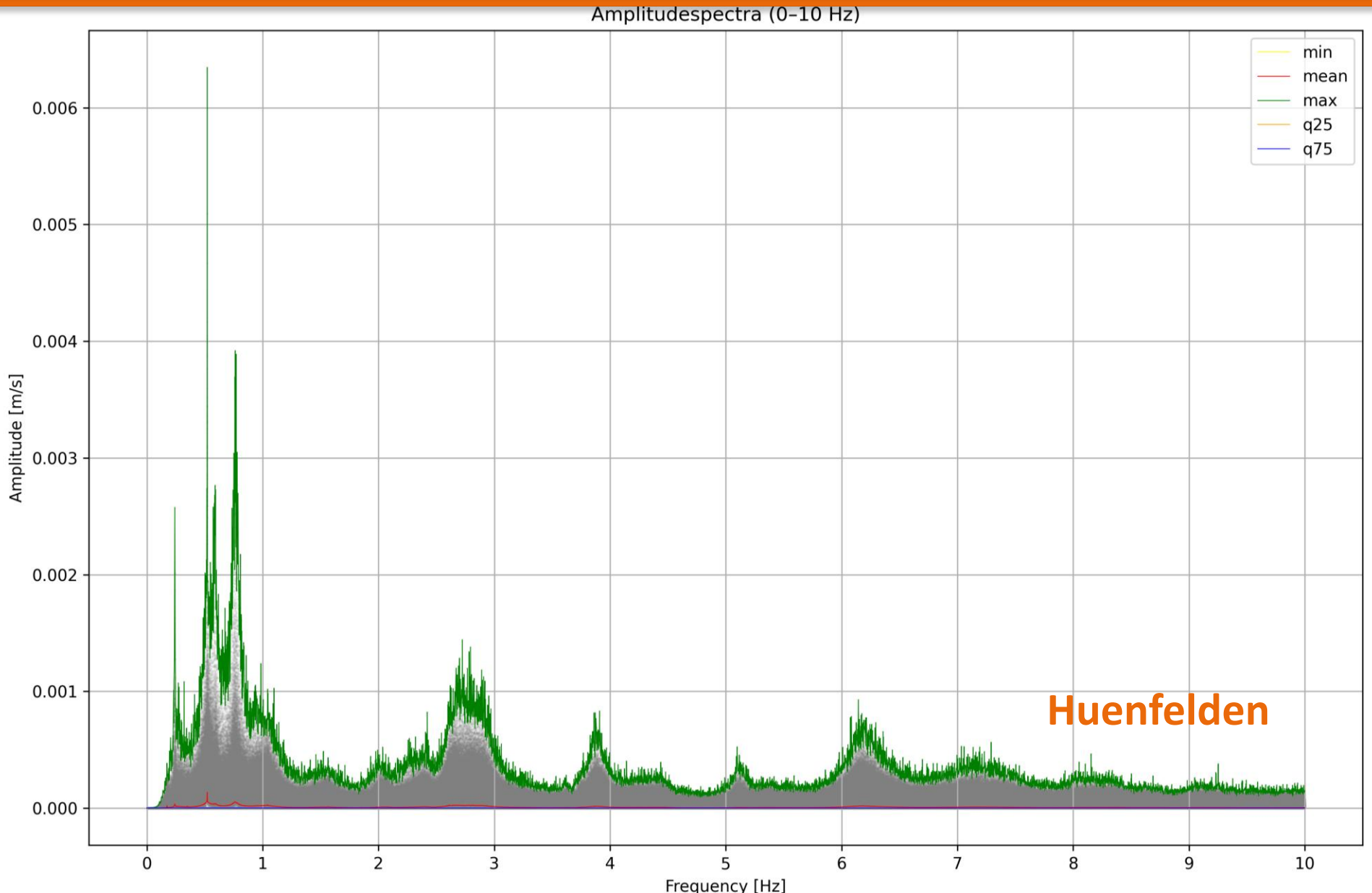


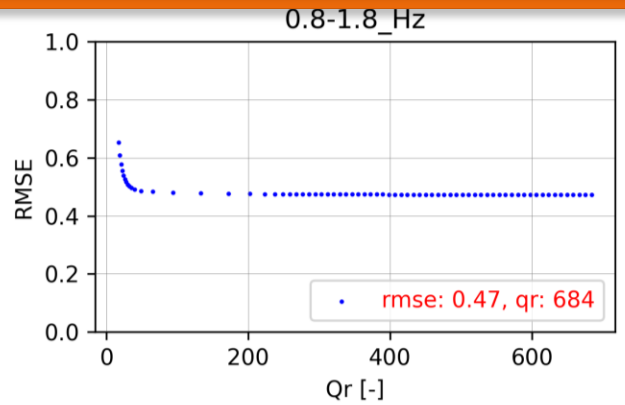


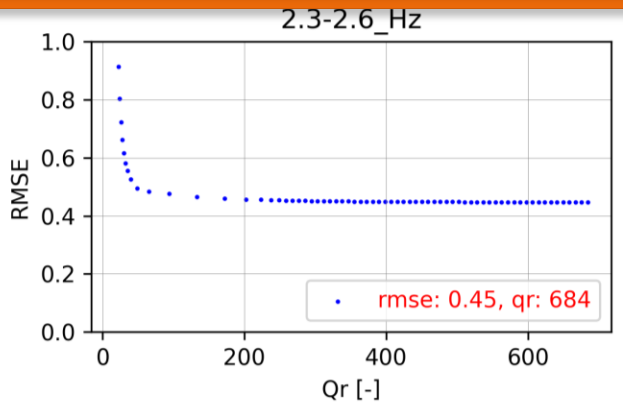


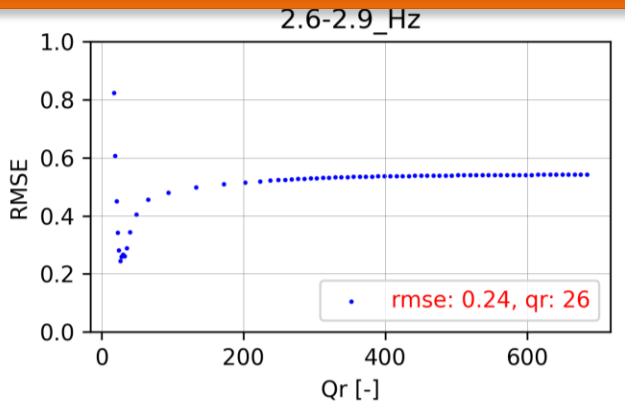
Haunetal

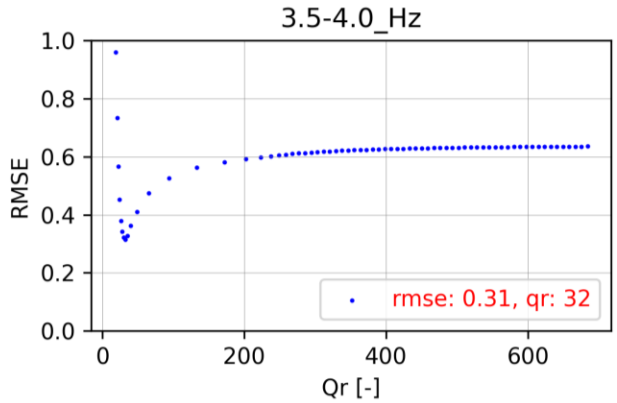
Qr = 49 – 65

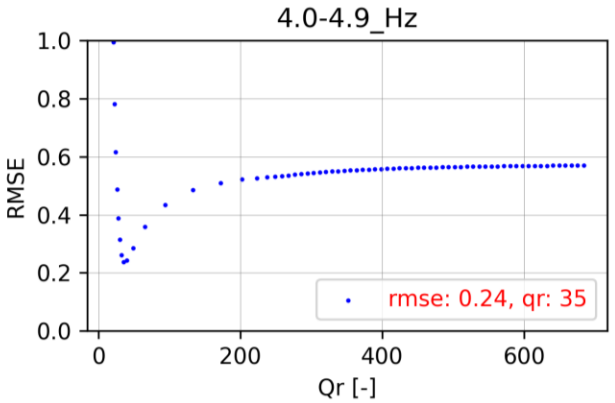

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.000
0.001
0.002
0.003
0.004
0.005
0.006
Frequency [Hz]
0
1
2
3
4
5
6
7
8
9
10
Huenfelden

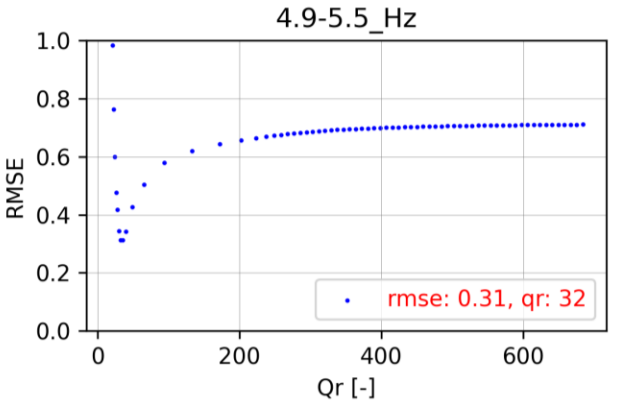


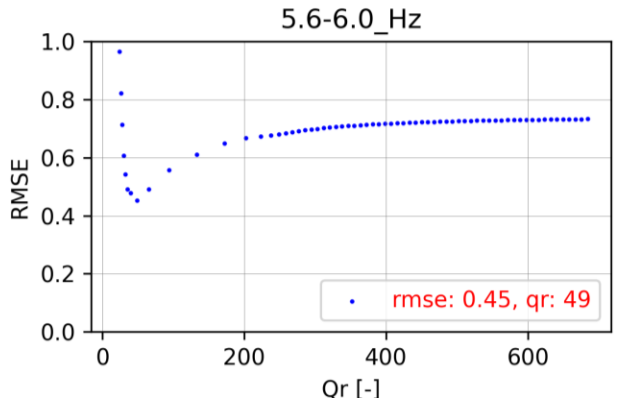


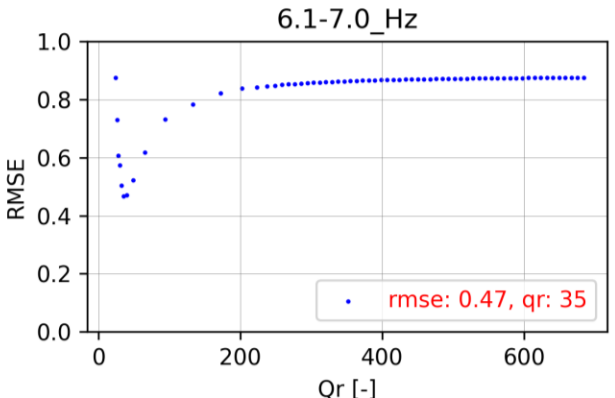




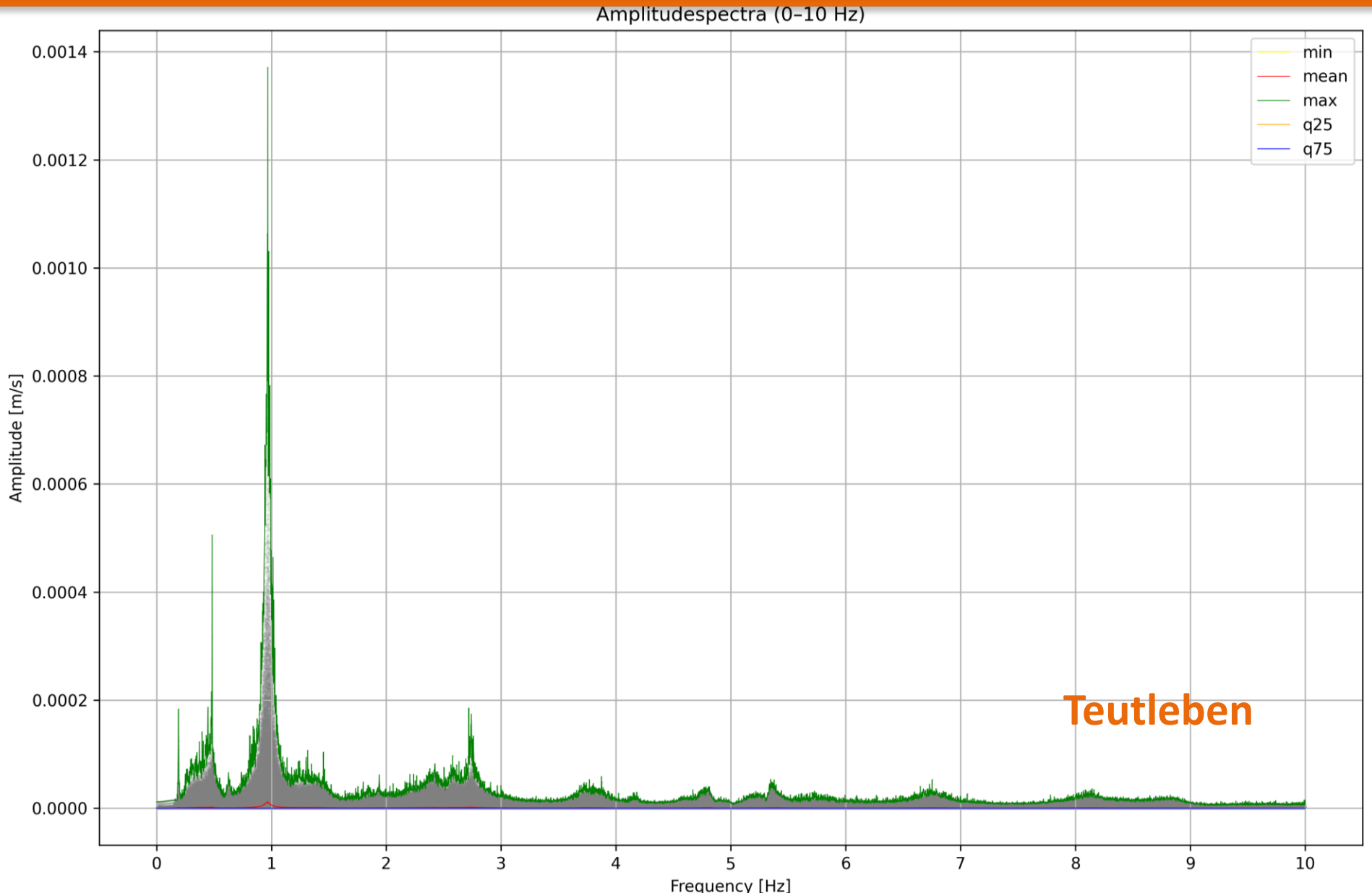


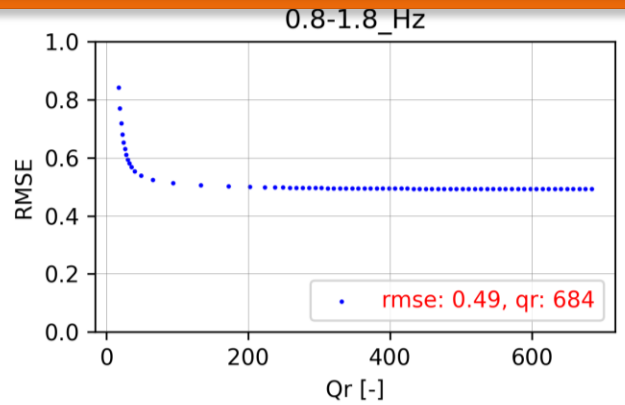


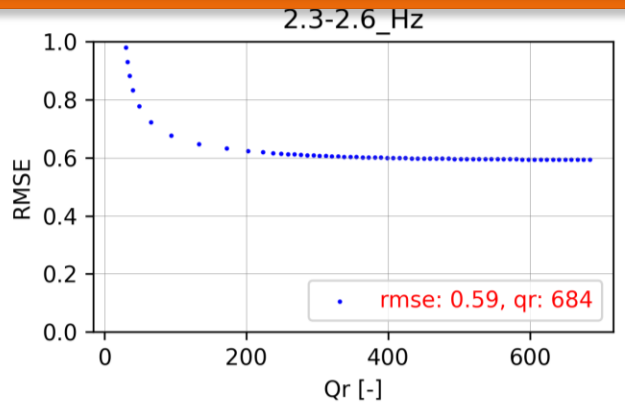


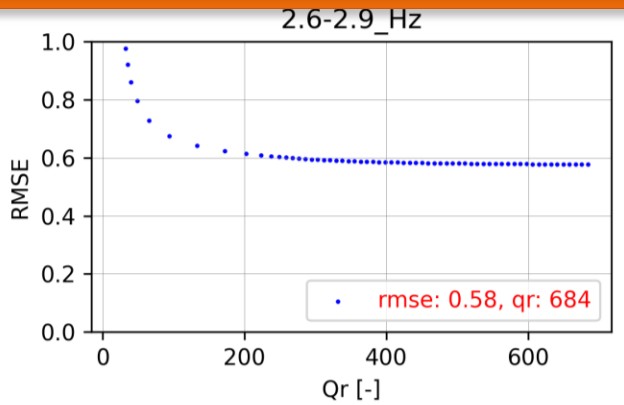


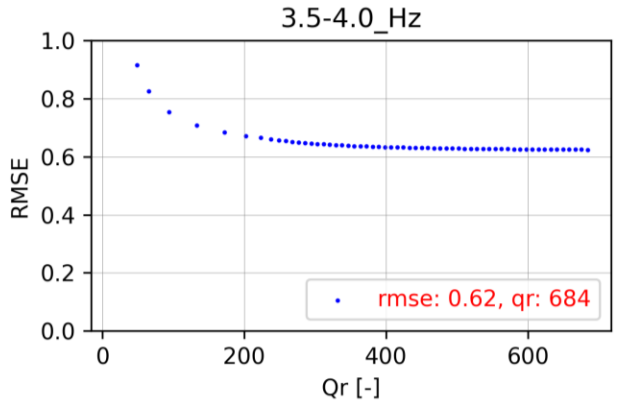
Huenfelden
Qr = 26 – 49

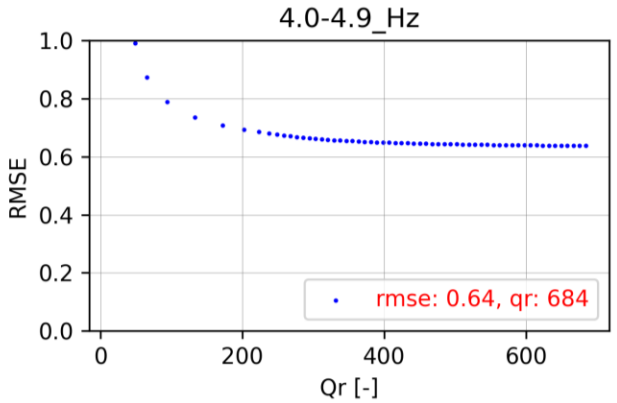

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
0
1
2
3
4
5
6
7
8
9
10
Frequency [Hz]
Teutleben

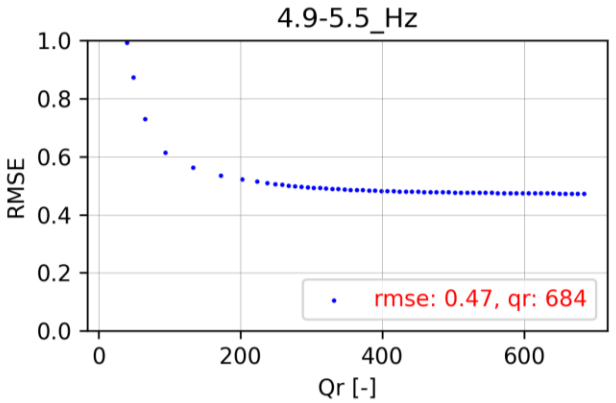


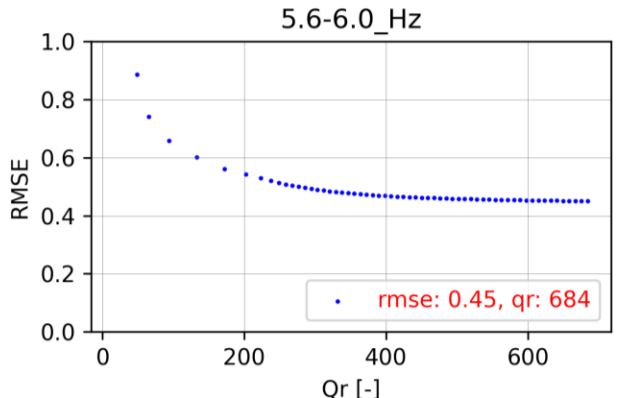


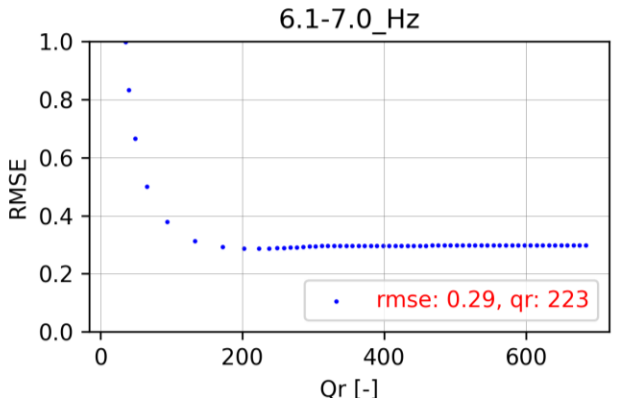










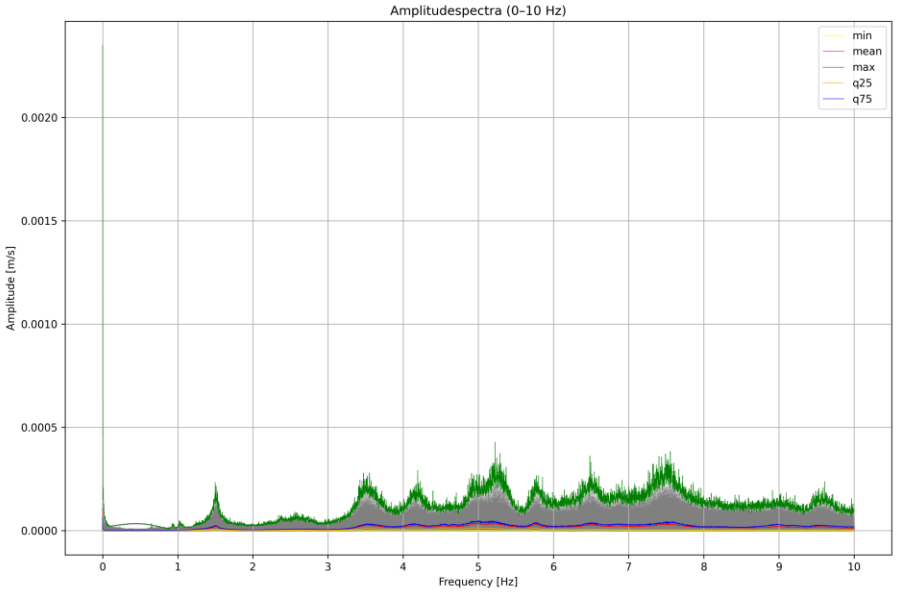


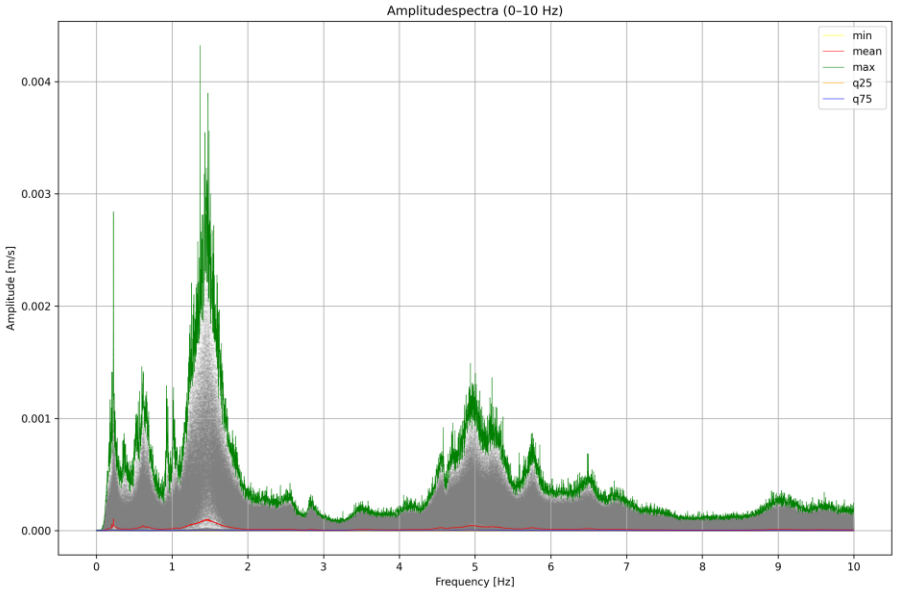
Teutleben
Qr = 223?

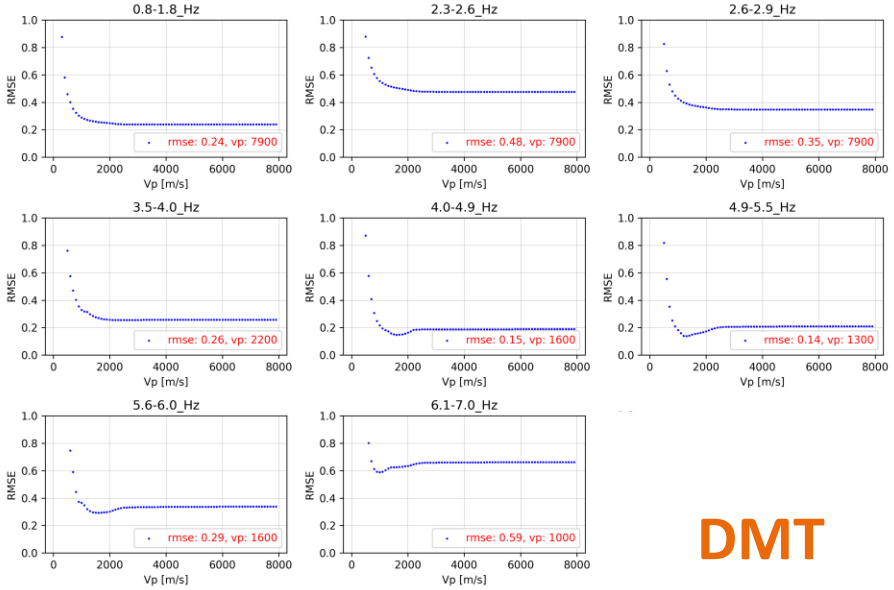
VORLÄUFIGE ERGEBNISSE FÜR QR

Standort	Qr aus Geschwindigkeitsmodell	Qr aus KIT – Messungen
Havixbeck	31 – 40 (L) 79 – 337 (F)	40 - 49
Tönisvorst	22 – 34 (L) 446 (F)	32 - 94
Salzkotten	17 – 79 (L) 195 (F)	40 - 65
Haunetal		49 - 65
Huenfelden		26 - 49
Teutleben		223 (?)

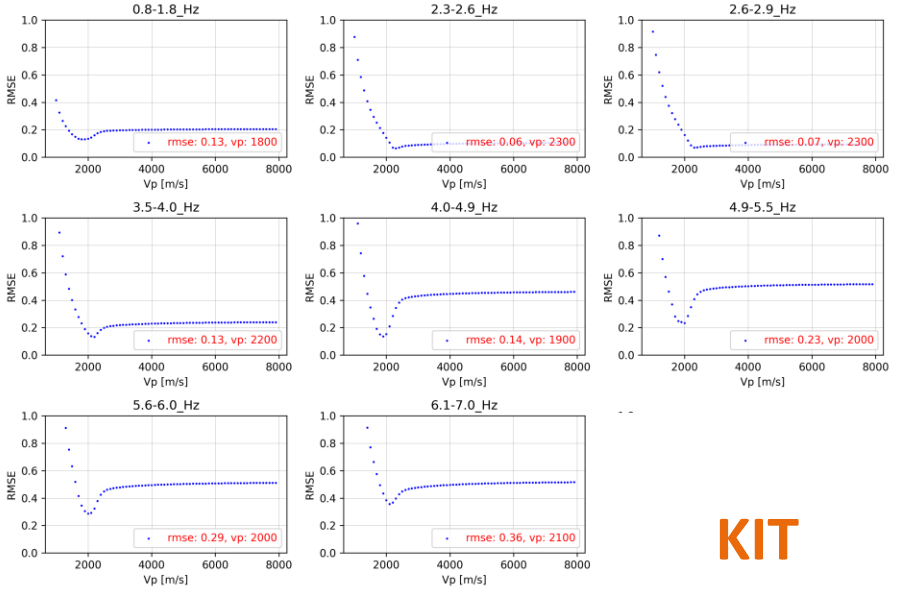
KIT / DMT MESSUNGEN BEI TÖNISVORT


Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
Frequency [Hz]

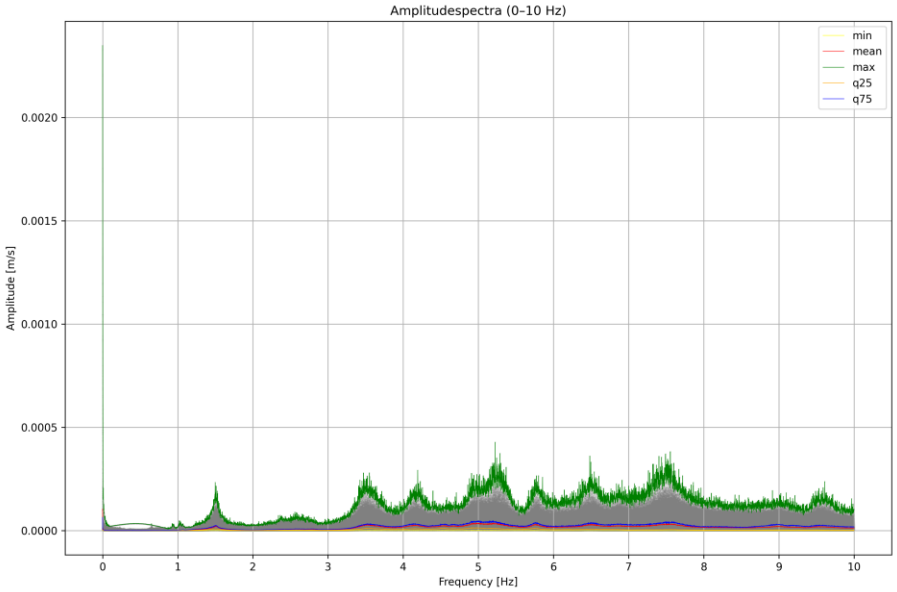

Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
Frequency [Hz]

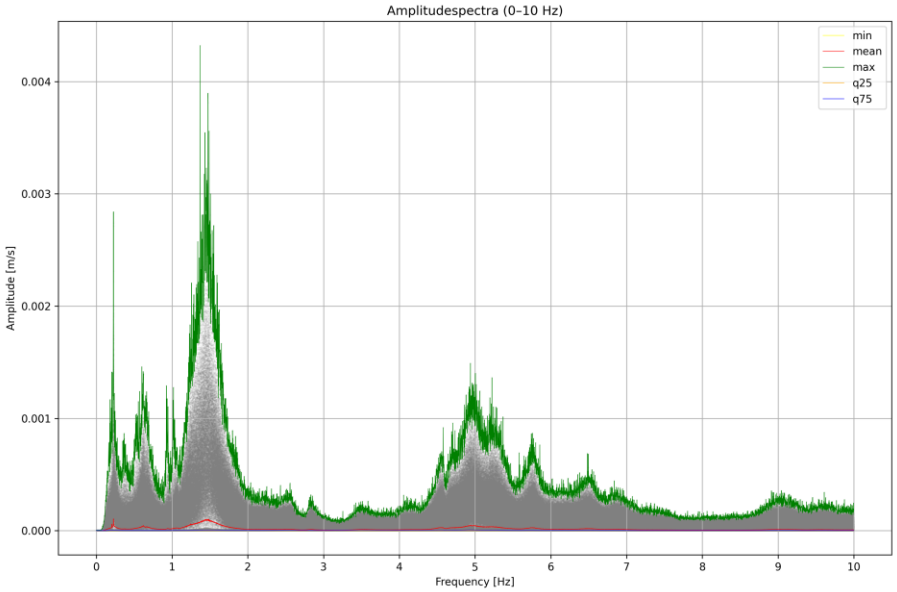

0.8-1.8_Hz
rmse: 0.24, vp: 7900
2.3-2.6_Hz
rmse: 0.48, vp: 7900
2.6-2.9_Hz
rmse: 0.35, vp: 7900
3.5-4.0_Hz
rmse: 0.26, vp: 2200
4.0-4.9_Hz
rmse: 0.15, vp: 1600
4.9-5.5_Hz
rmse: 0.14, vp: 1300
5.6-6.0_Hz
rmse: 0.29, vp: 1600
6.1-7.0_Hz
rmse: 0.59, vp: 1000
RMSE
Vp [m/s]

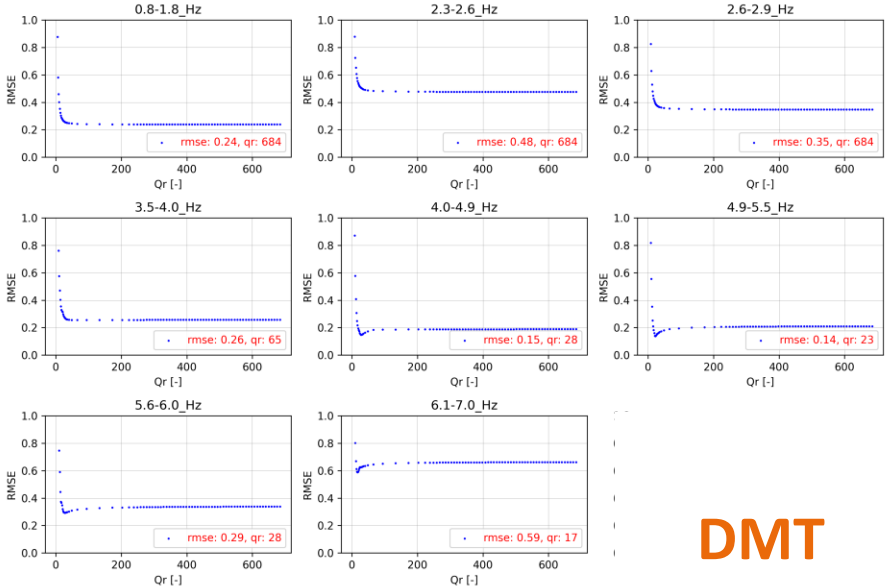
DMT


0.8-1.8_Hz
rmse: 0.13, vp: 1800
2.3-2.6_Hz
rmse: 0.06, vp: 2300
2.6-2.9_Hz
rmse: 0.07, vp: 2300
3.5-4.0_Hz
rmse: 0.13, vp: 2200
4.0-4.9_Hz
rmse: 0.14, vp: 1900
4.9-5.5_Hz
rmse: 0.23, vp: 2000
5.6-6.0_Hz
rmse: 0.29, vp: 2000
6.1-7.0_Hz
rmse: 0.36, vp: 2100
RMSE
Vp [m/s]

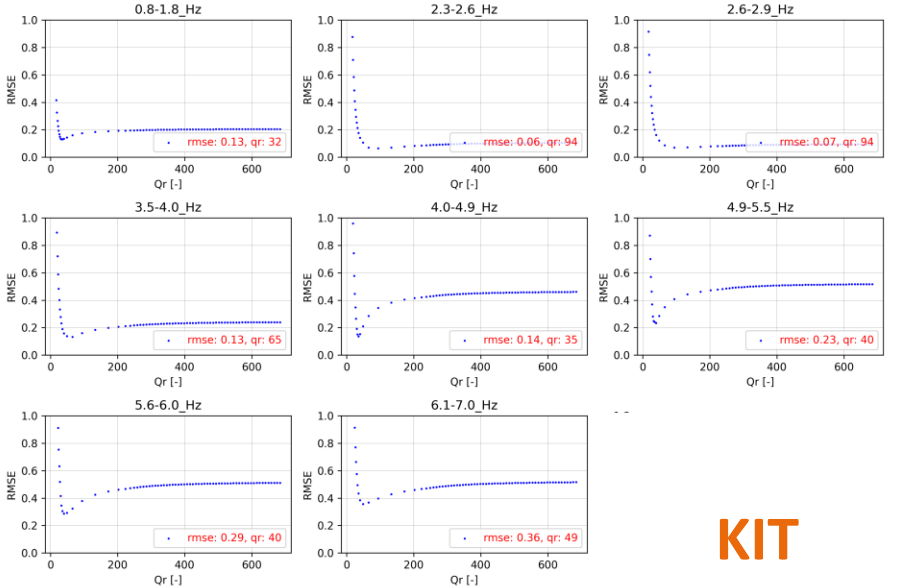
KIT


Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
Frequency [Hz]


Amplitudespectra (0–10 Hz)
min
mean
max
q25
q75
Amplitude [m/s]
Frequency [Hz]


0.8-1.8_Hz
rmse: 0.24, qr: 684
2.3-2.6_Hz
rmse: 0.48, qr: 684
2.6-2.9_Hz
rmse: 0.35, qr: 684
3.5-4.0_Hz
rmse: 0.26, qr: 65
4.0-4.9_Hz
rmse: 0.15, qr: 28
4.9-5.5_Hz
rmse: 0.14, qr: 23
5.6-6.0_Hz
rmse: 0.29, qr: 28
6.1-7.0_Hz
rmse: 0.59, qr: 17
RMSE
Qr [-]

DMT


0.8-1.8_Hz
rmse: 0.13, qr: 32
2.3-2.6_Hz
rmse: 0.06, qr: 94
2.6-2.9_Hz
rmse: 0.07, qr: 94
3.5-4.0_Hz
rmse: 0.13, qr: 65
4.0-4.9_Hz
rmse: 0.14, qr: 35
4.9-5.5_Hz
rmse: 0.23, qr: 40
5.6-6.0_Hz
rmse: 0.29, qr: 40
6.1-7.0_Hz
rmse: 0.36, qr: 49
RMSE
Qr [-]

KIT

VIELEN DANK FÜR DIE AUFMERKSAMKEIT!