CREWES 31st Annual Meeting Welcome and Introduction

CREWES Annual Sponsor's Meeting

Dec 10 2019

Banff AB CA

- Optimal to check out tomorrow prior to session; store luggage
- All content is online – use your hotel provided wifi

Slides

Passwords
Research Reports
Conf. Abstracts
Friday Talks
CREWES Software
CREWES News
Overview Slides
Talks & Courses
Sponsors Meeting
Sponsors Meeting Talks
Sponsors Meeting Posters
Sponsor Feedback

Slide Shows for 2019

Talk	Author(s)	Title	Availability
0	Kris Innanen	Welcome and overview of CREWES developments	Document
1	Don Lawton	VSP surveys at the CaMI Field Research Station	Document
2	Kevin Hall	Geophone calibration of the multicomponent DAS loop	Document
3	Matthew Eaid	DAS modelling for hydraulic fracture & caprock monitoring	Document
4	Heather Hardeman-Vooys	DAS event detection using mixture modeling and ICA	Document
5	Jorge Monsegny	Reverse-time migration of VSP data	Document
6	Marie Macquet	Exploring ambient noise at the CaMI FRS	Document
7	Joe Wong and Dave Henley	SWD and more: physical modelling update	Document
8	Scott Keating	Subtracting internal multiples in the generator domain	Document
9	Shang Huang	Migration with surface and internal multiples	Document
10	Ron Weir	De-risking the Duvernay: reflection and microseismic data	Document
11	Luping Qu	Transdimensional surface wave inversion of DAS data	Document
12	Raul Cova	Full waveform inversion of surface wave data	Document
13	Bernie Law	Reflection tomography	Document
14	Daniel Trad	Madagascar package for modeling, migration & deblending	Document
15	Kai Zhuang	Deblending with Radon operators I: the CMP domain	Document
16	Amr Ibrahim	Deblending with Radon operators II: Stolt-based operators	Document
17	Shahpoor Moradi	Quantum computing in seismic: from concept to algorithm	Document
18	Brian Russell	A numerical comparison of seismic inversion, multilayer and basis function neural networks	Document
19	Xin Fu	Double wavelet / double difference time-lapse FWI	Document
20	Da Li	FWI with the Sinkhorn approximation for optimal tran	Document
21	Qi Hu	Direct EFWI updating of rock physics properties	Document
22	Matthew Eaid	Constructing meaningful FWI gradients from DAS data	Document
23	Scott Keating	How to QC FWI: uncertainty analysis with null-space	Document
24	Marcelo Guarido	A CREWES Data Science / Machine Learning initiative	Document
25	Tianze Zhang	Viscoelastic FWI within a theory-guided RNN	Document
26	Hongliang Zhang	Interpolation through machine learning	Document
27	Zhan Niu	Deblending using residual neural networks	Document

CREWES in 2019

6 Research Staff - 8 Postdoctoral Fellows - 3 Directors - 7 Collaborators & Investigators & 24 Graduate students

We do the basic and applied science behind the creation and extension of new seismic technology

Our sponsors

CREWES

NSERC CRSNG

CANADA FIRST RESEARCH EXCELLENCE FUND

CMC RESEARCH INSTITUTES

Acceleware
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Chevron Corporation
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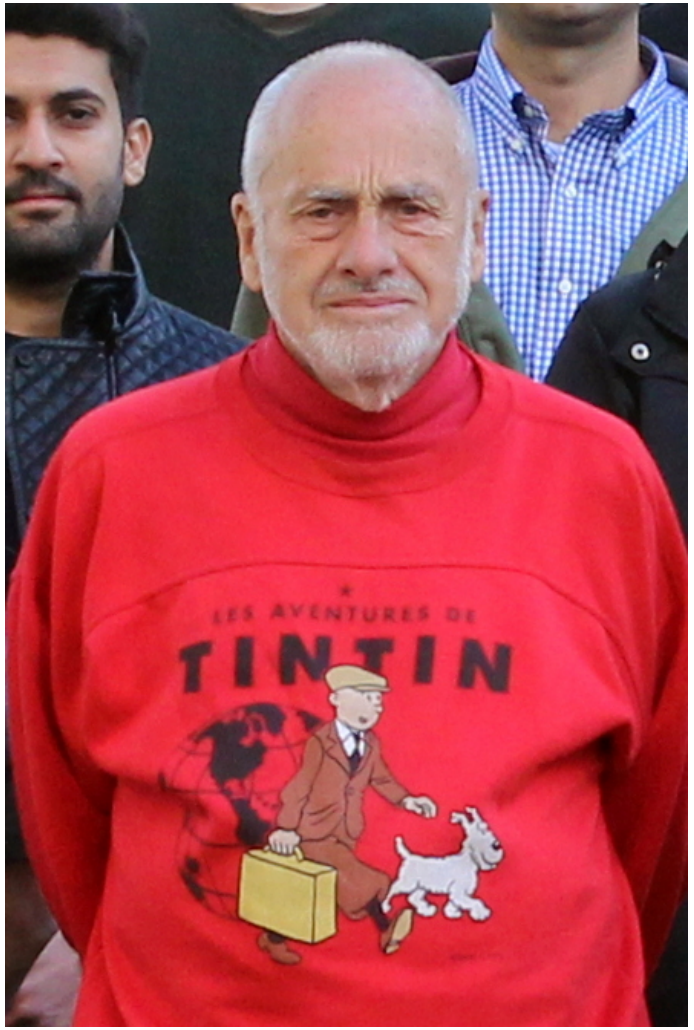
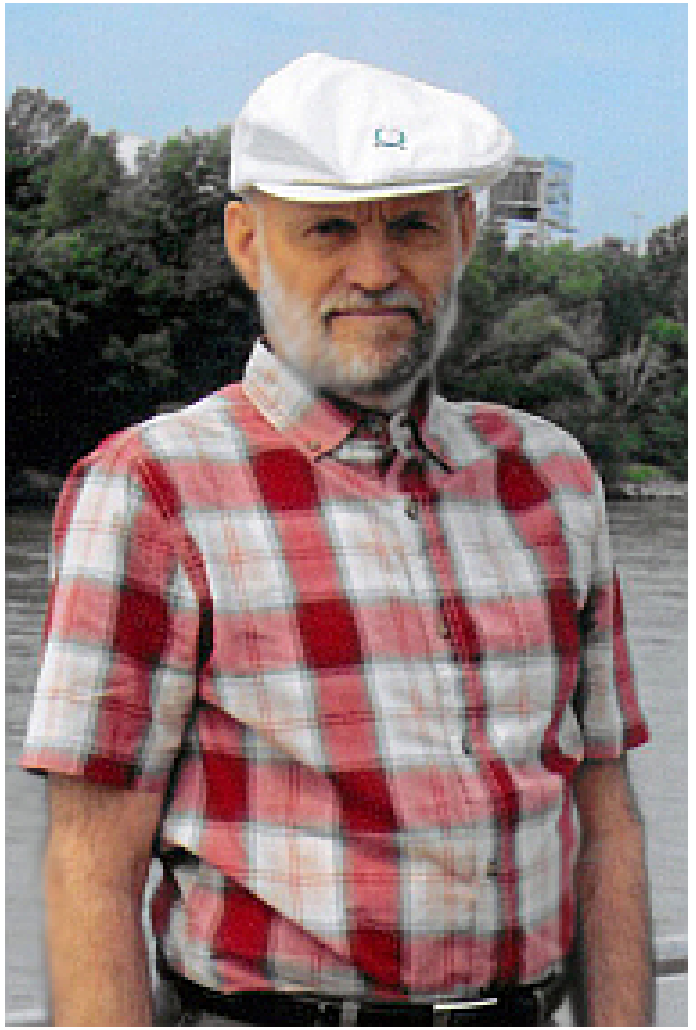
Repsol Oil and Gas
RIPED, Petrochina
SINOPEC
TGS

Claude Ribordy & Arnim Haase





Larry Lines

CREWES 2019 Annual Meeting Technical Program

Sun Dec 08

8:30am-3:00pm Short Course: Ideas, algorithms and applications of Machine Learning in geophysics

Tue Dec 10

Time	Session	Talk Title	Speaker
08:00	**ACQ / DAS**	Welcome	K. Innanen
08:20		VSP surveys at the CaMI Field Research Station	D. Lawton
08:40		Geophone calibration of the multicomponent DAS loop	K. Hall
09:00		DAS modeling: hydraulic fracturing & caprock monitoring	M. Eaid
09:20		DAS event detection using mixture modeling and ICA	H. Hardeman
09:40		Reverse-time migration of VSP data	J. Monsegny
10:00		***COFFEE***	
10:40	**PROC / MON**	Exploring ambient noise at the CaMI-FRS	M. Macquet
11:00		Seismic physical modelling update	Wong/Henley
11:20		Subtracting internal multiples in the generator domain	S. Keating
11:40		Migration with surface and internal multiples	S. Huang
12:00		***LUNCH***	
01:30	**INV / FWI**	De-risking the Duvernay with reflection and MS data	R. Weir
01:50		Transdimensional surface wave inversion of DAS data	L. Qu
02:10		Full waveform inversion of surface wave data	R. Cova
02:30		Reflection tomography	B. Law
02:50		***BREAK***	
03:10	**GC**	Madagascar package: modelling, migration & deblending	D. Trad
03:30		Deblending with Radon operators I: the CMP domain	K. Zhuang
03:50		Deblending with Radon operators II: Stolt-based	A. Ibrahim
04:10		Quantum computing in seismic: from concept to algorithm	S. Moradi

4:30pm -6:00pm **POSTERS**

Wed Dec 11

Time	Session	Talk Title	Speaker
08:00	**RsFWI**	Double wavelet/double difference time-lapse FWI	X. Fu
08:20		FWI with the Sinkhorn approximation for optimal transport	D. Li
08:40		Direct elastic FWI updating of rock physics properties	Q. Hu
09:00		Constructing meaningful FWI gradients from DAS data	M. Eaid
09:20		QC'ing FWI: uncertainty analysis with null-space shuttles	S. Keating
09:40		***COFFEE***	
10:10	**ML**	A CREWES Data science/machine learning initiative	M. Guarido
10:30		Viscoelastic FWI within a theory-guided RNN	T. Zhang
10:50		Interpolation through machine learning	H. Zhang
11:10		Deblending using residual neural networks	Z. Niu
11:30		***WRAP-UP & LUNCH***	

ACQ / DAS – Acquisition & DAS sensing
PROC / MON – Processing & monitoring
INV / FWI – Inversion and FWI
RsFWI – Seismic FWIin the reservoir
ML – Machine learning & data science
GC - Geocomputation

Don Lawton

Your support is critical!

Training (new academic and industry)

New seismic data-sets acquired for purpose

Creating and validating the next generation of technology

Increasing the value and the profile of geophysics

Detection of transient time-lapse seismic signatures associated with CO_2 injection

Kris Innanen, Don Lawton, Kevin Hall, Kevin Bertram and Malcolm Bertram

CREWES CaMI CMC / Somayeh Goodarzi

Motivation

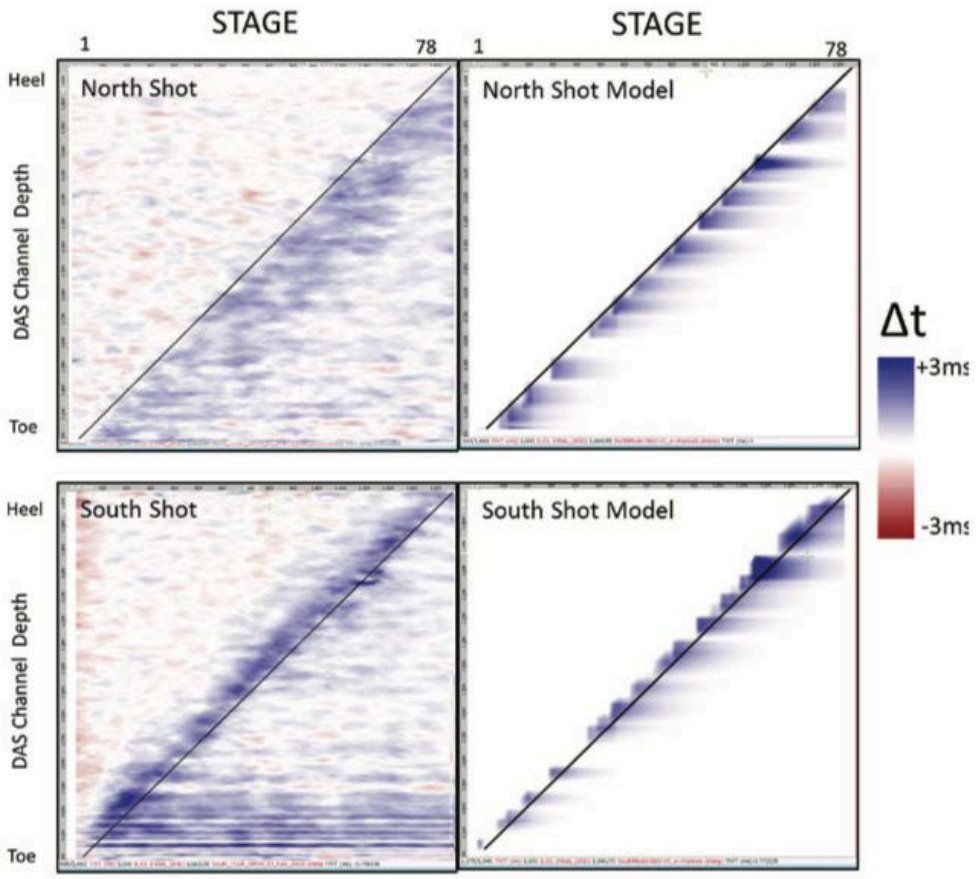
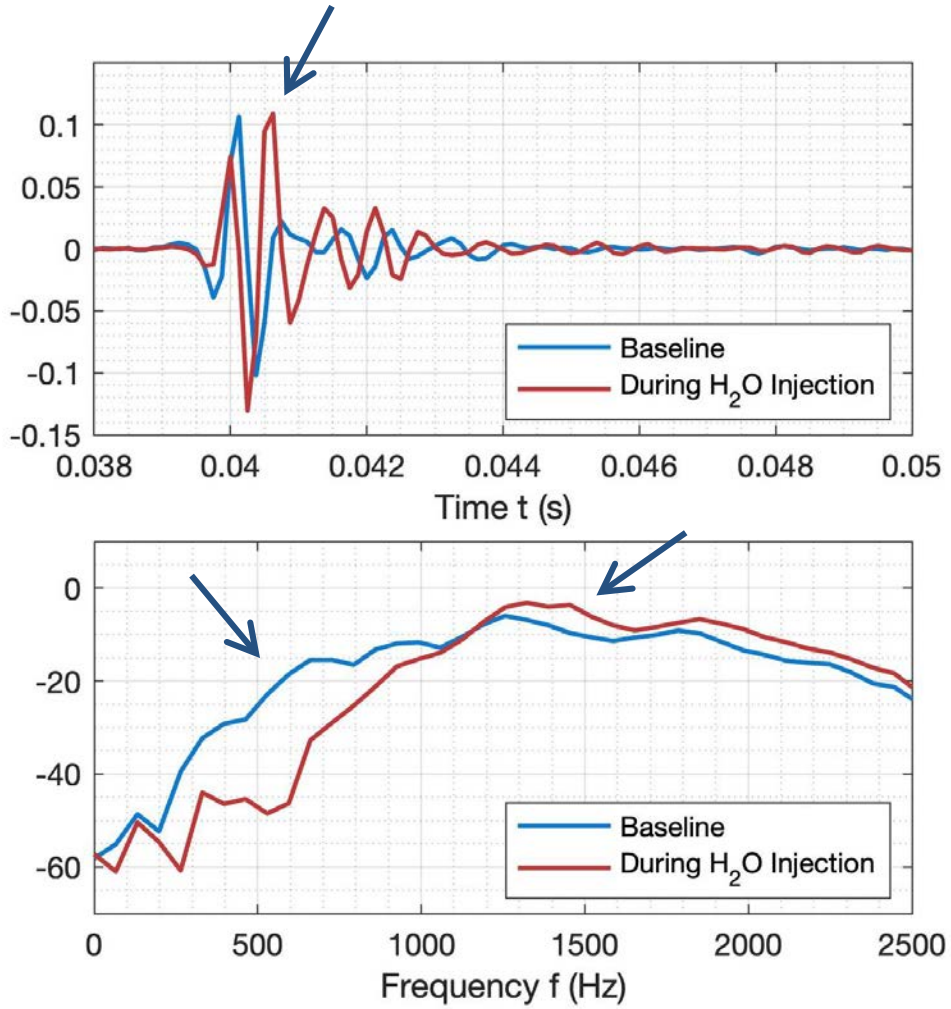


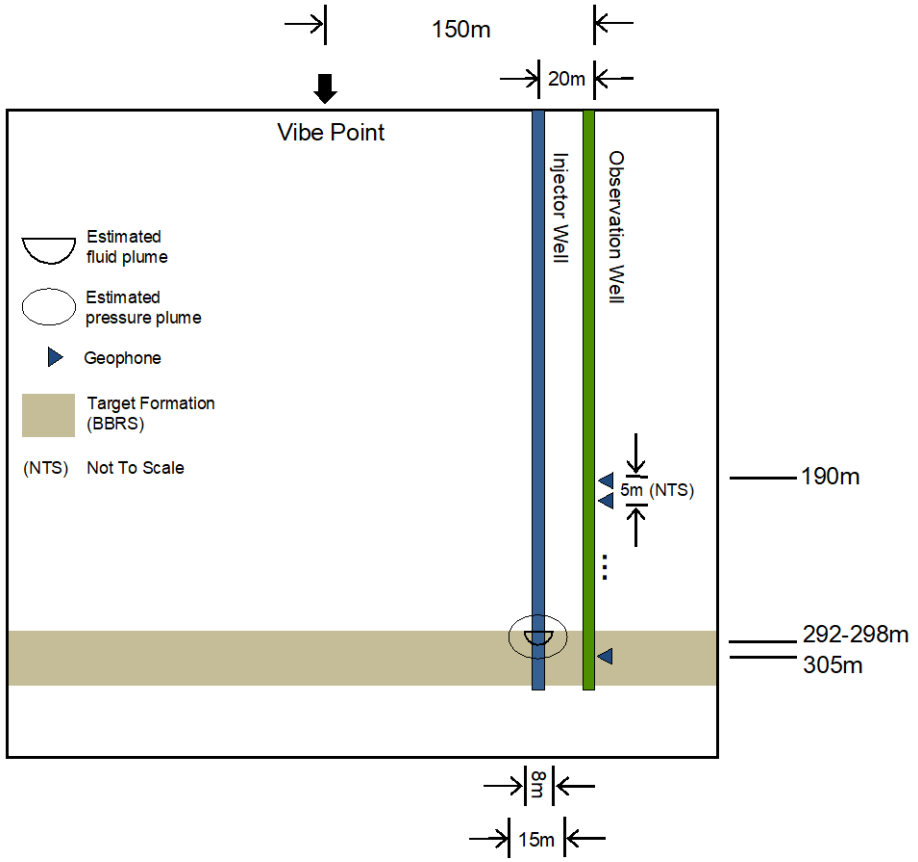
Figure 11. Measured (left) P-wave 4D time shifts versus (right) modeled 4D time shifts from the (top) north and (bottom) south interstage shot locations.

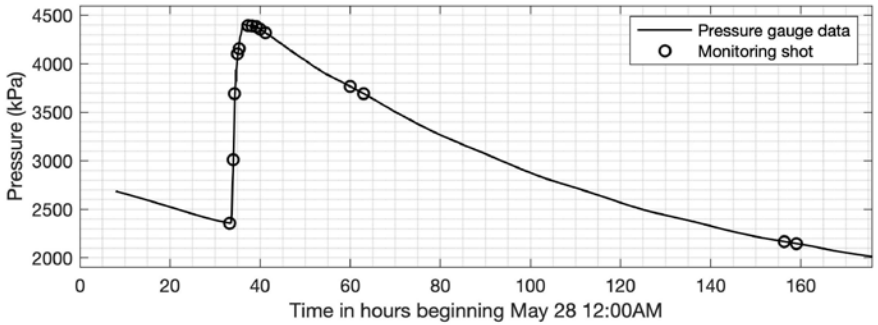
Byerley et al., TLE Nov 2018



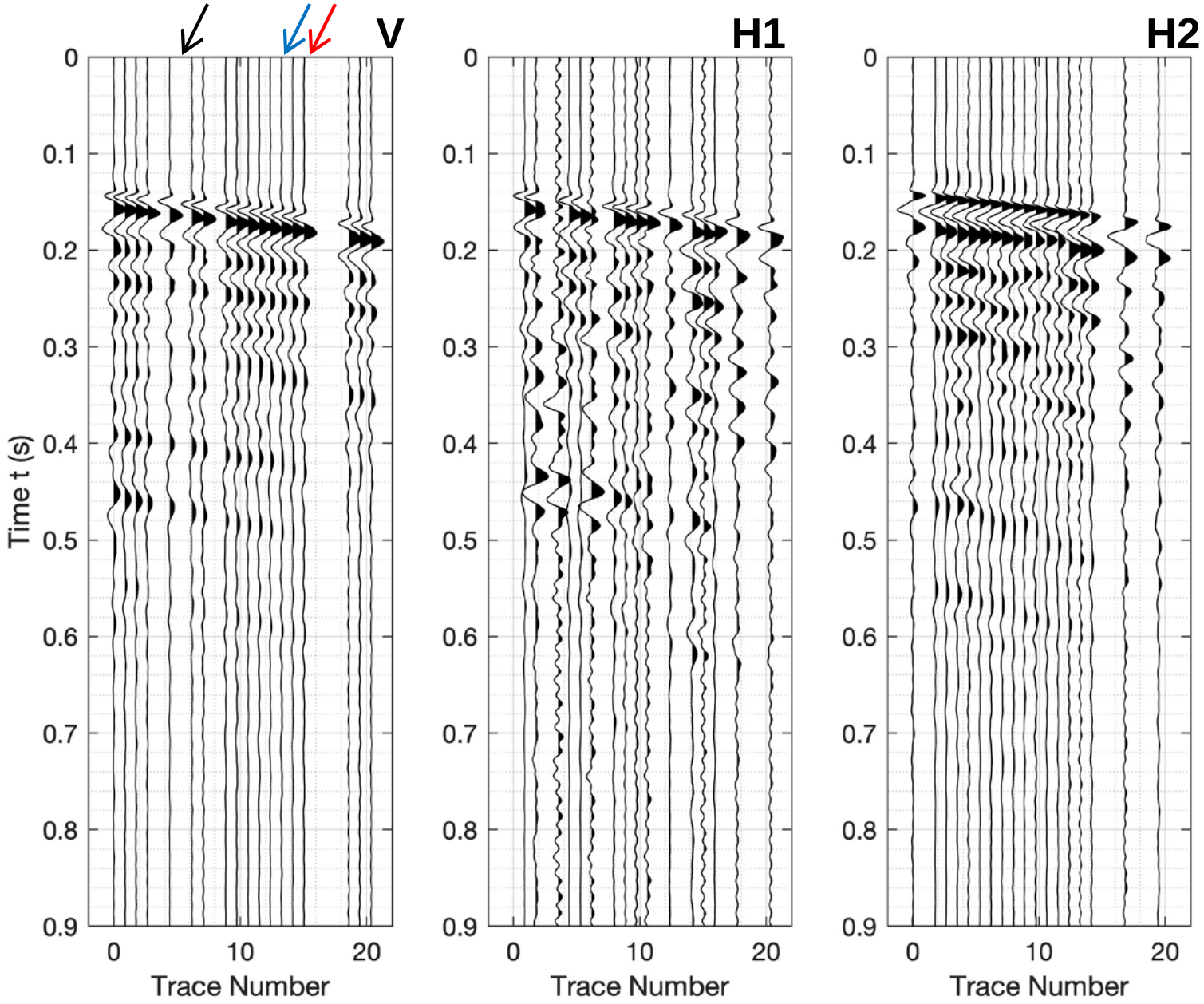
CREWES / JOGMEC 2018

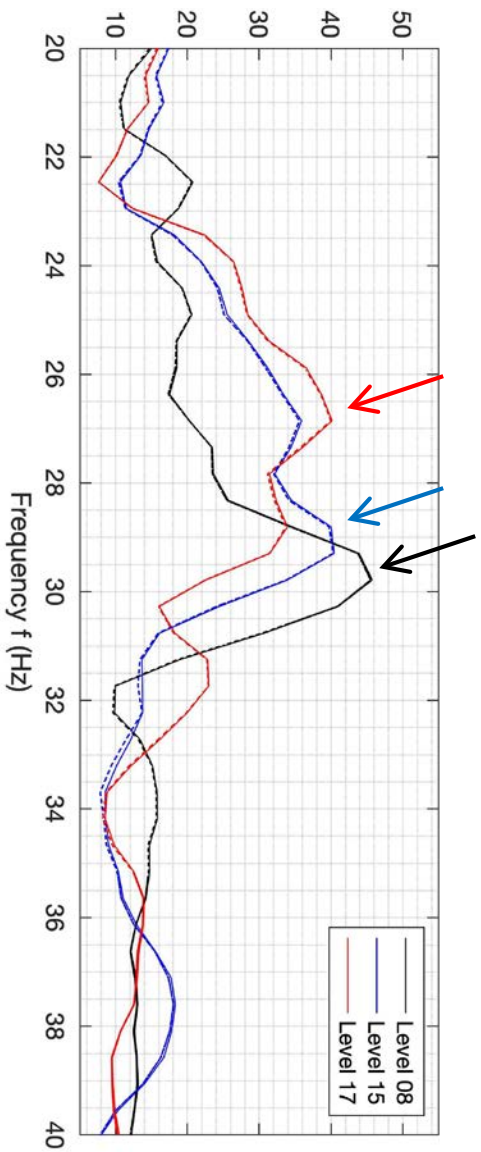
Experiment


150m
20m
Vibe Point
Injector Well
Observation Well
Estimated fluid plume
Estimated pressure plume
Geophone
Target Formation (BBRS)
(NTS) Not To Scale
5m (NTS)
190m
292-298m
305m
8m
15m

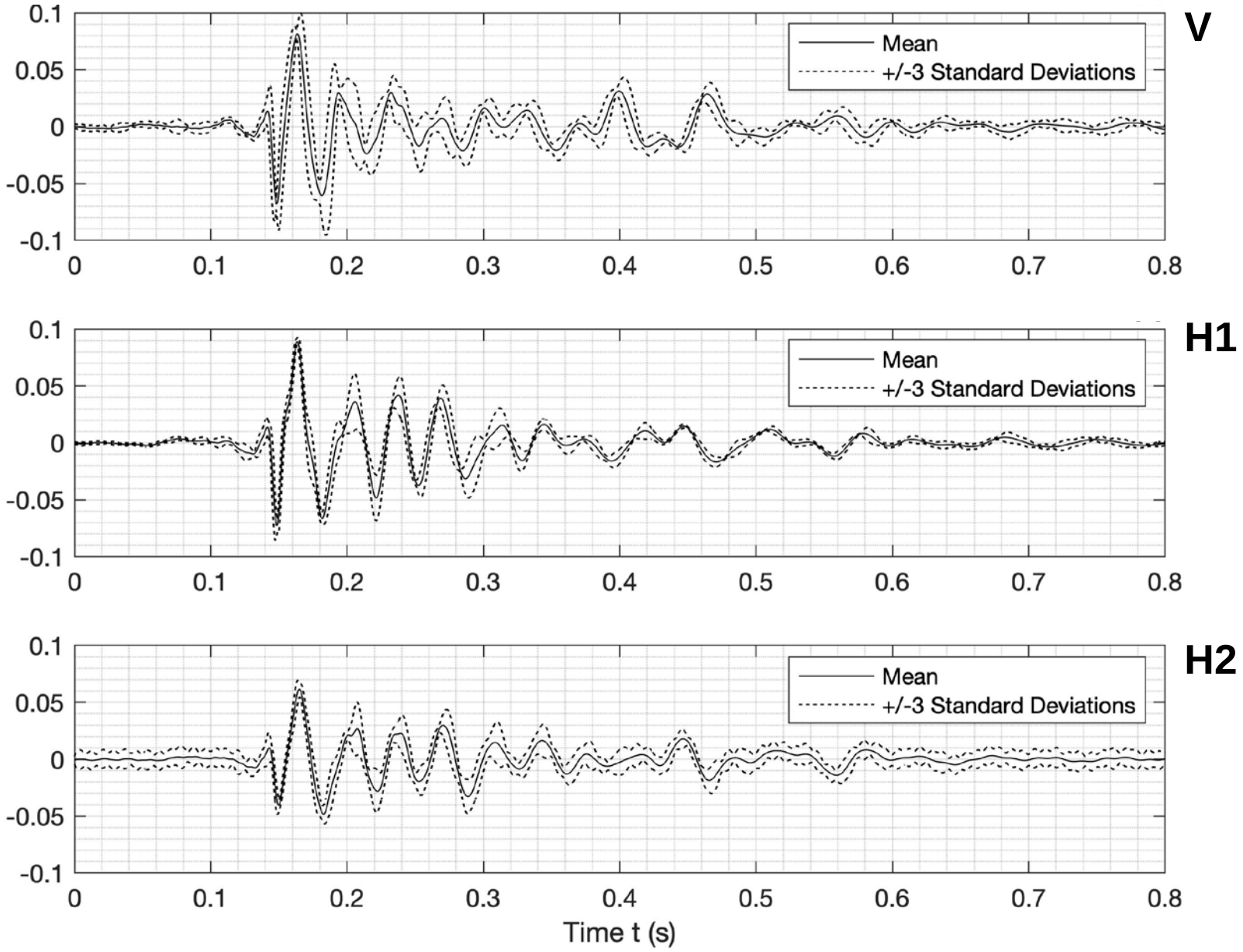

Pressure gauge data
Monitoring shot
Pressure (kPa)
4500
4000
3500
3000
2500
2000
0
20
40
60
80
100
120
140
160
Time in hours beginning May 28 12:00AM

Data

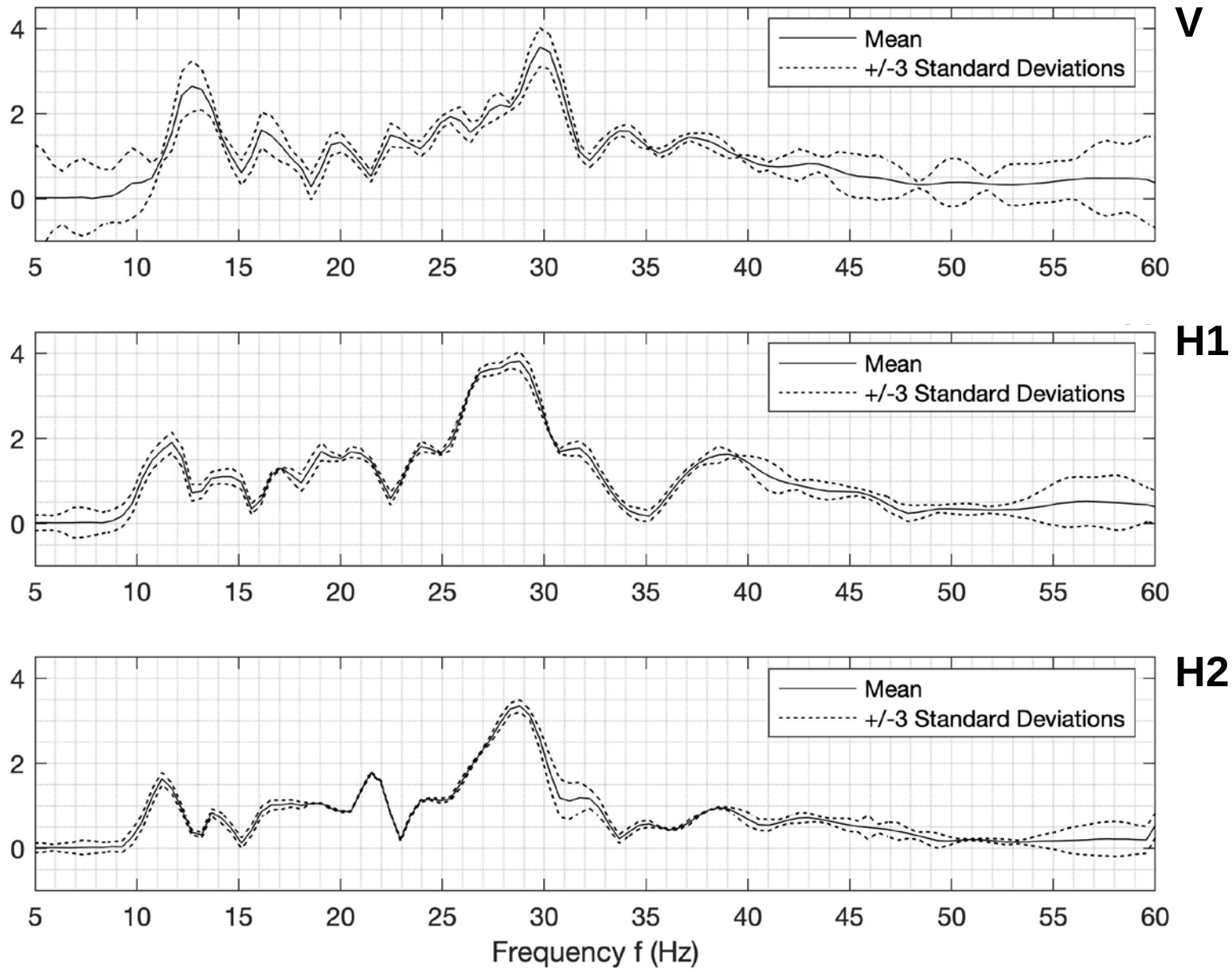

V
H1
H2
Time t (s)
Trace Number
Trace Number
Trace Number


Frequency f (Hz)
Level 08
Level 15
Level 17

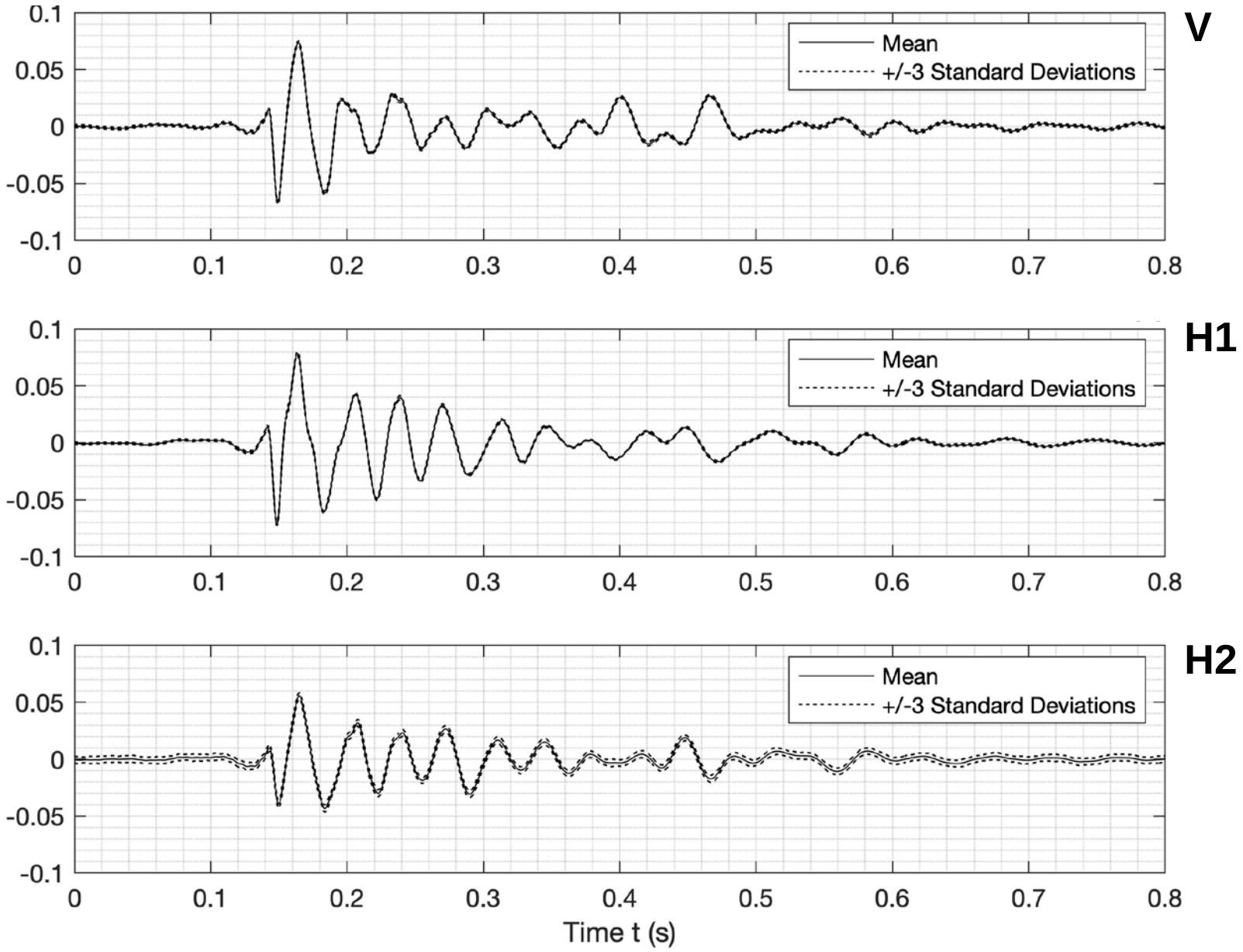
Repeatability – May 29 9:20AM



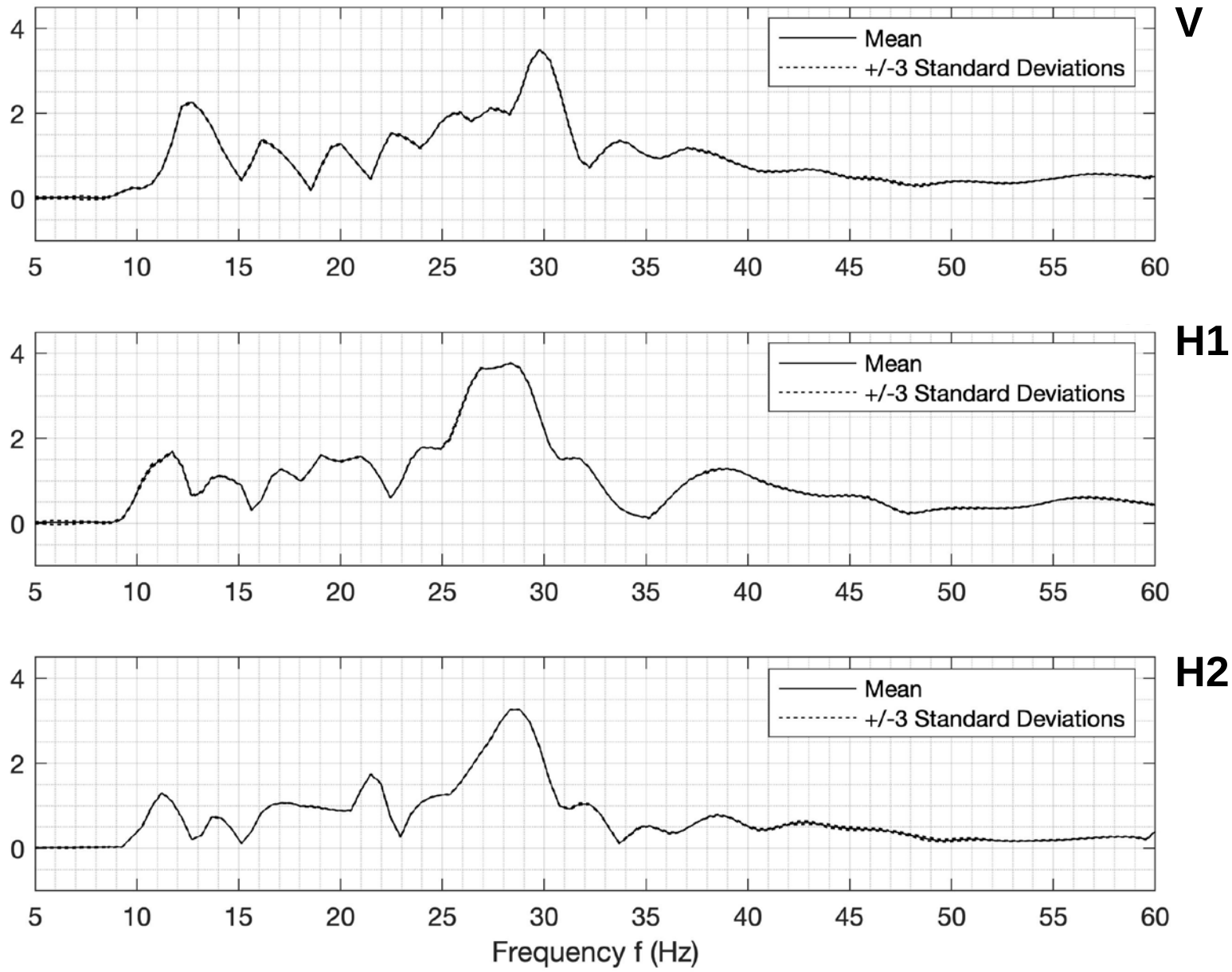
Repeatability – May 29 9:20AM



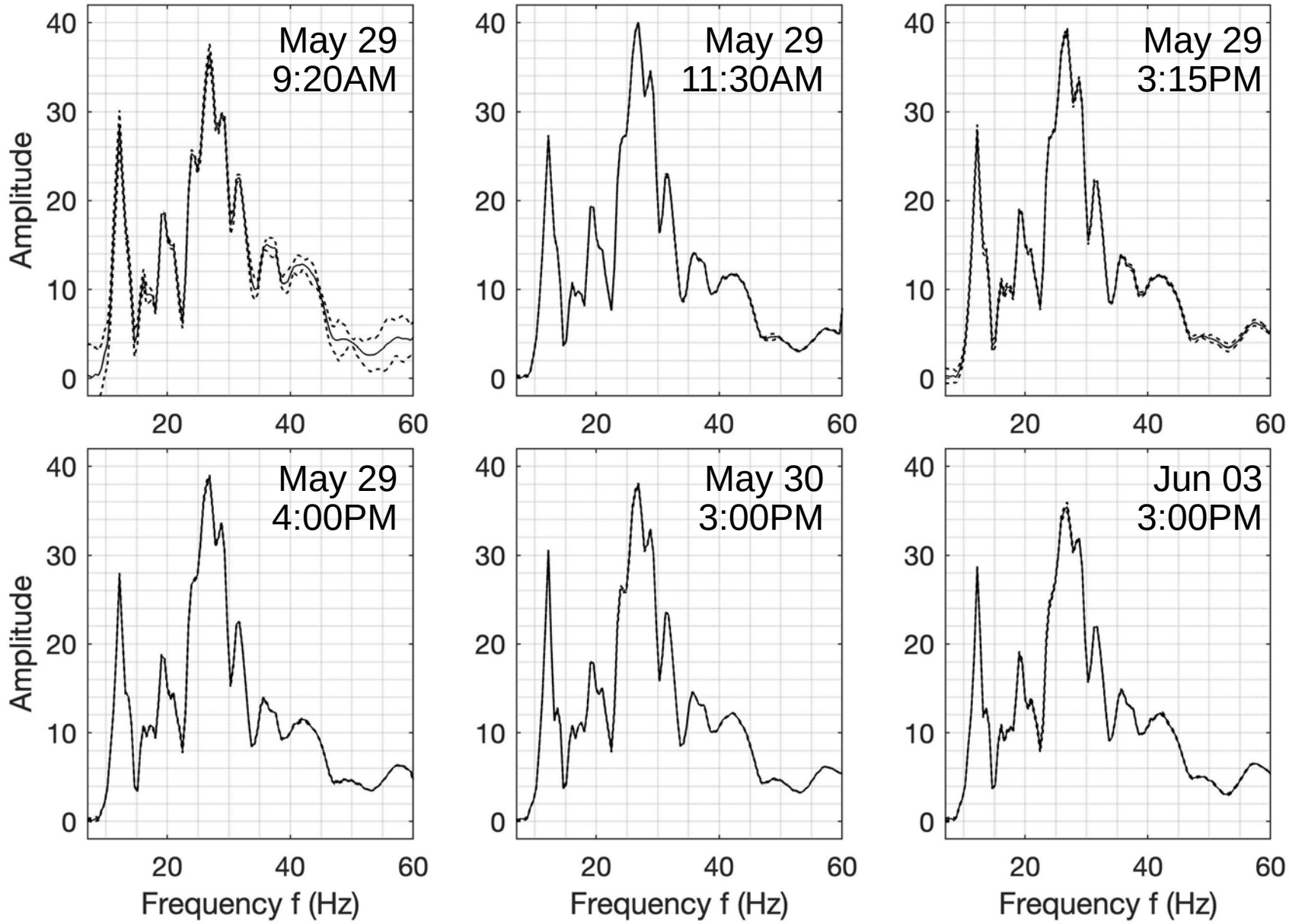
Repeatability – May 29 1:30PM



Repeatability – May 29 1:30PM

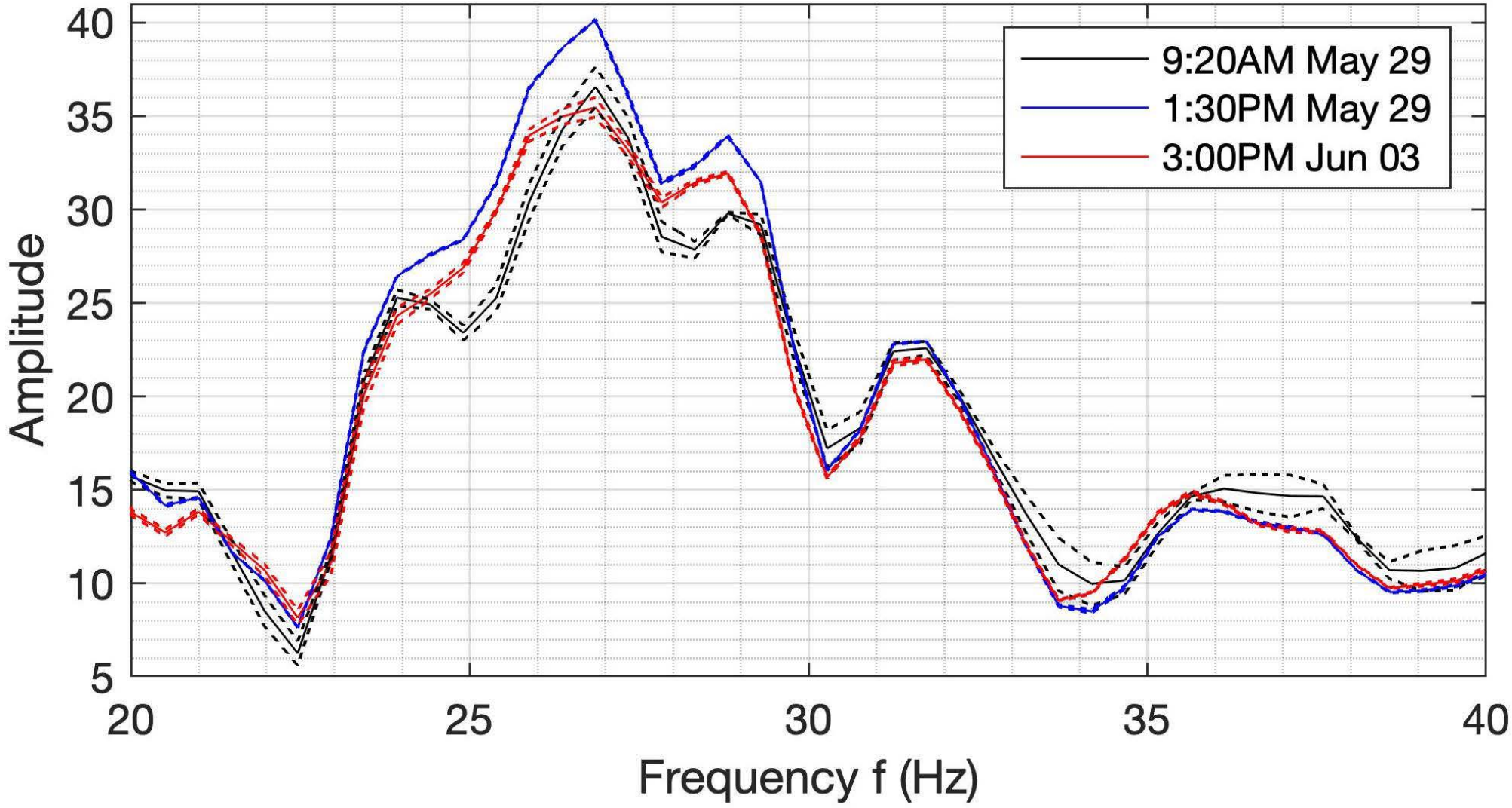


Transients

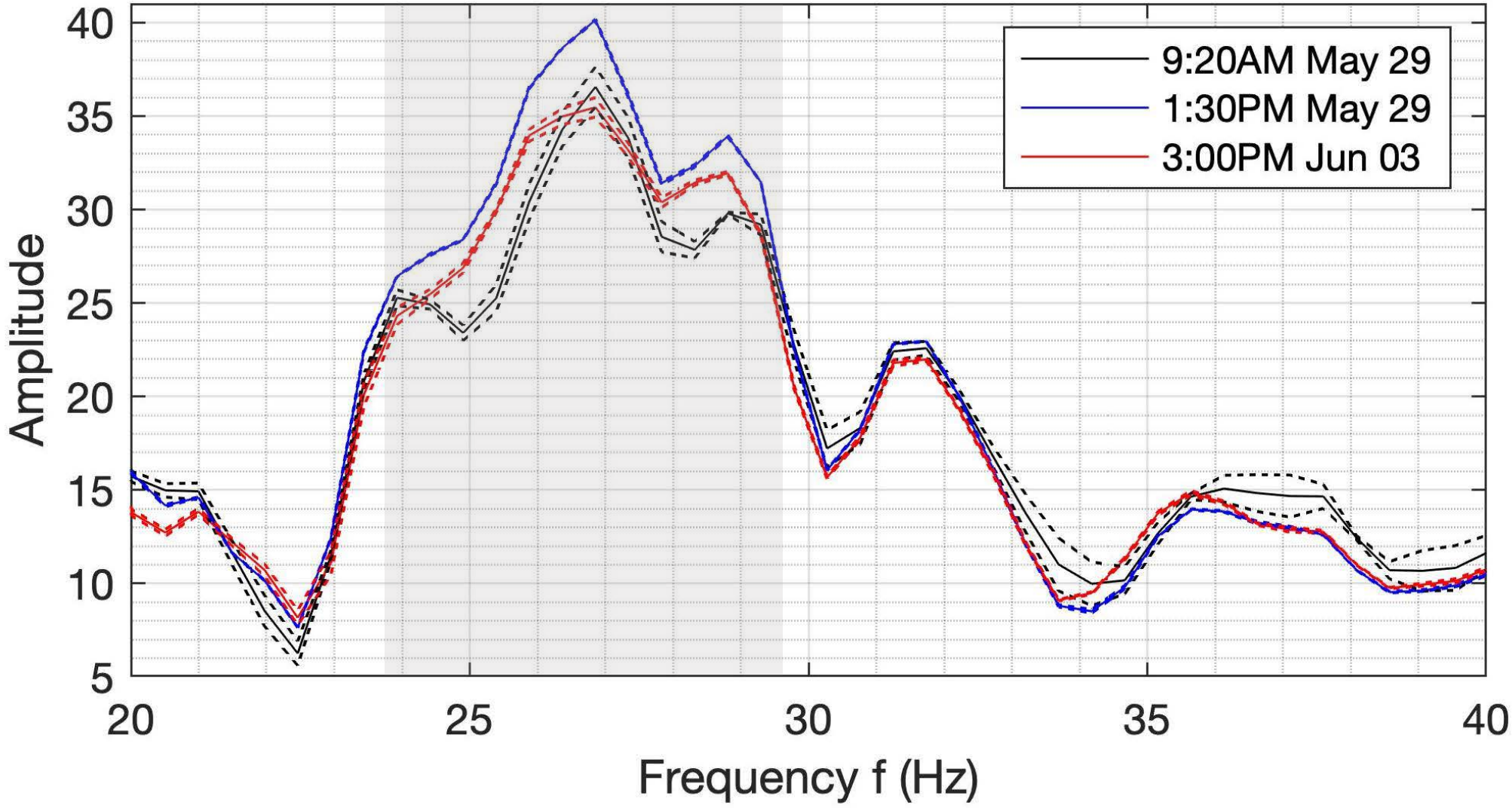


Vertical component Level 24

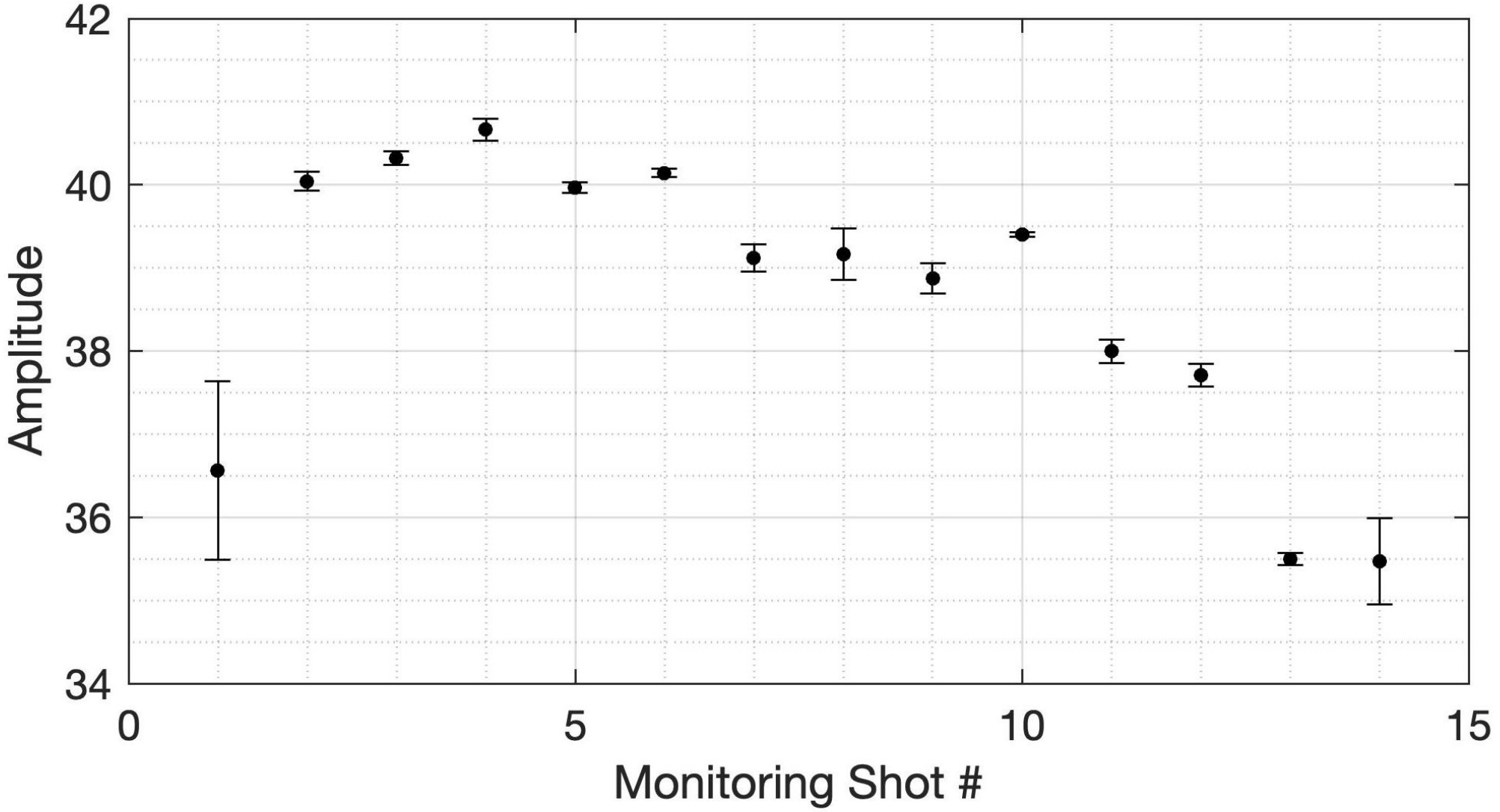
Transients


9:20AM May 29
1:30PM May 29
3:00PM Jun 03
Amplitude
Frequency f (Hz)
40
35
30
25
20
15
10
5
20
25
30
35
40

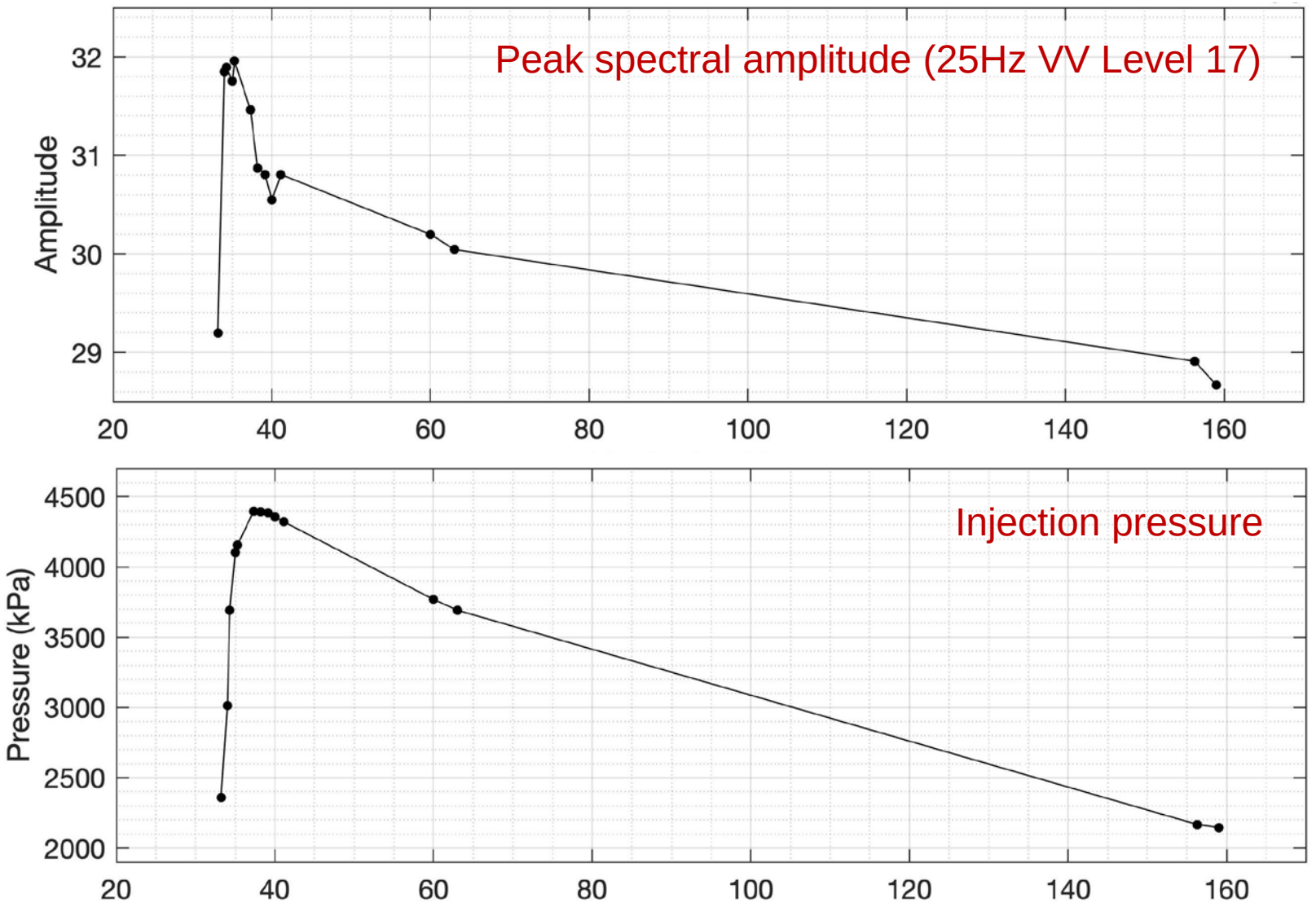
Transients


9:20AM May 29
1:30PM May 29
3:00PM Jun 03
Amplitude
40
35
30
25
20
15
10
5
20
25
30
35
40
Frequency f (Hz)

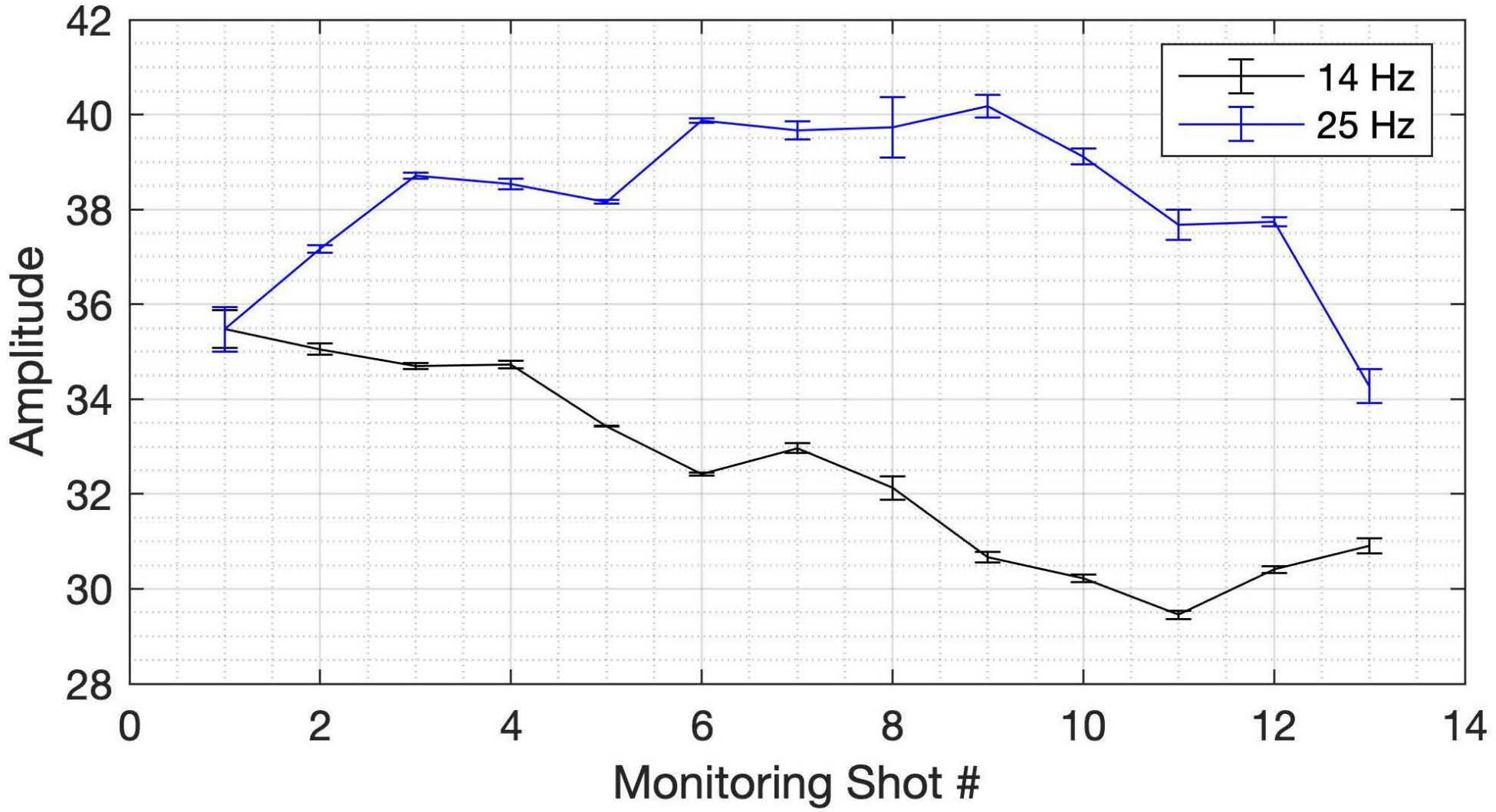
Transients – Amplitude +/- SD at 26Hz



Transients – Peak amplitude versus injection pressure



Loss of low frequencies / gain of high frequencies?



Conclusions

- Transients? – *yes*
- Above repeatability/variance? – *yes*
- Track with pressure? – *yes*
- Bracing? – *uncertain*
- New monitoring technology?
  - *Provided high density TL survey data, yes*
  - *An ideal DAS application*