



PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile




Attuazione dell'articolo 11 dalla legge 24 giugno 2009, n.77

MICROZONAZIONE SISMICA

allegato 2 INDAGINI SISMICHE – HVSR

Regione Emilia–Romagna Comune di Pianello Val Tidone



Regione	Soggetto realizzatore  S.G.P. SERVIZI DI GEO-INGEGNERIA E PROGETTAZIONE s.r.l. Via Bona di Savoia 10 - 27100 Pavia Tel. 0382-466111 / 463385 / 571865 (fax) - e-mail: sgpp@iol.it - pec sgpp@pec.it Prof. Geol. Pier Luigi Vercesi dott.ssa Geol. Daniela Barbano collaboratrici: dott.ssa Erika Corbella dott.ssa Geol. Silvia Passoni	Data gennaio 2023
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Sito puntuale P19

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Bilegno - Pianello Val Tidone (PC)

Latitude: 44.931010

Longitude: 9.383522

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

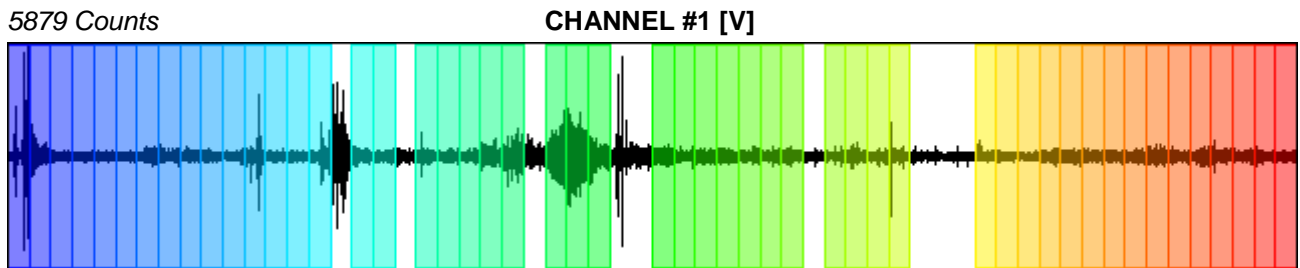
Recording start time: 23/06/2022 - 08:19:49

Recording length: 20 min

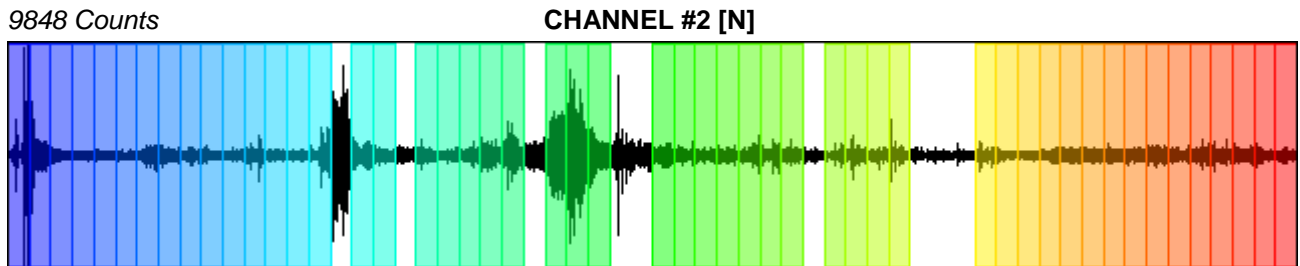
Windows count: 51

Average windows length: 20

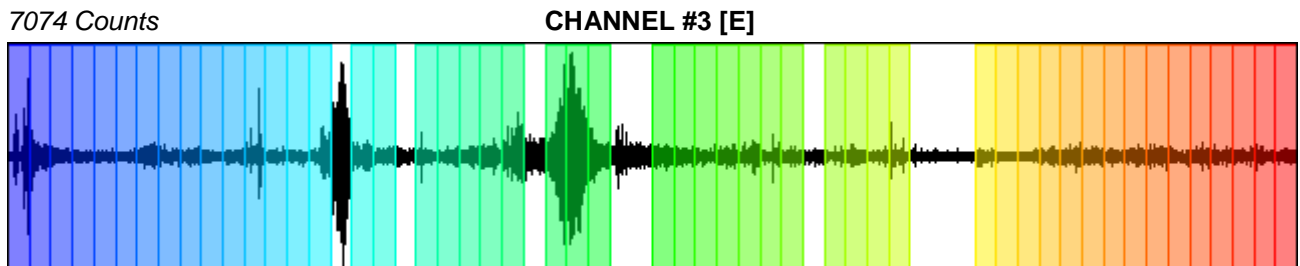
Signal coverage: 85%



-4899 Counts



-9922 Counts



-7557 Counts

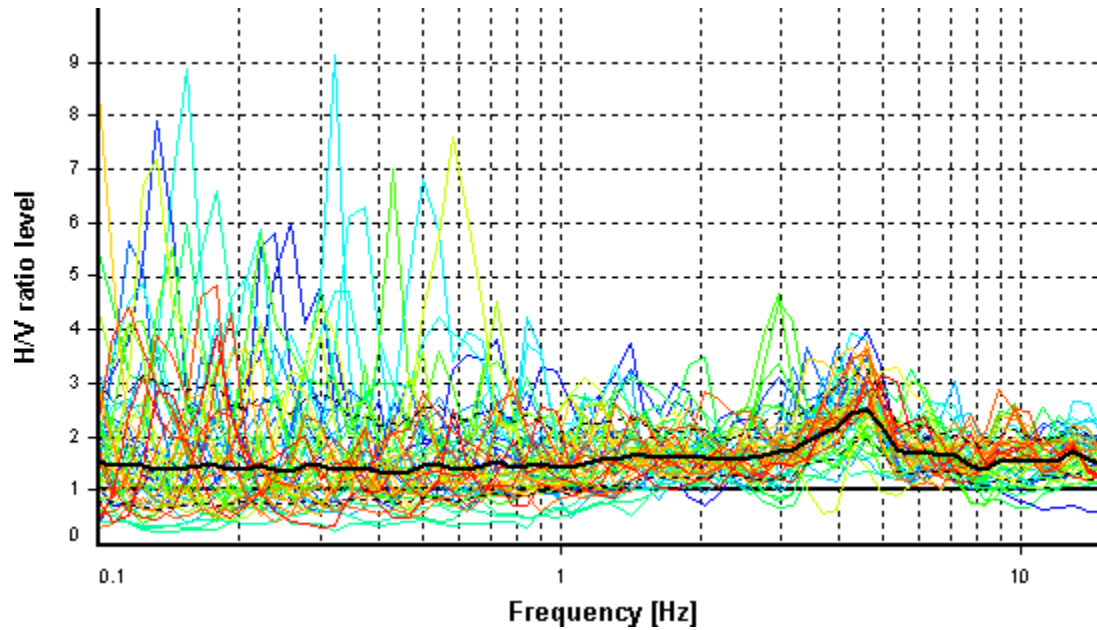
HVSR ANALYSIS

Tapering: Disabled

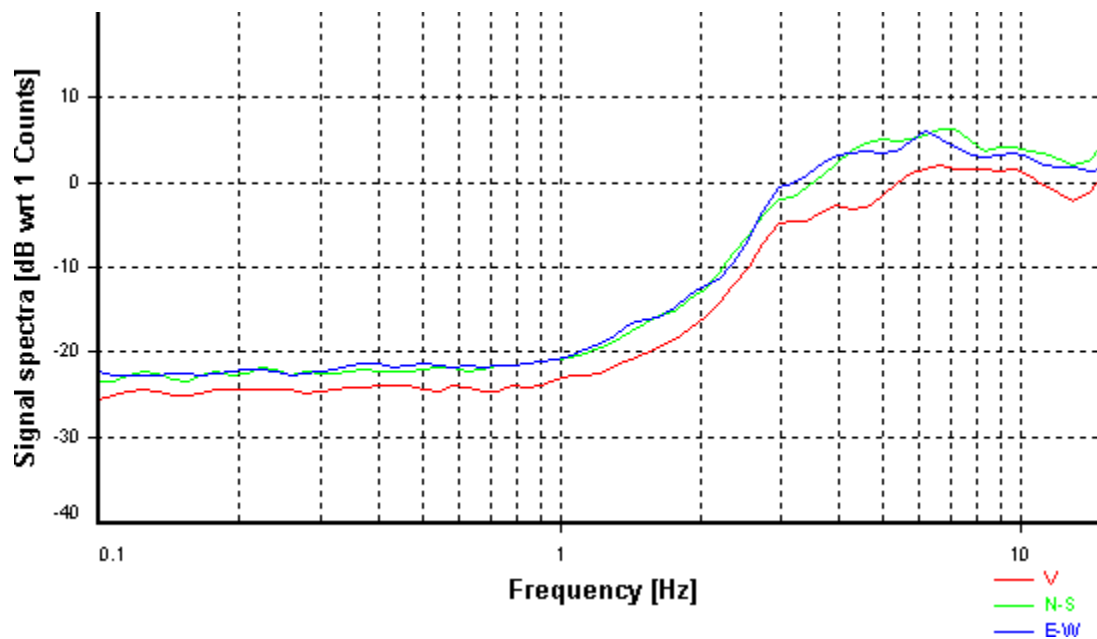
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

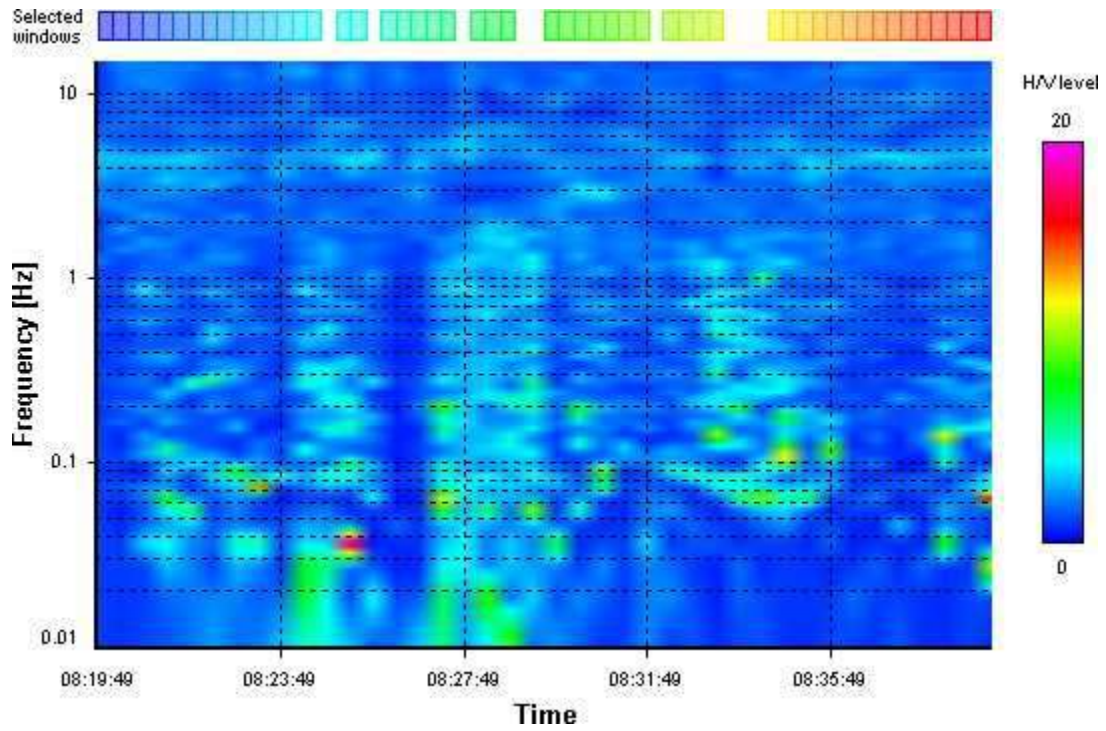
HVSR average



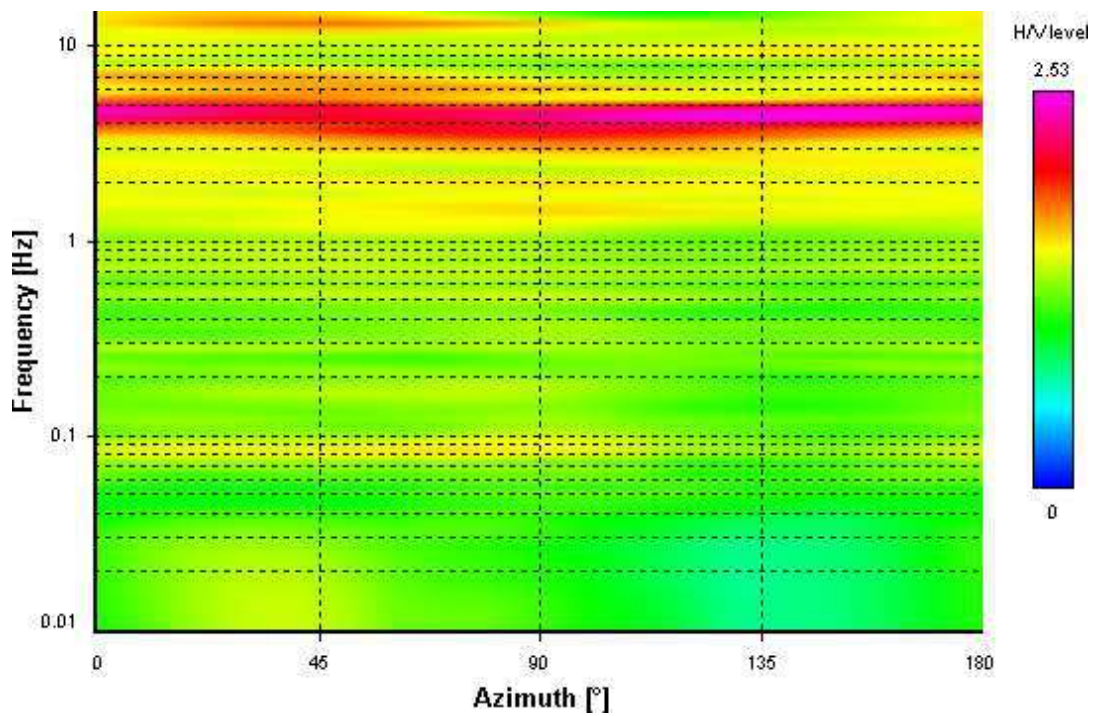
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



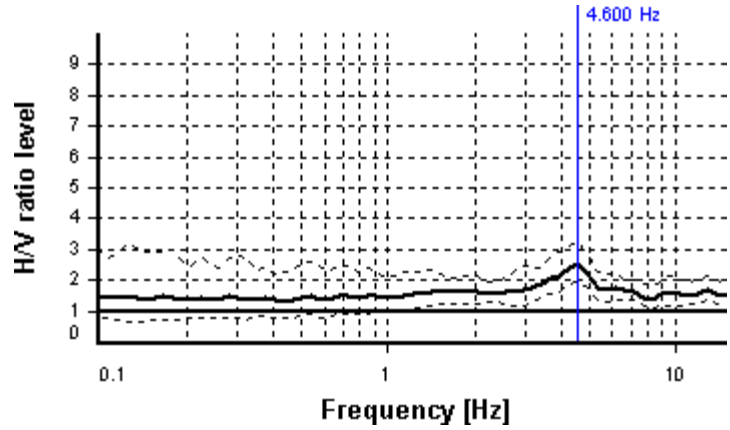
SESAME CRITERIA

Selected f_0 frequency

4.600 Hz

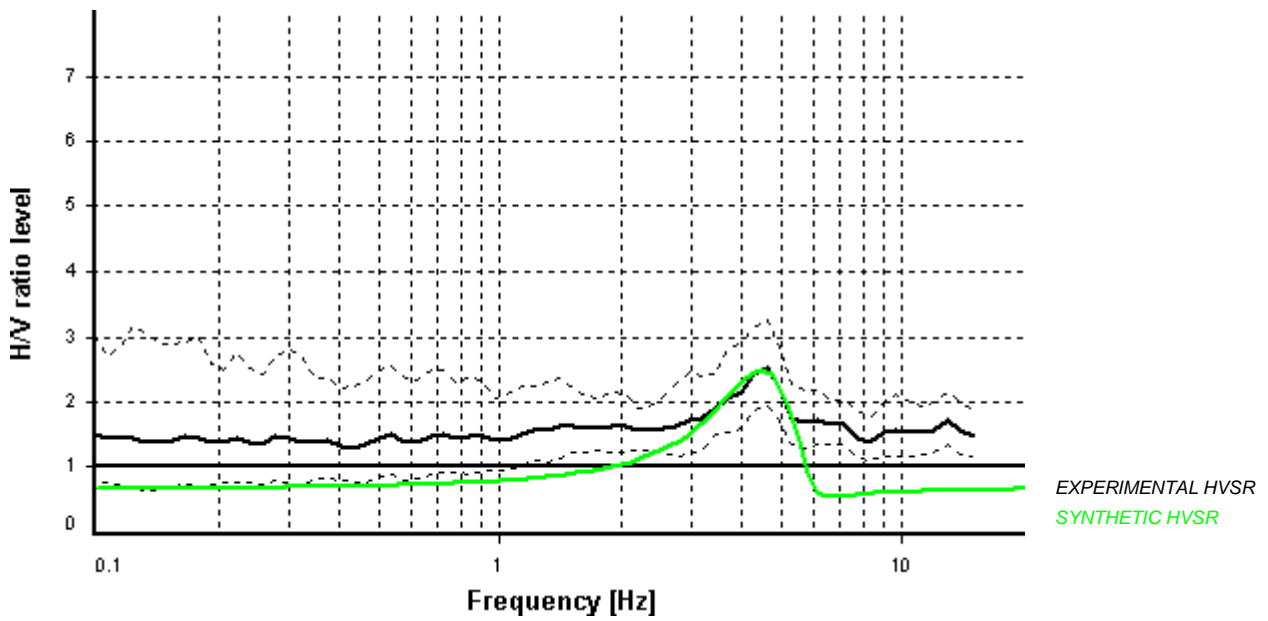
A_0 amplitude = 2.518

Average $f_0 = 4.546 \pm 0.705$

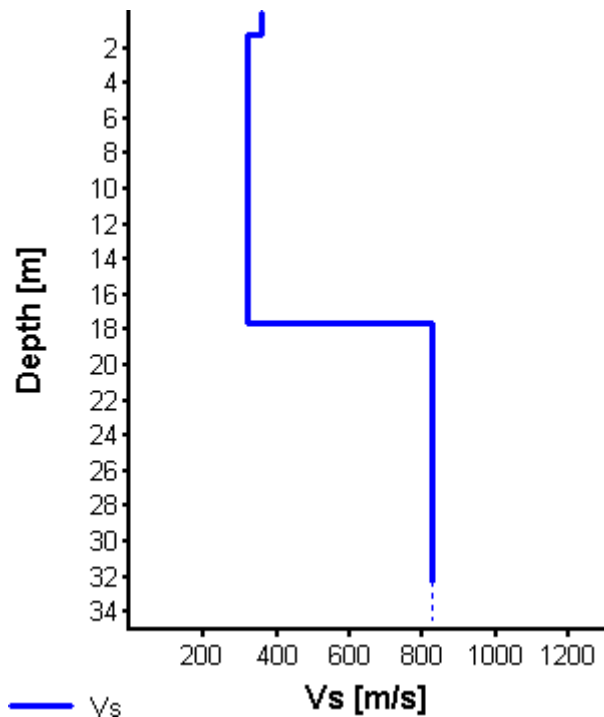


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	51 valid windows (length > 2.17 s) out of 51	OK
$n_c(f_0) > 200$	4692.28 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	0 Hz	NO
$\exists f^\dagger$ in $[f_0, 4f_0] \mid A_{H/V}(f^\dagger) < A_0$	0 Hz	NO
$A_0 > 2$	2.52 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.7046 >= 0.23001	NO
$\sigma_A(f_0) < \theta(f_0)$	1.2907 < 1.58	OK
Overall criteria fulfillment		NO

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
1.2	1.2	672	359	1700
16.4	17.6	602	322	1700
12.4	30	1425	828	1800



$V_{Seq} (H = 17.6 \text{ m}) = 324 \text{ m/s}$

Sito puntuale P20

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Case Gazzoli - Pianello Val Tidone (PC)

Latitude: 44.923750

Longitude: 9.410933

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

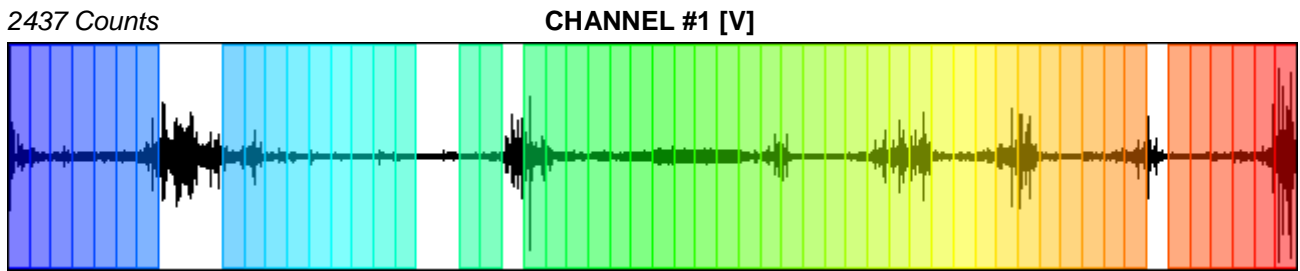
Recording start time: 23/06/2022 - 11:49:29

Recording length: 20 min

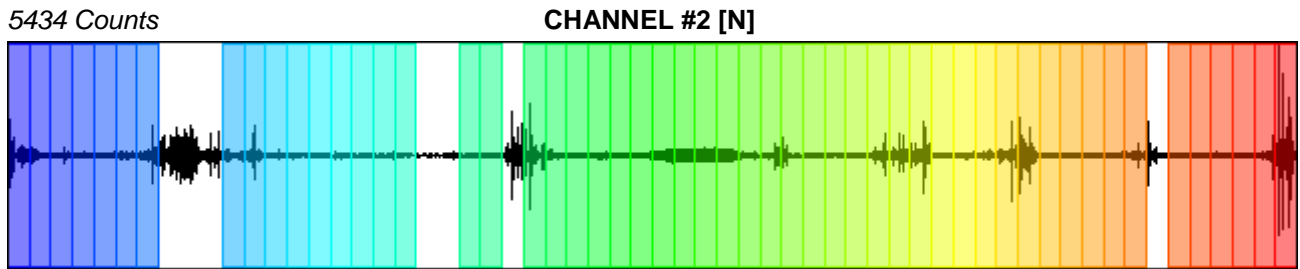
Windows count: 53

Average windows length: 20

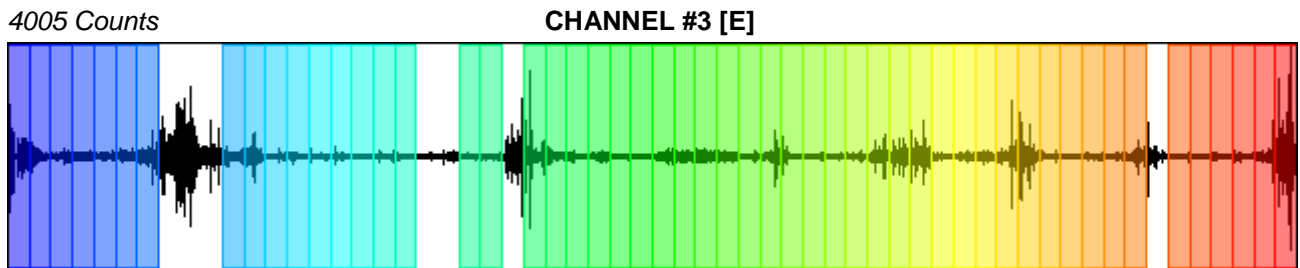
Signal coverage: 88.33%



-2325 Counts



-3835 Counts



-3376 Counts

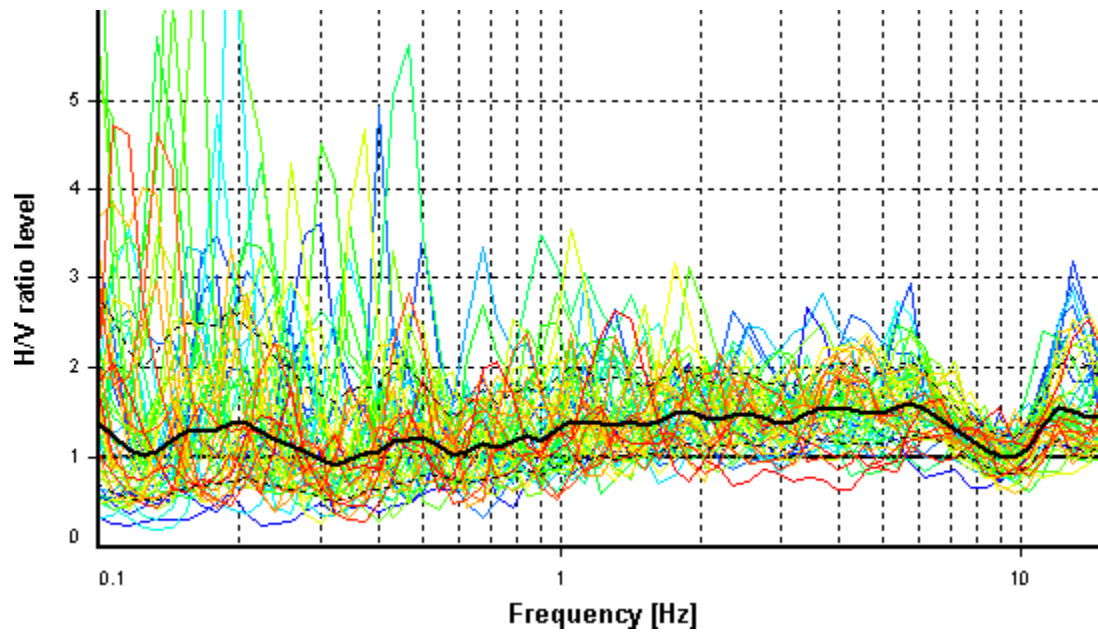
HVSR ANALYSIS

Tapering: Disabled

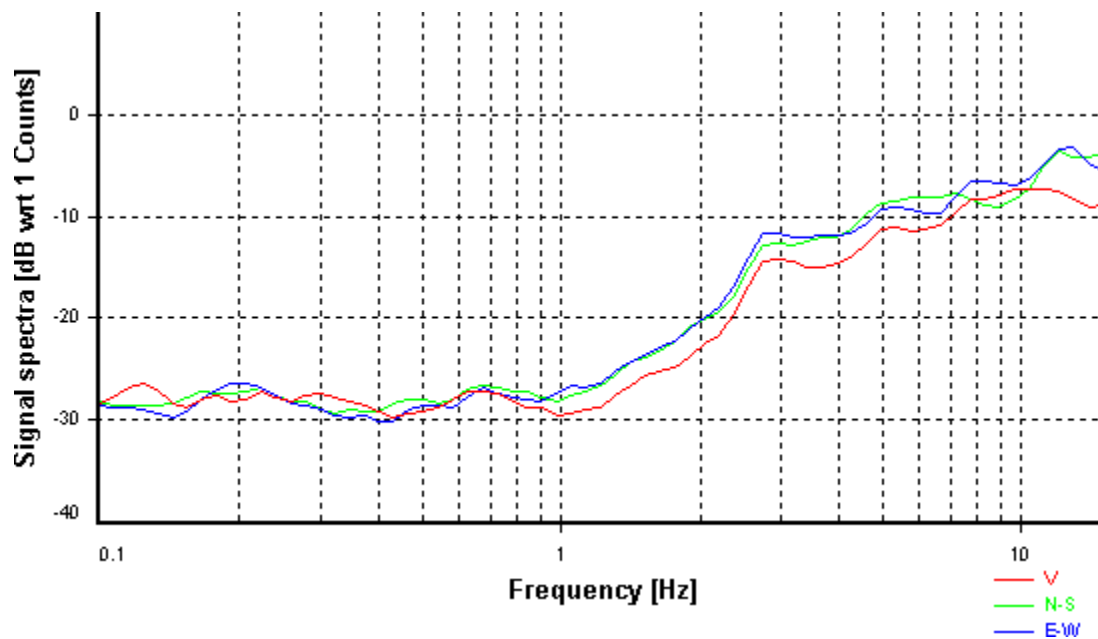
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

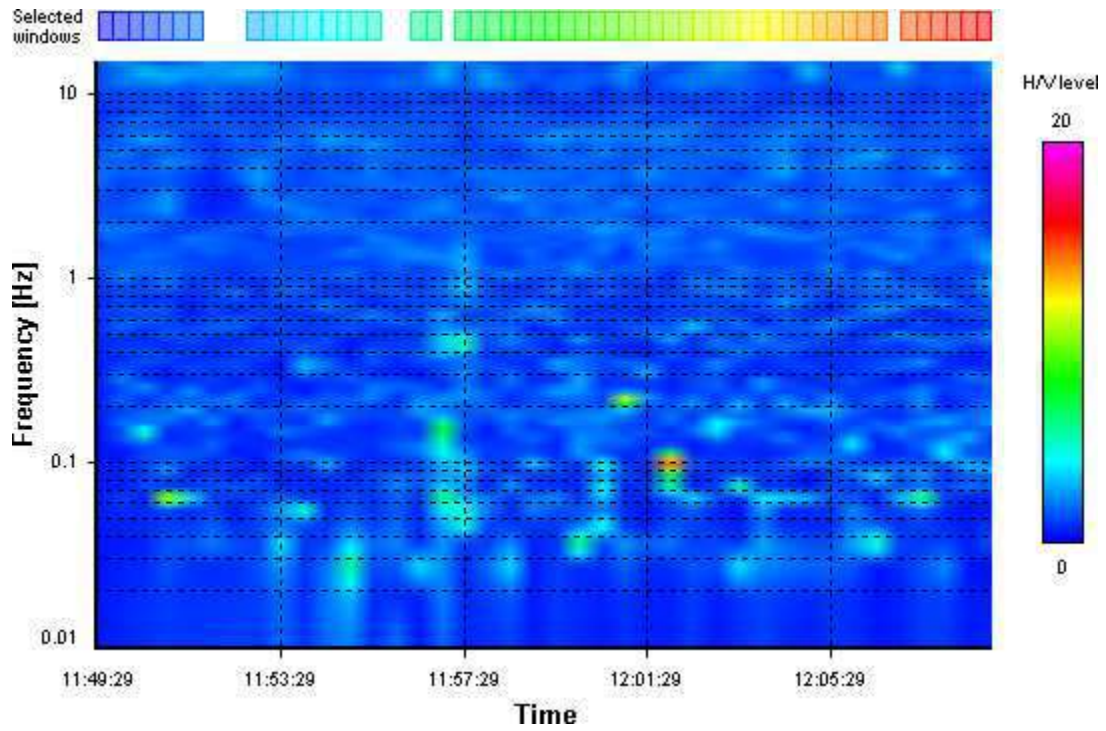
HVSR average



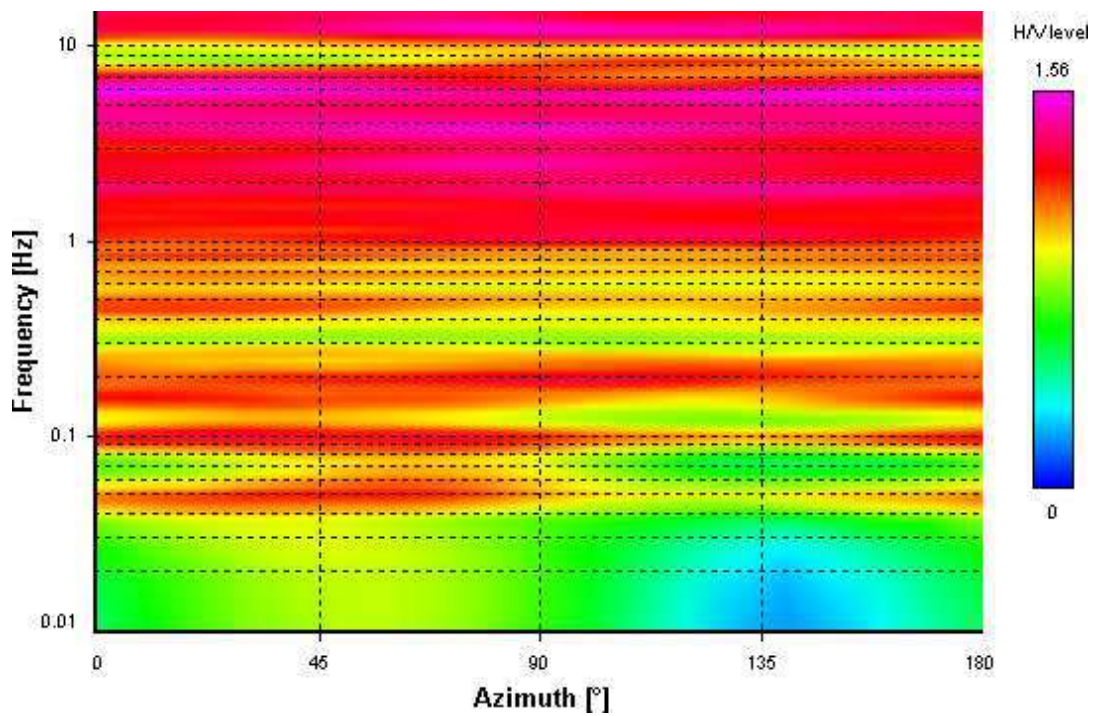
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



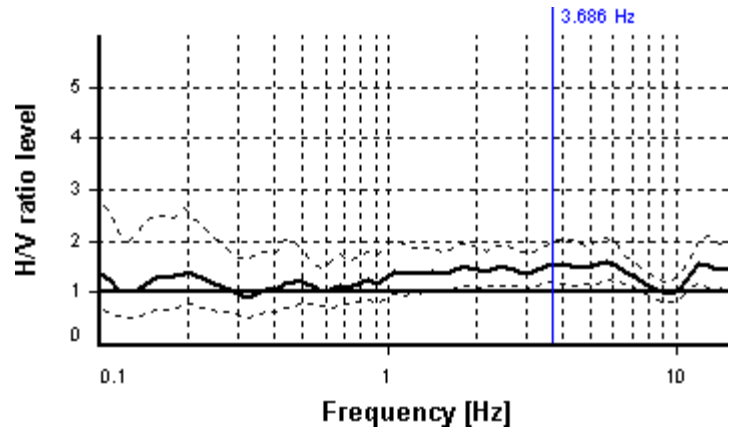
SESAME CRITERIA

Selected f_0 frequency

3.686 Hz

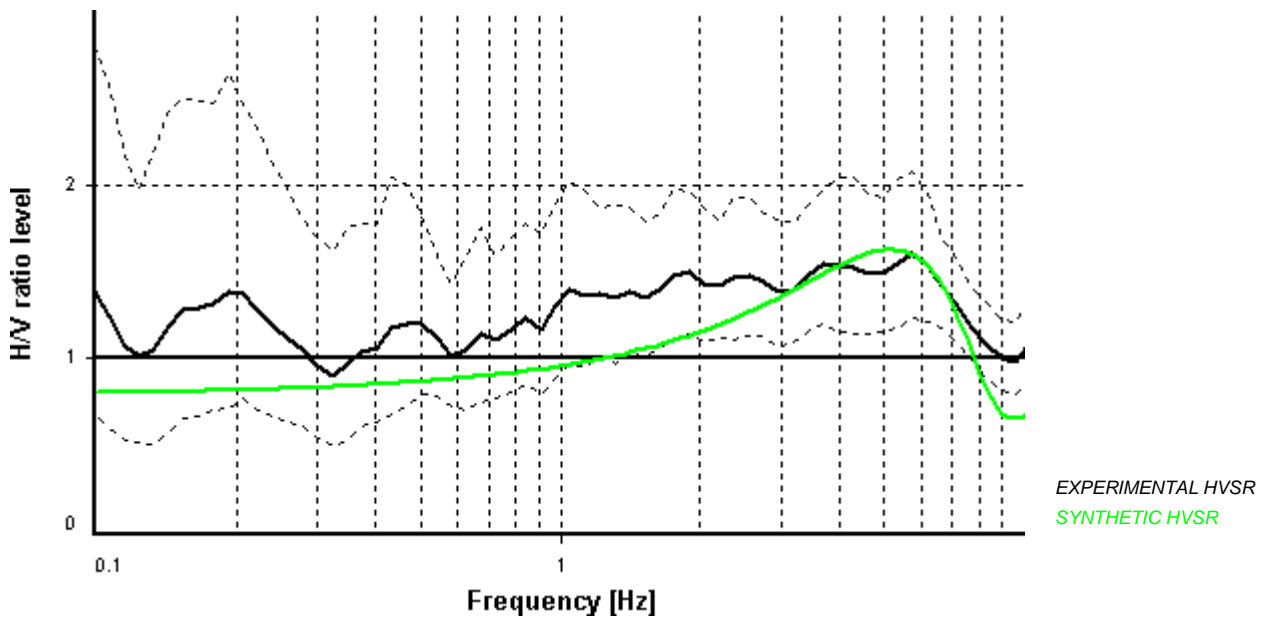
A_0 amplitude = 1.542

Average $f_0 = 3.950 \pm 0.802$

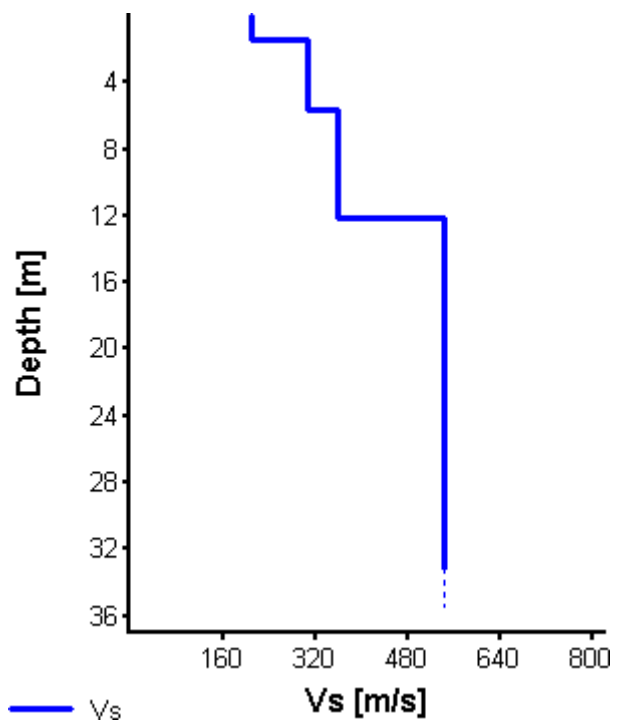


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	49 valid windows (length > 1.04 s) out of 49	OK
$n_c(f_0) > 200$	9436.85 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 16	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	0 Hz	NO
$\exists f^+$ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0$	0 Hz	NO
$A_0 > 2$	2.7 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.77546 >= 0.48147	NO
$\sigma_A(f_0) < \theta(f_0)$	1.27297 < 1.58	OK
Overall criteria fulfillment		NO

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
1.4	1.4	389	208	1700
4.3	5.7	572	306	1700
6.4	12.1	672	359	1800
18.8	30.9	1014	542	1800



$V_{Seq} (H = 30 \text{ m}) = 419 \text{ m/s}$

Sito puntuale P21

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Case Rebuffi - Pianello Val Tidone (PC)

Latitude: 44.937413

Longitude: 9.382491

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

Recording start time: 23/06/2022 - 08:52:22

Recording length: 20 min

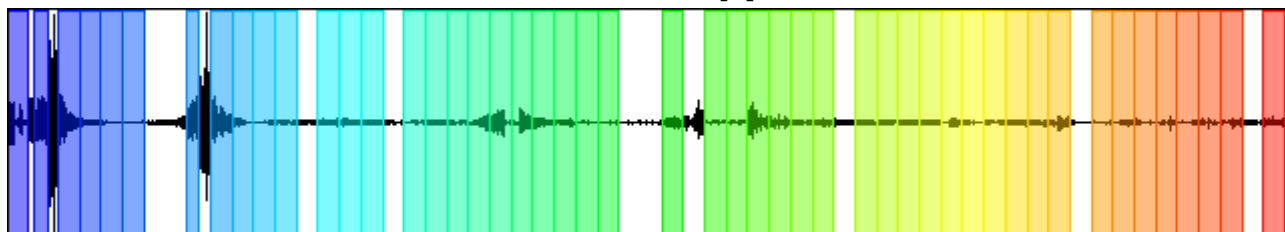
Windows count: 50

Average windows length: 19.5

Signal coverage: 81.26%

20588 Counts

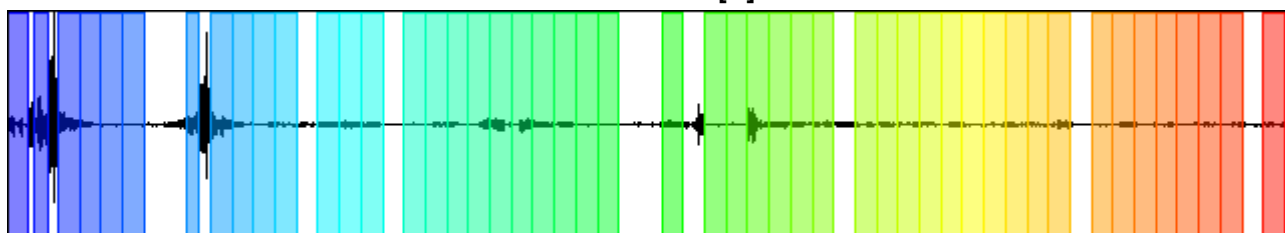
CHANNEL #1 [V]



-20984 Counts

51347 Counts

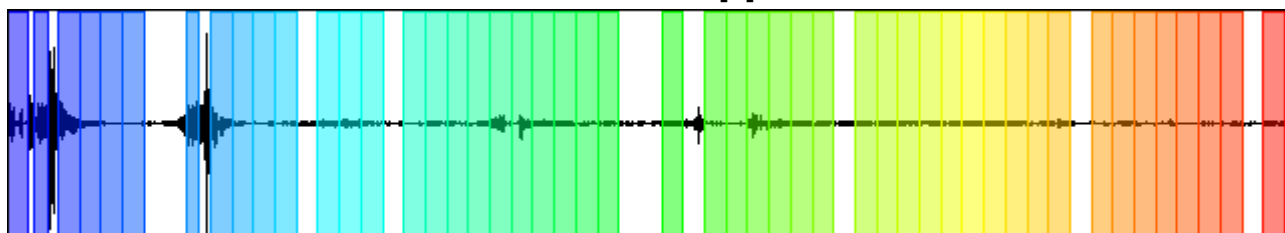
CHANNEL #2 [N]



-35333 Counts

36707 Counts

CHANNEL #3 [E]



-45535 Counts

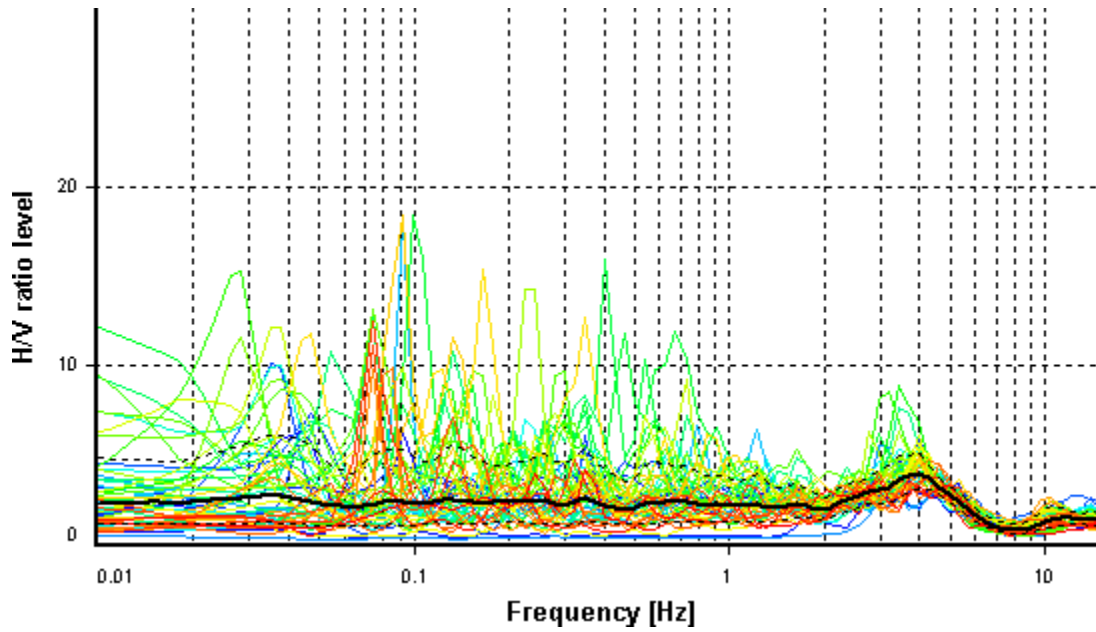
HVSR ANALYSIS

Tapering: Disabled

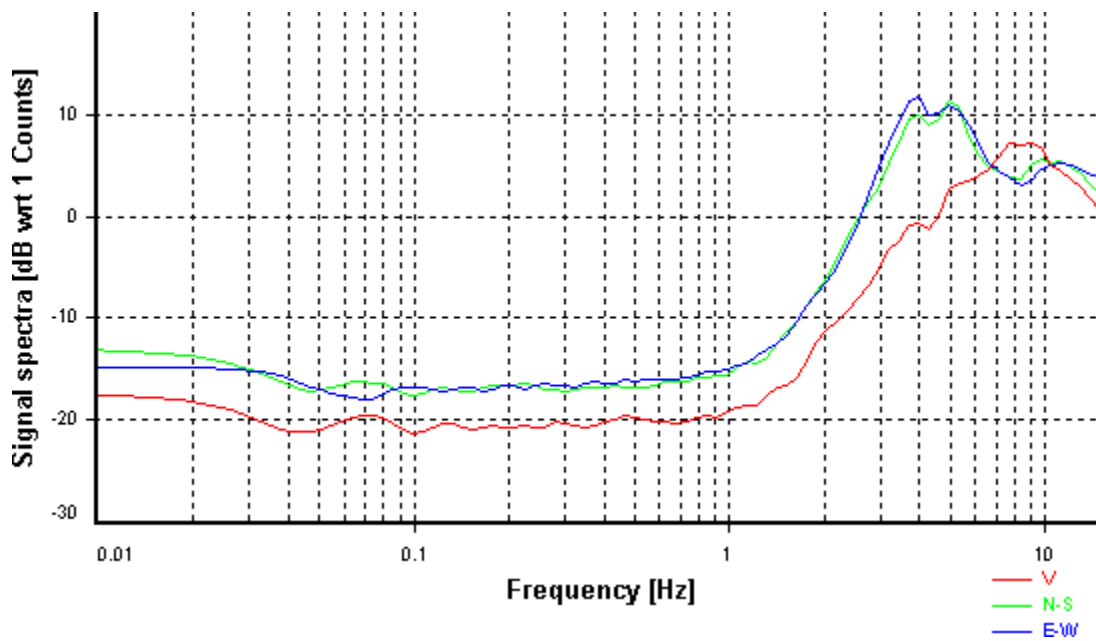
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

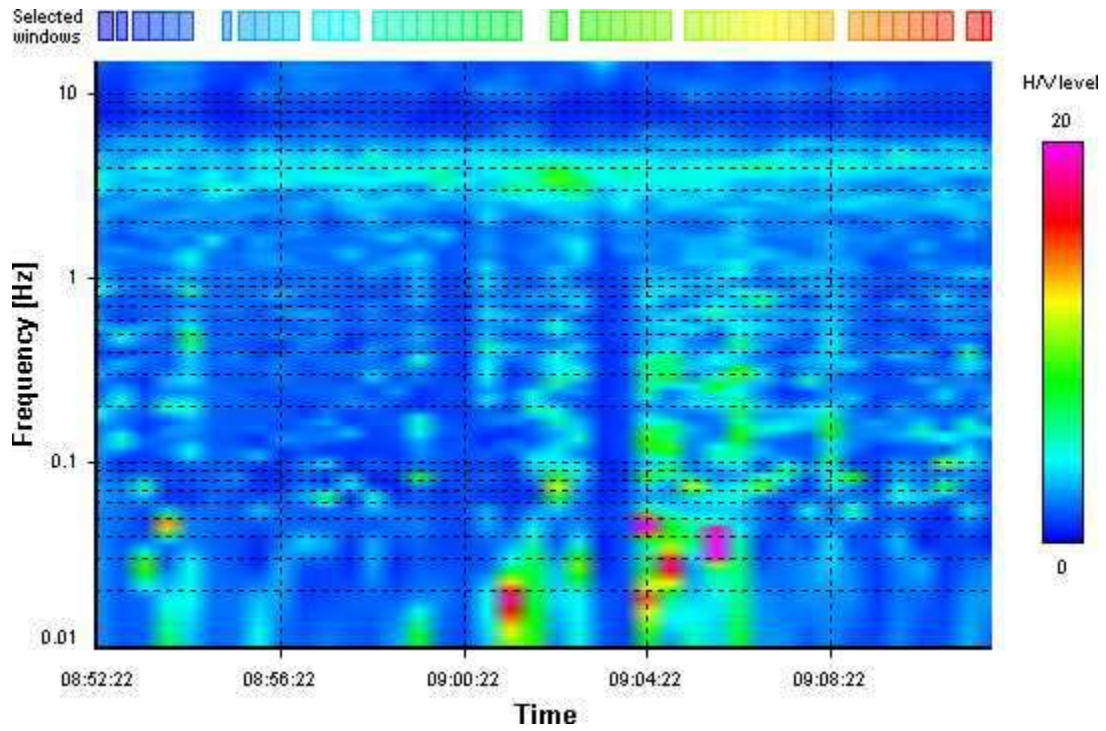
HVSR average



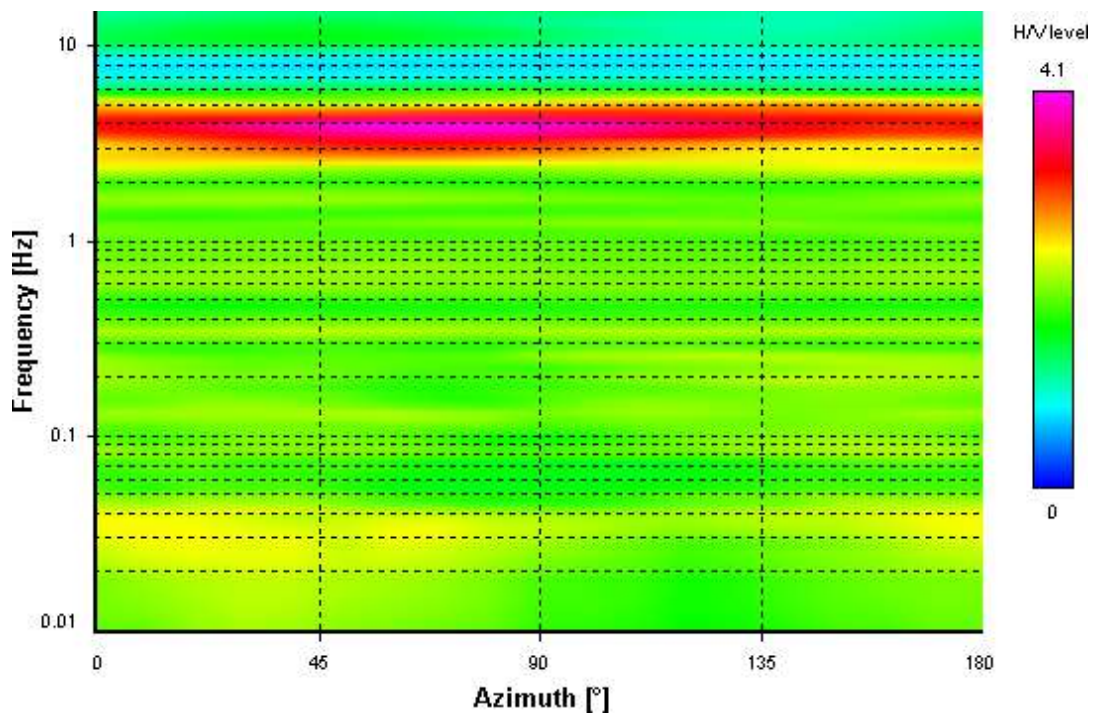
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



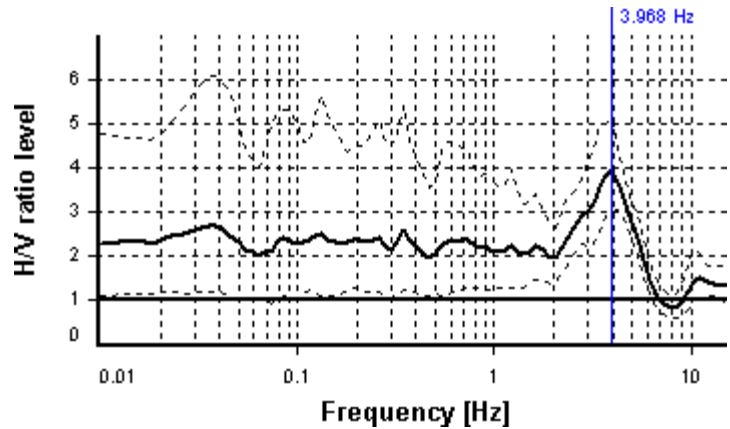
SESAME CRITERIA

Selected f_0 frequency

3.968 Hz

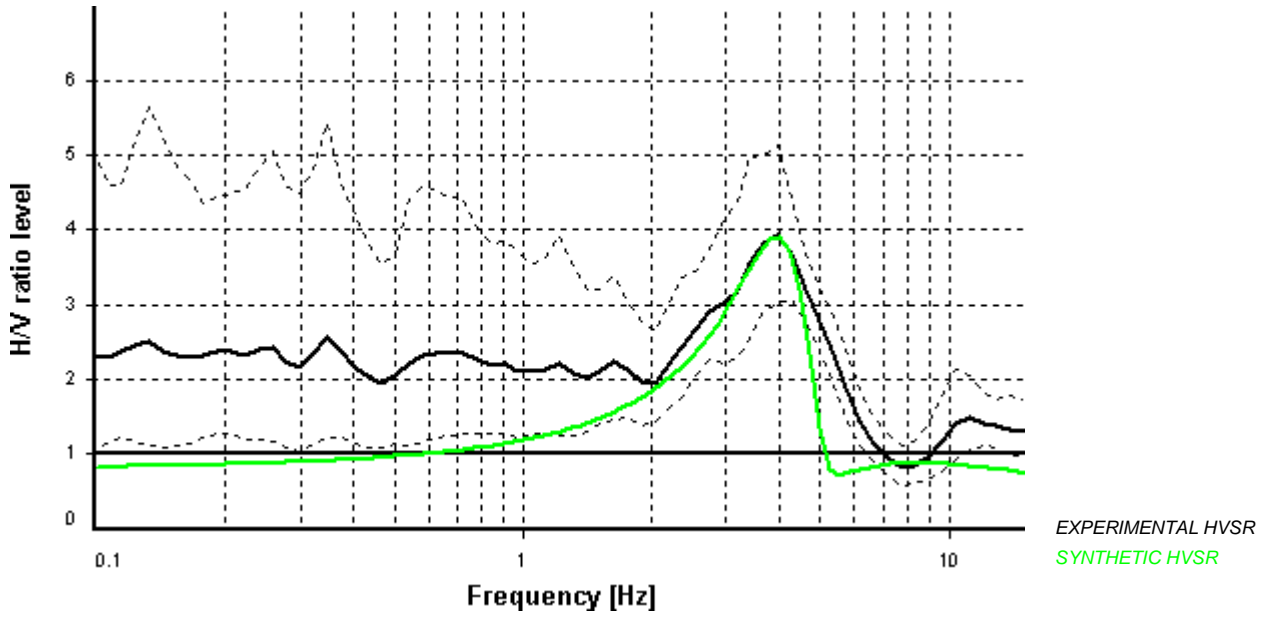
A_0 amplitude = 3.938

Average f_0 = 3.750 ± 0.443

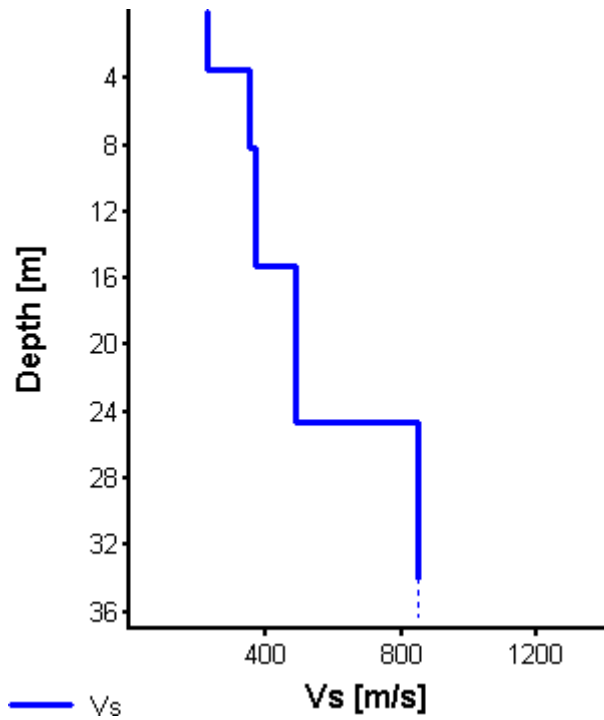


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	50 valid windows (length > 2.52 s) out of 50	OK
$n_c(f_0) > 200$	3869.6 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	2.0412 Hz	OK
$\exists f^+$ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0$	5.74154 Hz	OK
$A_0 > 2$	3.94 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	7.67% > 5%	NO
$\sigma_f < \varepsilon(f_0)$	0.4426 \geq 0.19842	NO
$\sigma_A(f_0) < \theta(f_0)$	1.30513 < 1.58	OK
Overall criteria fulfillment		NO

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
3.5	3.5	382	226	1700
4.7	8.2	604	352	1700
7.1	15.3	739	366	1800
9.3	24.6	833	489	1800
-	> 24.6	1275	850	2200



$V_{Seq} (H = 24.6 \text{ m}) = 365.76 \text{ m/s}$

Sito puntuale P22

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Chiarone - Pianello Val Tidone (PC)

Latitude: 44.909986

Longitude: 9.413929

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

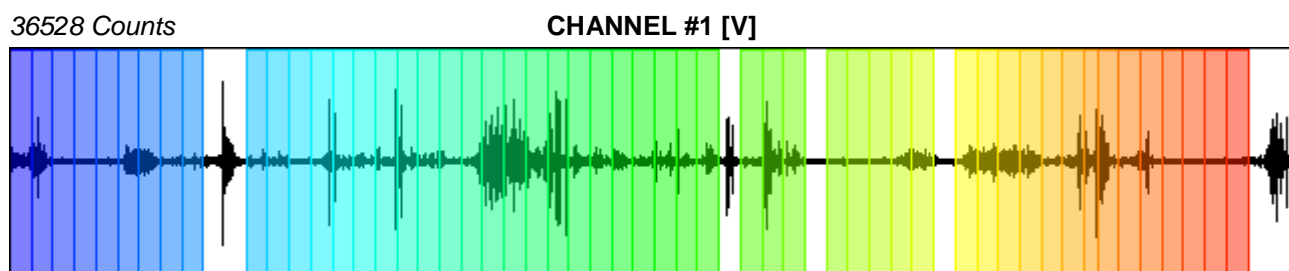
Recording start time: 23/06/2022 - 11:14:45

Recording length: 20 min

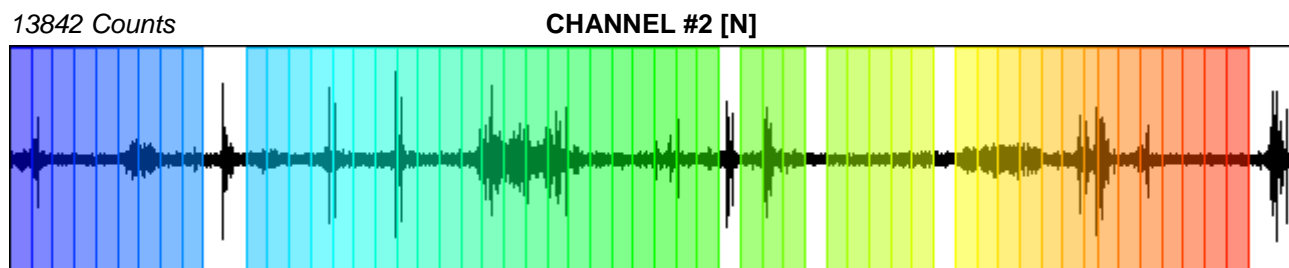
Windows count: 53

Average windows length: 19.86

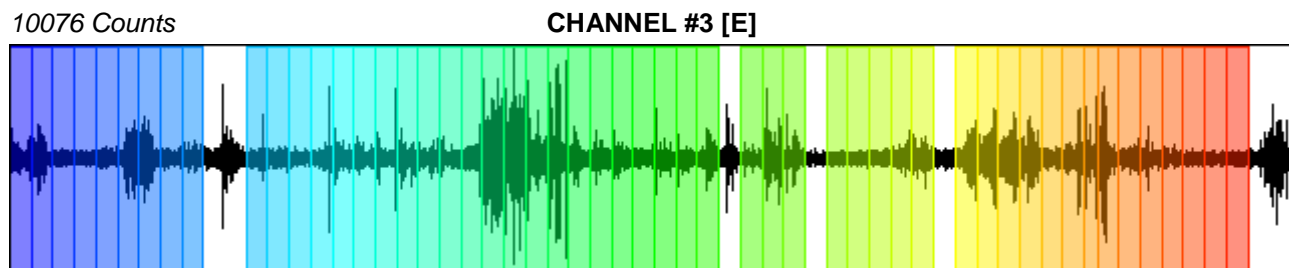
Signal coverage: 87.7%



-47810 Counts



-16986 Counts



-9567 Counts

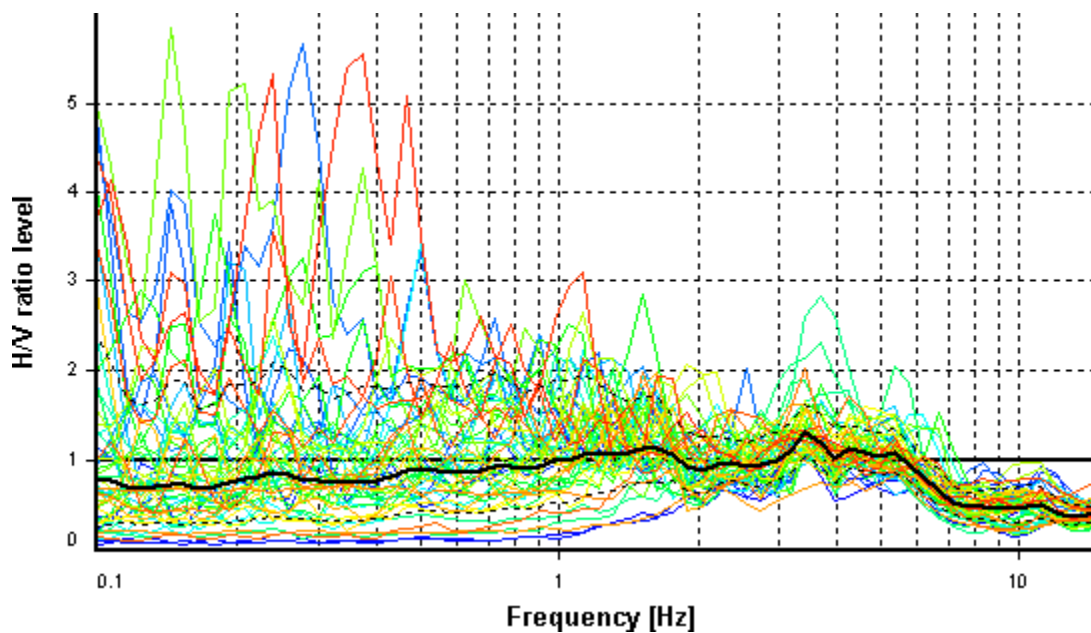
HVSR ANALYSIS

Tapering: Disabled

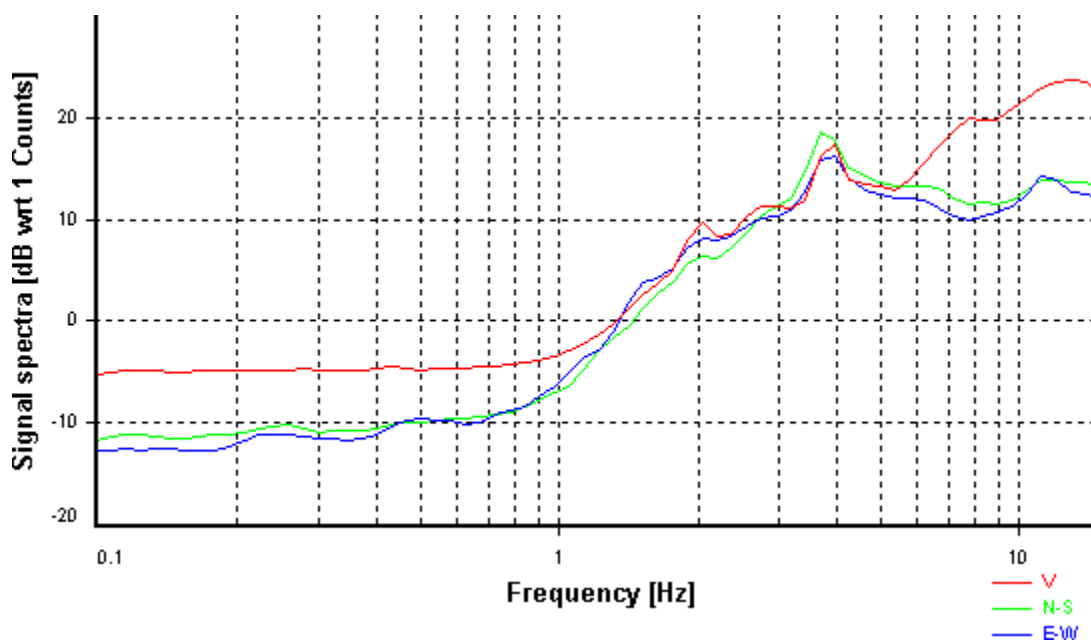
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

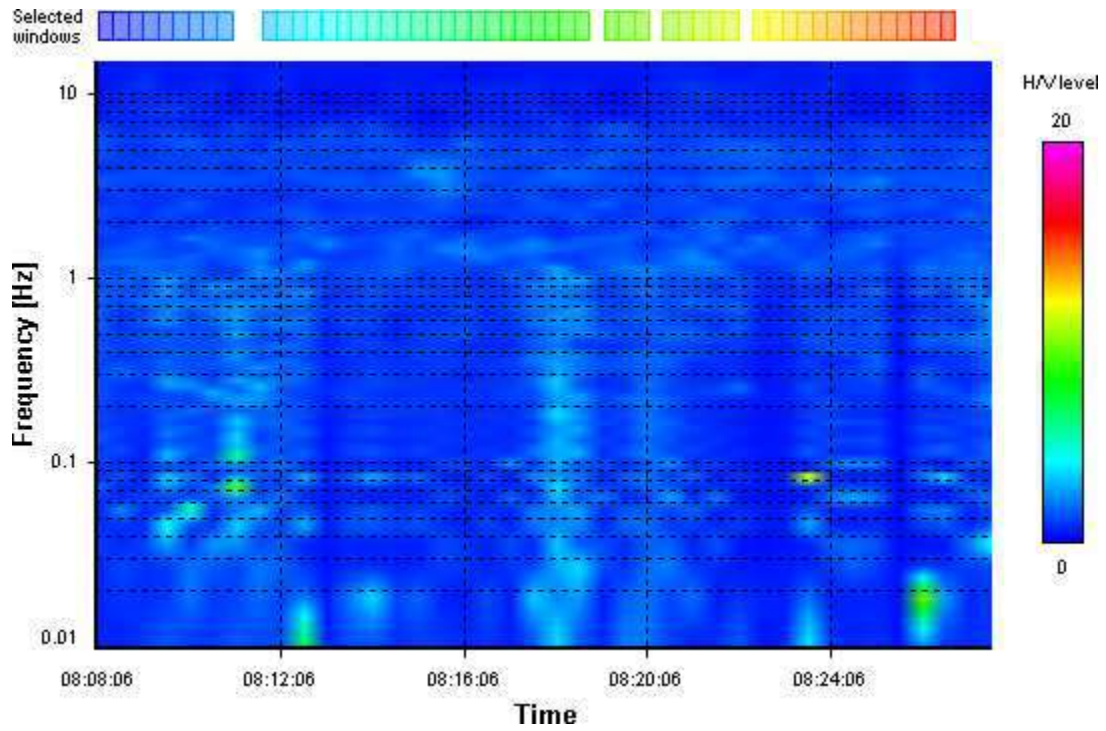
HVSR average



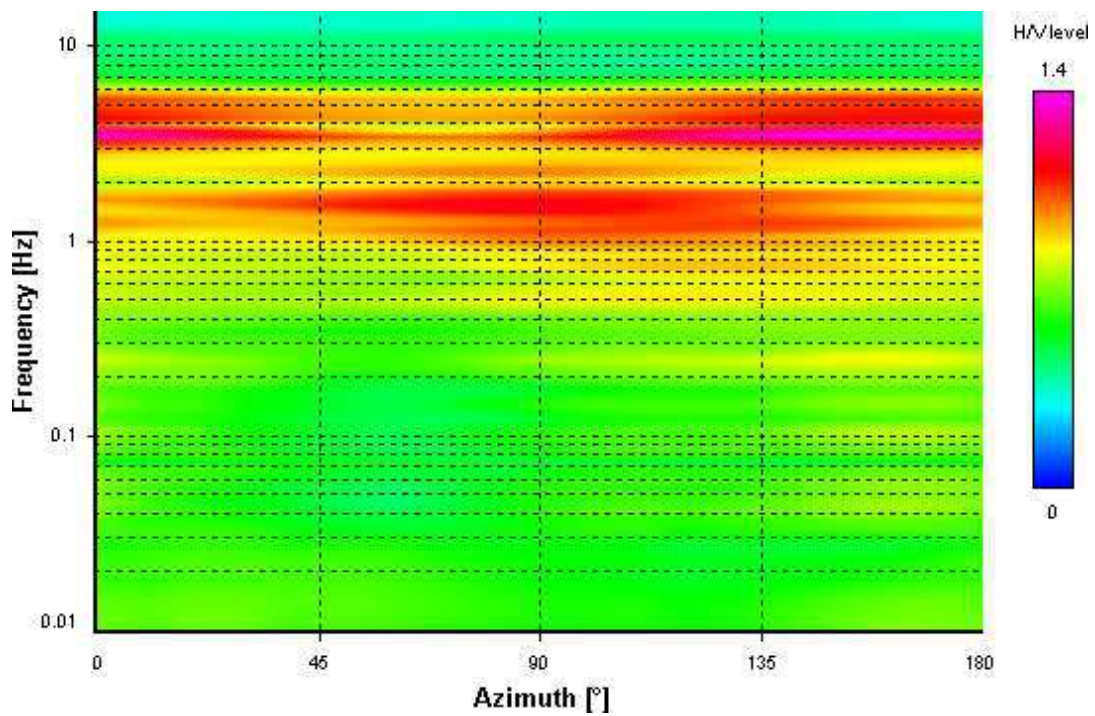
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



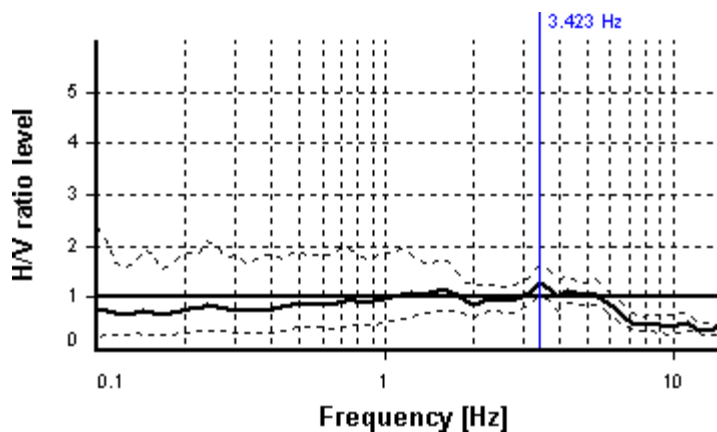
SESAME CRITERIA

Selected f_0 frequency

3.423 Hz

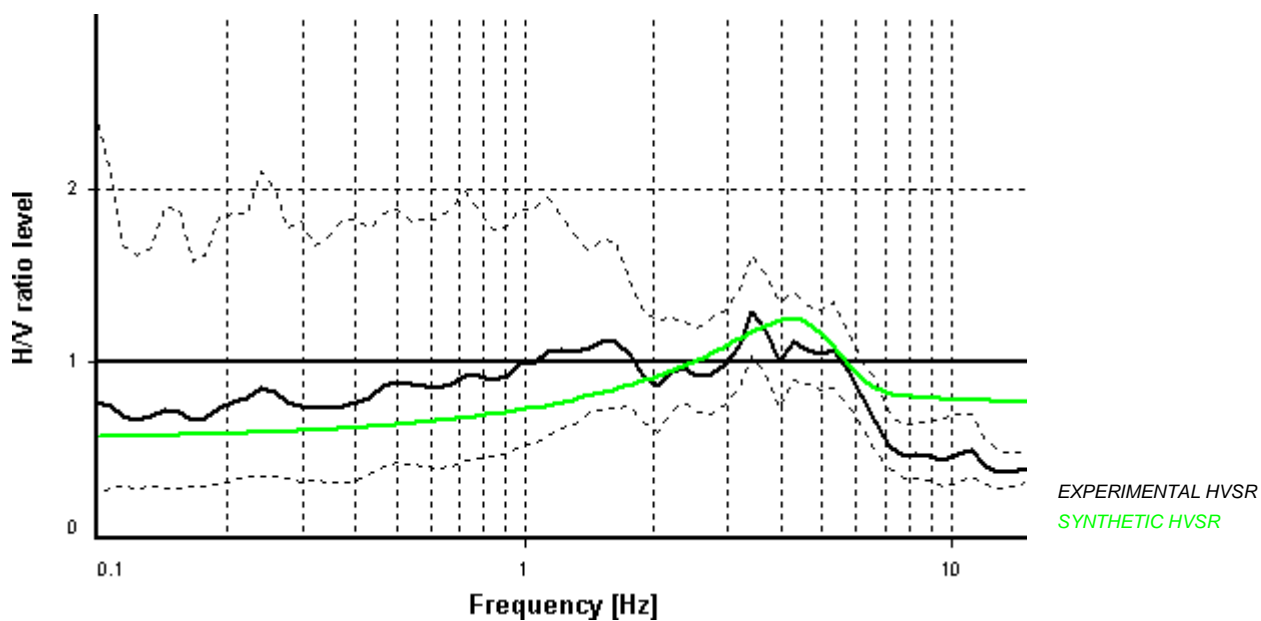
A_0 amplitude = 1.294

Average $f_0 = 3.660 \pm 0.548$

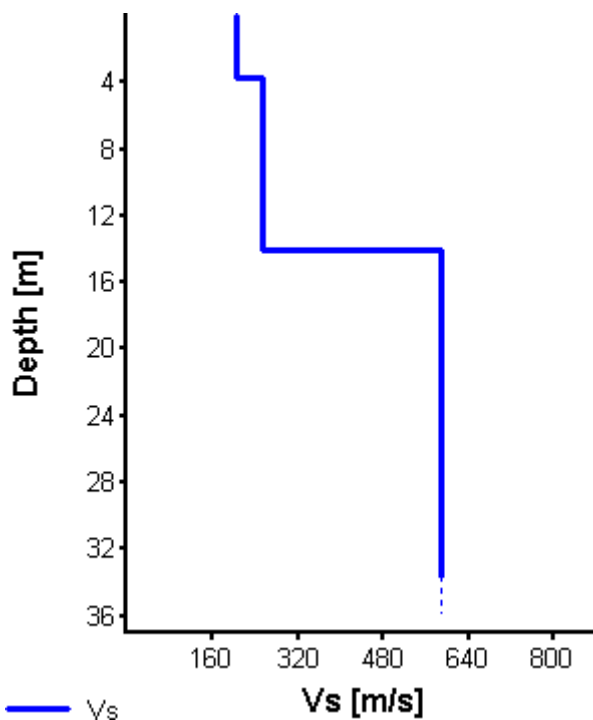


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	53 valid windows (length > 2.92 s) out of 53	OK
$n_c(f_0) > 200$	3602.78 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	0 Hz	NO
$\exists f^+$ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0$	7.16595 Hz	OK
$A_0 > 2$	1.29 <= 2	NO
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.54802 >= 0.17117	NO
$\sigma_A(f_0) < \theta(f_0)$	1.2514 < 1.58	OK
Overall criteria fulfillment		NO

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
3.7	3.7	335	203	1700
10.4	14.1	377	252	1700
17.1	31.2	2556	587	1800



$V_{Seq} (H = 30 \text{ m}) = 346 \text{ m/s}$

Sito puntuale P24

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Gabbiano Poggiolo - Pianello Val Tidone (PC)

Latitude: 44.924214

Longitude: 9.390148

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

Recording start time: 23/06/2021 - 10:01:56

Recording length: 20 min

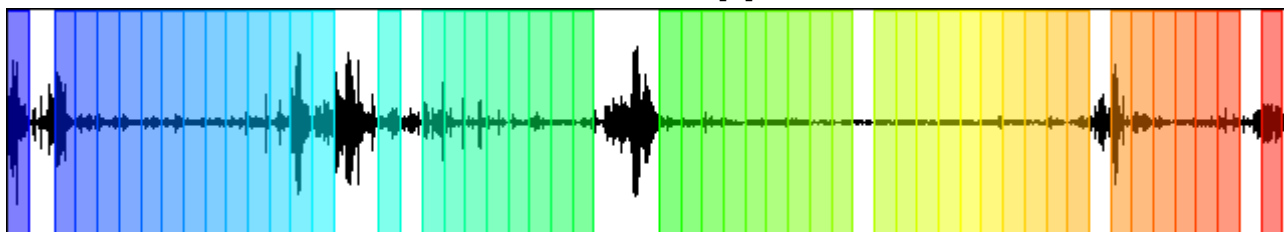
Windows count: 49

Average windows length: 20

Signal coverage: 81.67%

17278 Counts

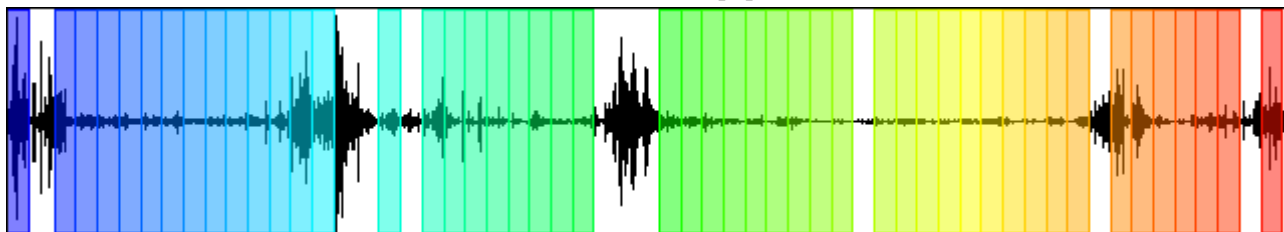
CHANNEL #1 [V]



-17791 Counts

33783 Counts

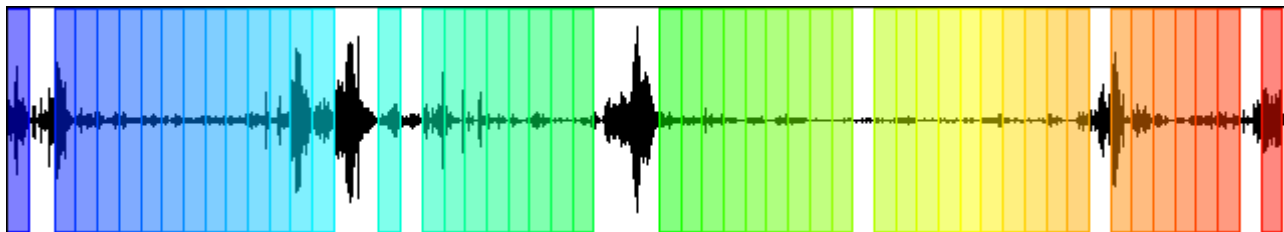
CHANNEL #2 [N]



-35384 Counts

49030 Counts

CHANNEL #3 [E]



-46987 Counts

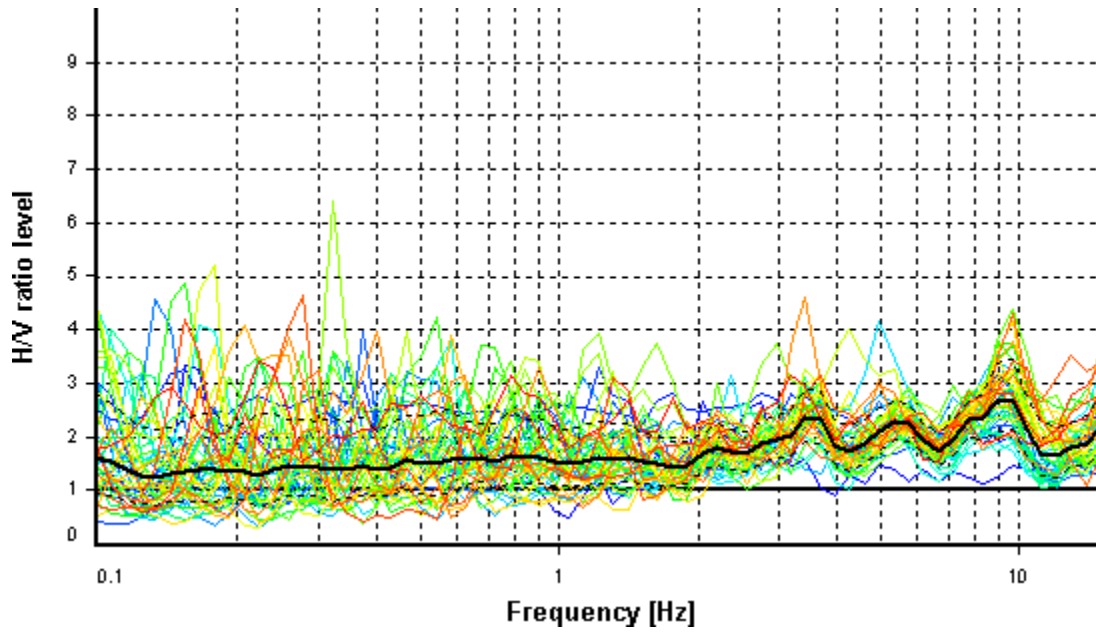
HVSR ANALYSIS

Tapering: Disabled

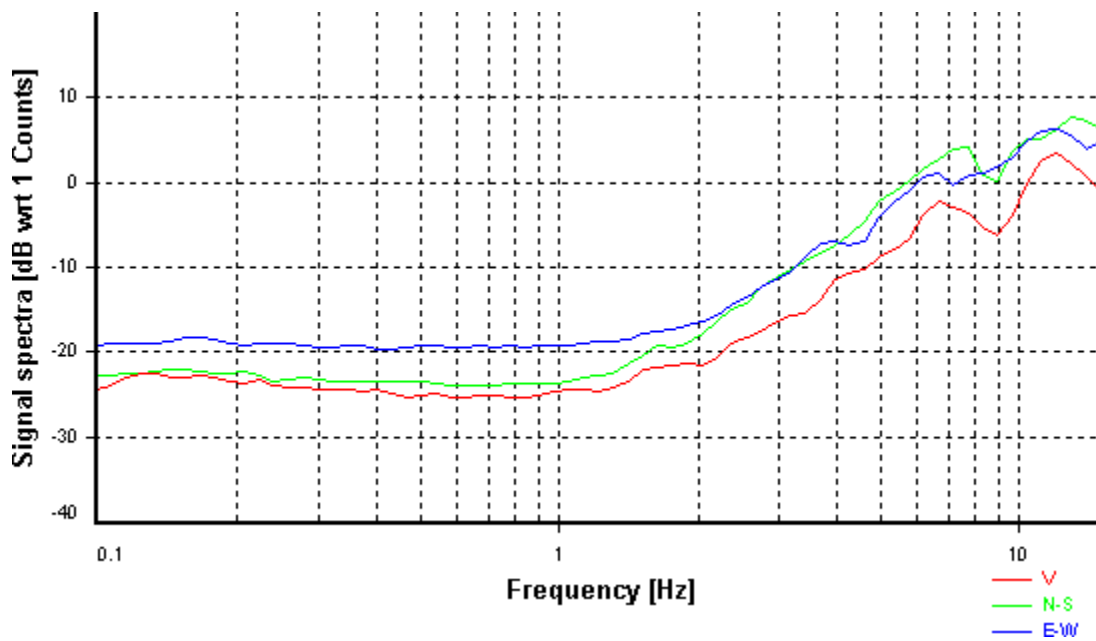
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

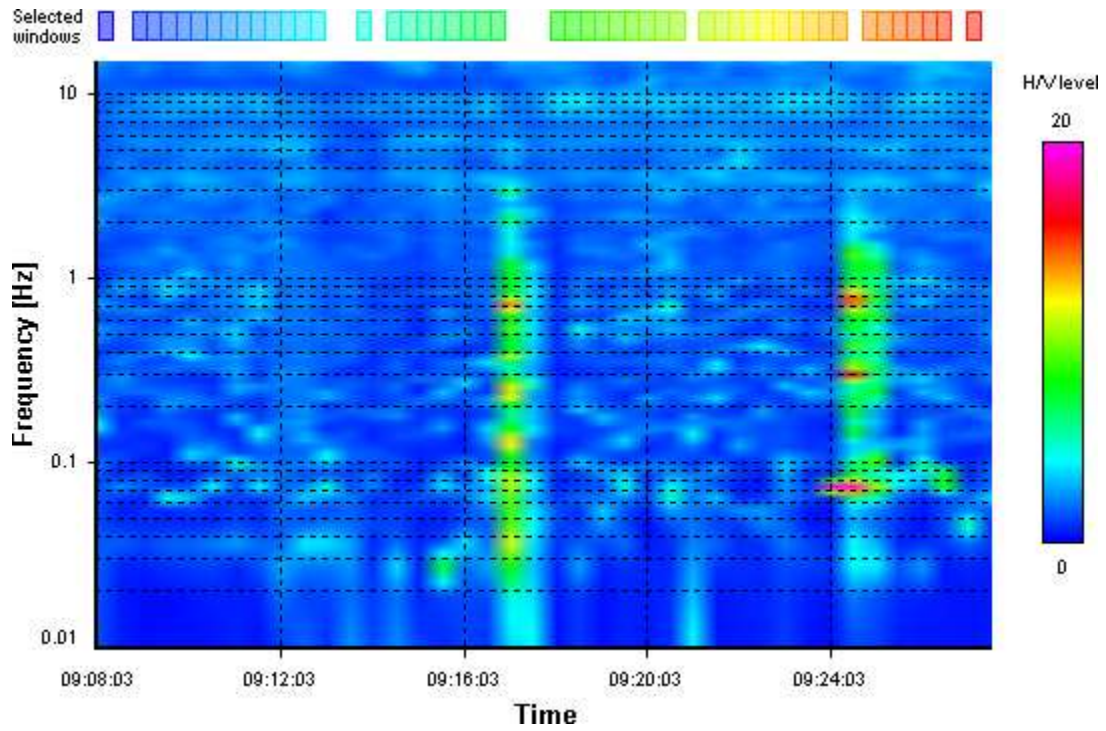
HVSR average



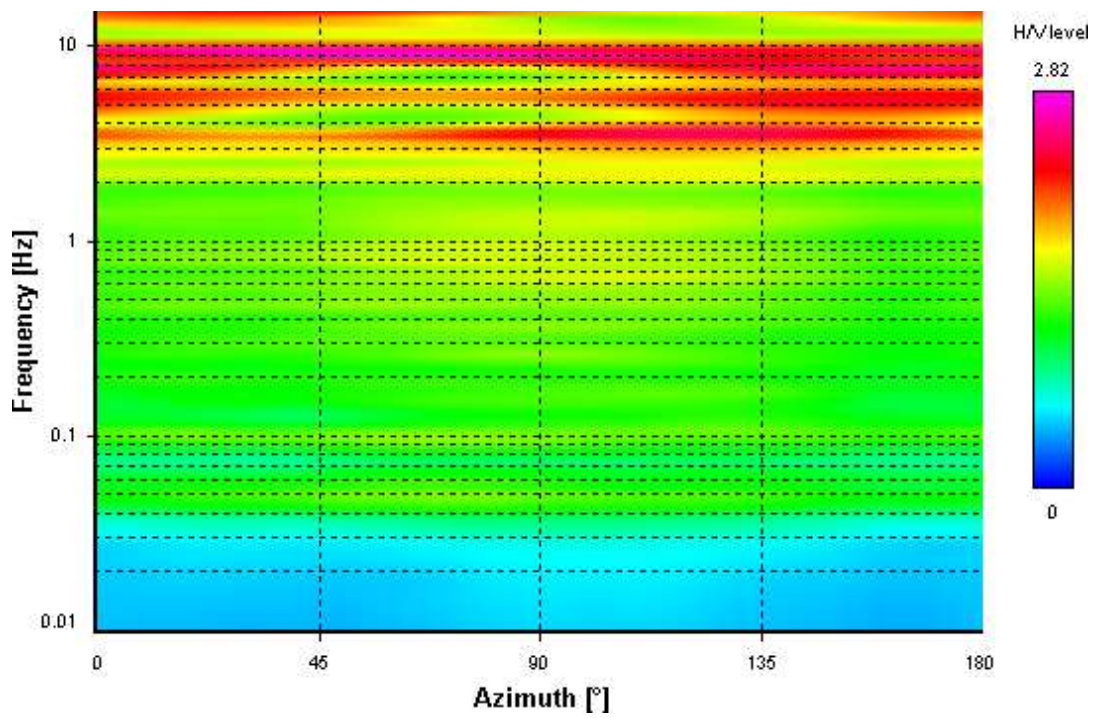
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



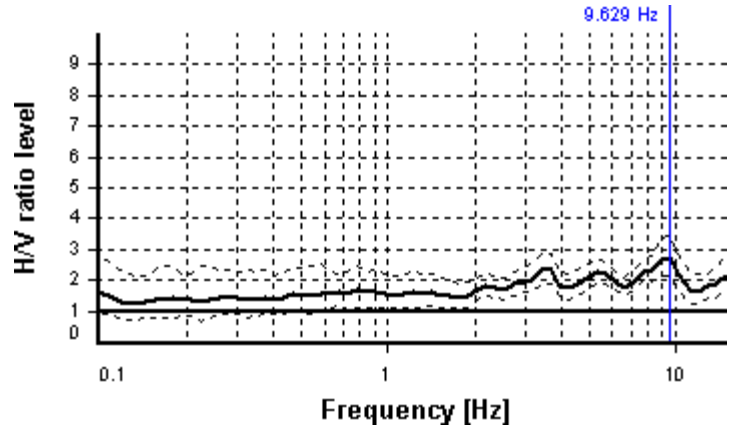
SESAME CRITERIA

Selected f_0 frequency

9.629 Hz

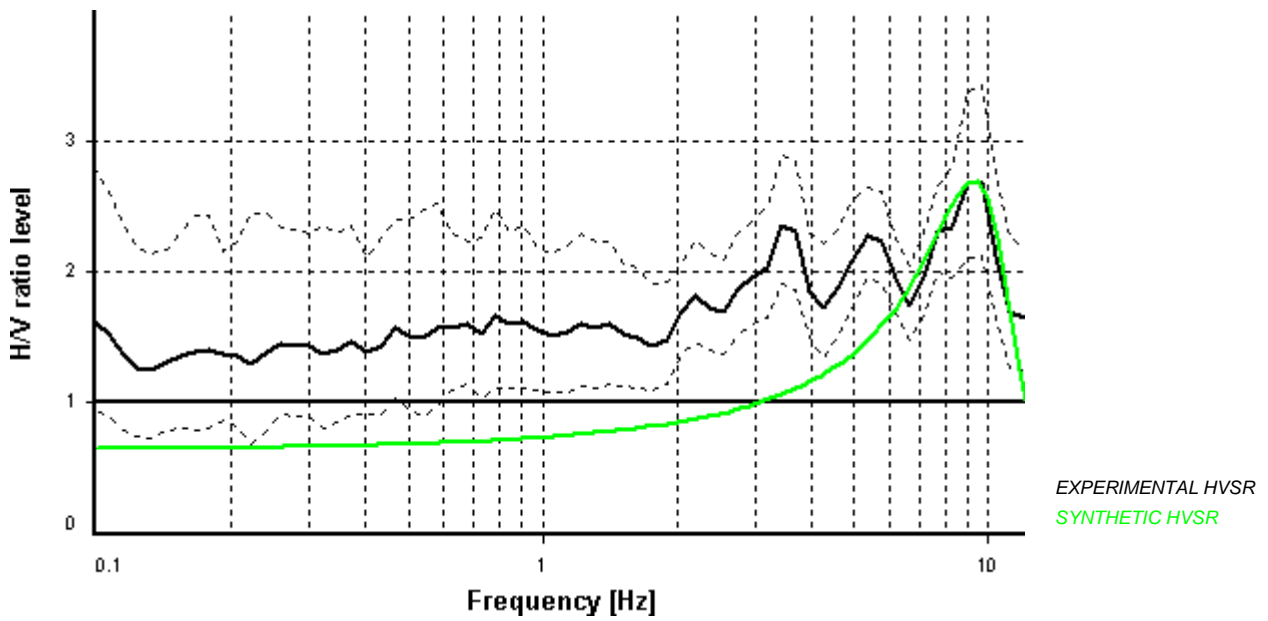
A_0 amplitude = 2.697

Average f_0 = 9.153 ± 0.775

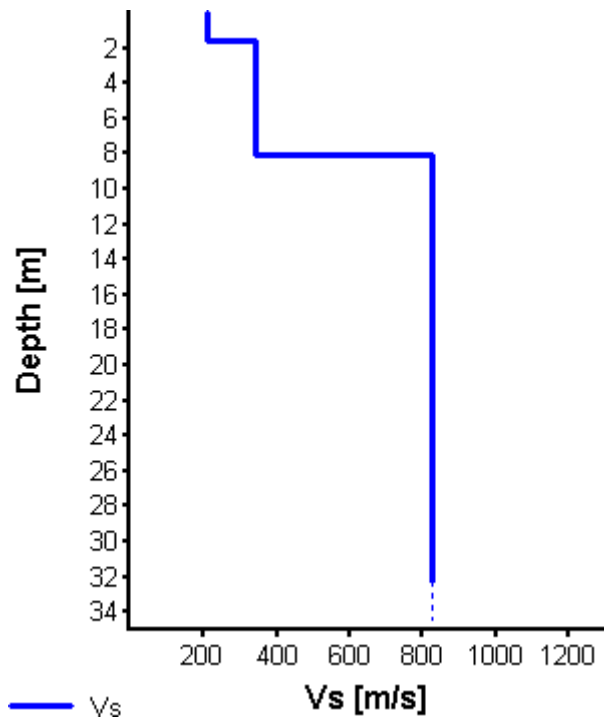


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	49 valid windows (length > 1.04 s) out of 49	OK
$n_c(f_0) > 200$	9436.85 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 16	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	0 Hz	NO
$\exists f^\dagger$ in $[f_0, 4f_0] \mid A_{H/V}(f^\dagger) < A_0$	0 Hz	NO
$A_0 > 2$	2.7 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.77546 >= 0.48147	NO
$\sigma_A(f_0) < \theta(f_0)$	1.27297 < 1.58	OK
Overall criteria fulfillment		NO

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
1.6	1.6	417	212	1700
6.5	8.1	576	339	1700
21.9	30	1628	829	2200



$V_{Seq}(H = 8.1 \text{ m}) = 303 \text{ m/s}$

Sito puntuale P25

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Via Carella - Pianello Val Tidone (PC)

Latitude: 44.943440

Longitude: 9.396255

Coordinate system: WGS84

Weather: Cielo sereno - assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

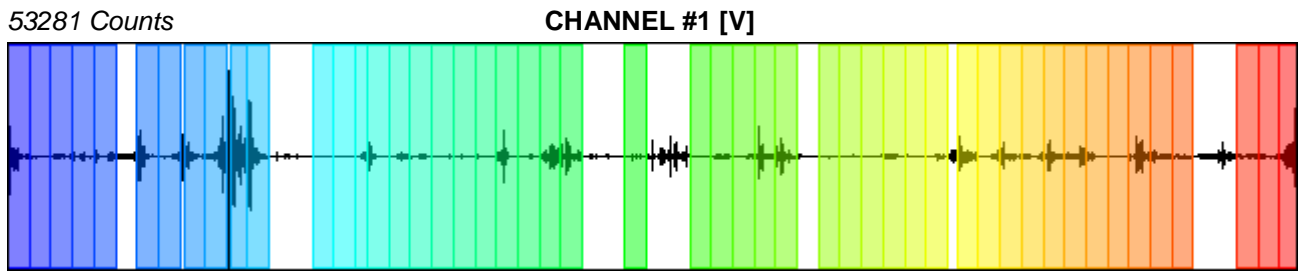
Recording start time: 23/06/2022 - 09:26:26

Recording length: 20 min

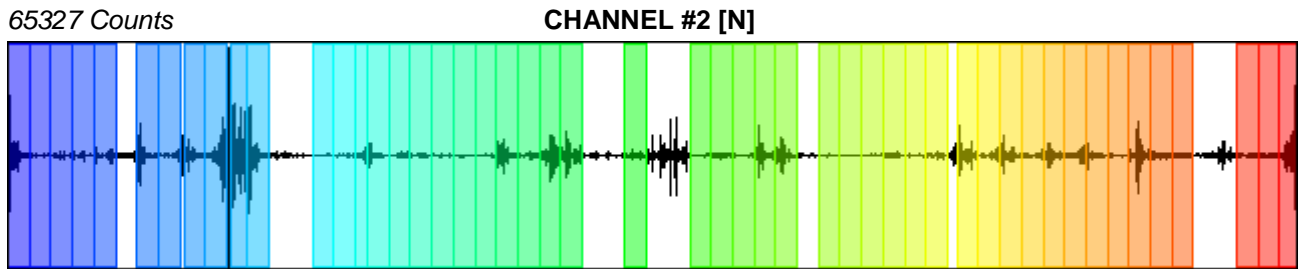
Windows count: 50

Average windows length: 19.62

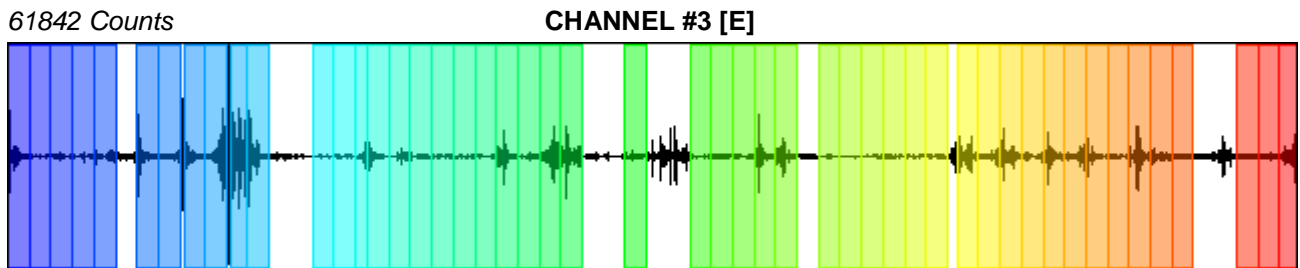
Signal coverage: 81.77%



-56903 Counts



-68201 Counts



-61357 Counts

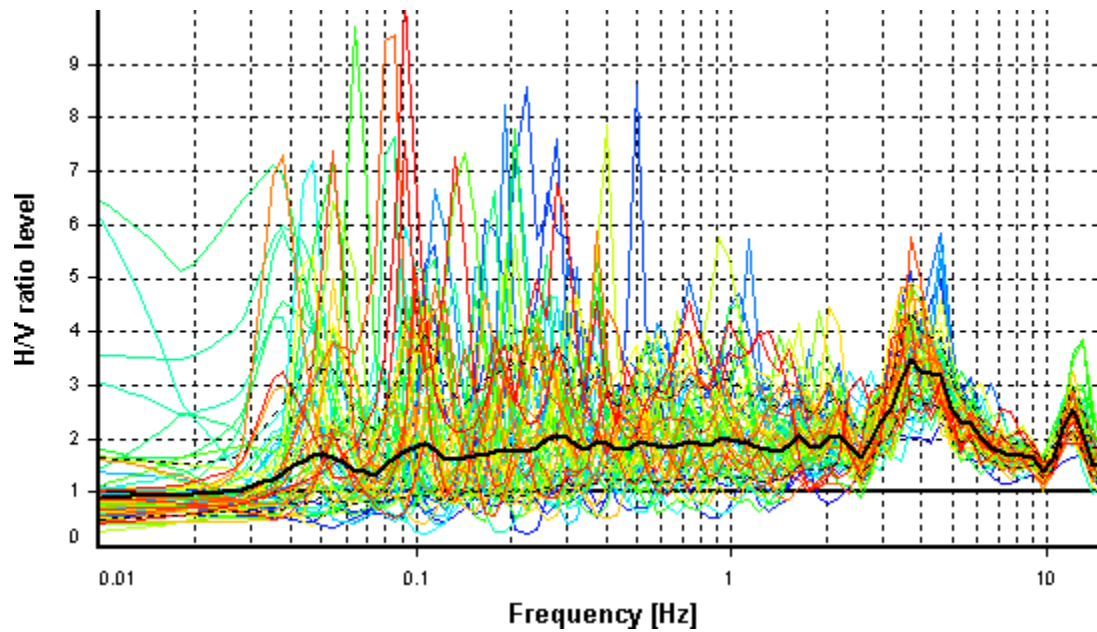
HVSR ANALYSIS

Tapering: Disabled

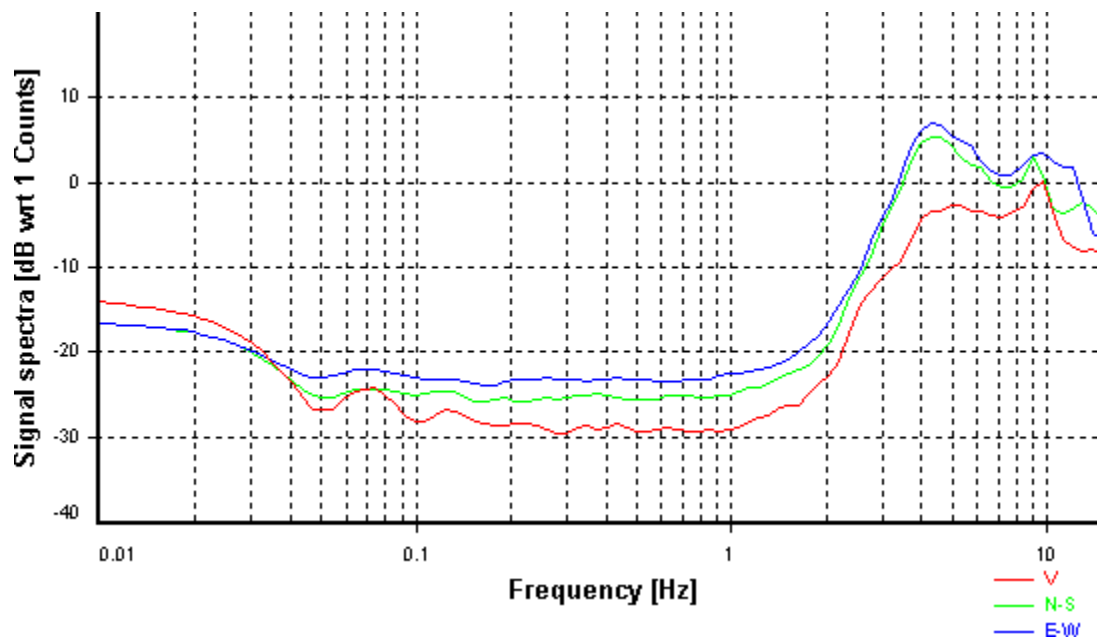
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

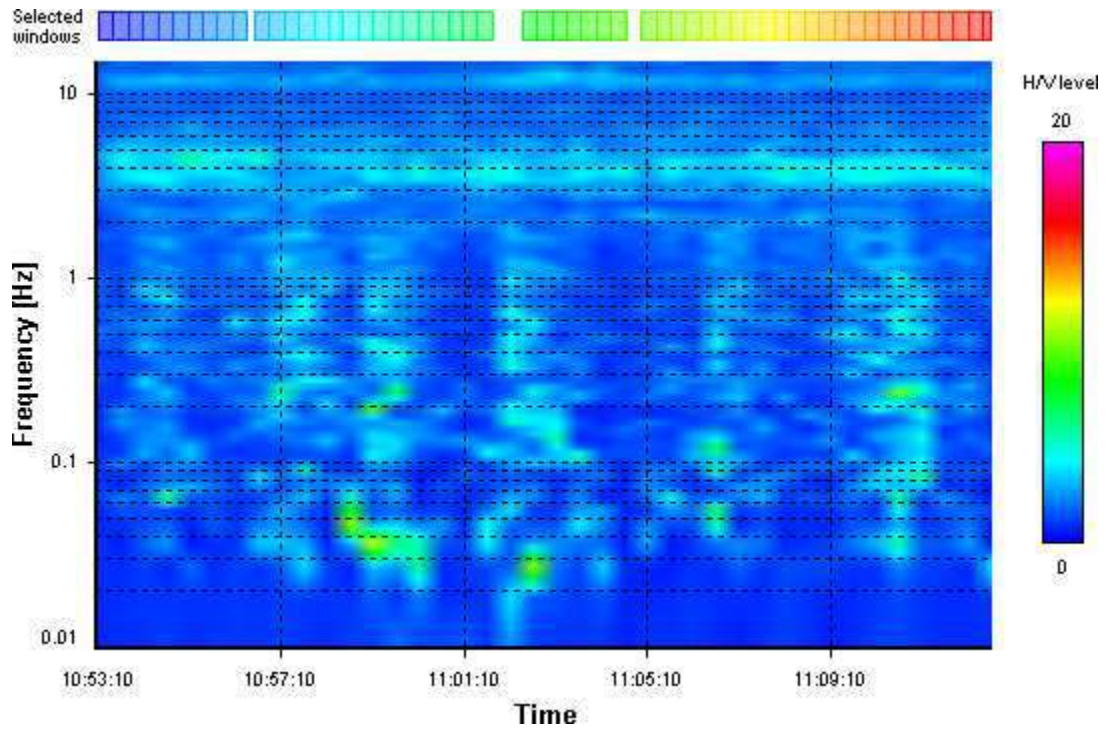
HVSR average



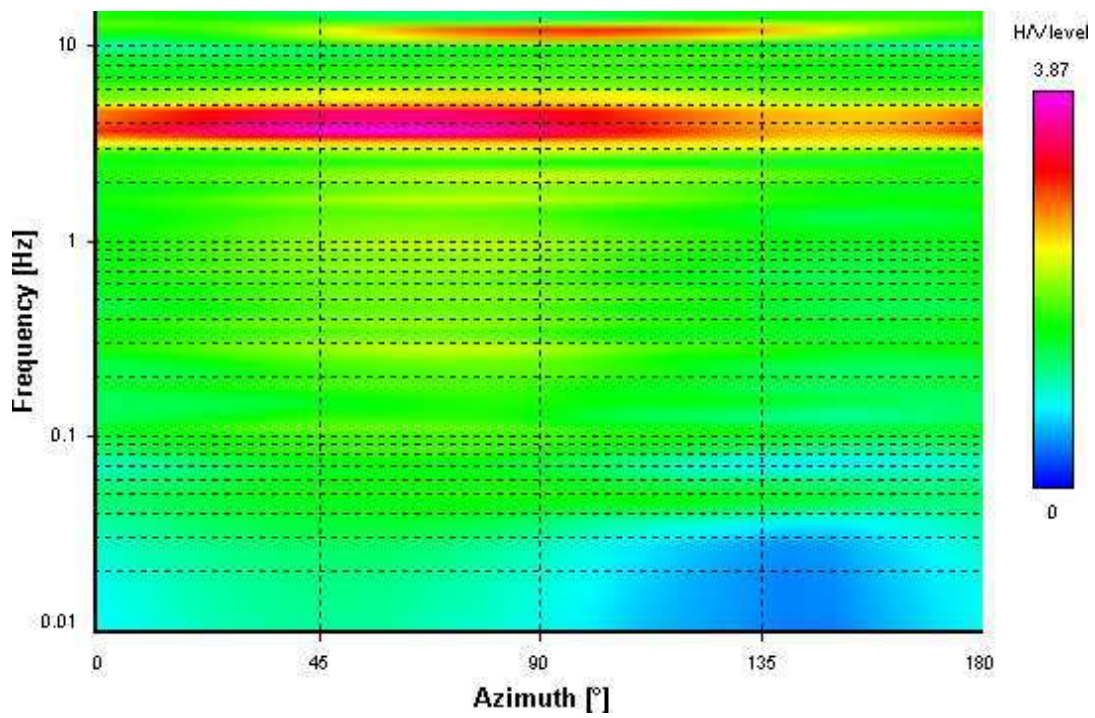
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



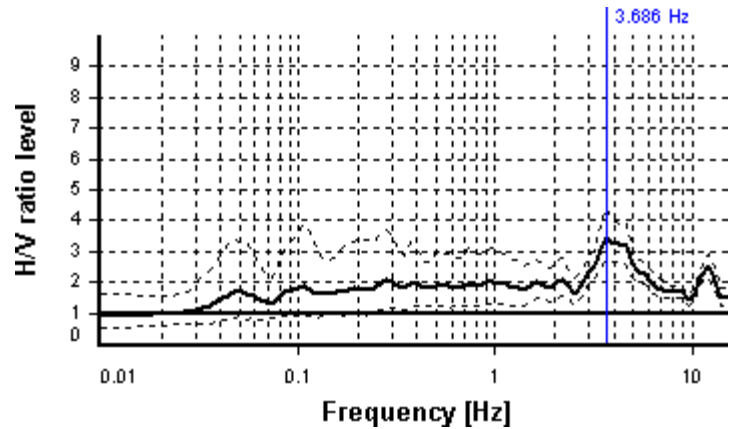
SESAME CRITERIA

Selected f_0 frequency

3.686 Hz

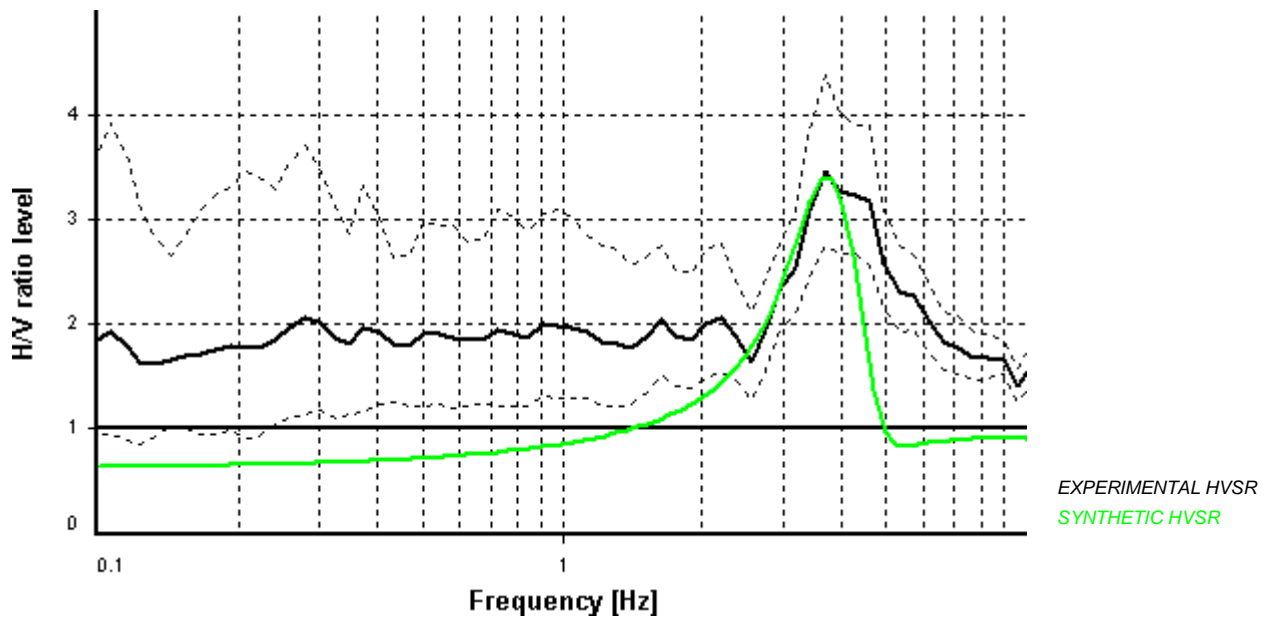
A_0 amplitude = 3.471

Average $f_0 = 3.935 \pm 0.471$

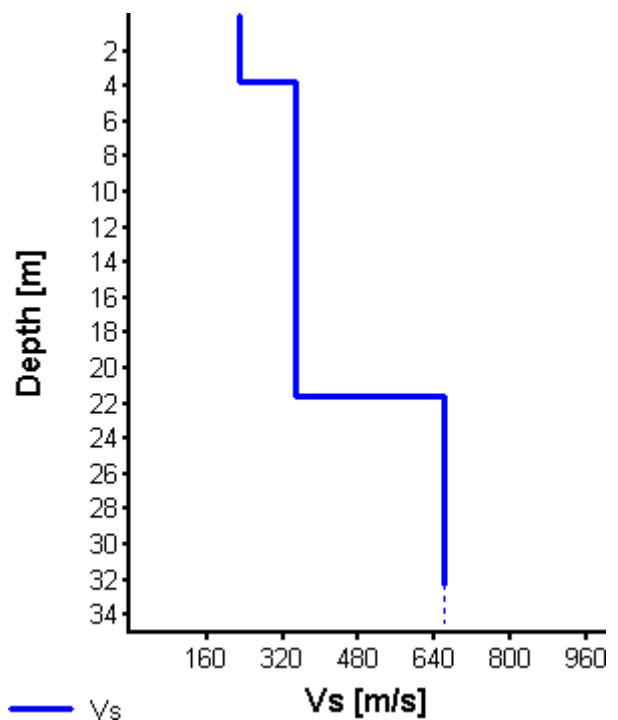


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	57 valid windows (length > 2.71 s) out of 57	OK
$n_c(f_0) > 200$	4166.75 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	2.54759 Hz	OK
$\exists f^\dagger$ in $[f_0, 4f_0] \mid A_{H/V}(f^\dagger) < A_0$	7.71535 Hz	OK
$A_0 > 2$	3.47 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.47069 >= 0.18429	NO
$\sigma_A(f_0) < \theta(f_0)$	1.26607 < 1.58	OK
Overall criteria fulfillment		OK

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
3.8	3.8	408	228	1700
15.4	19.2	627	349	1800
10.8	30	1615	661	1900



$$V_{\text{Seq}} (H = 30.0 \text{ m}) = 388.95 \text{ m/s}$$

Sito puntuale P26

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Località Pradaglia - Pianello Val Tidone (PC)

Latitude: 44.919706

Longitude: 9.369875

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

Recording start time: 23-06/2022 - 07:44:28

Recording length: 20 min

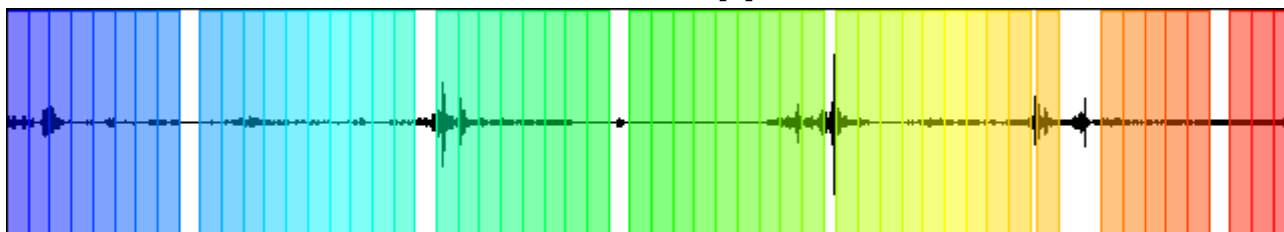
Windows count: 53

Average windows length: 20

Signal coverage: 88.33%

17655 Counts

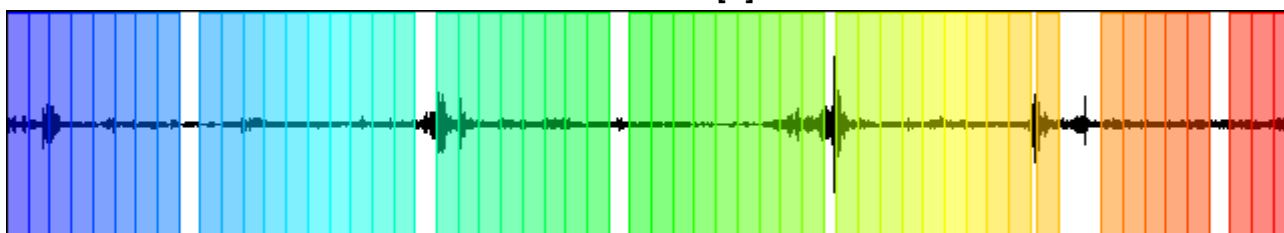
CHANNEL #1 [V]



-18304 Counts

14522 Counts

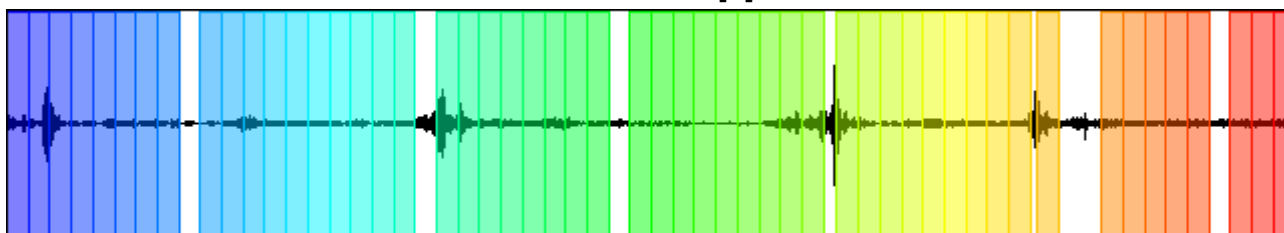
CHANNEL #2 [N]



-12352 Counts

17149 Counts

CHANNEL #3 [E]



-16156 Counts

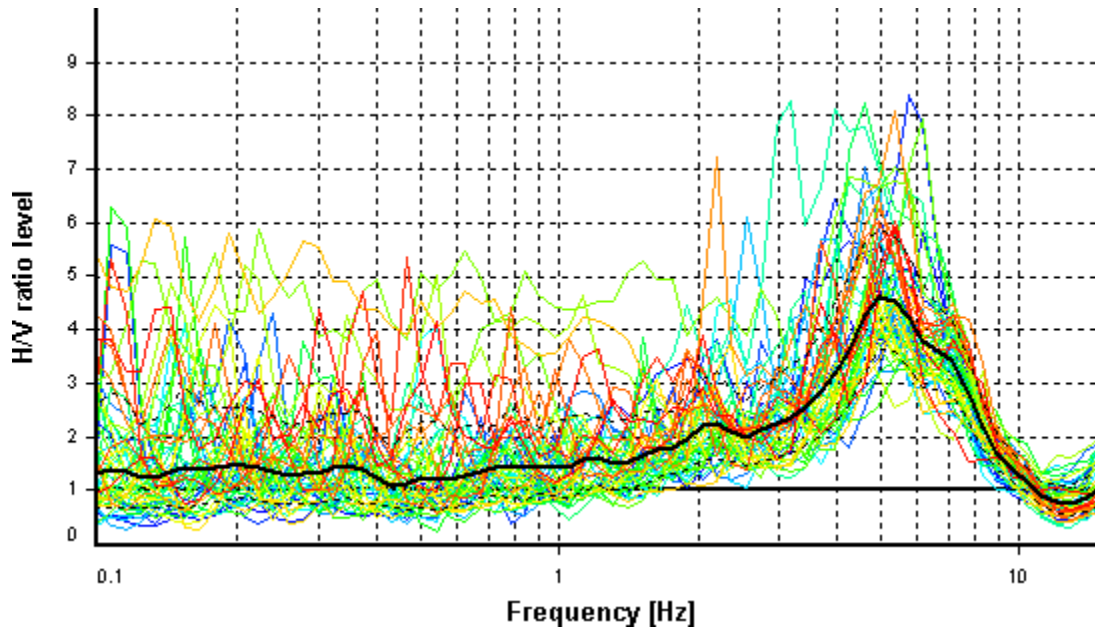
HVSR ANALYSIS

Tapering: Disabled

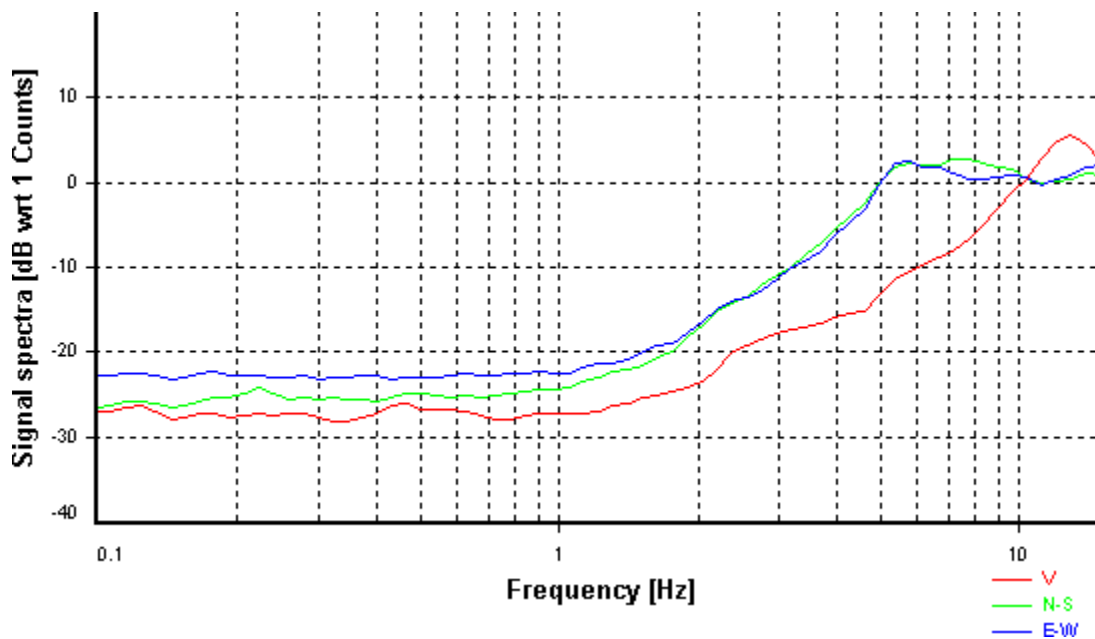
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

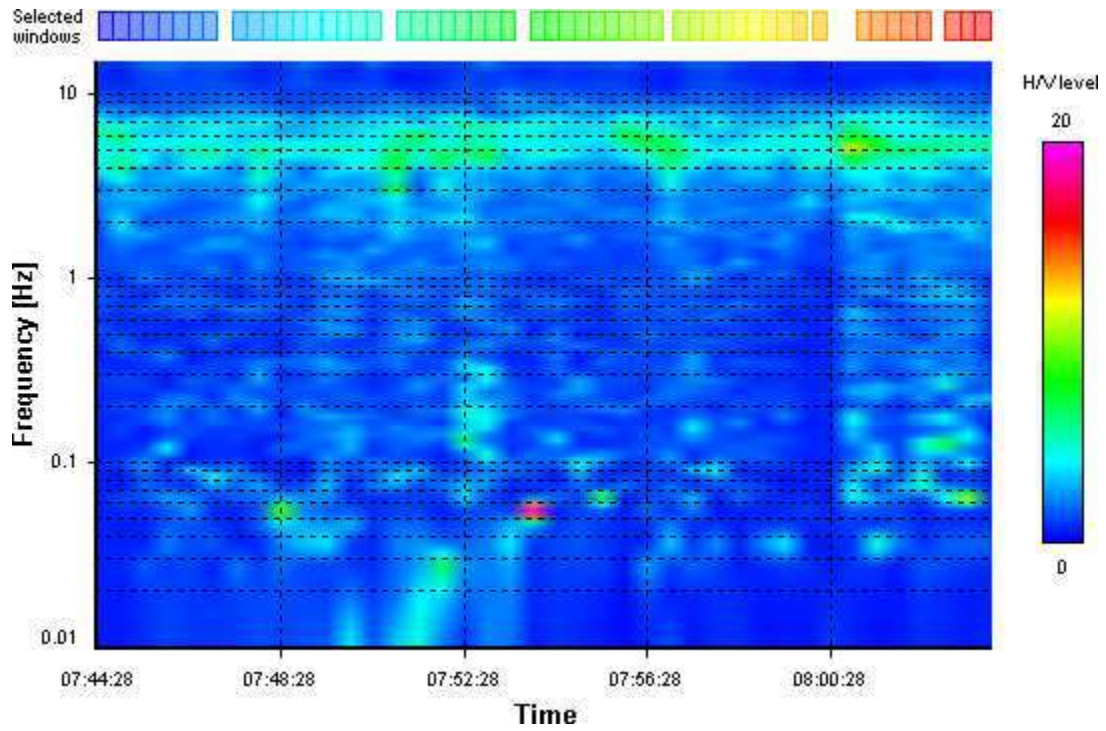
HVSR average



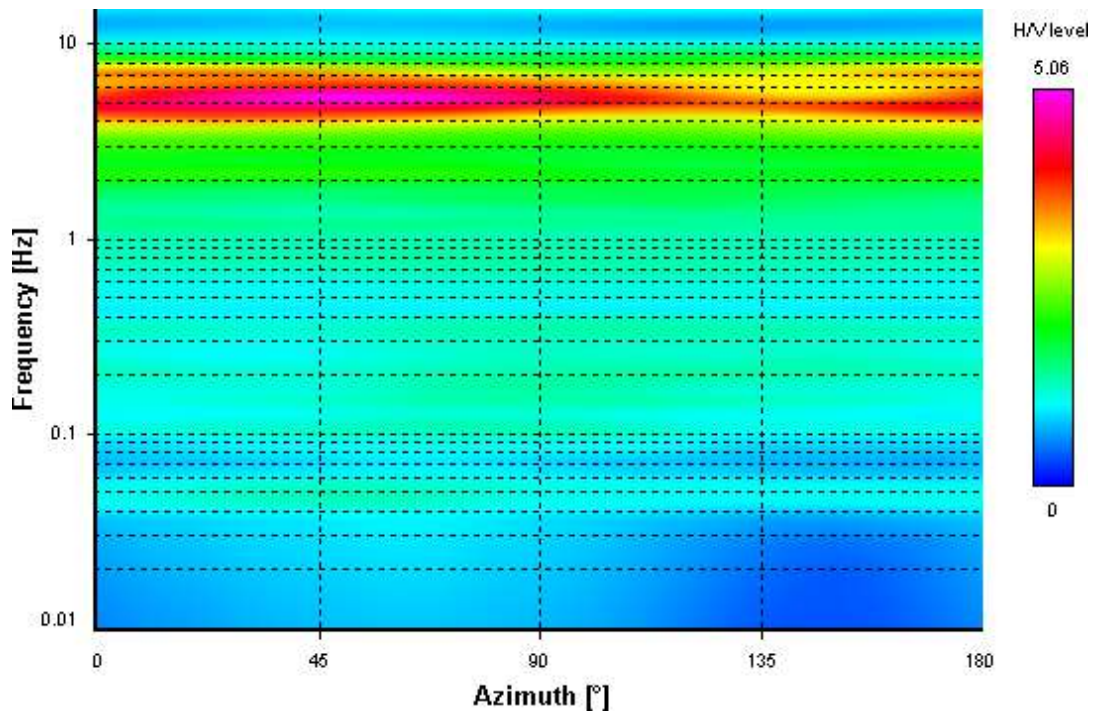
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



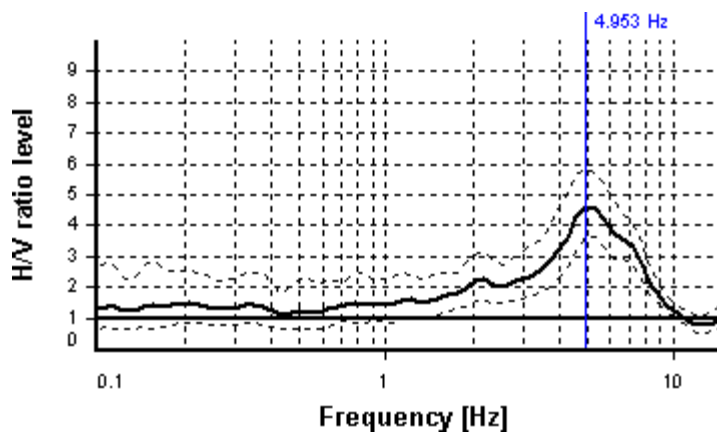
SESAME CRITERIA

Selected f_0 frequency

4.953 Hz

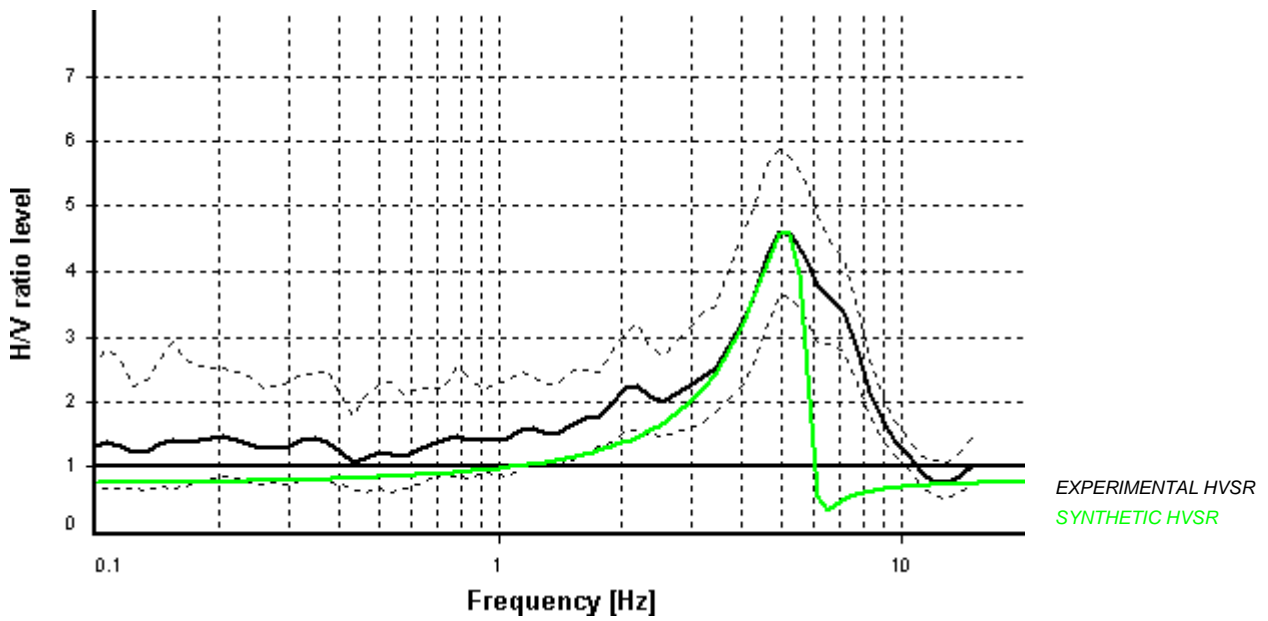
A_0 amplitude = 4.620

Average f_0 = 5.171 ± 0.624

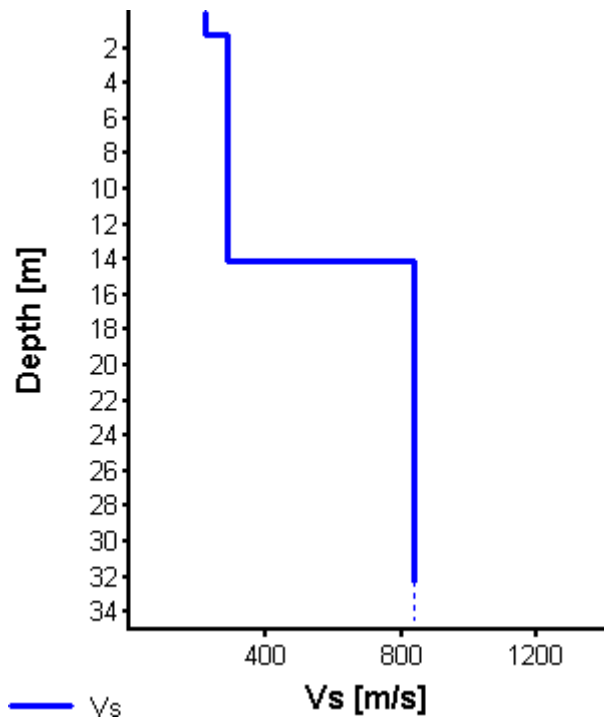


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	53 valid windows (length > 2.02 s) out of 53	OK
$n_c(f_0) > 200$	5250.14 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	2.9532 Hz	OK
$\exists f^\dagger$ in $[f_0, 4f_0] \mid A_{H/V}(f^\dagger) < A_0$	8.30687 Hz	OK
$A_0 > 2$	4.62 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.62368 >= 0.24765	NO
$\sigma_A(f_0) < \theta(f_0)$	1.27141 < 1.58	OK
Overall criteria fulfillment		OK

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
1.3	1.3	520	221	1700
12.8	14.1	588	286	1800
15.9	30	1280	837	2200



$V_{Seq} (H = 14.10 \text{ m}) = 278 \text{ m/s}$

Sito puntuale P28

STATION INFORMATION

Station code: Stazione 1

Model: SARA GEOBOX

Sensor: SARA SS45PACK (integrated 4.5 Hz sensors)

Notes: -

PLACE INFORMATION

Place ID: Stazione 1

Address: Case Garamonti - Pianello Val Tidone (PC)

Latitude: 44.921822

Longitude: 9.393417

Coordinate system: WGS84

Weather: Cielo sereno - Assenza di fenomeni

Notes: -

PHOTOGRAPHIC REFERENCES



SIGNAL AND WINDOWING

Sampling frequency: 300 Hz

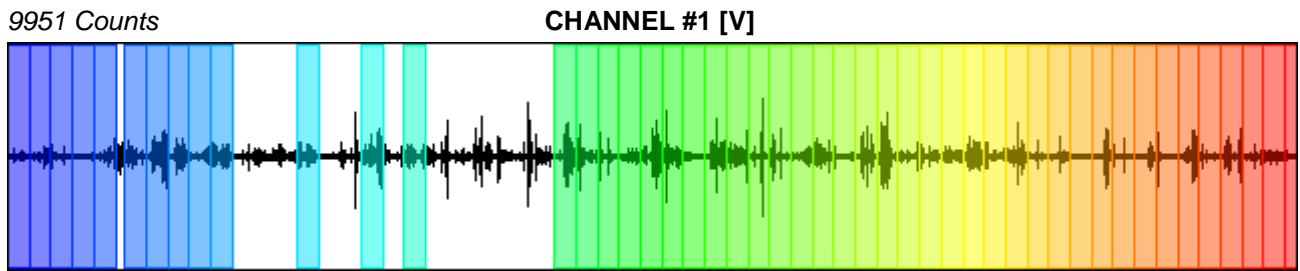
Recording start time: 23/06/2022 - 10:32:38

Recording length: 20 min

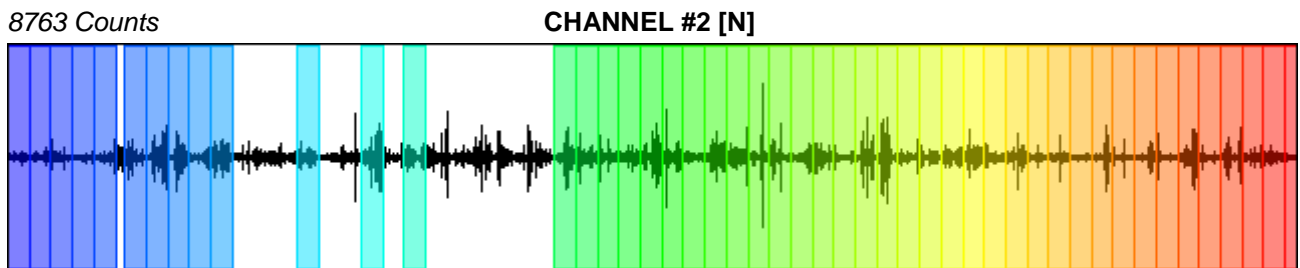
Windows count: 48

Average windows length: 19.81

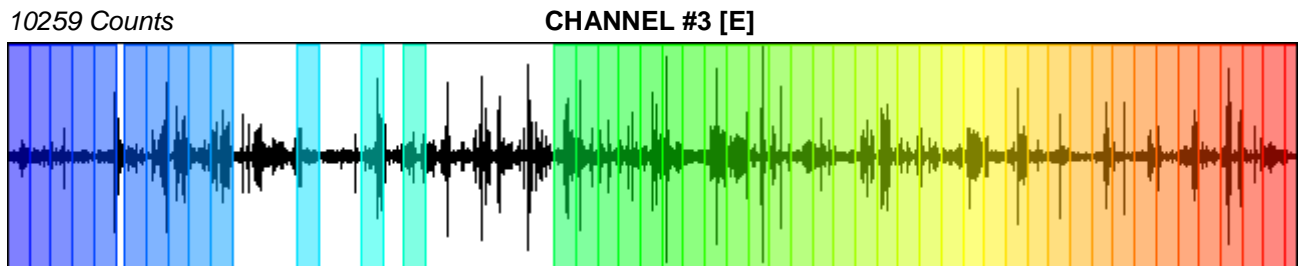
Signal coverage: 79.26%



-8377 Counts



-13243 Counts



-9710 Counts

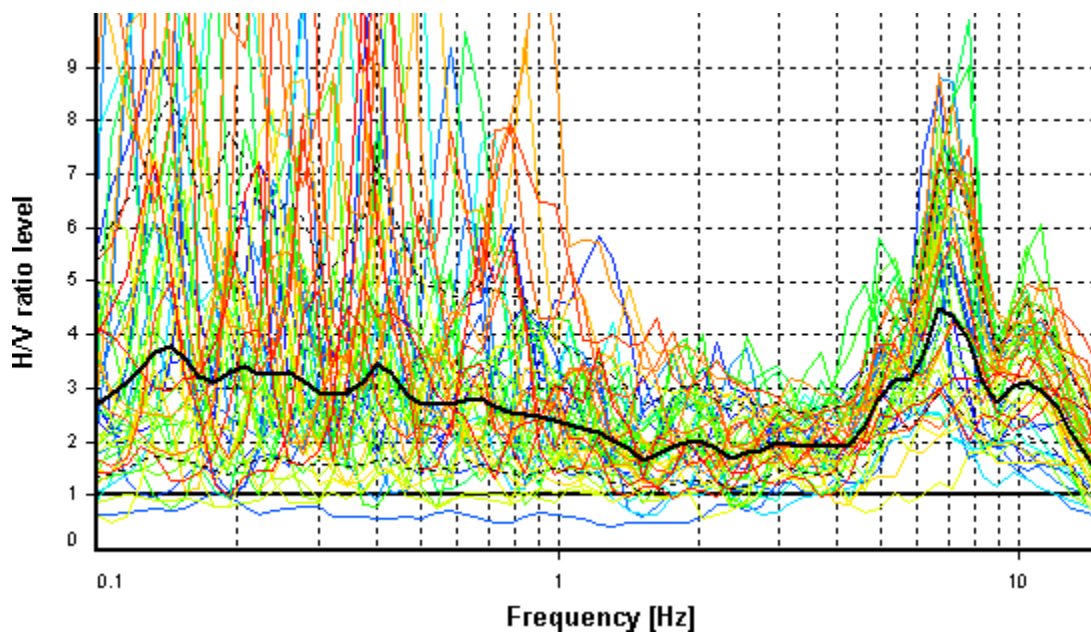
HVSR ANALYSIS

Tapering: Disabled

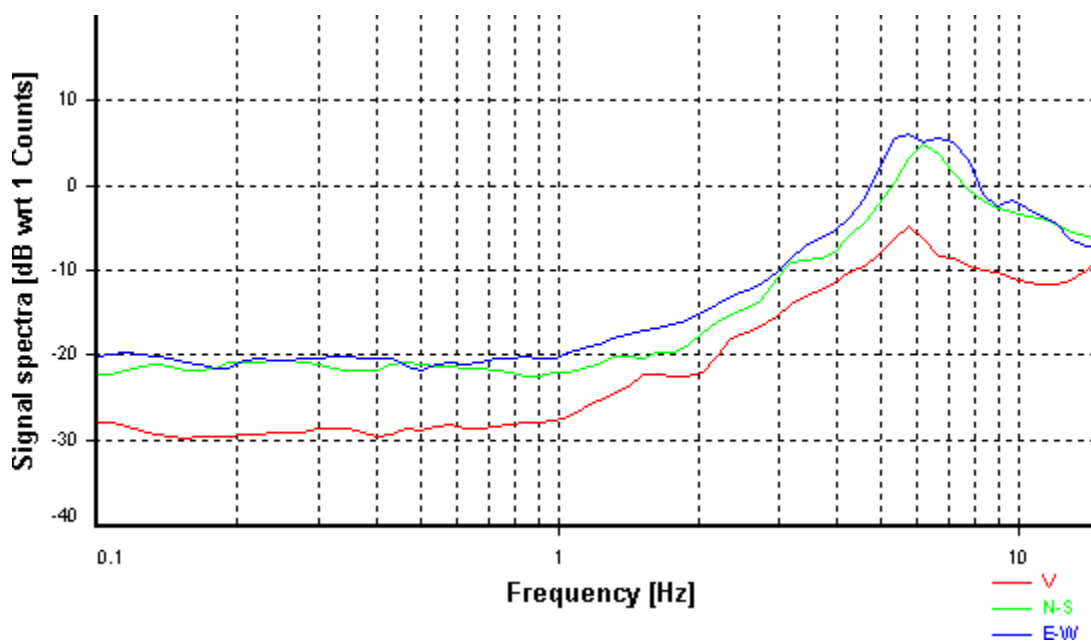
Smoothing: Konno-Ohmachi (Bandwidth coefficient = 40)

Instrumental correction: Disabled

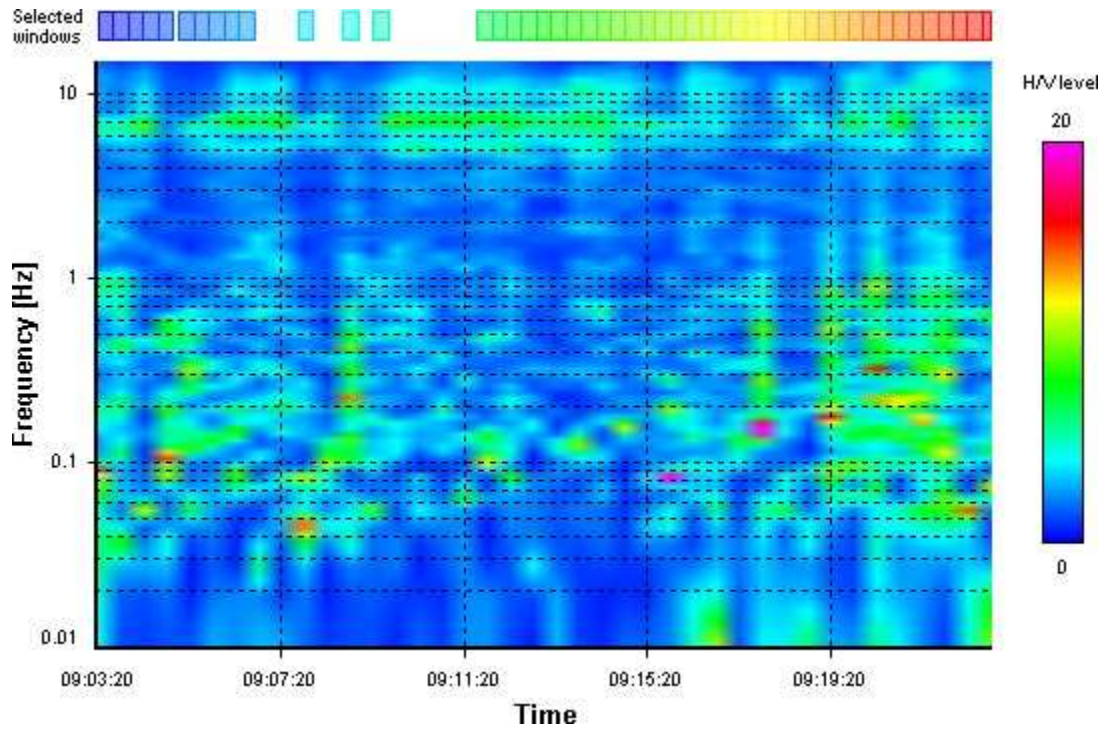
HVSR average



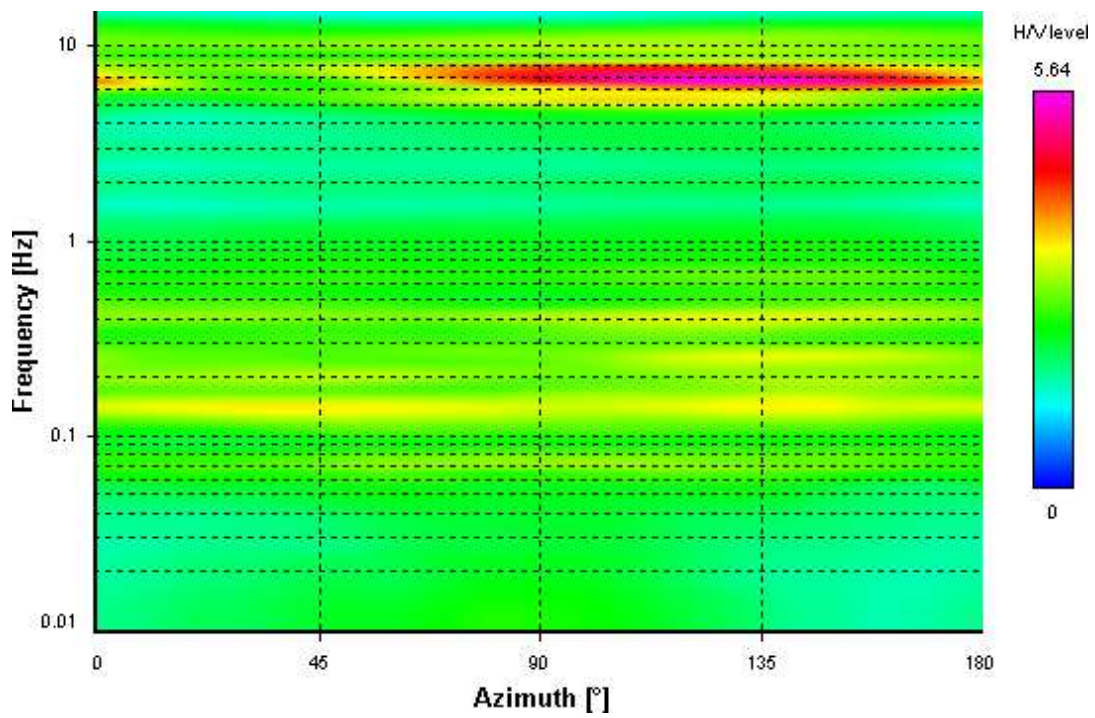
Signal spectra average



HVSR time-frequency analysis (30 seconds windows)



HVSR directional analysis



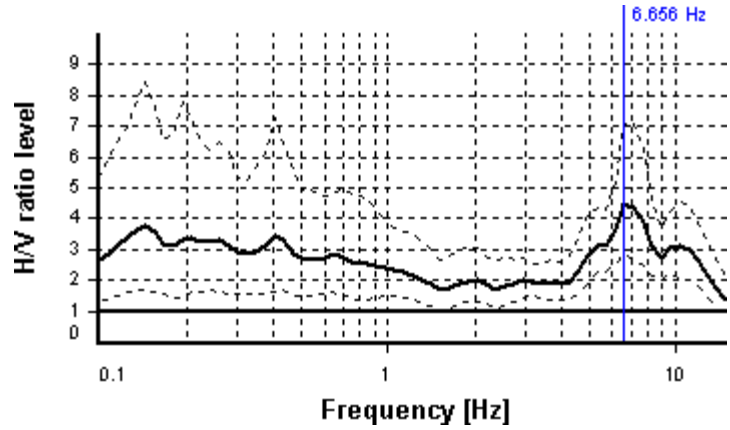
SESAME CRITERIA

Selected f_0 frequency

6.656 Hz

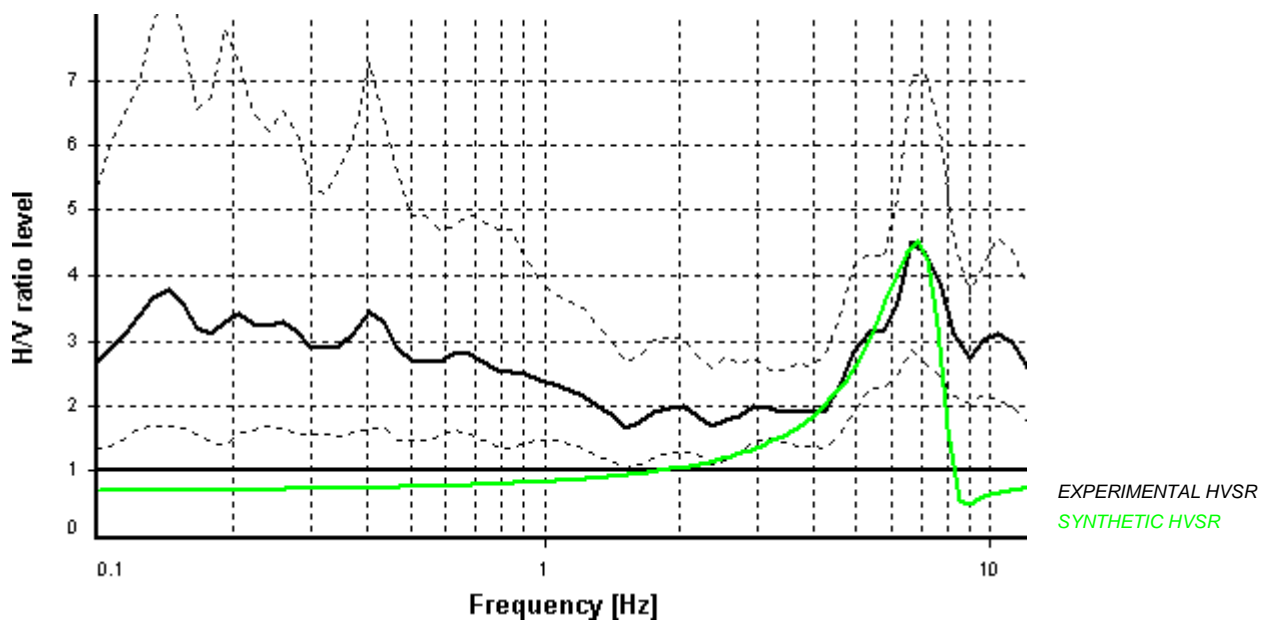
A_0 amplitude = 4.508

Average $f_0 = 7.011 \pm 0.775$

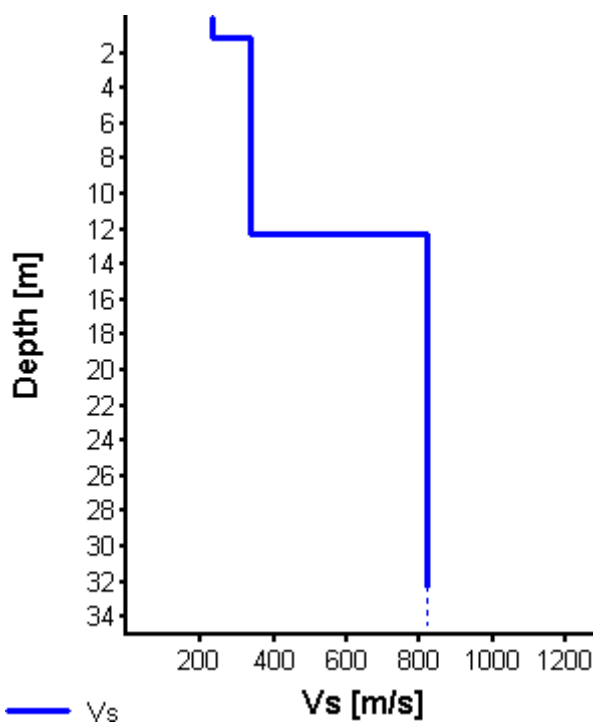


HVSr curve reliability criteria		
$f_0 > 10 / L_w$	48 valid windows (length > 1.5 s) out of 48	OK
$n_c(f_0) > 200$	6330.17 > 200	OK
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$	Exceeded 0 times in 19	OK
HVSr peak clarity criteria		
$\exists f$ in $[f_0/4, f_0] \mid A_{H/V}(f) < A_0$	4.27269 Hz	OK
$\exists f^+$ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0$	12.93981 Hz	OK
$A_0 > 2$	4.51 > 2	OK
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	0% <= 5%	OK
$\sigma_f < \varepsilon(f_0)$	0.77512 >= 0.33278	NO
$\sigma_A(f_0) < \theta(f_0)$	1.5715 < 1.58	OK
Overall criteria fulfillment		OK

Synthetic HVSR modelling



H [m]	D [m]	Vp [m/s]	Vs [m/s]	ρ [kg/m ³]
1.1	1.1	421	233	1700
11.2	12.3	639	336	1800
17.7	30	1633	819	2300



$V_{Seq} (H = 12.30 \text{ m}) = 323 \text{ m/s}$