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In collaborazione con

SGAT 
STUDIO GEOLOGICO-TECNICO AMBIENTE TERRITORIO
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Introduzione

Il presente documento riporta i risultati delle analisi svolte per la caratterizzazione in termini di V_S (velocità delle onde di taglio) di un edificio scolastico sito nel comune di Santa Caterina Albanese (CS).



Per la determinazione di un profilo V_S sufficientemente vincolato (e quindi robusto) si è effettuata l'analisi congiunta di tre "oggetti": le velocità di gruppo delle onde di Rayleigh (componente ZVF) e Love (componente THF) [sismica attiva] e il rapporto spettrale H/V [sismica passiva].





Le analisi HVSR mostrano un lieve picco a circa 3-4Hz (che soddisfa solo solo in parte i criteri SESAME).

La determinazione del profilo VS è stata quindi svolta dall'analisi congiunta della dispersione (componenti ZVF+RVF [analisi *Full Velocity Spectrum* - FVS]) + HVSR.

La classificazione del terreno viene delegata al professionista sulla base delle linee guida regionali (lo stesso profilo V_S può assumere diversi "significati" a seconda delle *consuetudini* regionali).

HVSR

DATA ACQUISITION

Date and time: 1980 01 06 21 11 06

Notes: a metà dello stendimento HoliSurface, parallele ad una strada trafficata

DATA PROCESSING

Sampling frequency (Hz): 128

Window length (sec): 15

Minimum frequency soundly determined [5 cycles]: 0.33333Hz

Length of analysed dataset (min): 13.8

Tapering (%): 5

Smoothing (%): 15

show data reset

step#1 (optional) - decimate
 12... new frequency resample

step#2 - HV computation
 remove events both Rad... clean axes

15 window length (s) Min. freq.: 0.3333Hz
 5 tapering (%)
 7 amplitude threshold test removal
 15% spectral smoothing (triangular window)

show particle motion and all HVSRs
 full output compute

continuity

3D motion
 save video show 3D motion

directivity analysis
 frequencies to 3.3 H comp...

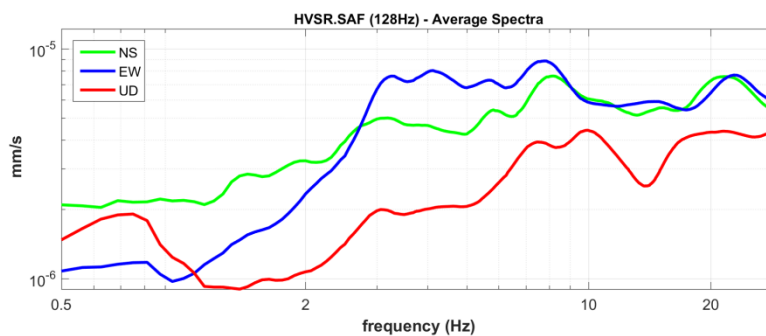
save - option#1: save HVSR as it is
 save HV from 0.5 to 30 Hz
 save HV curve (as it is)

save - option#2: picking HV curve
 pick HV curve save picked HV

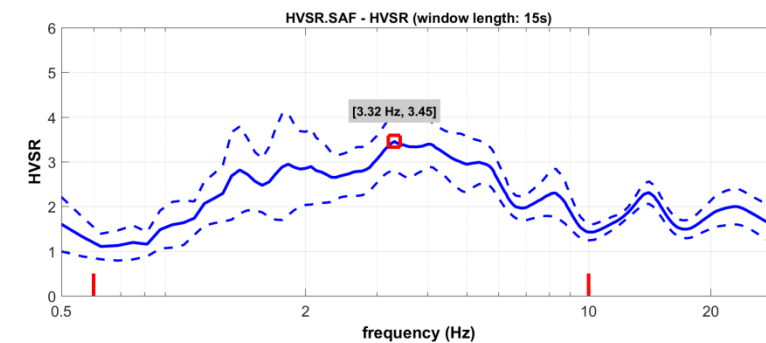
quick analysis (f=Vs/4H)
 200 average Vs (m/s) (from surface to bedrock)
 20 depth of the bedrock
 1000 Vs of the bedrock
 clean compute

highlight a frequency
 draw/highlight 10 Hz

directivity over time
 directivity in L... time 60 s



open working folder
 show location
 field notes



Criteria for a reliable H/V curve

#1: OK
 #2: OK
 #3: OK

Criteria for a clear H/V peak [3.32 Hz]

#1: OK
 #2: OK
 #3: OK
 #4: NO
 #5: NO
 #6: OK

To model the HVSR (also jointly with MASW or ReMI/ESAC data), save the HV curve, go to the "Velocity Spectrum/s, Modeling & Picking" panels and u

SESAME criteria

In the following the results considering the data in the 0.6-10.0Hz frequency range

Peak frequency (Hz): 3.3 (±2.0)

Peak HVSR value: 3.5 (±0.7)

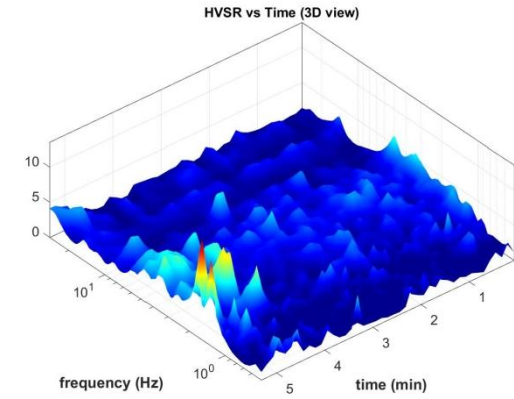
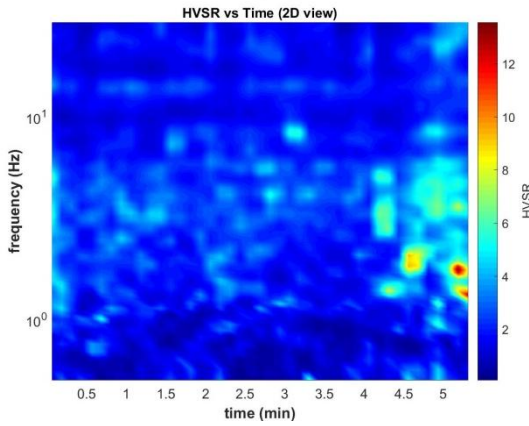
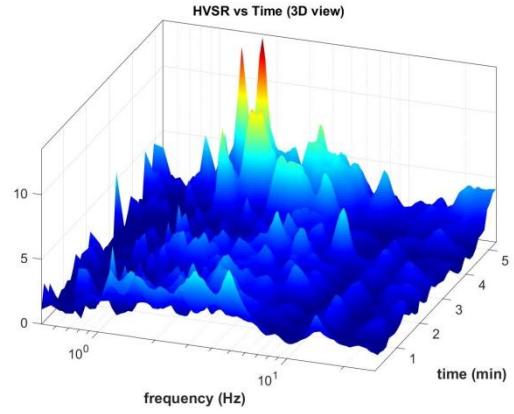
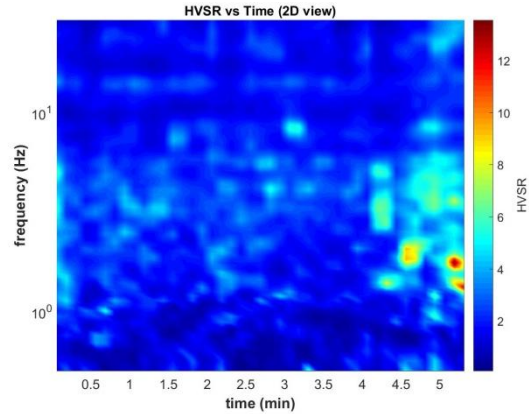
=== Criteria for a reliable H/V curve ===

- #1. [f0 > 10/Lw]: 3.316 > 0.66667 (OK)
- #2. [nc > 200]: 2139 > 200 (OK)
- #3. [f0>0.5Hz; sigmaA(f) < 2 for 0.5f0 < f < 2f0] (OK)

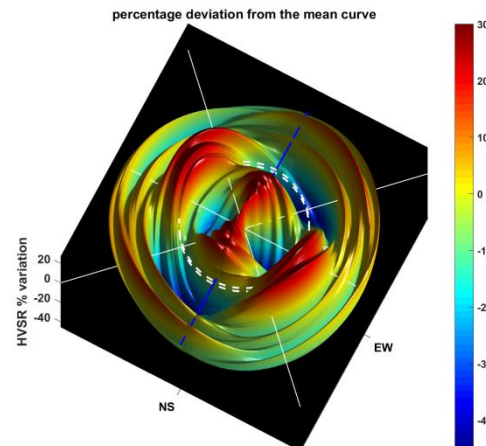
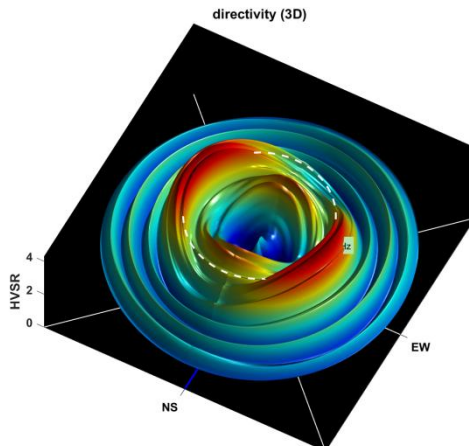
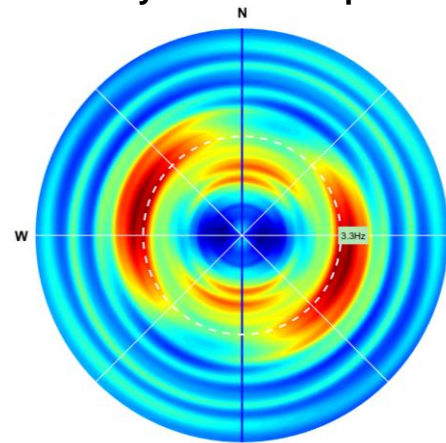
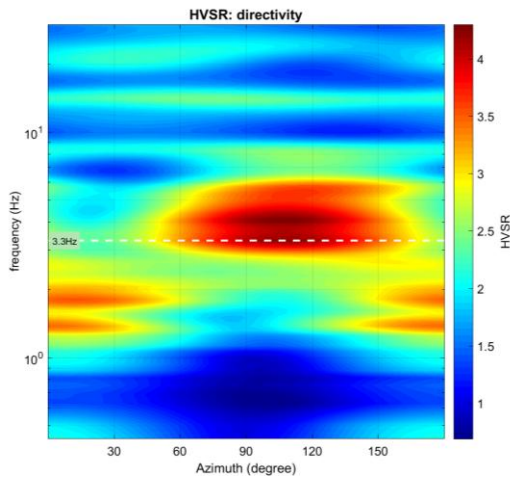
=== Criteria for a clear H/V peak (at least 5 should be fulfilled) ===

- #1. [exists f- in the range [f0/4, f0] | AH/V(f-) < A0/2]: yes, at frequency 0.9Hz (OK)
- #2. [exists f+ in the range [f0, 4f0] | AH/V(f+) < A0/2]: yes, at frequency 9.3Hz (OK)
- #3. [A0 > 2]: 3.5 > 2 (OK)
- #4. [fpeak[Ah/v(f) ± sigmaA(f)] = f0 ± 5%]: (NO)
- #5. [sigmaf < epsilon(f0)]: 2.024 > 0.166 (NO)
- #6. [sigmaA(f0) < theta(f0)]: 1.091 < 1.58 (OK)

Continuity (Persistence) of the H/V Spectral Ratio



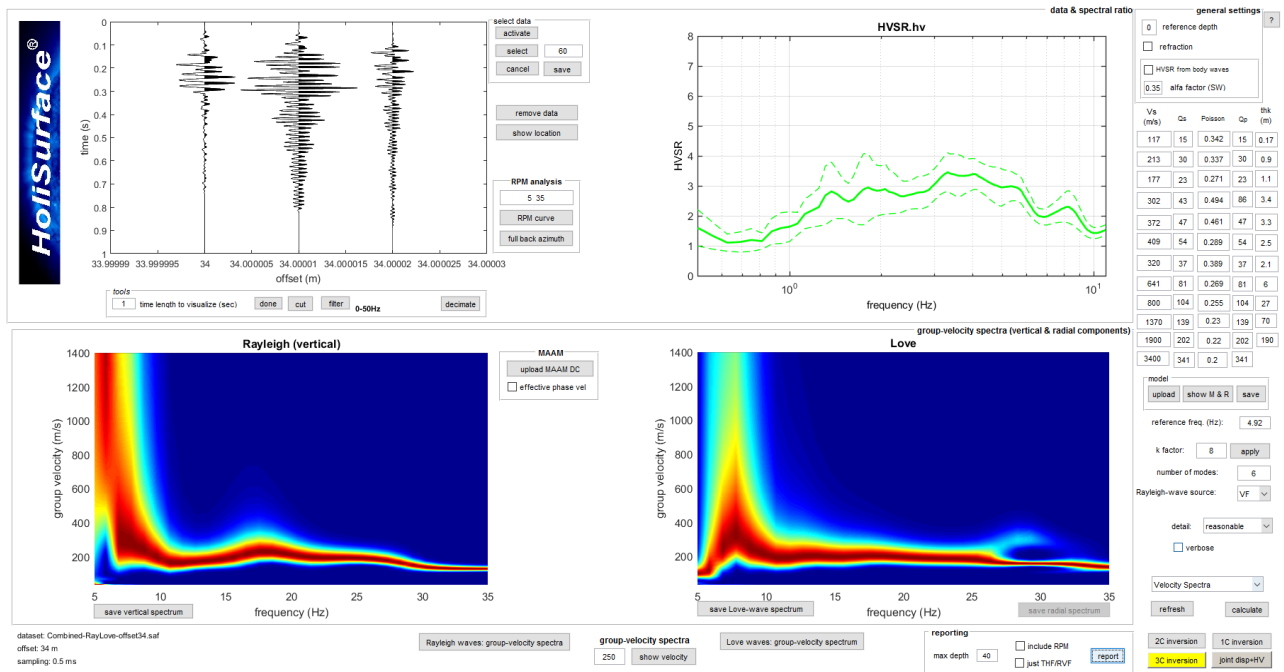
Directivity of the H/V Spectral Ratio



HoliSurface® - Holistic Analysis of Surface Waves - www.holisurface.com

Analisi congiunta della dispersione dell'onda di Rayleigh (componente verticale - ZVF) e di Love (componente THF), congiuntamente alla curva HVSr

Field data (active seismic traces, group-velocity spectra of the ZVF and THF components and HVSr).



Result of the joint analysis

Subsurface model

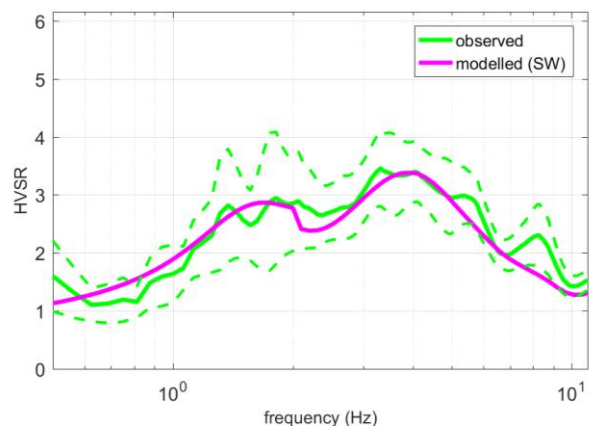
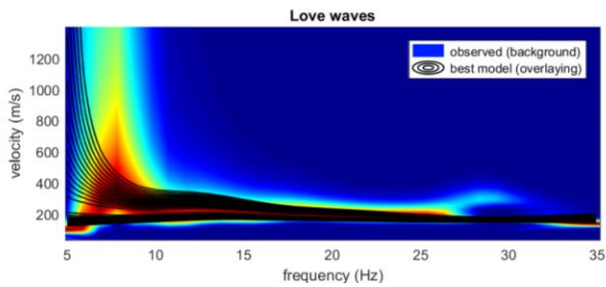
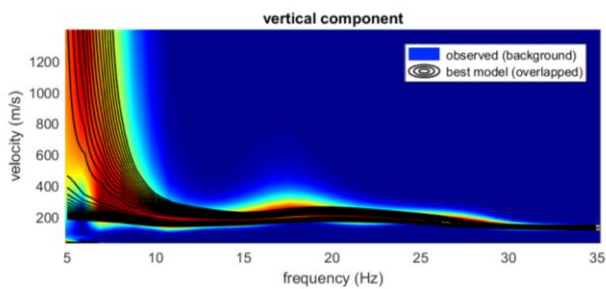
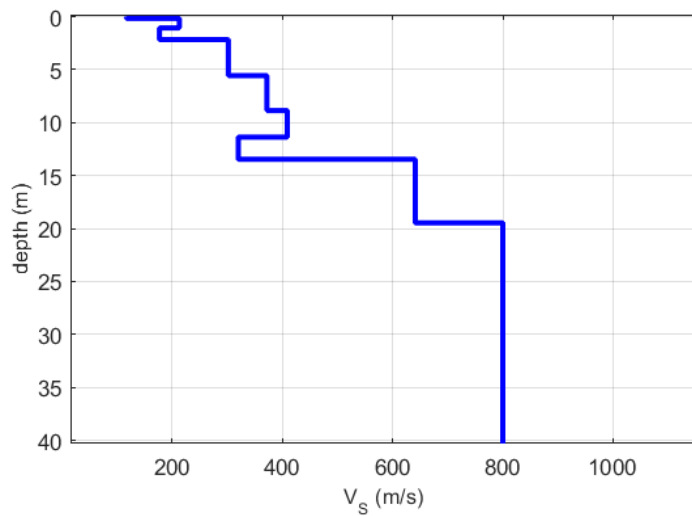
Shear-wave velocities (m/s): 117 213 177 302 372 409 320 641 800 1370 1900 3400

Thicknesses (m): 0.2 0.9 1.1 3.4 3.3 2.5 2.1 6.0 27.0 70.0 190.0

Vs30 (m/s): 446

Vs model (Vs30: 446 m/s)

layer	Vs (m/s)	thickness (m)
1	117	0.1700
2	213	0.9000
3	177	1.1000
4	302	3.4000
5	372	3.3000
6	409	2.5000
7	320	2.1000
8	641	6
9	800	27
10	1370	70
11	1900	190
12	3400	0



References

- Dal Moro G., 2014. *Surface Wave Analysis for Near Surface Applications*. ISBN 978-0-12-800770-9, Elsevier, 252pp.
- Dal Moro G., 2015. *Joint Inversion of Rayleigh-Wave Dispersion and HVSR of Lunar Seismic Data from the Apollo 14 and 16 sites*. *ICARUS*, 254, 338-349
- Dal Moro G., Keller L., Poggi V., 2015. *A Comprehensive Seismic Characterization via Multi-Component Analysis of Active and Passive Data*. *First Break*, 33, 45-53
- Dal Moro G., Moustafa S.R., Al-Arifi N., 2015. *Efficient acquisition and holistic analysis of Rayleigh waves*. *Proceedings Near-Surface EAGE 2015 (Turin - Italy)*
- Dal Moro G., Ponta R., Mauro R., 2015c. *Unconventional Optimized Surface Wave Acquisition and Analysis: Comparative Tests in a Perilagoon Area*. *J. Appl. Geophysics*, 114, 158-167