

Le risultanze dell'elaborazione sono presentate mediante graficazione dei rapporti spettrali H/V delle varie componenti indicando il massimo del rapporto HVSR nel valore di  $f_0$  – Frequenza/e di risonanza e la sua deviazione standard.

Viene riportata anche la check-list proposta dalla procedura SESAME per l'ottenimento di una curva H/V affidabile.

## HVSR 1

Dataset: MT\_20220120\_121234.SAF

Sampling frequency (Hz): 300

Window length (sec): 20

Minimum frequency soundly determined [10 cycles]: 0.5Hz

Length of analysed dataset (min): 10.0

Tapering (%): 0

Smoothing (%): 15

### **SPETTRI DELLE SINGOLE COMPONENTI - RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE**

show data:

step1 (optional) - decimate  
[64 Hz]

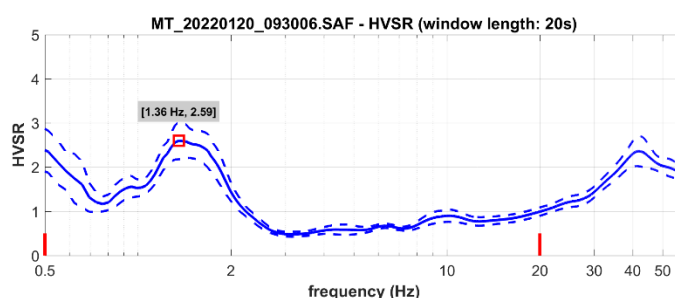
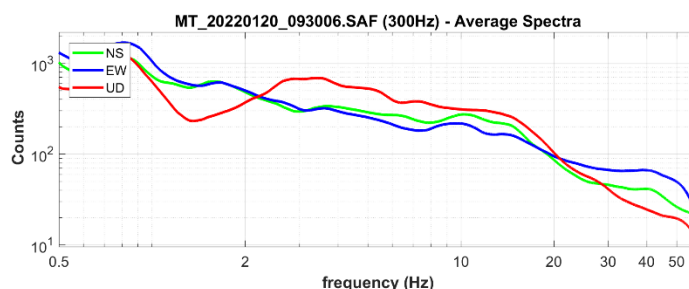
step2 - HV computation  
remove events:    
20 window length (s) Min. freq.: 0.5Hz  
0 tapering (%)   
15 amplitude threshold  
5 HVSR threshold  
15% spectral smoothing (triangular window)  
2 detrending order no equalization  
☐ Particle motion, all HVSRs, time lapse and vid.  
☒ full output   
  
3D motion ☐ save video

directivity analysis  
frequencies to highlight: 1.0 5.0 10.0 Hz

save-options: save HVSR as it is  
save HV from 0.5 to 60 Hz  
save HV curve (as it is)  
picking HV or amplitude spectra  
HVSR   
save picked HV

quick analysis (1m/s/4H)  
200 average  $V_s$  (m/s) (from surface to bedrock)  
20 depth of the bedrock  
1000  $V_s$  of the bedrock

highlight a frequency  
draw/highlight: 10 Hz  
directivity over time  
directivity in time: time 120 s



your comments

default axes

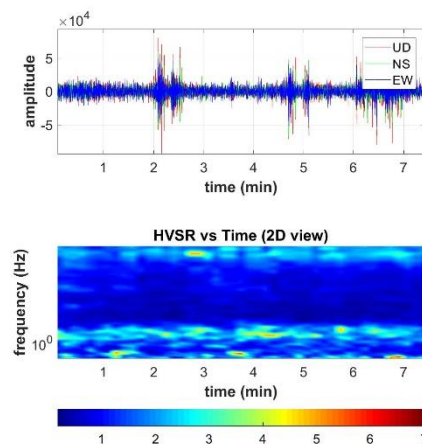
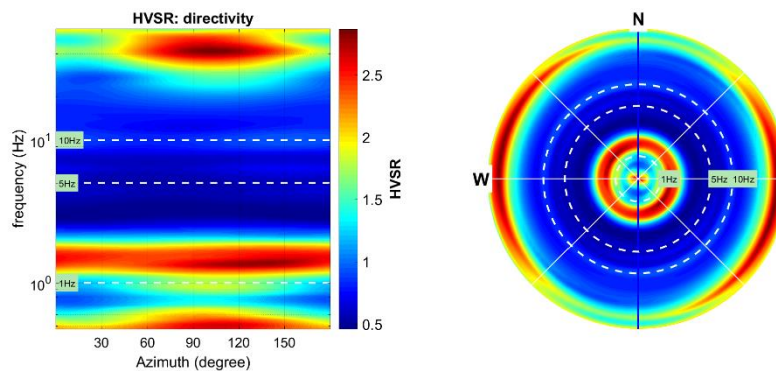
Criteria for a reliable H/V curve

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

Criteria for a clear H/V peak [1.36 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/a, Modeling & Picking" panels and upload the saved HV curve

**PERSISTENZA H/V****DIREZIONALITA' H/V**

**In the following the results considering the data in the 0.5-20.0Hz frequency range**

Peak frequency (Hz): 0.5

Peak HVSR value: 6.5

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

- #1.  $[f_0 > 10/L_w]$ :  $0.513 > 0.5$  (OK)
- #2.  $[n_c > 200]$ :  $585 > 200$  (OK)
- #3.  $[f_0 > 0.5\text{Hz}; \sigma_A(f) < 2 \text{ for } 0.5f_0 < f < 2f_0]$  (OK)

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

- #1.  $[\text{exists } f_- \text{ in the range } [f_0/4, f_0] \mid A_{H/V}(f_-) < A_0/2]$ : (NO)
- #2.  $[\text{exists } f_+ \text{ in the range } [f_0, 4f_0] \mid A_{H/V}(f_+) < A_0/2]$ : yes, at frequency 0.7Hz (OK)
- #3.  $[A_0 > 2]$ :  $6.5 > 2$  (OK)
- #4.  $[f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%]$ : (OK)
- #5.  $[\sigma_{\text{maf}} < \epsilon(f_0)]$ :  $0.077 < 0.077$  (OK)
- #6.  $[\sigma_A(f_0) < \theta(f_0)]$ :  $67.361 < 2$  (NO)

*Please, be aware of possible industrial/man-induced peaks or spurious peaks due to meaningless numerical instabilities. Remember that SESAME criteria should be considered in a flexible perspective and that if you modify the processing parameters they can change*

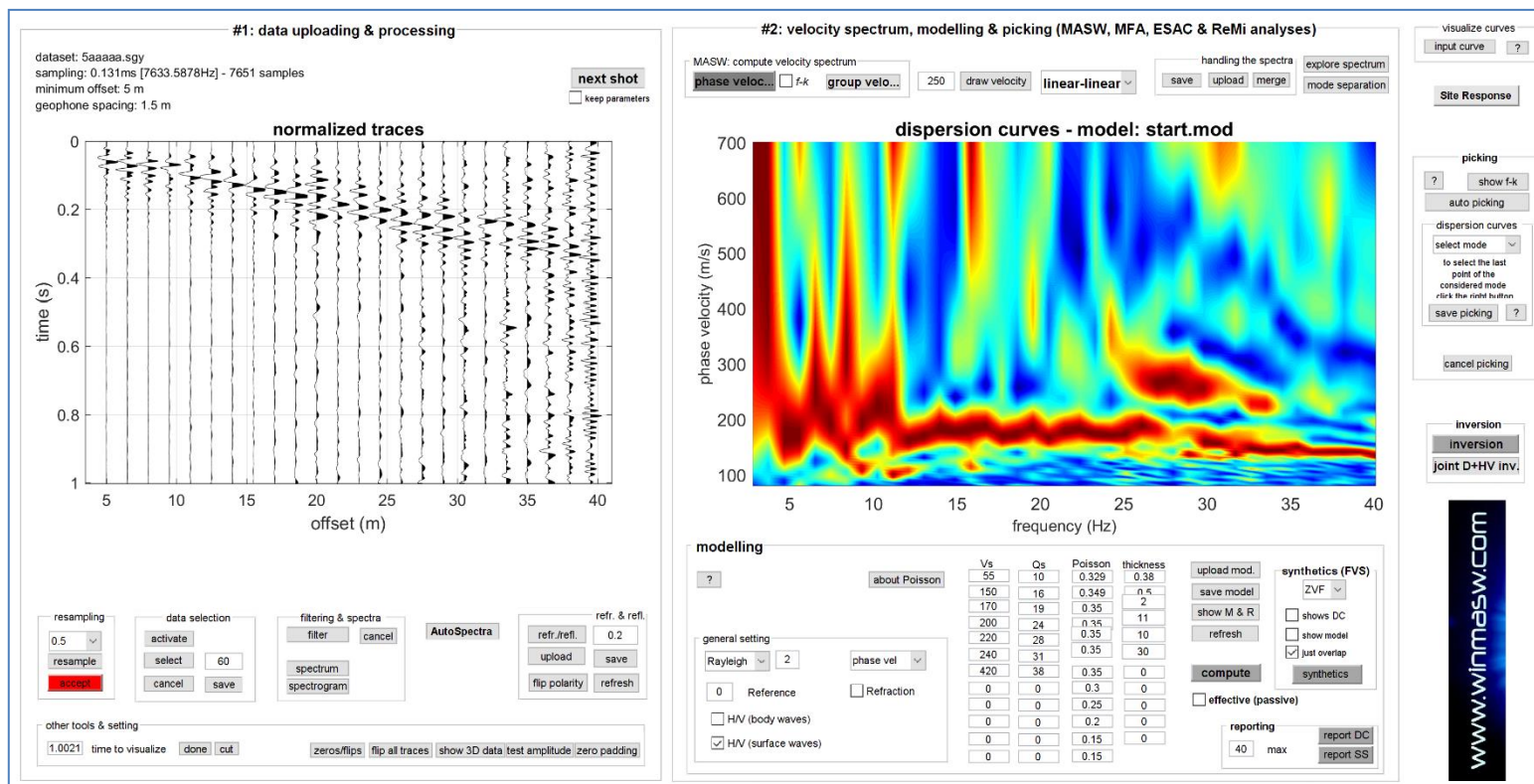


Figura 4: Sulla sinistra le tracce sismiche relative alla componenti ZVF e sulla destra i relativi spettri di velocità

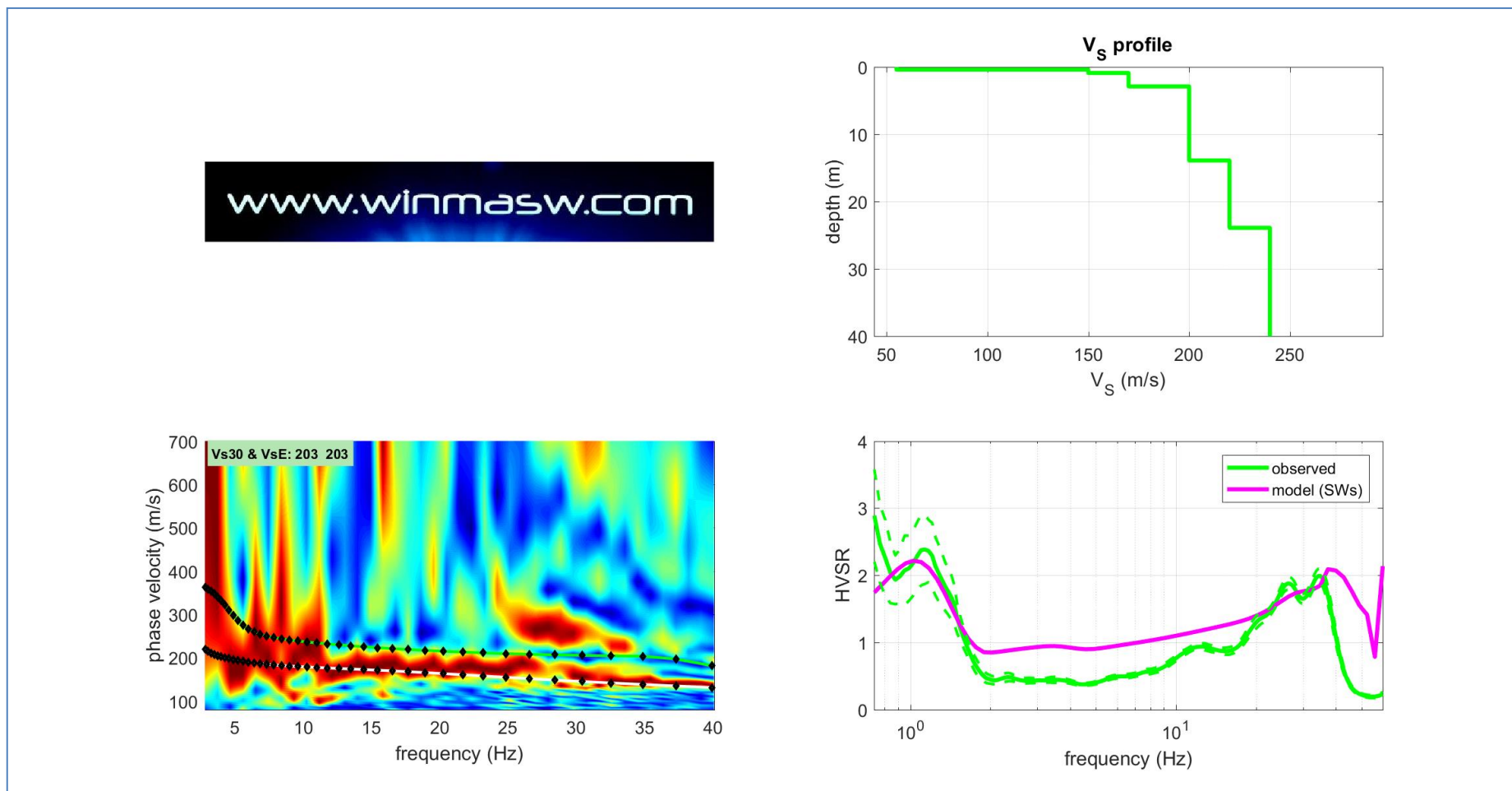


Figura 5 Sulla sinistra gli spettri di velocità relativi alla componenti ZVF con in sovrapposizione le curve di dispersione per l'onda di Rayleigh; Sulla destra in basso in verde le misure HVSR effettuate in sito e in magenta la curva HVSR modellata tramite ellitticità delle onde di superficie (Lunedei & Albarello, 2009); in alto il modello usato per la modellazione.

**Mean model**

Vs (m/s): 55, 150, 170, 200, 220, 240, 420

Thickness (m): 0.4, 0.5, 2.0, 11.0, 10.0, 30.0

**Vs model (Vs30 & VsE: 203 203 m/s)**

| layer | Vs (m/s) | thickness (m) | depth (m) |
|-------|----------|---------------|-----------|
| 1     | 55       | 0.3800        | 0.3800    |
| 2     | 150      | 0.5000        | 0.8800    |
| 3     | 170      | 2             | 2.8800    |
| 4     | 200      | 11            | 13.8800   |
| 5     | 220      | 10            | 23.8800   |
| 6     | 240      | 30            | 53.8800   |
| 7     | 420      | 0             | 0         |

Density (gr/cm3) (approximate values): 1.52 1.77 1.80 1.84 1.87 1.89 2.02

Seismic/Dynamic Shear modulus (MPa) (approximate values): 5 40 52 74 90 109 357

Analyzing Phase velocities

Analysis: Rayleigh Waves

Approximate values for Vp and Poisson

Vp (m/s): 109 312 354 416 458 499 874

Poisson: 0.33 0.35 0.35 0.35 0.35 0.35 0.35

Vs30 and VsE (m/s): 203 203

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San Giuliano Terme (PI),

23 gennaio 2022

**GAIA Servizi S.r.l.****Dott. Jacopo Martini**
