LN BORGIANELLO MASW

Analyzing Phase velocities

==o== SECTION#1
dataset: 215 borgianello-CLEAN1.sgy
minimum offset (m): 5
geophone spacing (m): 1.5
sampling (ms): 2
Dispersion curve: LN BORGIANELLO MASW.cdp
Number of individuals: 80
Number of generations: 81

Rayleigh-wave dispersion analysis

Analyzing Phase Velocities

Adopted search space (minimum Vs & thickness): 211.2 1.32 204.6 2.508 244.2 4.29 429 9.9 792
Adopted search space (maximum Vs & thickness): 448 2.8 434 5.32 518 9.1 910 21 1680
Adopted Poisson values: 0.34992 0.35041 0.34989 0.29998 0.35

Output folder: ..\IO\output_disp

==o== SECTION#2

Rayleigh wave analysis
Optimizing Vs & Thickness - generation: 1; average & best misfits: -95.5496 -20.8049
Optimizing Vs & Thickness - generation: 2; average & best misfits: -88.2098 -20.8049
Optimizing Vs & Thickness - generation: 3; average & best misfits: -80.9736 -20.8049
Optimizing Vs & Thickness - generation: 4; average & best misfits: -75.0333 -19.0568
Optimizing Vs & Thickness - generation: 5; average & best misfits: -68.2777 -19.0568
Optimizing Vs & Thickness - generation: 6; average & best misfits: -62.1677 -18.4944
Optimizing Vs & Thickness - generation: 7; average & best misfits: -56.7937 -14.9697
Optimizing Vs & Thickness - generation: 8; average & best misfits: -52.5384 -14.9697
Optimizing Vs & Thickness - generation: 9; average & best misfits: -55.2705 -12.9856
Optimizing Vs & Thickness - generation: 10; average & best misfits: -53.0883 -12.9856
Optimizing Vs & Thickness - generation: 11; average & best misfits: -52.0302 -12.9856
Optimizing Vs & Thickness - generation: 12; average & best misfits: -49.859 -12.9856
Optimizing Vs & Thickness - generation: 13; average & best misfits: -49.54 -12.9856
Optimizing Vs & Thickness - generation: 14; average & best misfits: -53.2326 -11.0978
Optimizing Vs & Thickness - generation: 15; average & best misfits: -50.63 -11.0079
Optimizing Vs & Thickness - generation: 16; average & best misfits: -46.7055 -11.0079
Optimizing Vs & Thickness - generation: 17; average & best misfits: -47.3869 -11.0079

Optimizing Vs & Thickness - generation: 18; average & best misfits: -42.9183
-8.66838
Optimizing Vs & Thickness - generation: 19; average & best misfits: -41.5505
-8.66838
Optimizing Vs & Thickness - generation: 20; average & best misfits: -37.5385
-8.66838
Optimizing Vs & Thickness - generation: 21; average & best misfits: -37.2113
-8.66838
Optimizing Vs & Thickness - generation: 22; average & best misfits: -35.2271
-7.00938
Optimizing Vs & Thickness - generation: 23; average & best misfits: -33.8783
-5.04031
Optimizing Vs & Thickness - generation: 24; average & best misfits: -34.2631
-5.04031
Optimizing Vs & Thickness - generation: 25; average & best misfits: -37.1515
-5.04031
Optimizing Vs & Thickness - generation: 26; average & best misfits: -39.2052
-5.04031
Optimizing Vs & Thickness - generation: 27; average & best misfits: -31.6485
-5.04031
Optimizing Vs & Thickness - generation: 28; average & best misfits: -32.3042
-5.04031
Optimizing Vs & Thickness - generation: 29; average & best misfits: -34.9564
-5.04031
Optimizing Vs & Thickness - generation: 30; average & best misfits: -31.2994
-5.04031
Optimizing Vs & Thickness - generation: 31; average & best misfits: -37.2033
-5.04031
Optimizing Vs & Thickness - generation: 32; average & best misfits: -42.3665
-5.04031
Optimizing Vs & Thickness - generation: 33; average & best misfits: -38.2217
-5.04031
Optimizing Vs & Thickness - generation: 34; average & best misfits: -31.4364
-5.04031
Optimizing Vs & Thickness - generation: 35; average & best misfits: -31.6482
-5.04031
Optimizing Vs & Thickness - generation: 36; average & best misfits: -30.6645
-5.04031
Optimizing Vs & Thickness - generation: 37; average & best misfits: -29.4569
-5.04031
Optimizing Vs & Thickness - generation: 38; average & best misfits: -30.856
-5.04031
Optimizing Vs & Thickness - generation: 39; average & best misfits: -30.8036
-5.04031
Optimizing Vs & Thickness - generation: 40; average & best misfits: -33.3565
-5.04031
Optimizing Vs & Thickness - generation: 41; average & best misfits: -34.277
-5.04031
Optimizing Vs & Thickness - generation: 42; average & best misfits: -31.4517
-5.04031
Optimizing Vs & Thickness - generation: 43; average & best misfits: -36.9695
-5.04031
Optimizing Vs & Thickness - generation: 44; average & best misfits: -32.3241
-4.76339
Optimizing Vs & Thickness - generation: 45; average & best misfits: -37.1059
-4.76339
Optimizing Vs & Thickness - generation: 46; average & best misfits: -37.3667
-4.76339
Optimizing Vs & Thickness - generation: 47; average & best misfits: -34.3065
-4.76339
Optimizing Vs & Thickness - generation: 48; average & best misfits: -35.6393
-4.76339
Optimizing Vs & Thickness - generation: 49; average & best misfits: -31.1382
-4.76339
Optimizing Vs & Thickness - generation: 50; average & best misfits: -29.6398
-4.76339
Optimizing Vs & Thickness - generation: 51; average & best misfits: -30.0432
-4.76339

Optimizing Vs & Thickness - generation: 52; average & best misfits: -29.3955
-4.76339
Optimizing Vs & Thickness - generation: 53; average & best misfits: -30.2915
-4.76339
Optimizing Vs & Thickness - generation: 54; average & best misfits: -28.8639
-4.76339
Optimizing Vs & Thickness - generation: 55; average & best misfits: -32.6177
-4.76339
Optimizing Vs & Thickness - generation: 56; average & best misfits: -34.3266
-4.76339
Optimizing Vs & Thickness - generation: 57; average & best misfits: -30.0111
-4.76339
Optimizing Vs & Thickness - generation: 58; average & best misfits: -31.8272
-4.76339
Optimizing Vs & Thickness - generation: 59; average & best misfits: -30.7039
-4.76339
Optimizing Vs & Thickness - generation: 60; average & best misfits: -31.092
-4.76339
Optimizing Vs & Thickness - generation: 61; average & best misfits: -27.3401
-4.76339
Optimizing Vs & Thickness - generation: 62; average & best misfits: -28.7027
-4.76339
Optimizing Vs & Thickness - generation: 63; average & best misfits: -25.8736
-4.70892
Optimizing Vs & Thickness - generation: 64; average & best misfits: -25.4758
-4.70892
Optimizing Vs & Thickness - generation: 65; average & best misfits: -30.5156
-4.56395
Optimizing Vs & Thickness - generation: 66; average & best misfits: -26.7437
-4.56395
Optimizing Vs & Thickness - generation: 67; average & best misfits: -29.723
-4.56395
Optimizing Vs & Thickness - generation: 68; average & best misfits: -28.9586
-4.56395
Optimizing Vs & Thickness - generation: 69; average & best misfits: -33.0808
-4.56395
Optimizing Vs & Thickness - generation: 70; average & best misfits: -32.0028
-4.54368
Optimizing Vs & Thickness - generation: 71; average & best misfits: -30.4797
-4.34867
Optimizing Vs & Thickness - generation: 72; average & best misfits: -28.1378
-4.34867
Optimizing Vs & Thickness - generation: 73; average & best misfits: -26.7225
-4.34867
Optimizing Vs & Thickness - generation: 74; average & best misfits: -24.2321
-4.34867
Optimizing Vs & Thickness - generation: 75; average & best misfits: -30.449
-4.34867
Optimizing Vs & Thickness - generation: 76; average & best misfits: -27.6788
-4.34867
Optimizing Vs & Thickness - generation: 77; average & best misfits: -28.9459
-4.34867
Optimizing Vs & Thickness - generation: 78; average & best misfits: -22.6318
-3.70933
Optimizing Vs & Thickness - generation: 79; average & best misfits: -22.467
-3.70933
Optimizing Vs & Thickness - generation: 80; average & best misfits: -22.1754
-3.70933
Optimizing Vs & Thickness - generation: 81; average & best misfits: -24.1207
-3.70933

Forcing the search space

Now a finer search around the most promising search space area

Rayleigh wave analysis
Optimizing Vs & Thickness - generation: 1; average & best misfits: -75.1034
-3.70933

Optimizing Vs & Thickness - generation: 2; average & best misfits: -68.4094
-3.70933
Optimizing Vs & Thickness - generation: 3; average & best misfits: -61.6305
-3.70933
Optimizing Vs & Thickness - generation: 4; average & best misfits: -54.7379
-3.70933
Optimizing Vs & Thickness - generation: 5; average & best misfits: -51.9917
-3.70933
Optimizing Vs & Thickness - generation: 6; average & best misfits: -46.2262
-3.70933
Optimizing Vs & Thickness - generation: 7; average & best misfits: -52.2531
-3.70933
Optimizing Vs & Thickness - generation: 8; average & best misfits: -48.9011
-3.70933
Optimizing Vs & Thickness - generation: 9; average & best misfits: -44.7412
-3.70933
Optimizing Vs & Thickness - generation: 10; average & best misfits: -40.9218
-3.70933
Optimizing Vs & Thickness - generation: 11; average & best misfits: -37.4934
-3.70933
Optimizing Vs & Thickness - generation: 12; average & best misfits: -37.7661
-3.70933
Optimizing Vs & Thickness - generation: 13; average & best misfits: -34.057
-3.70933
Optimizing Vs & Thickness - generation: 14; average & best misfits: -32.0389
-3.70933
Optimizing Vs & Thickness - generation: 15; average & best misfits: -28.7944
-3.70933
Optimizing Vs & Thickness - generation: 16; average & best misfits: -25.2725
-3.70933
Optimizing Vs & Thickness - generation: 17; average & best misfits: -27.2723
-3.70933
Optimizing Vs & Thickness - generation: 18; average & best misfits: -26.0876
-3.70933
Optimizing Vs & Thickness - generation: 19; average & best misfits: -31.9166
-3.70933
Optimizing Vs & Thickness - generation: 20; average & best misfits: -34.0317
-3.70933
Optimizing Vs & Thickness - generation: 21; average & best misfits: -32.2836
-3.70933

Model after the Vs & Thickness optimization (fixed Poisson values):
Vs (m/s): 329 311 436 653 1108
Thickness (m): 2 5.1 6.2 13

Poisson: 0.35 0.35 0.35 0.3 0.35
Number of models considered to calculate the average model: 22

##
RESULTS
##

Dataset: 215 borgianello-CLEAN1.sgy
Analyzed curve: LN BORGIANELLO MASW.cdp

==o== SECTION#3

Analyzing Phase Velocities

Analyzing Rayleigh-Wave Dispersion

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MEAN MODEL

Vs (m/s): 326 312 432 653 1113
Standard deviations (m/s): 6 1 6 2 6

Thickness (m): 2.0 5.0 6.0 13.5
Standard deviations (m): 0.3 0.2 0.3 0.4

Approximate values for Vp, density, Poisson & Shear modulus
Vp (m/s): 678 650 899 1222 2317
Density (gr/cm3): 1.96 1.95 2.03 2.10 2.26
Vp/Vs ratio: 2.08 2.08 2.08 1.87 2.08
Poisson: 0.35 0.35 0.35 0.30 0.35
Shear modulus (MPa): 208 190 378 897 2798

Fundamental mode
Mean model
frequency (Hz) VR(m/s)
8.22566 745.6524
9.33882 680.52
10.3901 603.5676
11.627 523.8087
12.802 468.7032

First higher mode
Mean model
22.6349 534.9047
27.2112 498.8473

==o== SECTION#4

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BEST MODEL

Vs (m/s): 329 311 436 653 1108
thickness (m): 1.97171 5.07242 6.2115 13.1831

Approximate values for Vp, density, Poisson & Shear modulus
Vp (m/s): 685 648 907 1222 2306
Density (gr/cm3): 1.96 1.95 2.03 2.10 2.26
Vp/Vs ratio: 2.08 2.08 2.08 1.87 2.08
Poisson: 0.35 0.35 0.35 0.30 0.35
Shear modulus (MPa): 212 188 386 897 2771

dispersion curve (frequency - Rayleigh phase velocity)

Fundamental mode
best model
F(Hz) VR(m/s)
8.22566 744.3838
9.33882 679.5653
10.3901 601.336
11.627 520.7954
12.802 465.9288

First higher mode)
best model
22.6349 533.2203
27.2112 496.299

Vs5 (mean model): 318 467 m/s
Vs5 (best model): 318 466 m/s

Vs20 (mean model): 428 467 m/s
Vs20 (best model): 427 466 m/s

Vs30 (mean model): 501 467 m/s
Vs30 (best model): 500 466 m/s

==o== SECTION#6

For Italian Users:
Decreto 17 gennaio 2018 in aggiornamento alle Norme Tecniche per le Costruzioni e pubblicato sul Supplemento ordinario n° 8 alla Gazzetta Ufficiale del 20/02/2018:
A - Ammassi rocciosi affioranti o terreni molto rigidi caratterizzati da valori di velocità delle onde di taglio superiori a 800 m/s, eventualmente comprendenti in superficie terreni di caratteristiche meccaniche più scadenti con spessore massimo pari a 3 m.
B - Rocce tenere e depositi di terreni a grana grossa molto addensati o terreni a grana fina molto consistenti, caratterizzati da un miglioramento delle proprietà meccaniche con la profondità e da valori di velocità equivalente compresi tra 360 m/s e 800 m/s.
C - Depositi di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti con profondità del substrato superiori a 30 m, caratterizzati da un miglioramento delle proprietà meccaniche con la profondità e da valori di velocità equivalente compresi tra 180 m/s e 360 m/s.
D - Depositi di terreni a grana grossa scarsamente addensati o di terreni a grana fina scarsamente consistenti, con profondità del substrato superiori a 30 m, caratterizzati da un miglioramento delle proprietà meccaniche con la profondità e da valori di velocità equivalente compresi tra 100 e 180 m/s.
E - Terreni con caratteristiche e valori di velocità equivalente riconducibili a quelle definite per le categorie C o D, con profondità del substrato non superiore a 30 m.

Per qualsiasi condizione di sottosuolo non classificabile nelle categorie precedenti, è necessario predisporre specifiche analisi di risposta locale per la definizione delle azioni sismiche.

Results saved in the folder "..\IO\output_disp".

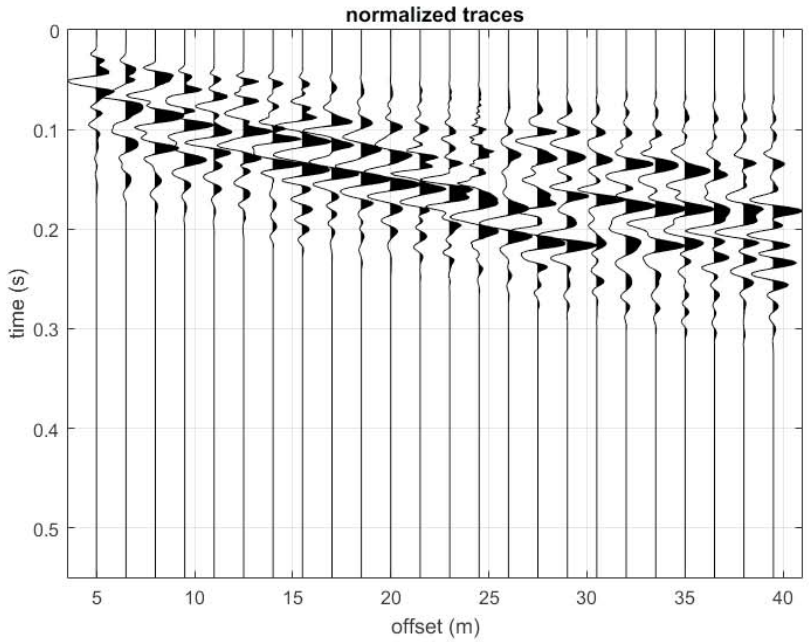
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winMASW - Surface Waves & Beyond

www.winmasw.com
Number of models used to define the mean model: 22
Vs5 for the best model: 318 466
Vs30 for the best model: 500 466

#1: uploading & processing (MASW analyses)

dataset: 215 borgianello-CLEAN1.sgy
sampling: 2 ms
minimum offset: 5 m
geophone spacing: 1.5 m



resampling
0.5
resample
accept

data selection
activate
select
60
cancel
save

filtering & spectra
filter
cancel
spectrum
spectrogram

refraction
refraction
100
upload
save
clear refraction

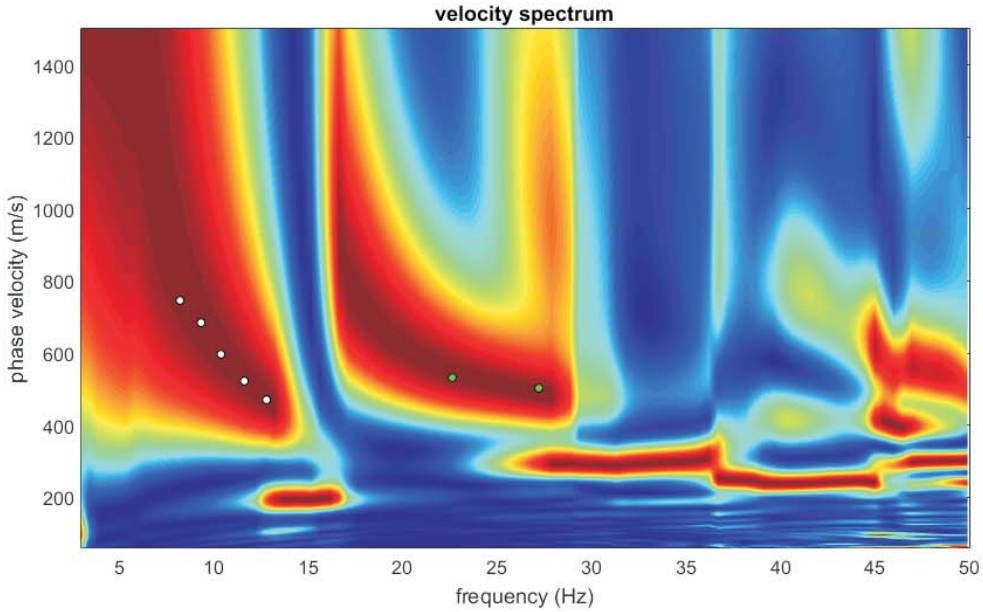
other tools & setting
0.55
time length to visualize (s)
done
cut
flip traces
zero padding

#2: velocity spectrum, modelling & picking (MASW/ReMi/ESAC analyses)

MASW: compute velocity spectrum
phase velocity
f-k
group velocity

handling the spectra
save
upload
merge

explore spectrum
mode separation



modelling

?
about Poisson

general setting
Rayleigh
2
phase vel
0
Reference depth
Refraction
H/V body waves
0
H/V modes (SW ellipticity)

Vs (m/s)	Poisson	thickness (m)
320	0.35	2
310	0.35	3.8
370	0.35	6.5
650	0.3	15
1200	0.35	0
0	0.35	0
0	0.3	0
0	0.2	

compute
upload mod.
save model
refresh
report

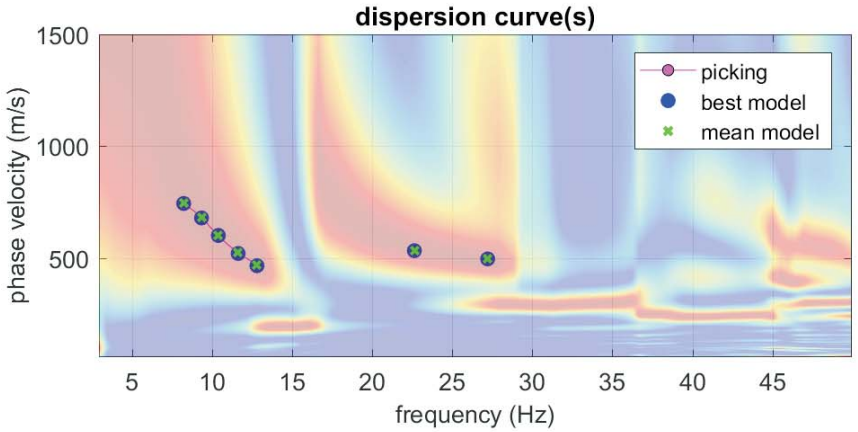
synthetics
ZVF
shows DC
synthetics

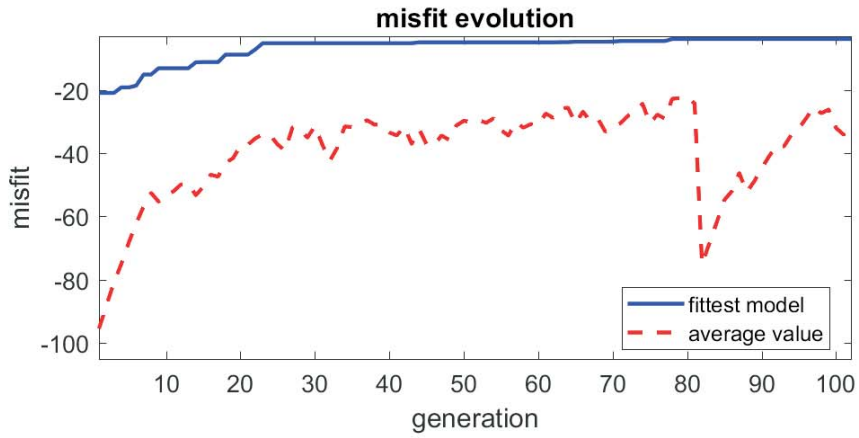
visualize curves
input curve
?

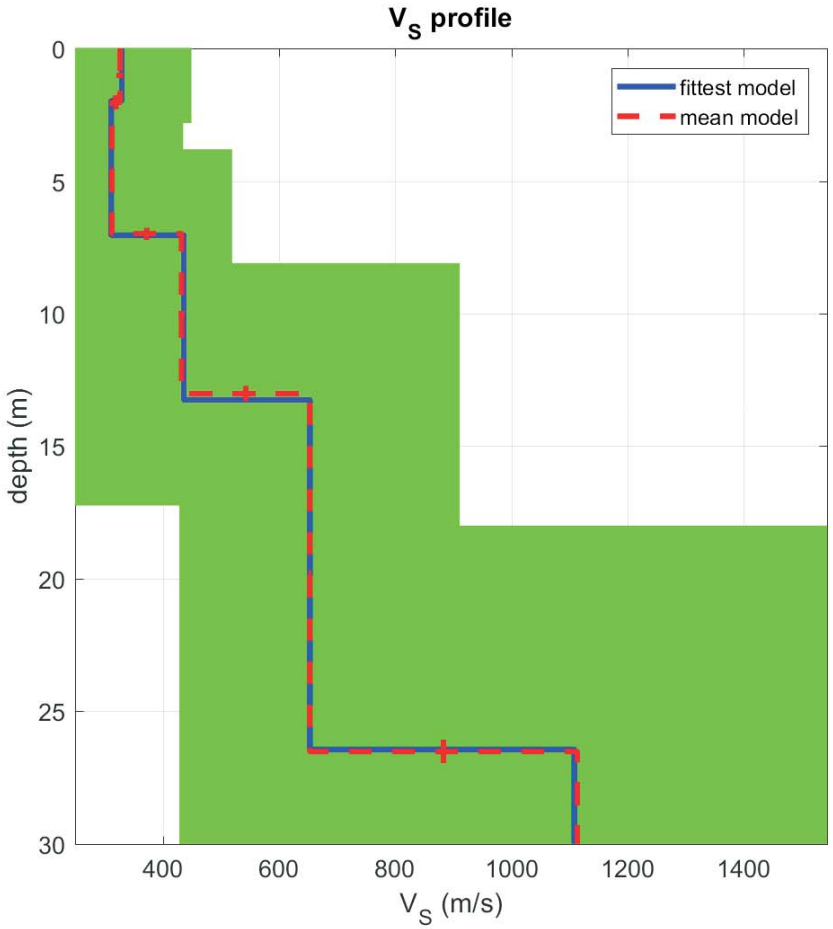
picking
?
show f-k
first higher
to select the last point of the considered mode click the right button
save picking
?
LN BORGIANELLO MASW.cdp
cancel picking

inversion
inversion
Joint DC-HV inv.

www.winmasw.com







www.winmasw.com

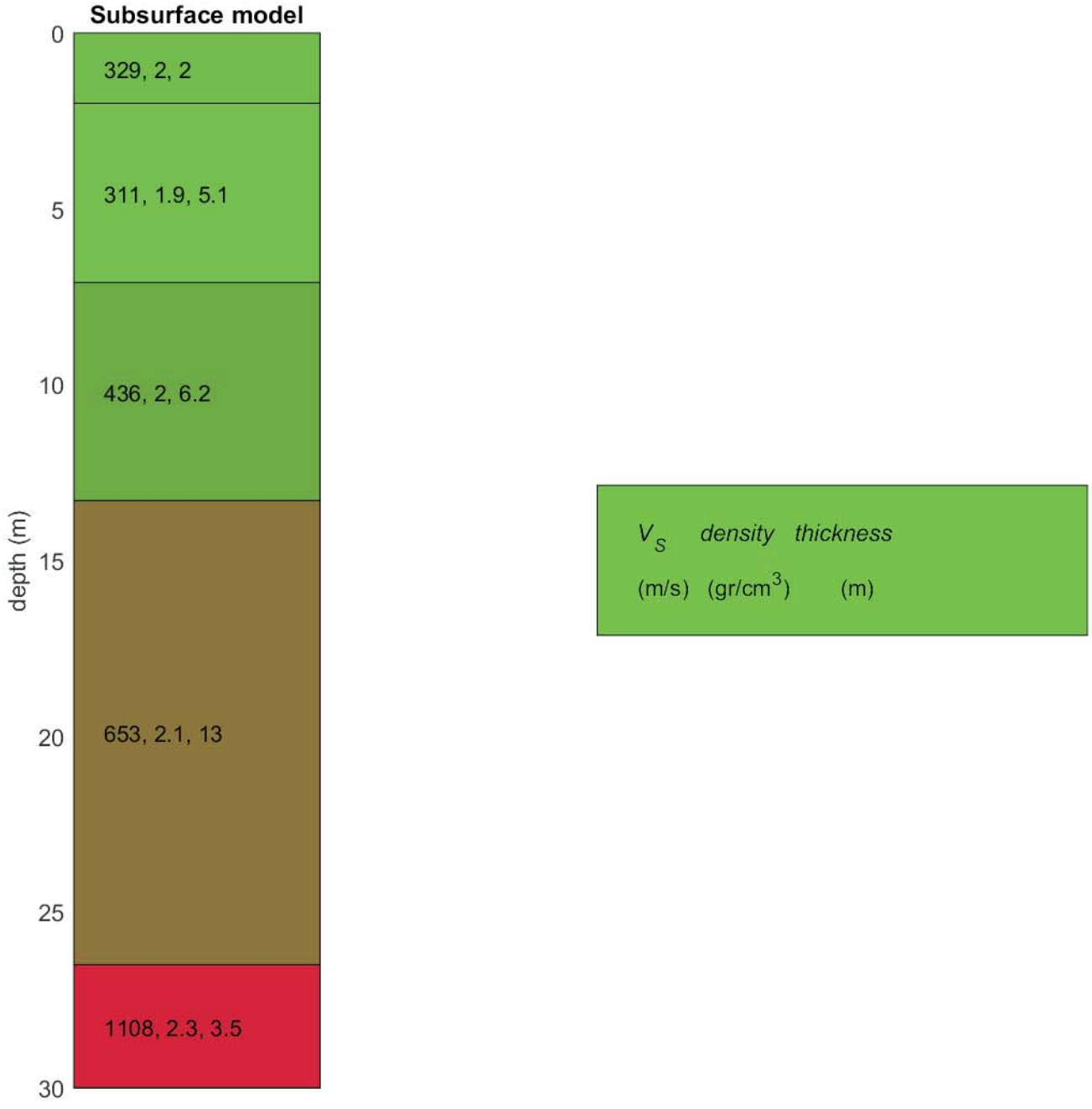
dataset: 215 borgianello-CLEAN1.sgy

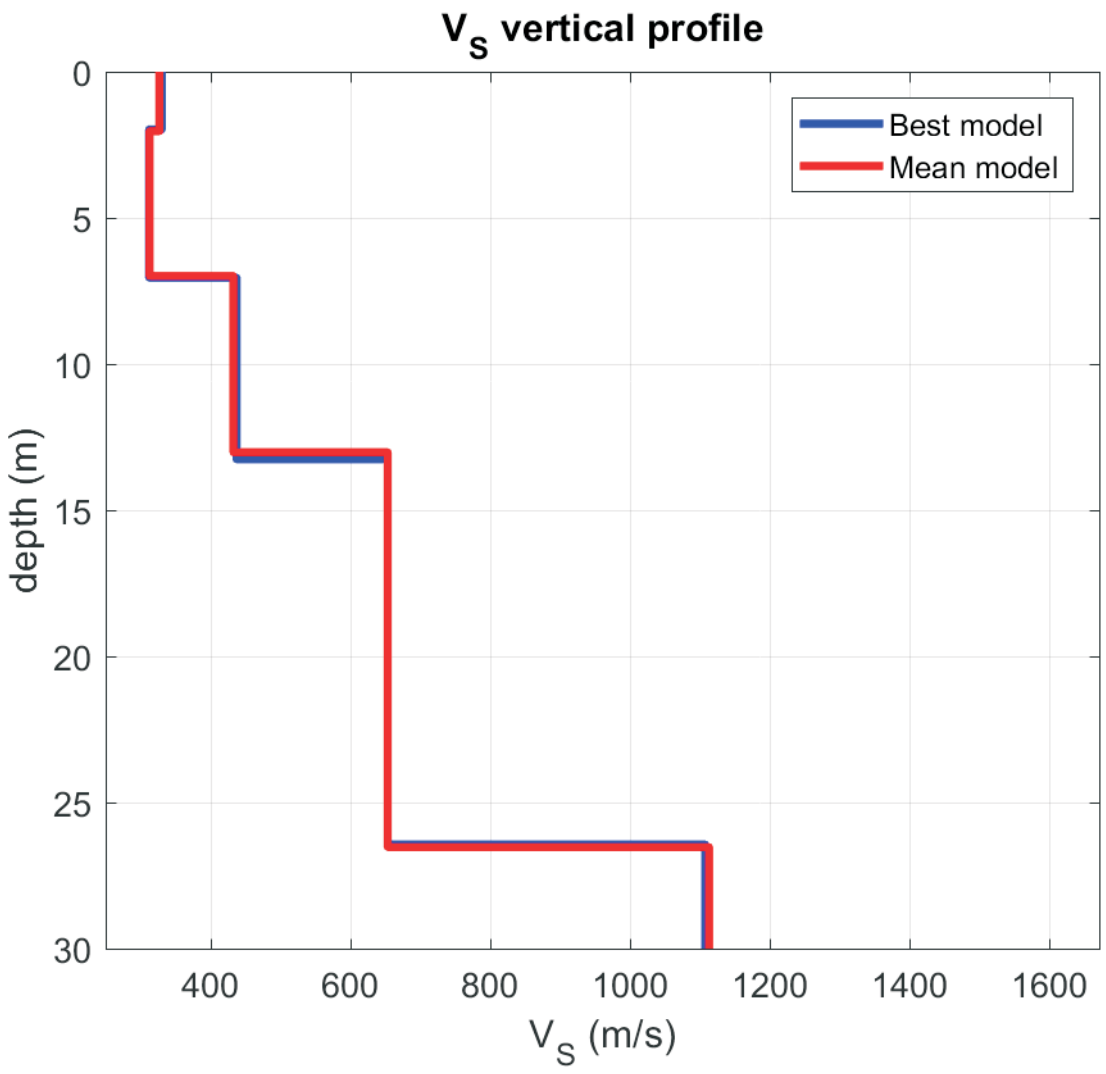
dispersion curve: LN BORGIANELLO MASW.cdp

Vs30 & VsE (best model): 500 466 m/s

Vs30 & VsE (mean model): 501 467 m/s

half-space


Subsurface model
0
5
10
15
20
25
30
depth (m)
329, 2, 2
311, 1.9, 5.1
436, 2, 6.2
653, 2.1, 13
1108, 2.3, 3.5
V_S density thickness
(m/s) (gr/cm^3) (m)


V_S vertical profile
Best model
Mean model
depth (m)
0
5
10
15
20
25
30
400
600
800
1000
1200
1400
1600
V_S (m/s)