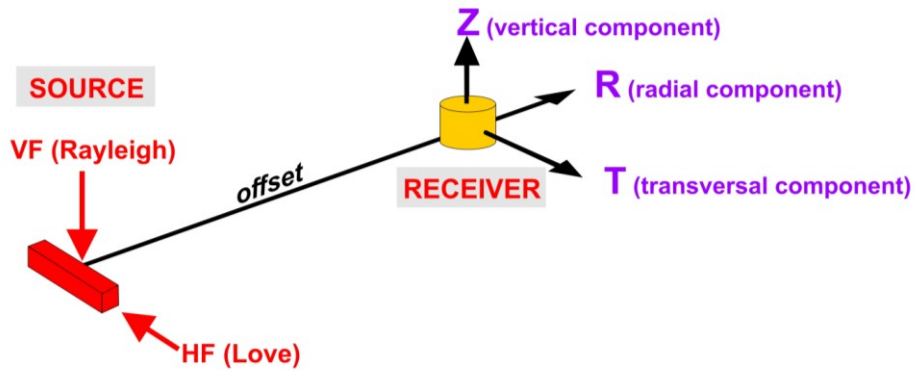




# HoliSurface® - Holistic Inversion of Surface-Wave Propagation

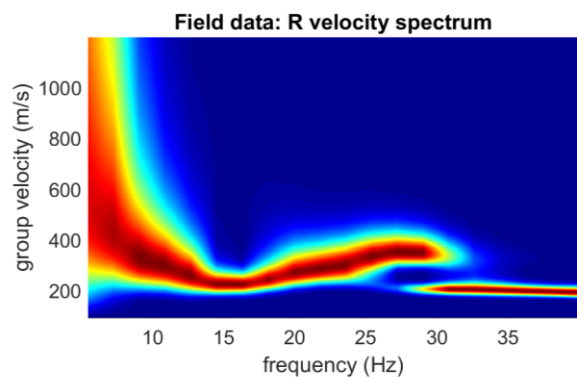
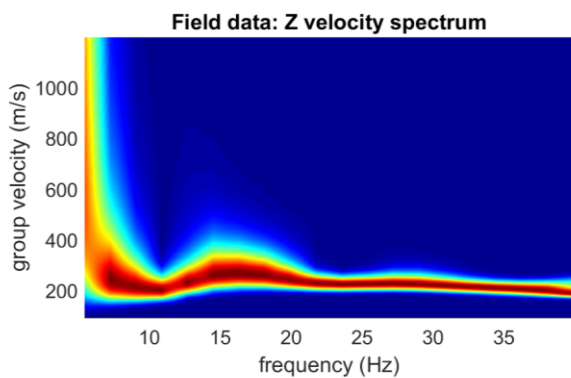
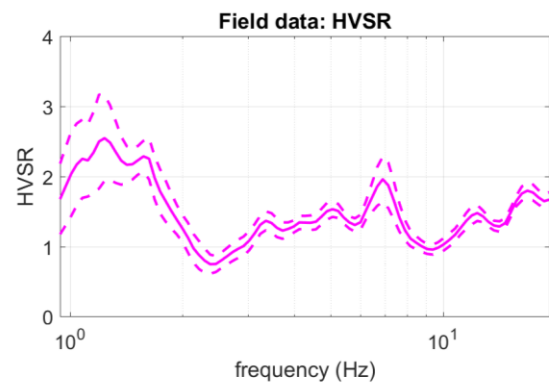
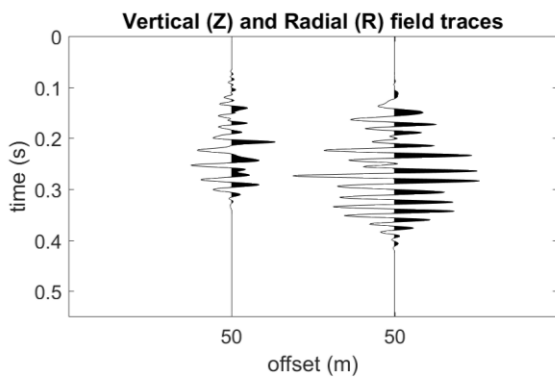


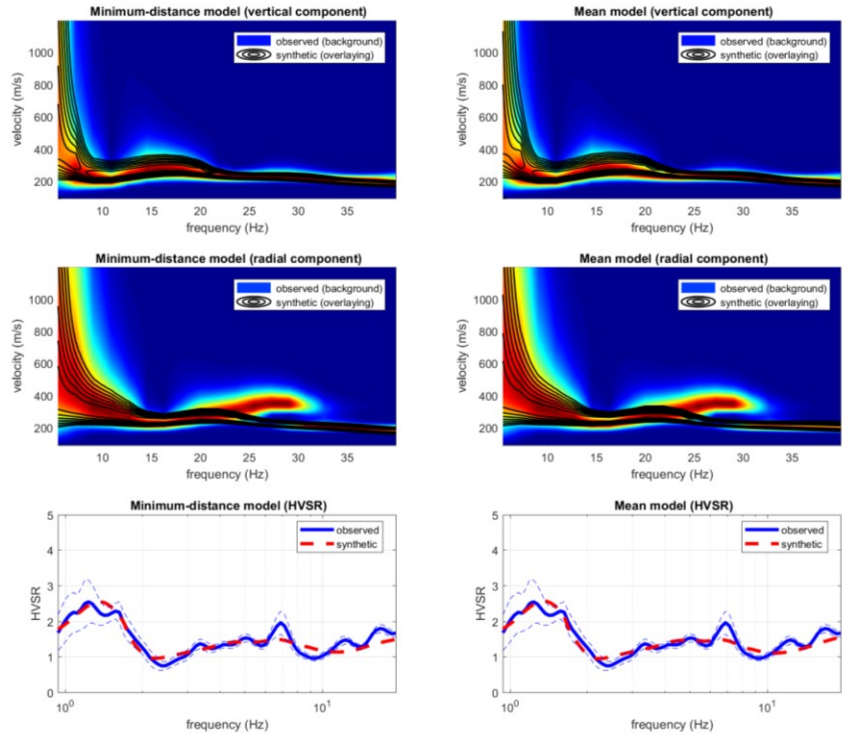
Group velocity spectra and HVSR (active and passive data)

offset: 50 m

Analysis: Rayleigh Waves (group velocities)

## FIELD DATA





**Minimum-distance (from the utopia point) model**

Vs30 and VsE of the minimum-distance model (m/s): 410, 410

Shear-wave velocities (m/s): 52, 197, 248, 285, 361, 411, 341, 696, 409, 639, 587, 1500

Thicknesses (m): 0.2, 0.4, 1.2, 0.8, 4.0, 3.9, 4.0, 9.2, 5.0, 15.3, 65.1

Seismic/Dynamic Shear modulus (MPa) (approximate values): 4 69 115 162 258 330 224 1026 333 844 707 5086

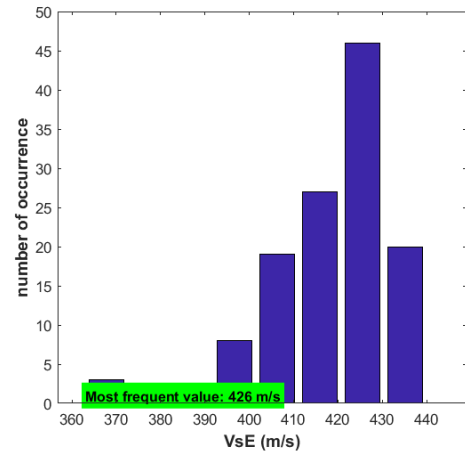
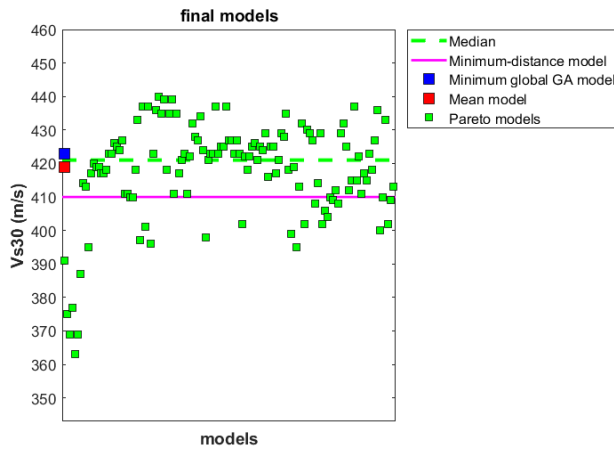
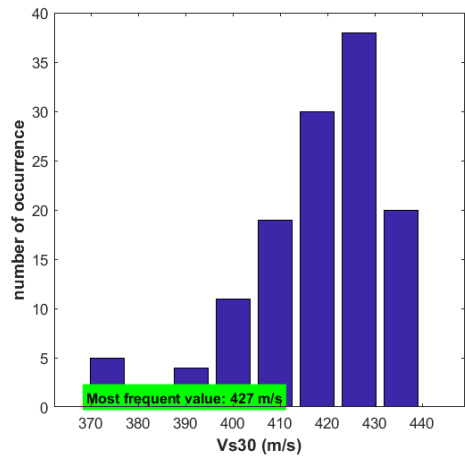
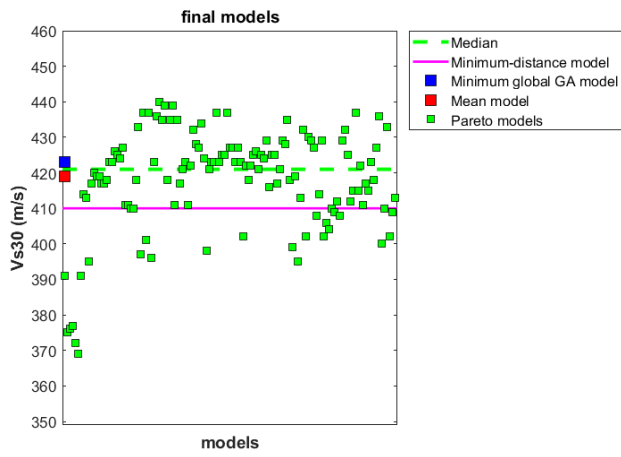
**Mean model**

Vs30 and VsE of the mean model (m/s): 419, 419

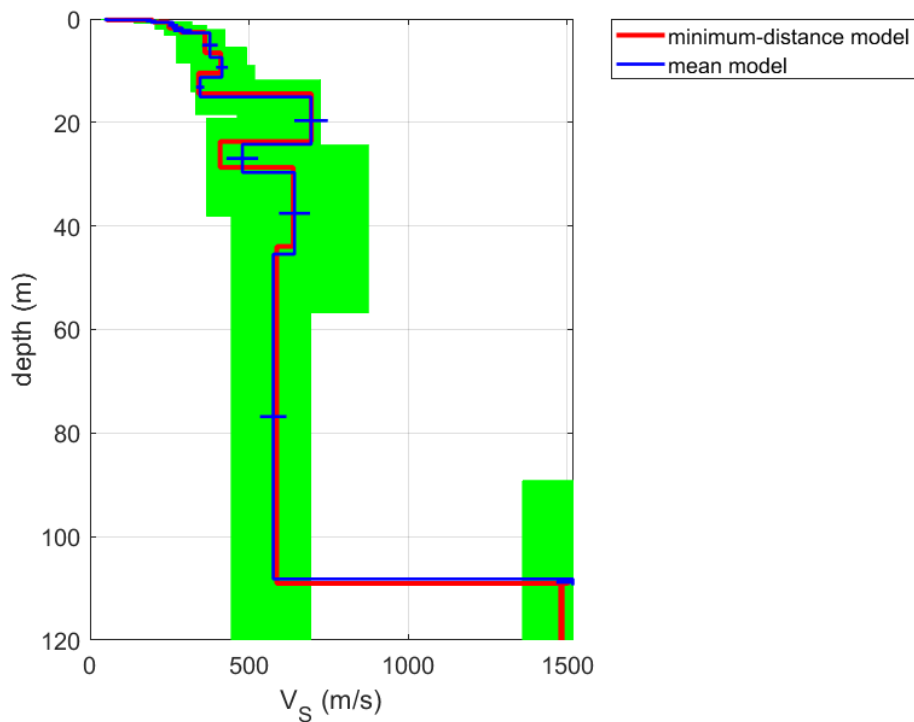
Shear-wave velocities (m/s): 50, 192, 261, 291, 377, 415, 346, 695, 479, 643, 576, 1518

Thicknesses (m): 0.2, 0.5, 1.2, 0.9, 4.8, 3.8, 3.8, 9.1, 5.5, 15.8, 62.7

Seismic/Dynamic Shear modulus (MPa) (approximate values): 4 65 128 168 286 336 231 1026 461 852 679 5215



Minimum Vs30 (m/s): 369  
 Maximum Vs30 (m/s): 440  
 Minimum VsE (m/s): 363  
 Maximum VsE (m/s): 440



Soil classification must be performed by the user.

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.

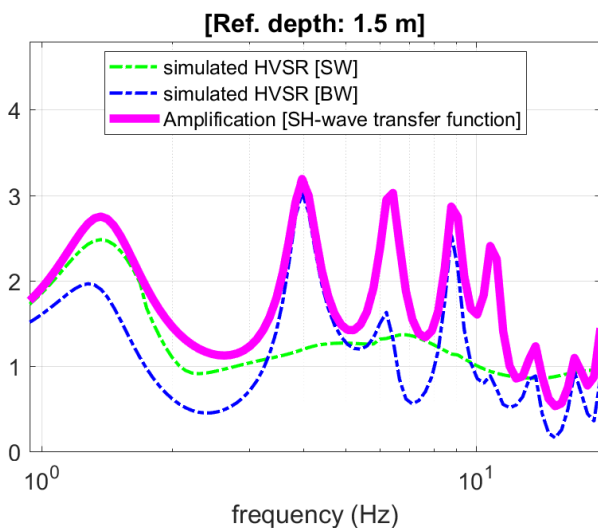
C - Depositati di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti con profondità del substrato superiori a 30 m, caratterizzati da un miglioramento delle proprietà meccaniche con la profondità e da valori di velocità equivalente compresi tra 180 m/s e 360 m/s.

D - Depositati 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.

### Amplification curve [SH-wave transfer function] – reference depth 1.5 m



## References

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Single- and multi-component inversion of surface waves acquired by a single 3-component geophone: an illustrative case study (Dal Moro G. and Puzilli L.M.), *Acta Geodyn. Geomater.*, 14, 431-444: [https://www.irsm.cas.cz/materialy/acta\\_content/2017\\_doi/DalMoro\\_AGG\\_2017\\_0024.pdf](https://www.irsm.cas.cz/materialy/acta_content/2017_doi/DalMoro_AGG_2017_0024.pdf)

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Four Geophones for seven possible objective functions: active and passive seismics for tricky areas (Dal Moro G.) Invited presentation and Extended Abstract for the Urban Geophysics workshop of the 22nd EAGE Near Surface Geoscience conference (4-8 September 2016 - Barcelona, Spain)

Less is more: from van der Rohe to the 4-channel system for the efficient and holistic acquisition and analysis of surface waves. An urban case study. (Dal Moro G., Moustafa S.R., Al-Arifi N., 2015). *Proceedings of the GNGTS (Gruppo Nazionale Geofisica della Terra Solida - ogs.trieste.it) congress* (17-19 November 2015 - Trieste, Italy)

Geophysikalische In-situ-Bestimmung der Eingangsparameter in die seismischen Standortanalysen am Beispiel des Ambassador House Opfikon (Keller L., Weber T., Dal Moro G., 2015). *Proceedings of the 14th D-A-CH conference of the Swiss Society for Earthquake Engineering and Structural Dynamics*, Zurich, August 21-21, SIA D0255, ISBN 978-3-03732-060-0

A Comprehensive Seismic Characterization via Multi-Component Analysis of Active and Passive Data (Dal Moro G., Keller L., Poggi V., 2015), *First Break*, 33, 45-53

Efficient acquisition and holistic analysis of Rayleigh waves (Dal Moro G., Moustafa S.R., Al-Arifi N.), *Proceedings of the Near-Surface EAGE 2015 congress* (Turin - Italy) [having received a very high score from the reviewers, the work was invited to be published in *Near Surface Geophysics*]

Joint Inversion of Rayleigh-Wave Dispersion and HVSR of Lunar Seismic Data from the Apollo 14 and 16 sites (Dal Moro G., 2015), *ICARUS*, 254, 338-349

Unconventional Optimized Surface Wave Acquisition and Analysis: Comparative Tests in a Perilagoon Area (Dal Moro G., Ponta R., Mauro R., 2015), *Appl. Geophysics*, 114, 158-167

Surface Wave Analysis for Near Surface Applications (Dal Moro G., 2014), Elsevier, ISBN 978-0-12-800770-9, 252pp (theory, field practice and advanced joint analysis) [see in particular paragraphs 2.2, 7.2 and case studies #2, 6, 8, 12 and 14]

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