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Lessons learned from active and passive seismic surveys at a test site in Romania

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Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO)

INTRODUCTION AND MAIN RESULTS

This presentation provides insights methodological framework for MAM Microtremor Array Measurements (MAM) and Multichannel Analysis of Surface Waves (MASW) techniques applied for a test site in Magurele, Romania.

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Introduction

This work presents the methodological framework for Microtremor Array Measurements (MAM) and Multichannel Analysis of Surface Waves (MASW) techniques applied for a test site in Magurele, near the headquarters of the National Institute for Earth Physics. These are non-invasive and non-destructive geophysical methods widely applied in site characterization, geotechnical investigations, engineering studies, and earthquake hazard assessments.

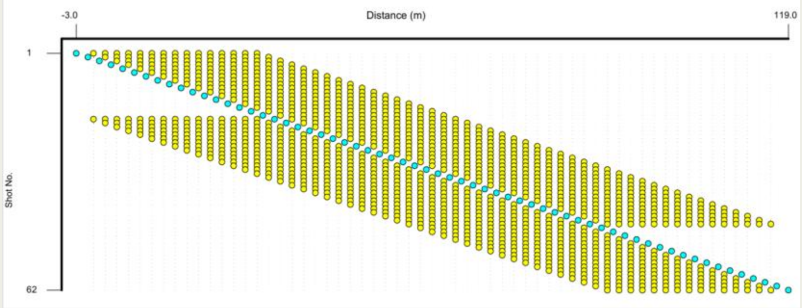

Fig. 1 Acquisition geometry source - receivers used in the survey. Seismic sources are represented by the blue dots and receivers by the yellow dots.

Methods/Data

Fifteen ATOM units with 3-component 2 Hz sensors were used to accomplish the aim of this study. The ATOM units were used for passive (ambient noise) and active (sledgehammer shots) measurements, containing low-frequency and high-frequency seismic waves, respectively.
MAM provides information about deeper subsurface layers using low-frequency seismic waves, while MASW utilizes high-frequency surface waves to provide detailed information about shallower layers.
MAM processing is based on the Spatial Autocorrelation (SPAC) method (Aki, 1957), where the dispersion curves are inverted to obtain 1D Vs profiles.
MASW data is transformed into frequency–wavenumber (f–k) spectra for inversion (Park, 1999), providing 1D and 2D VS profiles. The 2D Vs cross-section highlights vertical layering and lateral variations.
MAM and MASW 1D can be combined to obtain a more detailed 1D Vs profile. Both methods were processed through the SeisImager software package.

Results

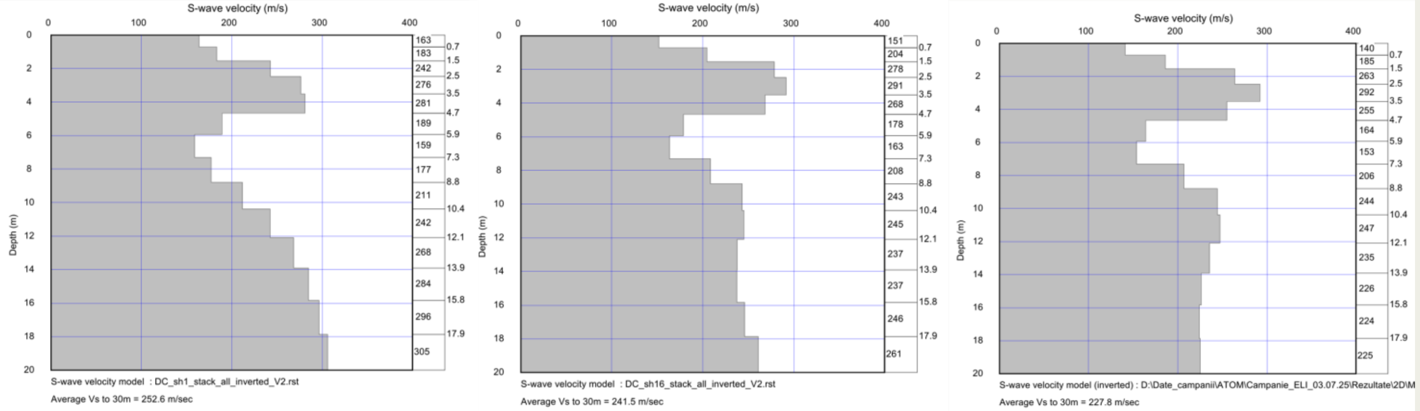

Fig. 2 Shear wave velocity (Vs) profiles obtained from MASW on three consecutive linear profiles.

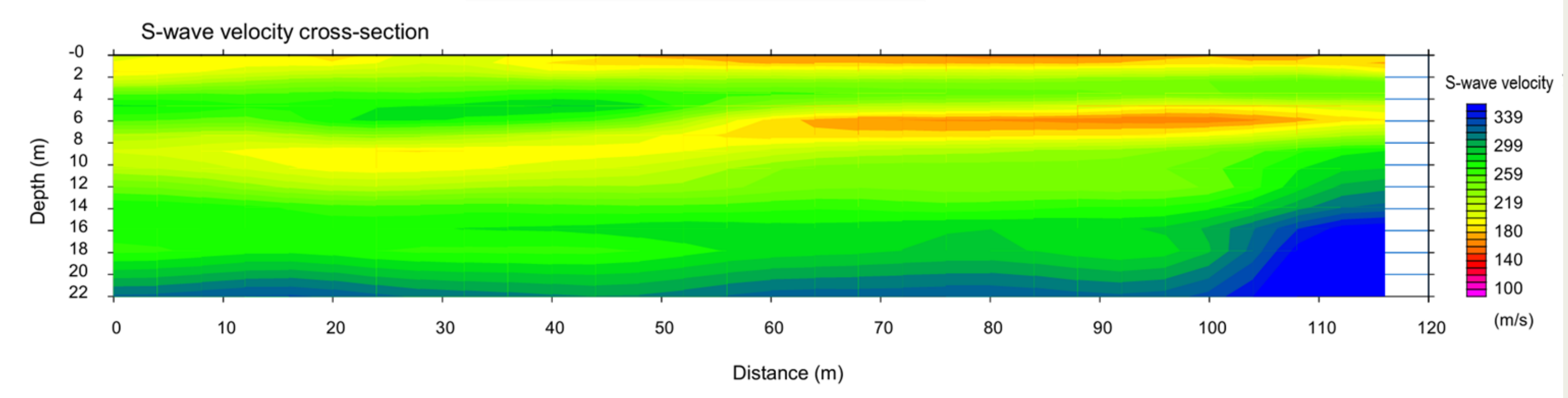

Fig. 3 The 2D Vs cross-section.

Conclusions

The results obtained for the first 20 meters of the subsoil (Fig. 2) show relatively low values of Vs (< 300 m/s) which would correspond to a soil class C (deep deposits of dense or medium-dense sand, gravel or rigid clay with thicknesses ranging from several tens to several hundreds of meters) according to the seismic design codes EUROCODE 8 and the Romanian code P100-1/2013.

The MASW analysis highlights the stratigraphy of the subsoil, starting with a low-velocity layer for the first 2m. The next layer is a higher-velocity layer, suggesting a denser material, followed by a softer layer that extends from approximately 5m to 11m depth. This trend is also present for both 2D and 1D profiles obtained in this study, which may influence the local seismic site response and wave propagation characteristics.

The MAM analysis for this site did not provide reliable results due to the presence of a local perturbative noise close to the study area.

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