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Hierachical imaging strategy for shallow subsurface from dispersion curve analysis to full waveform inversion

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Imaging the shallow subsurface is very challenging because of high variability of mechanical properties and because of the additional complex interaction between waves and topography. Based on real seismic data collected in a well-constrained experimental structure nearby Turin (Italy), we investigate the similarity of real and synthetic waveforms with numerical simulations based on a 3D spectral-element method (integrated computer code SEM46 for seismic imaging). A quantitative description of the medium parameters is based on known material properties of the target structure. The related 3D volume is discretized with a simple meshing strategy allowing the computation of records for a Ricker wavelet of central frequency of 60 Hz (Trinh et al., 2017).

Since real and synthetic surface waves show relatively similar behaviour, we consider designing initial model from dispersion curve analysis using an innovative method based on a data transform of these dispersion curves (Socco et al., 2017; Socco and Comina, 2017).This method allows the contemporary estimation of smooth S-wave and P-wave velocity models from dispersion data only. Other parameters needed for simulations, such as density and quality factor, are inferred through simple rheological relations. In this initial model, a real source wavelet is obtained by deconvolving the field seismograms by synthetic ones (Pratt, 1999).

According to the improved similarity between field and synthetic data for this initial model, we analyze real sensitivity kernels for different source/receiver configurations for various parameter variations in order to select the pertinent parametrization to be recovered by an inversion of complete full waveforms. The adopted hierarchical workflow from the dispersion curve analysis to full waveform matching is a promising improvement for a complete full waveform inversion of real datasets for shallow targets.

References

Pratt, R. G. (1999). Seismic waveform inversion in the frequency domain, Part I: theory and verification in a physical scale model. *Geophysics*, 64:888-901.

Socco, L. V., Comina, C., and Khosro Anjom, F. (2017). Time-average velocity estimation through surface-wave analysis: Part 1 — S-wave velocity. *Geophysics*, 82(3):U49–U59.

Socco, L. V. and Comina, C. (2017). Time-average velocity estimation through surface-wave analysis: Part 2 — P-wave velocity. *Geophysics*, 82(3):U61–U73.

Trinh, P. T., Brossier, R., Métivier, L., Tavard, L., and Virieux, J. (2017). Efficient 3D elastic FWI using a spectral-element method. In *87th SEG Conference and Exhibition 2017, Houston*.