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Determination of the optimal initial parametrization for inversion of surface wave dispersion curves in deep basins (Case study: Tehran)

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Extended Abstract

Summary

In this paper, we examined the influence of initial parametrization in the inversion of surface wave dispersion curves. First, the steps for choosing the most desirable parameters are described. Then, the influence of parametrization is investigated using two experimental approaches and also a systematic approach to find a consistent solution. The final results show that suitable values for initial parameters considering some basic principles and local site conditions can reduce the uncertainty in the final results. However, this uncertainty also strongly depends on a-priori information that could be implemented in the parametrization and also the inversion process.

Introduction

Global search algorithms like the neighborhood algorithm, which is implemented in the software for inversion of surface wave dispersion curves need reliable parametrization values. These algorithms are defined with the initial set of model parameters. In these methods, searching to find the best profiles in the initial parameters space leads to a set of profiles with the lowest error based on the misfit function. The influence of these parametrizations is widely discussed by many authors over the years. All these methods unanimously agreed that the rational estimation of bedrock, besides the number of layers, is a decisive parameter for choosing initial conditions. However, it is not easy to find some permanent solution to define the model parameters because the values strongly depend on the site. Such studies indicate the importance of accurate and correct determination of these parameters in future studies.

Methodology and Approaches

The goal of inversion of surface wave dispersion curves is to retrieve the shear wave velocity profiles. Generally, extracting shear wave velocity needs reliable information all over the frequency band, which is not provided in most case studies. The model parameters could constraint the final results with a limited frequency band. In such a situation, a reasonable estimation of the model parameters reduces the uncertainty. In this study, some crucial concepts to check the reliability of model parameters are reviewed. In this regard, the influence of local site conditions like the past geological studies and some initial observations based on the shape of dispersion curves and the wavelengths are examined. We have also investigated the influence of three different methods to retrieve model parameters. Finally, the effect of presence or absence the a-priori information in the same array has been studied.

Results and Conclusions

The experimental and also systematic approaches, used in this study, for the parametrization in the inversion of surface wave dispersion curves are very powerful tools to estimate model parameters in blind studies or the regions that are studied for the first time where no information about the site is available. Preliminary results of different approaches show the strong dependence of the results on the initial model parameters especially in deep parts where the wavelengths of surface waves are not enough to provide information in these parts. Constraining the deep parts, adding some information like stratigraphic logs, H/V resonance peak frequency or any other information could converge the final results in which the existence of a-priori information in the accuracy of final results is very important.