Automatic P- and S-Phase Picker for High-Resolution Local Source Tomography: Application to the Alpine Region

Introduction

Resolution and reliability of tomographic velocity models strongly depend on quality and consistency of available traveltime data. Arrival times routinely picked by manual analysis or in batch-processing basis often yield a high level of noise due to misprints and other inaccuracies, particularly in remote areas.

Considerable improvement in the quality of phase data can only be achieved by massive re-picking of tomograms in combination with consistent error assessment of timing and identification of pick phases. Considering the amount of data necessary for regional high-resolution tomography, algorithms comprising accurate picking with an automated error assessment represent a style to detect large-scale seismicolve artifacts.

Automatic P-Phase Picker: MannekenPix

Basis Concept

1. Step: Calibration Procedure
   - Analysis of the model and pick for the automatic S-phase picker for up-pick on a test of the model data set.
   - Using automatic picking of the data set.

2. Step: Production Procedure
   - Final pick for the automatic S-phase picker.
   - P-code using a method where the model data set is re-picked to complete the rate of the data.

Local Source P-wave Tomography with Highly Consistent Data Set

Conclusion from P-Wave Study:

Although the loss rate of the automatic approach is much higher (compared to manual picking), this is compensated by the automatic picking of very high quality. As demonstrated in this study, the lack of consistent loading the quantity of the available arrival data.

Consistent automatic picking of arrival times significantly improves the resolution and reliability of tomographic depth.

References & Further Reading:


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Automatic S-Phase Picker: Combined Approach

Basis Concept

Case Study: Application to the Alpine Region

Further examples of automatic phase picker show good agreement between the model data set and the available arrival data.

Example of phase misidentification in routine phase data.

Well Resolved

Top: Comparison of the model data set with a high-quality re-picked phase data set. The very good agreement with Moho models from Controlled Source Seismology (CSS) and receiver function studies demonstrates the consistency of the re-picked tomographic model.

Bottom: Ray-coverage of final data sets derived from automated re-picking approaches in the greater Alpine region.

Well Resolved

Top: Comparisons of the model data set with a high-quality re-picked phase data set. The very good agreement with Moho models from Controlled Source Seismology (CSS) and receiver function studies demonstrates the consistency of the re-picked tomographic model.

Bottom: Ray-coverage of final data sets derived from automated re-picking approaches in the greater Alpine region.