



ActiveSeismoPick3D - automatic first arrival determination for large active seismic arrays

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We developed a tool for automatic determination of first arrivals in active seismic data based on an approach, that utilises higher order statistics (HOS) and the Akaike information criterion (AIC), commonly used in seismology, but not in active seismics. Automatic picking is highly desirable in active seismics as the number of data provided by large seismic arrays rapidly exceeds of what an analyst can evaluate in a reasonable amount of time.

To bring the functionality of automatic phase picking into the context of active data, the software package ActiveSeismoPick3D was developed in Python. It uses a modified algorithm for the determination of first arrivals which searches for the HOS maximum in unfiltered data. Additionally, it offers tools for manual quality control and postprocessing, e.g. various visualisation and repicking functionalities. For flexibility, the tool also includes methods for the preparation of geometry information of large seismic arrays and improved interfaces to the Fast Marching Tomography Package (FMTOMO), which can be used for the prediction of travel times and inversion for subsurface properties. Output files are generated in the VTK format, allowing the 3D visualization of e.g. the inversion results.

As a test case, a data set consisting of 9216 traces from 64 shots was gathered, recorded at 144 receivers deployed in a regular 2D array of a size of 100 x 100 m. ActiveSeismoPick3D automatically checks the determined first arrivals by a dynamic signal to noise ratio threshold. From the data a 3D model of the subsurface was generated using the export functionality of the package and FMTOMO.