Geophysical Research Abstracts
Vol. 20, EGU2018-6819, 2018
EGU General Assembly 2018

A consistent and uniform research earthquake catalog for the AlpArray region

Irene Molinari (1), Matteo Bagagli (1), Tobias Diehl (2), Edi Kissling (1), John Clinton (2), Domenico Giardini (1), Stefan Wiemer (2), and The AlpArray Working Group (3)

(1) Institute of Geophysics, ETH Zürich, Zürich, Switzerland (irene.molinari@erdw.ethz.ch), (2) Swiss Seismological Service, ETH Zürich, Zürich, Switzerland, (3) AlpArray Seismic Network (www.alparray.ethz.ch)

To improve our understanding of the seismotectonics and the seismic hazard in the greater Alpine, a homogeneous earthquake catalog in terms of location and magnitude is needed. This requires merging of waveform data of many regional and national seismic networks. AlpArray initiative (www.alparray.ethz.ch), with its AlpArray Seismic Network (AASN), provides unprecedentedly uniform station coverage for the region with more than 650 broadband seismic stations, 300 of which are temporary. The AASN operates since January 2016 and is expected to continue until the end of 2018.

Our main goals are: i) consistent and precise hypocenter locations and ii) provide preliminary but uniform magnitude calculations across the region. For this study, we collected the first two years of data (2016-2017) from more than 1000 stations ($>$ 15TB of data) and we systematically checked the data and metadata quality. Our workflow is based on the iterative use of automatic P-wave pickers, detection and nonlinear location algorithms with a high-quality re-picking approach finally providing consistent phase arrival times in combination with a picking quality assessment. First, we detect events in the region in 2016 and 2017 using the STA/LTA based detector of the SeisComP3 monitoring system in off-line mode. To minimize the impact of erroneous automatic triggers on the location, the initial automatic hypocenters are derived by the Equal-Differential Time (EDT) algorithm implemented in the NonLinLoc location software. In addition, a quality-score is determined for each automatic origin and the one with the highest score is the preferred solution for the event.

Among the detected events, we select 50 geographically homogeneously distributed events with magnitudes $\geq$ 2.5 representative for the entire catalog. We manually pick the selected events to establish a consistent P-phase reference data set, including arrival-time time uncertainties. The reference data, are used to adjust the secondary, high-quality automatic post-pickers and to assess their performance. The first post-picker is an iterative phase picker, searching for the most likely first-arrival P-onset of the seismogram. This pick is used as initial pick for the secondary post-picker, the advanced MannekenPix (MPX) algorithm. The MPX picker provides consistent and reliable automatic first arrival P picks together with a pick-quality estimate.

Subsequently, high-quality automatic picks of all well-locatable earthquakes are used to calculate a minimum 1D P-wave velocity model for the region with appropriate stations corrections. Finally, all the events are relocated with the NonLinLoc algorithm in combination with the updated 1D model. We compare our locations with existing earthquake catalogs (ISC, EMSC, national catalogs). The proposed procedure represents an important step towards the uniform earthquake catalog for the entire greater Alpine region using the AASN.