Geophysical Research Abstracts
Vol. 21, EGU2019-17079, 2019
EGU General Assembly 2019

High-resolution automatic earthquake catalog of the 2016-17 Central Italy seismic sequence

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The 2016-17 central Italy sequence activated an about 60-km-long normal-fault system composed by a set of SW-dipping normal fault segments (Chiaraluce et al., 2017). Following the first main-shock of August 24 (MW 6.0), a very intense seismic activity developed in space and time. The hit area was regularly monitored before the sequence onset by the Italian National Seismic Network (RSNC, Amato et al., 2006) and by additional stations of the RESIICO regional network (Marzorati el al.,2016). Starting from the day of the first main-shock, the SISMIKO emergency team of INGV began to install a dense array of temporary seismic stations composed by 22 stations deployed complementary to the permanent ones (Moretti et al., 2016). After few days, colleagues of the British Geological Survey (BGS) and of the School of Geo-sciences at the University of Edinburgh deployed additional 24 broad-band stations. The 10th of September, the seismic network counts 60 station, with a mean inter-distance of 6-8 km, comparable to the earthquakes distribution at depth.
This network configuration produced a final dataset of continuous waveforms, recorded at 155 stations located within 50km of distance from the epicentral area, of more than 2.5 TB of data. This dataset of continuous recording represents the base for generating a high resolution catalog of earthquakes by means of the fully automatic procedure CASP (Complete Automatic Seismic Processor) (Scafidi et al., under revision) including modules for stations trigger detection, event detection, P- and S-waves arrival times, location and magnitude computation.
The detected events are analyzed through the advanced automatic picker engine RSNI-Picker2 (Scafidi et al. 2018; Scafidi et al., 2016; Spallarossa et al., 2014), that is the core of the automatic procedure. The RSNI-Picker2 is based on an iterative procedure for the automatic identification of phase arrival times by calculating AIC functions (Akaike Information Criterion; Akaike 1974). Iterations consist of different steps, separately performed for P- and S-phases, where pick identification is checked and refined based on computed locations. NonLinLoc software (Lomax et al. 2000) has been used for locating events, first using a 1D model calibrated for the area (De Luca et al., 2009) and then using a final re-location obtained by including stations corrections.
From August 2016 to August 2017 the automatic procedure detected more than 450000 earthquakes, of which more than 430000 are considered of good quality, based on an empirical criterion illustrated in Michele et al., (2018), for an extremely detailed picture of the seismicity which is capable of focusing on structural details of the area. The automatic procedure detected also more than 6800000 P waves arrival times and more than 9900000 S waves arrival times, for an unprecedented result both in terms of number and quality of data.