Toward a renewed data processing of the Engineering Strong Motion (ESM) database

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Strong-motion records and open access to strong-motion data repositories are fundamental to seismology, earthquake engineering and practice. The main archive to disseminate high quality processed waveforms for the European-Mediterranean region is the Engineering Strong-Motion Database (ESM, https://esm-db.eu). ESM is developed under the general coordination of the ORFEUS Strong-Motion Management Committee (Observatories and Research facilities for European Seismology; http://orfeus-eu.org/), with the aim to provide users daily access to updated strong-motion waveforms of earthquakes with magnitude greater than 4, mainly recorded in the Pan-European regions. ESM is fully compatible with the European Integrated Data Archive (EIDA; http://orfeus-eu.org/data/eida/) and disseminates waveforms and related metadata according to the Federation of Digital Seismograph Networks (FDSN, https://www.fdsn.org/networks/).

The strategy of ESM is to disseminate only manually processed data to ensure the highest quality. However, the rapid increase in the number of waveforms, due to the increment of seismic stations, leads to the need of automatic procedures for data processing and data quality control.

In this work, we present *ESMpro*, a modular Python software for a renewed processing framework of ESM. The ESM data processing is improved with:

(1) automated data quality-check that speeds up the processing time through the rejection of poor-quality records;

(2) advancement of the automatic settings for waveform trimming and filtering;

(3) introduction of different algorithms for data processing (Paolucci et al., 2011; Schiappapietra et al., 2021);

(4) modular and flexible software structure that allows the addition of new algorithms and custom workflows.

The accuracy of the updated automatic processing is evaluated by comparison with the waveforms processed by expert analysts, used as benchmarks (Mascandola et al., 2022).

ESMpro is distributed in a stand-alone Beta version available on GitLab (D'Amico et al., 2022;

https://shake.mi.ingv.it/esmpro/), following the Open Science principles to promote collaborations and contributions from the scientific community. In the next future, a renewed ESM web-processing frontend will be developed to include the ESMpro improvements, as well as new functionalities to process stand-alone data (i.e., not stored in the ESM database) and to allow different input seismic data formats.