Seismological network of AFAD, visit by J. Havskov and M Özyazıcıoğlu, October 2015

Introduction

The purpose of this visit was to continue general SEISAN improvements of the installation finish the Ml paper and help prepare a data set for a country wide coda Q analysis.

Processing and data base

The EA software has been much improved with new interfaces for all magnitudes, location of both local and distant events and use of both Hypo200 and Hypocenter. The interface to the relational data base (DB) has been improved. Some more details in the following.

Magnitudes

Magnitudes Ml, mb, mB, Mwp, Ms and MS have been implemented in EA. They can work both manually and automatically, except Mwp which only works automatically. The implementation seems to working well and has been compared to SEISAN magnitudes except Mwp. In addition, the spectral amplitudes have been implemented. Q, geometrical spreading, kappa are given in a parameter file. All the information is written to the DB and when taking out data from the DB to the S-file. There were a few errors: F0 should be f0, for many events number of stations on header line was written as an unrelated real number and there should be a blank line between events. It would also be nice if the stations could be ordered chronologically|. For Mwp the seismic moment is written, for each station to the DB, and it is not transferred to SEISAN. It is recommended that the spectral analysis also calculate noise spectra to ensure a good signal to noise ratio for the analysis.

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Moment tensor solutions

Solutions made in individual computers with SEISAN. The results are transferred to the DB and the original solution is not always saved. The DB does not have the moment tensor elements. The data base can only contain one solution per event.

Fault plane solutions

Solutions with polarity are made in a separate computer where a special file is prepared to run the PINV program (original version). The solutions are then manually inserted in the data base. Since polarities are picked with EA, polarities are available in the extracted S-files, however not the fault plane solutions. PINV is not the best program to use and it would be better to use one of the SEISAN programs. It would also be a lot faster.

The relational data base

Data can be extracted as S-files via the web pages (www.deprem.gov.tr). Search criteria are set up, all events are displayed and one of the options is to extract a CAT file with all the selected events. Fault plane solutions and moment tensors are in a different data base and are not included in the S-file. Similarly additional processing results, whether in SEISAN or other systems, are not included in the DB and are hard to find or lost.

Suggestion for improving the data base:

Many parameters in the S-file are missing. Ideally all data in S-file should be included, at least the fault plane and moment tensor solutions. Alternatively the whole s-file could be stored in the data base: The procedure could then be

* Initial processing in EA
* Save results in DB as now
* Make an S-files in data base as one entry based on the initial data
* Further processing e.g. for fault plane solution: the user extracts the S-file from DB, does the processing and puts it back in with added results. The DB is updated for fault plane solution but not for hypocenter and magnitude.
* The next user can search in the DB based on original parameters but will receive the updated S-files.

For outside users, there should be a way to get waveform data for corresponding events.

Problems: Over time the S-data base and the DB will be different. However AFAD has a policy of not changing the web page solutions so maybe not a problem. A procedure could be made to update the DB from the S-files if needed.

SEISAN data base

There is not central data base maintained and with the new system it is hardly needed. The only data base available for general SEISAN work is the data used for the Ml study. So any SEISAN work requires extraction of S-files from the main DB and getting access to the waveform data through the archive. This is however slow, and also requires one to work with one of the computers connected to the archive. A new program, get\_arc was therefore written to extract waveform files from the archive and register the name in the S-file.

Data for coda Q and other studies

About 38000 events for mainland Turkey were selected. The events were updated and waveform files put in (30 s before and 300 s after origin time). Extracting the files (only stations with readings) took about 24 h. A test run was made for coda Q and 15000 Q-determinations were made, not a lot considering the amount of data. However many events have a low signal to noise ratio

Conclusion

Overall, the has been an impressive progress, both with the capabilities of AV, and the relational data base. With the new S-file interface to the relational data base it is very easy to extract out data, it can immediately be plotted from the archive. Alternatively, the waveform files can be extracted and analysis in SEISAN can be made independently of the archive. The only thing missing is to store more data in the data base and make them available in the S-file or store the S-file in the data base.

Appendix

Get\_arc program

A program to extract waveform files from the archive corresponding to S-files and register the name in the S-file.

The program uses an S-file as input (one or many files). The stations to select from the archive can be user specified, all stations with readings, all stations in archive or all stations in a given distance from the epicenter. All channels for each station are automatically selected and the is no option for selecting e.g. all Z-channels. The output file get\_arc.out contains the input data with the waveform file lines added. If the process is done twice and the same waveform file name is created, it will only be recorded once in the S-file. The output file must be split into the data base and possiblyely overwrite existing S-files.