Cooperation between the Institute of GoeSciences, Polytechnic University of Tirana and the University of Bergen.

Report # 3

Albania seismologcal network, current status and plans

September 2022

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Introduction

This report describes the activities during the week of the visit of Jens Havskov to the National Seismic Monitoring Centre of the Department of Seismology (Institute of GeoSciences, IGEO). The main purpose was to review progress in data recovery, look into more use of the data for fault plane solutions aiming the implementation in the routine data processing, check status of the data base and discuss possible new project activities.

Data recovery

Anila Xhahysa has extracted acceleration data from the continuous data stream from 2013 to 2022 based on ISC event information for events larger than magnitude 4.0, a total of 200 events. The extracted data was in gcf format, The data was converted to event MiniSeed files by Migena. Ceyhan. Several station codes were not correct so had to be converted to the official station codes as given in the ISC registry. The component codes were also corrected. All correction definitions are found in file gursei.def in DAT. The work was not completely finished because of doubts of some original station codes. It also turned out that in 2019 and 2020, the data in the data base did not contain component codes (data was taken from GSE files, see below) so data could not be put in before this is fixed. It turned out that several important events were not in the data base despite available acceleration data so they were missed in the bulletins.

Actions: fix 2019-2020, convert the rest when codes have been found, put in hypocenters for strong motion data which does not have it. When new data is extracted, put it in. Response files should also be added.

Continuous data and old event files.

It has earlier been a problem to collect all old continuous data due to lack of disk space. A new 18TB disk (courtesy of University of Bergen) was installed and the process of copying all old wav data was initiated.

Action: copy all old waveform data to the new disk including GBV-316 data, in GSR format, and whatever data available in Mseed and yfile format and write a complete inventory. It would be desirable to also save all the continuous aftershock data for the 2019 event.

Aftershocks 2019 of event

It has long been the intention to put in the aftershock data in the data base from the 2019 events. About 95 events have been processed with both the field stations and the permanent network, however not all data has been found.

Action: Find the data and integrate with the data base

The data base

When looking for aftershocks for the 2019 event, some problems with the data from 2019 and 2020 were discovered. At the time of putting in this data, the source used was the GSE files from the Nanometrics system. The GSE files were generated from the original Hypoinverse solutions and stored in a kind of data base in the Athena Web Server part of Apollo Suite Nanometrics system, a total of 2344 events. However, GSE data does not contain components so it would be desirable to replace this data with the original locations in Hypoinverse format. In theory the two should be the same. The Hypoinverse data for 2019 was recovered (1858 events, it was used directly for the bulletins) and Figure 1 compares the two data sources. It is clear they are very different in both number of events and distribution.

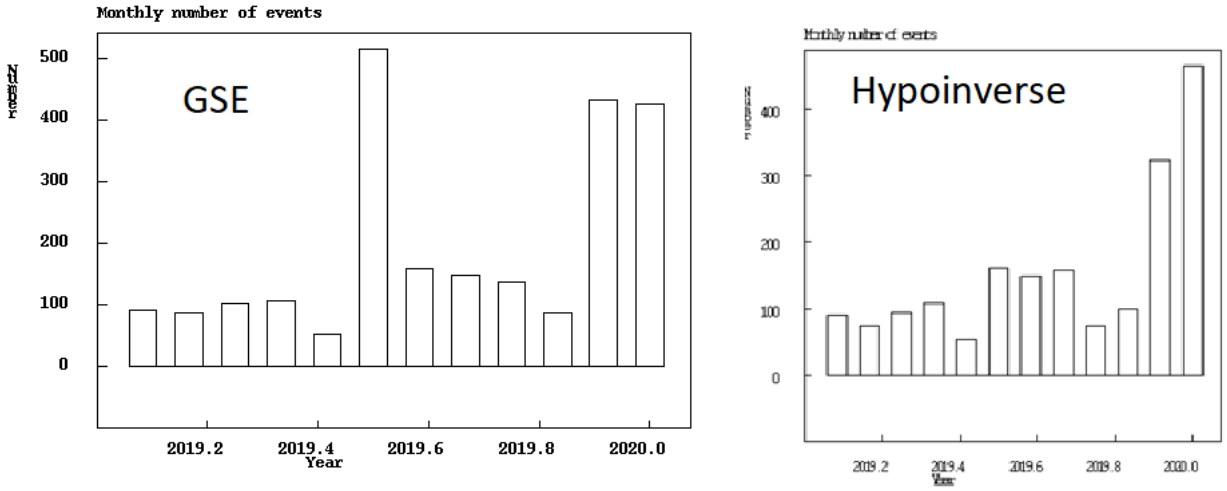

Figure 1 number of events per month in data base (left) and in Hypoinverse output (right).

The largest difference is that the Hypoinverse data do not have all the aftershocks for the large June 2019 event, in Korça region.

Since most of the regenerated data in the data base is based on the bulletins and not the original location files, it is possible that more data is missing if it for some reason had not been put into the bulletin.

Action: clean up 2019 and 2020.

Back up of data base

Currently all changes in the data base and waveform files are saved to the server. However, if some mistakes are made in the S-files, those faulty S-files will then also be updated to the server and replacing the good S-files. It was decided to back up the S-files once a week by making a collect of the whole data base and storing the collect.out file in /home/seismo/BACKUP-SFILES with a name giving the date of collect.out like sfiles.2022.09.22. The files in BACUP-SFILES are now included in the backup to the server. Migena Ceyhan volunteered to do this. In the future this should be done automatically with a script.

Action: check that it is done

Fault plane solutions and reading polarity

A short introduction to fault plane solutions using polarities and how produce them in SEISAN was given to the Analysts and other members of the Department of Seismology. Currently polarities are not read. Searching for events with enough polarities for fault plane solutions is time consuming. However, if polarities are read at the same time as phases are picked, it takes little extra time. There are not many events with enough clear polarities (at least 8) so reading

polarities for only those events is minimal extra work. It was decided that reading polarities for potential events now shall be part of the routine. Fault plane solutions should then be made and revised by Edmond.

Action: follow up that polarities are read.

Local data base and data base for seismic hazard

It is known that the current data base, which has been made using old bulletins, is not complete and currently it cannot be used for seismic hazard, partly because it is not complete and partly because there is uncertainty with magnitudes (many are coda magnitudes), particularly for older data. The unified earthquake catalog, EFEHR | Earthquake Catalogue (ethz.ch), could be a good reference and probably better than anything that can be made locally since it has been cleaned for duplicates and magnitudes have been unified. However, the local data base should also be complete for all events above a certain magnitude and the simplest way to achieve this is to compare to the ISC and copy in missing data and also update the catalog with relevant magnitudes from ISC. For a start, all events from ISC with any magnitude larger than or equal to 4.0 could be put in. All the data from ISC is already in the ISC data base in a local data base. For the years 2010-2017 there were 187 events with any magnitude larger than or equal to 4 in our ISC data base (similar to what Anila Xhahysa found) for our prime area, see Figure 2.

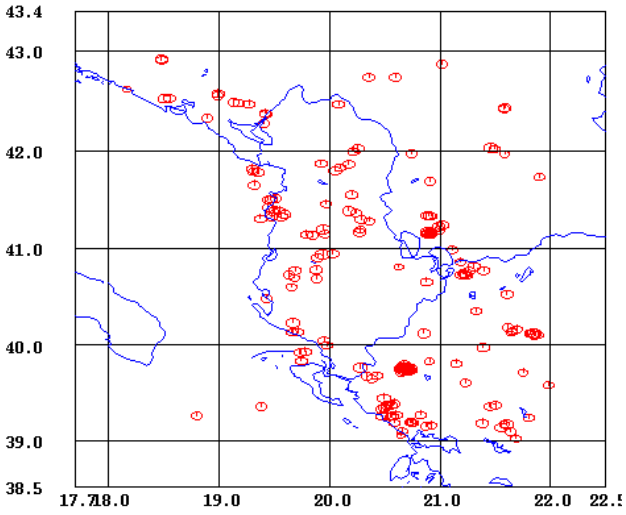

Figure 2 Events from ISC from 2010 to 2017 with any magnitude larger than 4.0.

The TIR data base contains 270 events with magnitude larger than or equal to 4.0 in the same area. This does not sound realistic compared to the ISC data base. Revising a few of these events showed that they were often based on very few stations, there we no info on coda or amplitude

and the events could not be found in the ISC data base. So the magnitudes are clearly wrong and should be removed.

Action: clean up the data base so it is correct for all events larger than and equal to 4.

Projects

CodaQ: An initial test was made with Edmond Dushi for data from 2021-2022. There seem to be more than enough data for a study. Initial results indicate that Q is quite low in Albania, comparable to e.g. the Azores.

Criteria for data selection was : area 37.5-43.0 N ,18.5 -23.0 E, depth less than or equal to 30 km and hypocentral distance less than or equal to 60km. 6400 events were available, see Figure 3.

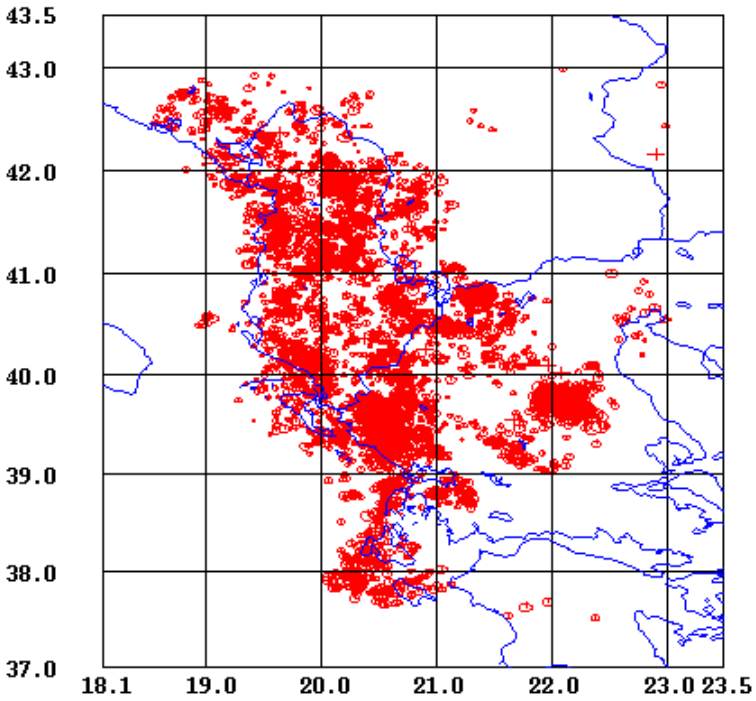

Figure 3 Events which potentially can be used for CodaQ

2030 events had data with good enough signal to noise ratio to be used. Figure 4 shows the locations representing the results which are the midpoints between the station and events where Q results are available.

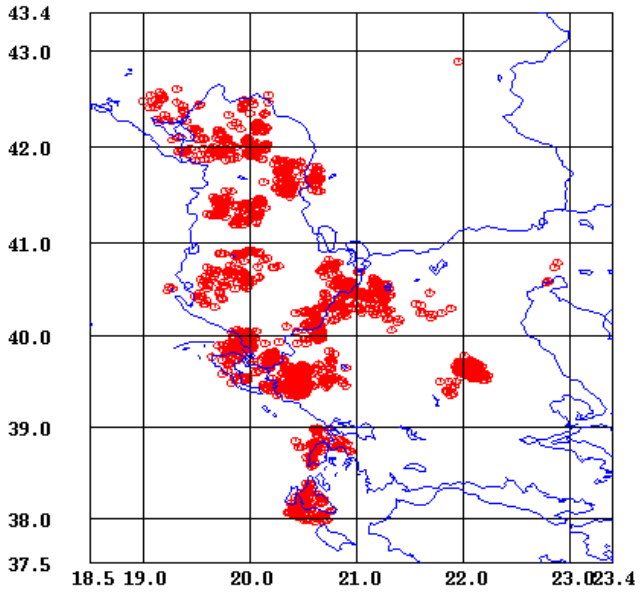

Figure 4 The midpoints between stations and events for calculated Q values.

Action: do a detailed analysis of the results and correlate with tectonics.

Soil response

Tests were made with noise data using segments of data from the network. It seems that there is little amplification at the permanent stations. A study will be made for all stations by Anila Xhahysa and Klajdi Qoshi to get an initial idea of amplification. Figure 5 shows an example for station KBN.

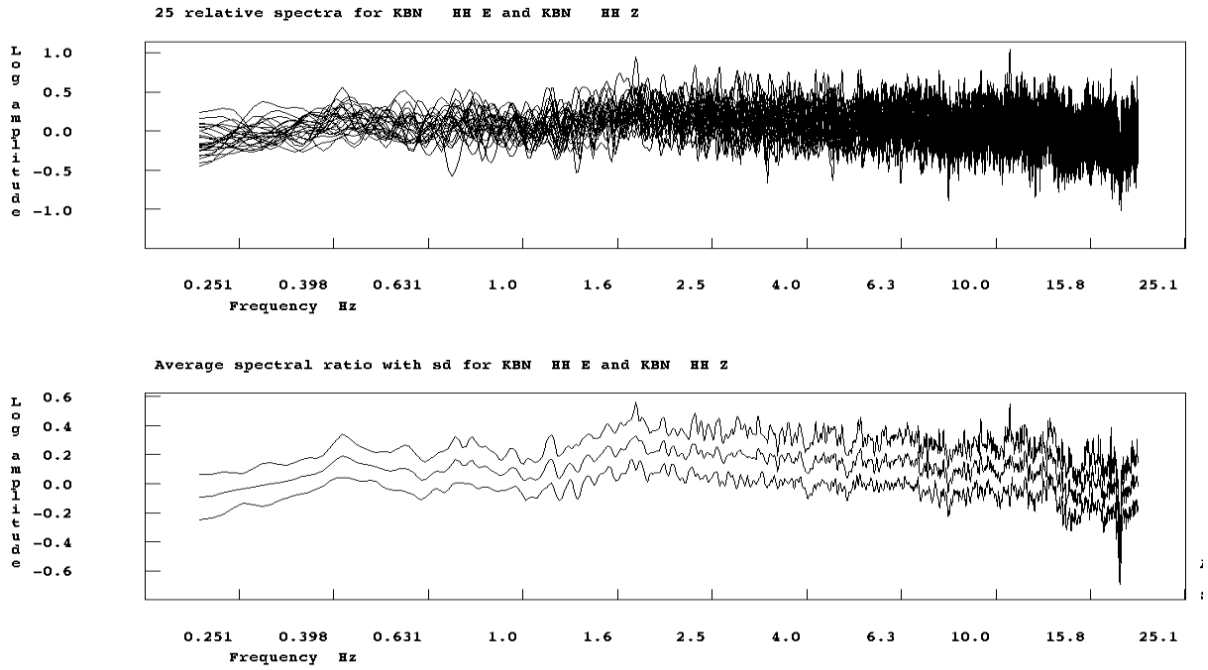

Figure 5 Example of a H/V ratio for station KBN. The top figure shows 25 relative spectra and the bottom figure is the average with standard deviation of the 25 spectra.

The study should measure H/V for all stations, using separately the E and N components. It could also be interesting to try different time periods with different noise levels like day and night and summer and winter.

Later another study could be made using a field station and measuring noise in Tirana. The results should be compared with available knowledge of soil structure.

Another source could be the data from the field stations recording aftershocks for the 2019 event.

For the initial test a parameter file has been set up in directory ./WOR/SPECRATIO. The parameter file is spec.par.

The outcome should be compared to the online version HVSRweb: A web application for HVSR processsing which probably calculates H/V more correctly than SEISAN. However an initial comparison did not show any significant difference in results.

Action: Finish report using permanent stations, make a study with the aftershocks, measure noise in Tirana.