From Corinth gulf extension to Ionian subduction/collision (W. Greece) : micro-seismicity survey to constrain local tectonics

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Introduction

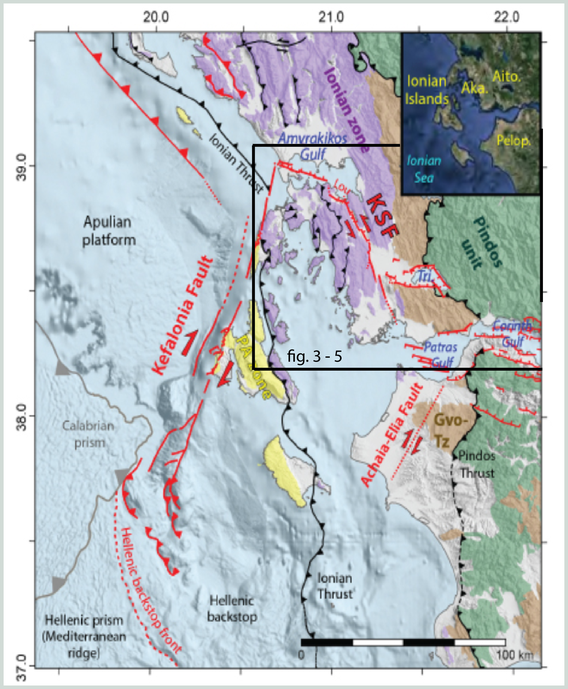

Figure 1 : Tectonic map of Western Greece by E. Pérouse (2013) [1] showing active (red) and inactive (black) faults. Lou: Loutraki normal fault ; KSF: Katouna-Stamna Fault ; Tri: Trichonis lake.

The Western region of the Gulf of Corinth is characterized by the Island Akarnanian Block (IAB) microplate, which has been progressively separating itself since the Pleistocene (less than ~1.5 My) [1]. This plate is bounded to the North-East by the Katouna-Stamna Fault (KSF), a North-South left lateral strike-slip fault system, to the North by normal faults reaching the limit between Apulian and Eurasian plates, and to the East by normal faults forming the East-West graben of Trichonis lake *(fig. 1)*.

Even though, these faults are known, there are notable differences in fault location according to the different authors [1],[2]. In terms of instrumental and seismicity, the area remains poorly studied, the seismicity recorded by the Greek national network(Hellenic Unified Seismological Network, HUSN) shows discrepancies regarding to the faults mapped at surface.

With the help of a temporary seismological network (MADAM experiment) we are implementing a large seismic catalog to constrain seismic slip zones and movements, and have a better understanding of tectonics and geodynamics of this region.

Seismic data

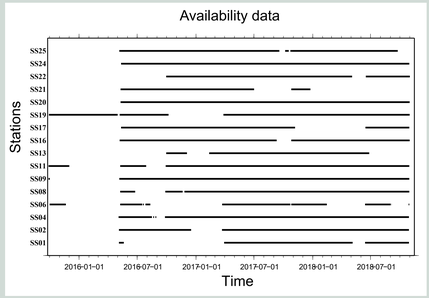

***Figure 2 :** Data availability for the temporary network from October 2015 to October 2018.*

***Figure 3 :** Alexis and me after facing the dangers at seismic station SS06.*

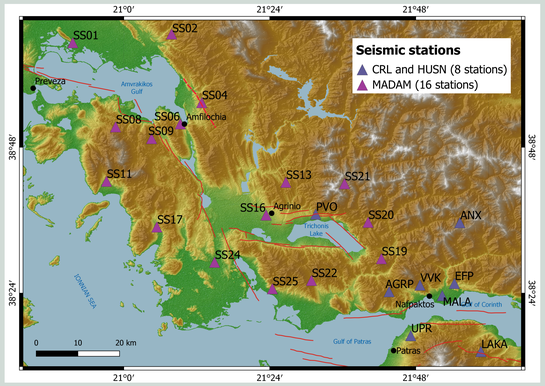

***Figure 4 :** Seismic networks location map.*

Processing

Microseismic data are processed with the frequency band picker method [3] which compares the short-term average (STA) to the long-term average (LTA) in term of frequency. For accessibility issues, a basic seismic picking and checking home made python program is used for this study.

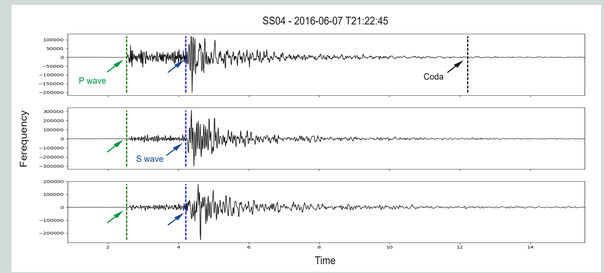

***Figure 5 :** Example of seismic piking for SS04 station. These three graphs represent Vertical, North-South and Est-West component, respectively. Dashed lines is P- (green), S- (blue) waves arrival times and coda (black).*

Preliminary results (October 2015 - December 2016)

3 times more events detected
compare to the NOA catalog

8 seismic swarms
4 detected owing to MADAM network

Microseismicity mainly above 25 km depth

With the MADAM network we have well located 5363 seismic events compare to ther 1610 events for the Natioonal Observatory of Athens (NOA) during the same time period and for the same area. It corresponds to an increase of 230% of event locations.

The events in the NOA catalog are located mostly deeper than those from the MADAM catalog, indicating that the NOA catalog is poorly constrained in depth, most probably due to the wave velocity model used, while we use the local model from *Hasslinger et al. (1999)* [4].

We identify 8 swarms, 4 of which were already in the NOA catalog, the other 4 being revealed thanks to the MADAM network *(black dashed ellipses fig. 6).* The seismogenic dynamics in this area seems to be controlled by swarm activity. In particular, one can note the important seismic activity at the passage from the Gulf of Corinth to the Gulf of Patras, indicating a high deformation area [5].

Some of those swarms, themself sometimes constituted by small clusters, are active during short time periods (from a few days to several weeks). North to the Amvrakikos gulf the swarm is active from July 2016 to September 2016, and at the Mesolonghi bay (South to SS24 station) from May 2016 to June 2016.

During this observation period, a low seismic activity is associated with the major KSF active structure.

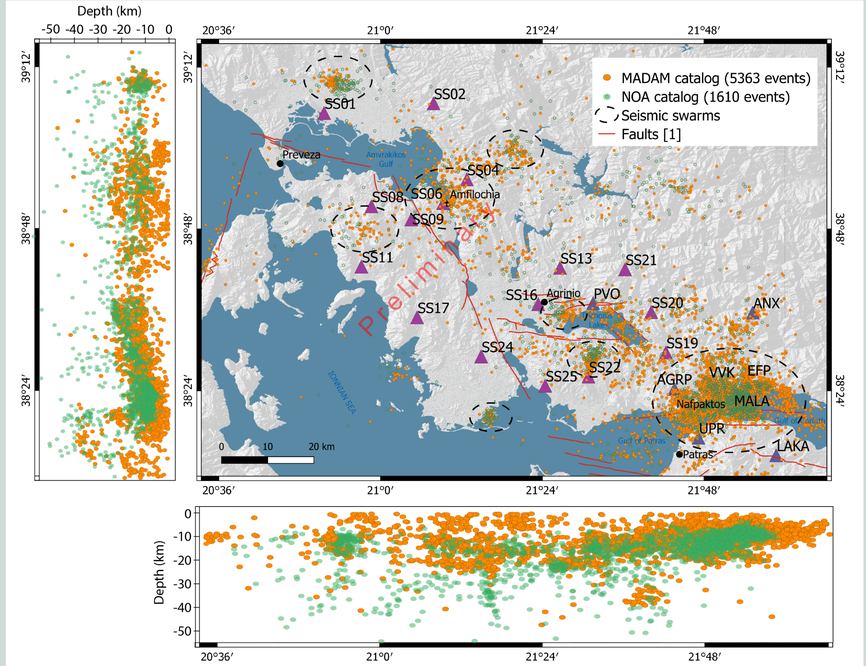

***Figure 6 :** Location seismic event map (October 2015 - December 2016). MADAM seismicity catalog (orange dots) and NOA seismicity catalog (green dots). Longitudinal and latitudinal cross-sections.*

Conclusion and Perspectives

Preliminary results indicate the need to have a denser seismic network to study the local microseismicity with a 230% increase in the detections. These new data reveal that the local seismic dynamics is potentially controled by swarm activities.

Next step is to complete the microseismic catalog with the 2017 dataset. This final catalog will allow to better constrain the seismic velocity model with an appropriate Poisson's ratio.

Once the catalog completed, magnitudes could be constrained and focal mechanisms determined. Then, the tectonic interpretation could begin in order to constrain the geodynamics of the area and the seismic potential of the faults. Finally the goal is to constrain a seismo-tectonic model consistent with the local and regional geodynamics, GPS and InSAR observations.

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