

# Setting a COST proposal for NFOs & CRL

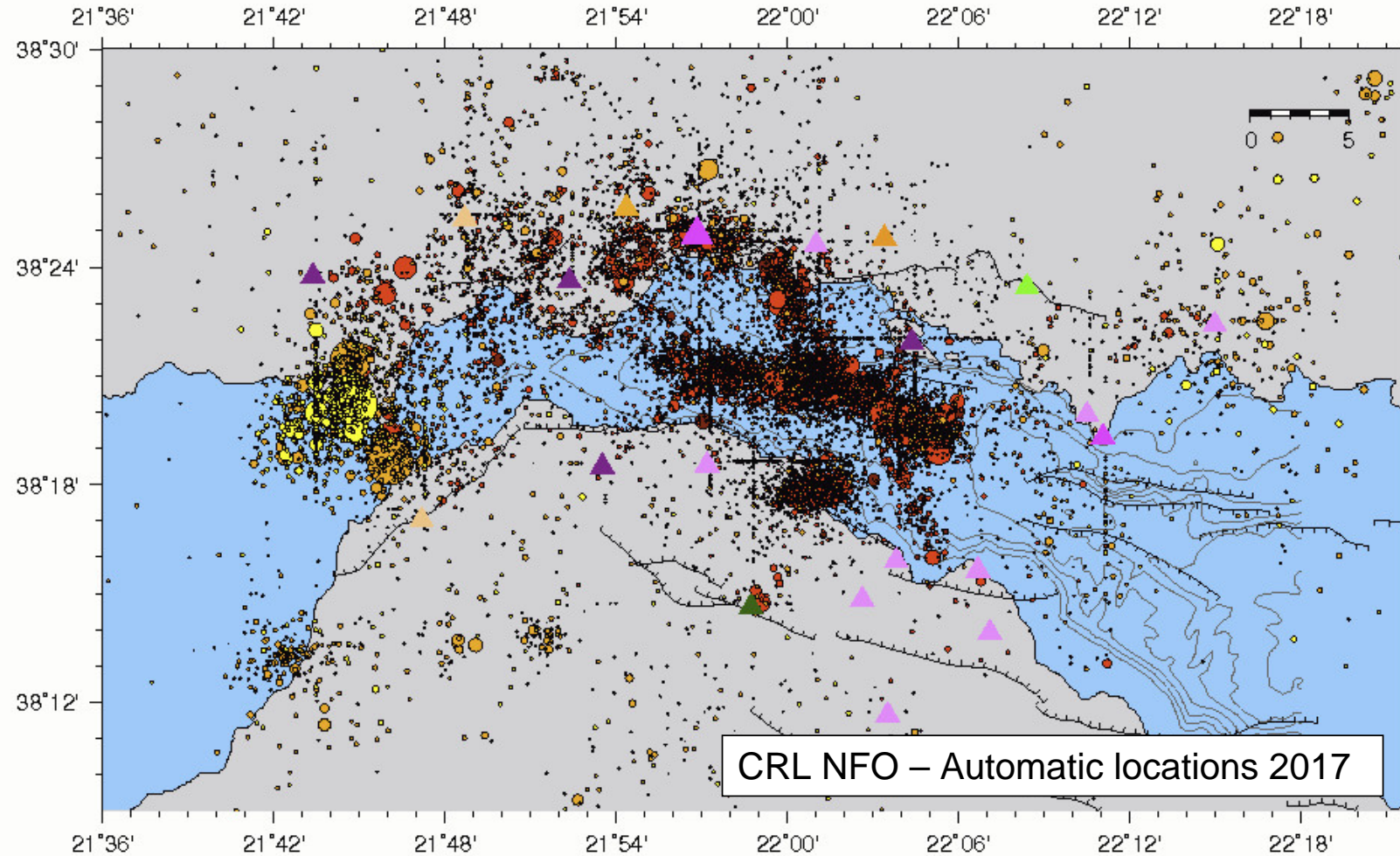
**CRL/CRO team**

**NFO meeting @ Postojna November 2019**





# Western Corinth rift : the most seismic area in Europe



# Devastating historical earthquakes



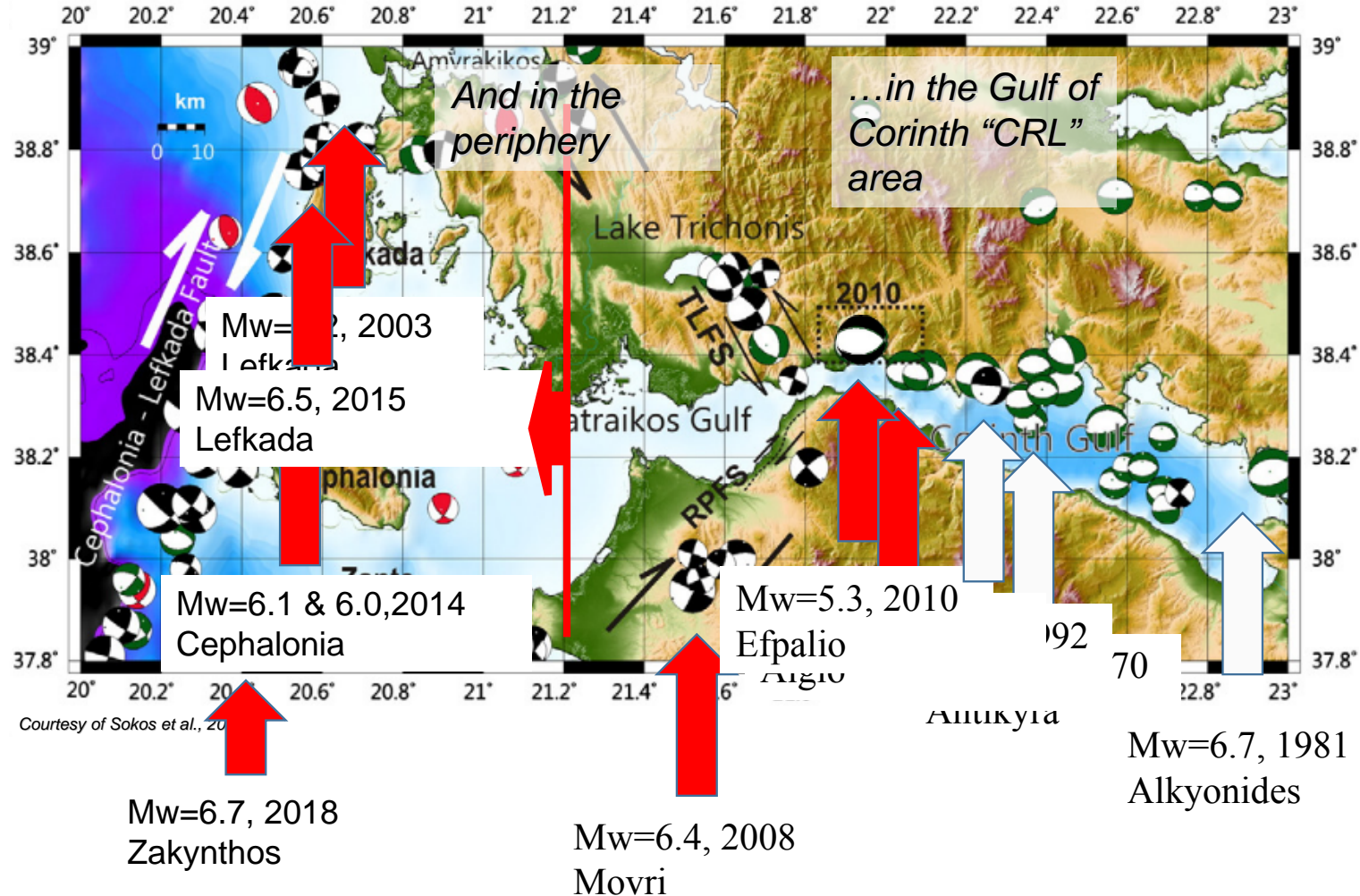
## **Agion 25 May 1748**

A violent earthquake at 3 pm, preceded by a strong foreshock, caused extensive damage in the northern Peloponnese.

Following the earthquake the sea in the gulf of Corinth receded a great distance from the shore and, on returning with great violence, flooded the town three times. The third wave was so large that it reached the upper part of the town. (Ambraseys, 2009)



# Recent earthquakes



One of the highest seismicity rates in the Euro-Mediterranean region

# Large cities and infrastructures

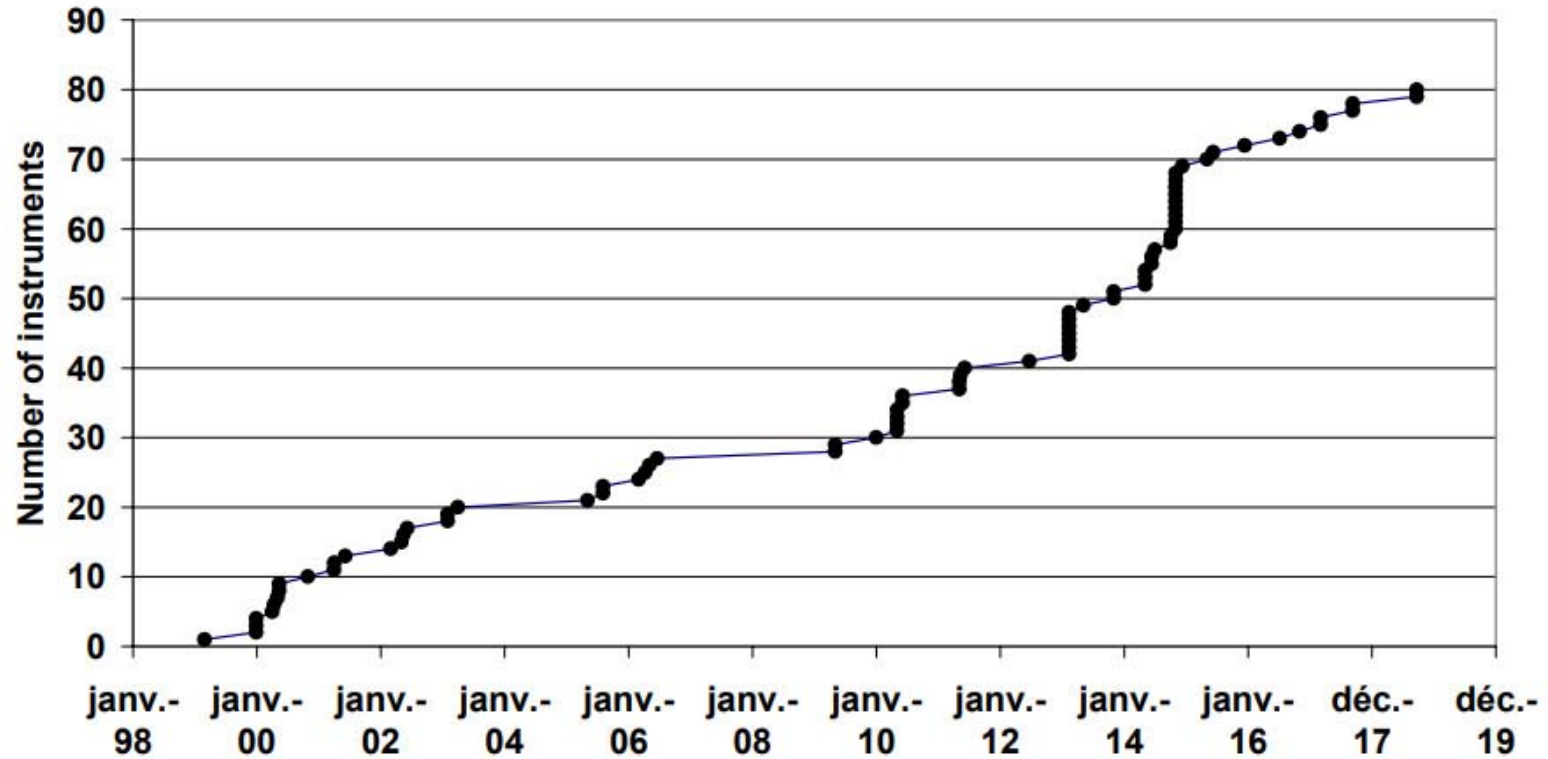




# Hand on major faults

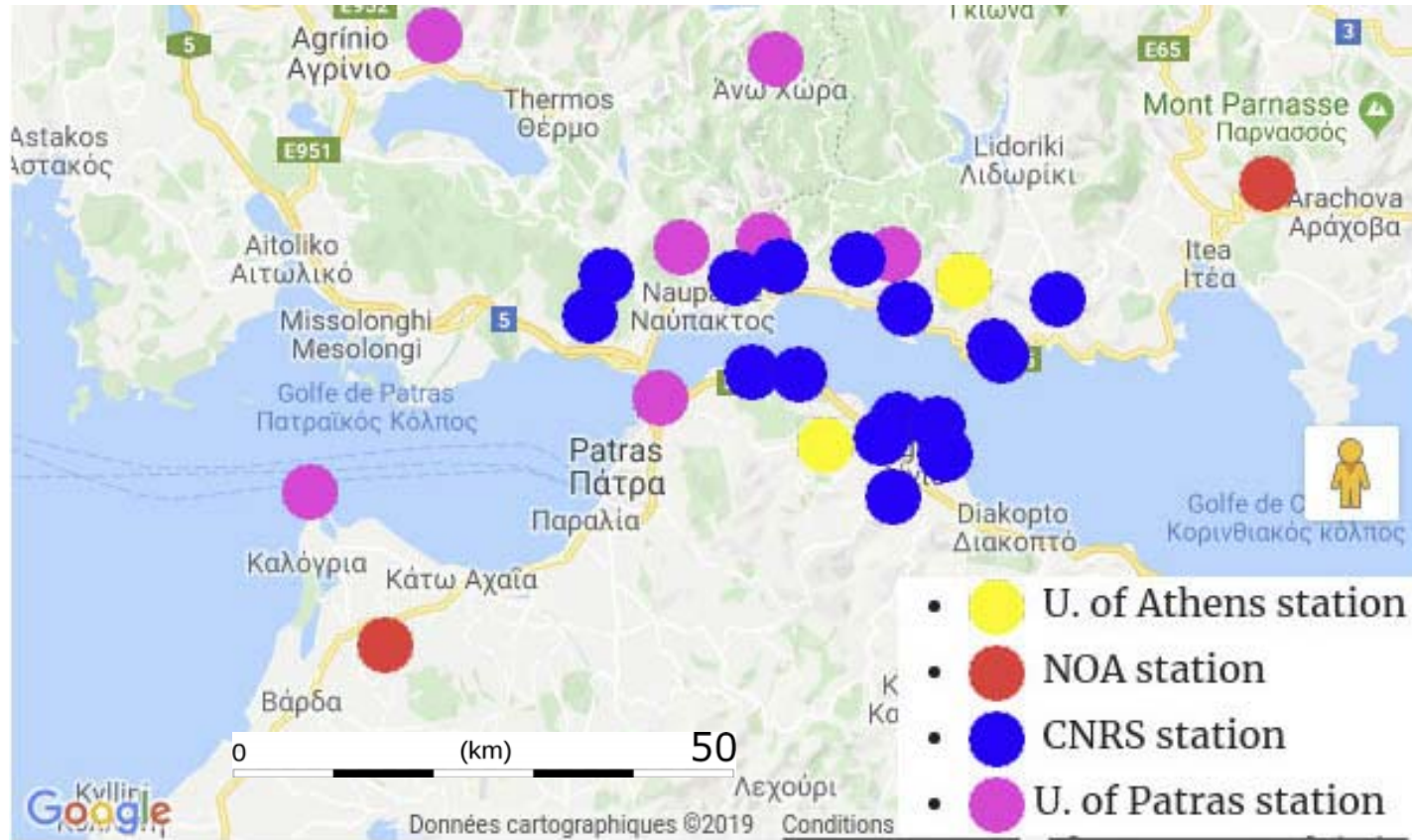


# CRL Near Fault Observatory = 80+ permanent instruments



**Figure 4.** Evolution of the CRL observatory array (number of sensors)

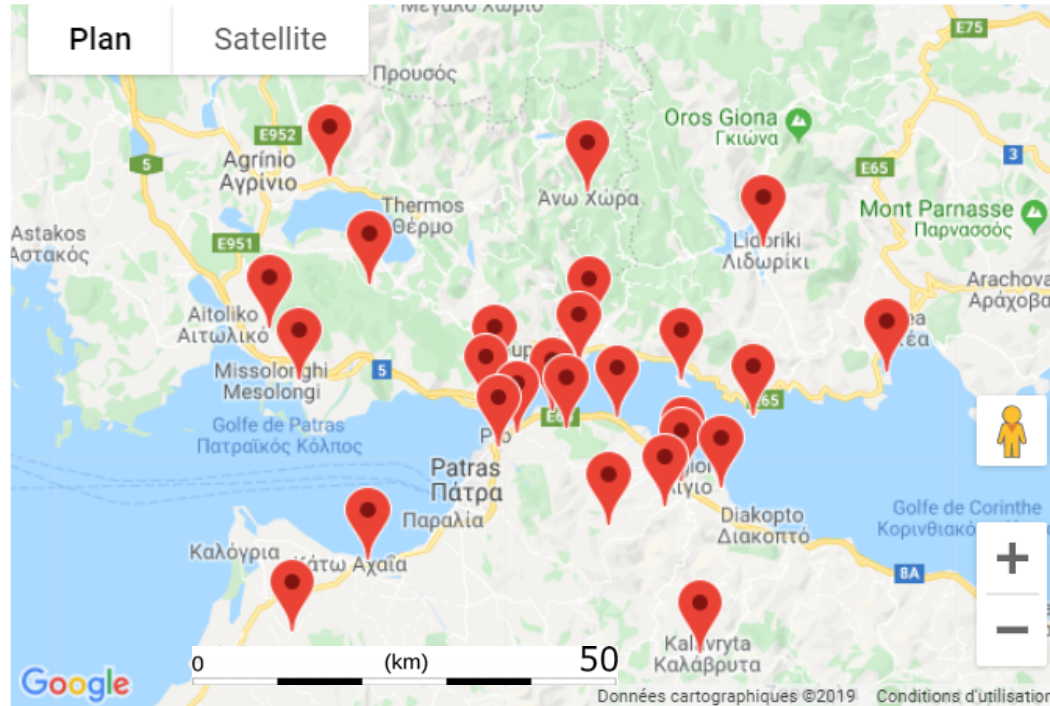
# CRL NFO : permanent seismic networks






Seismic network. **Objective:** high resolution continuous monitoring of the seismicity in the Aigion-Patras area

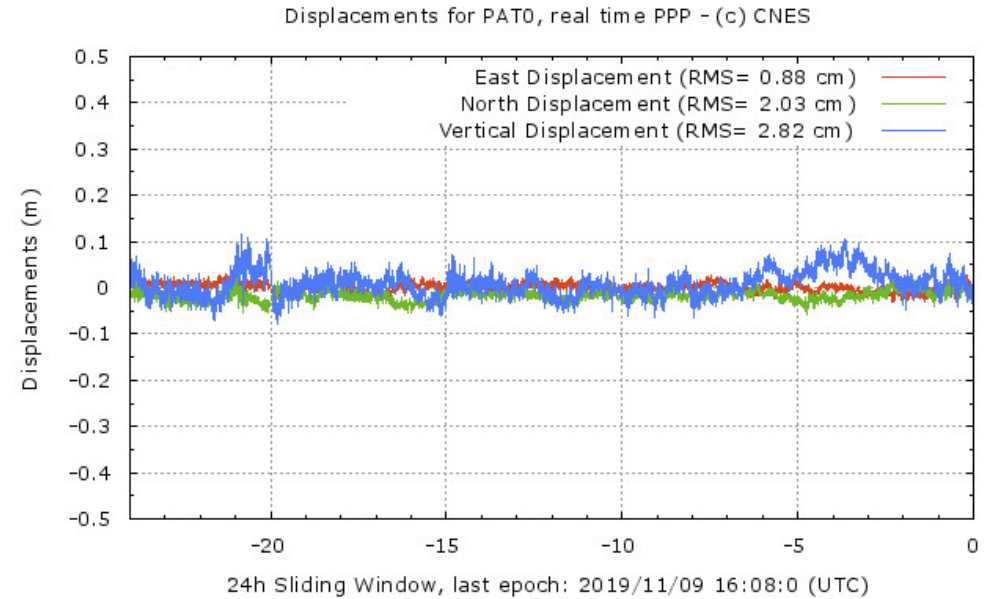
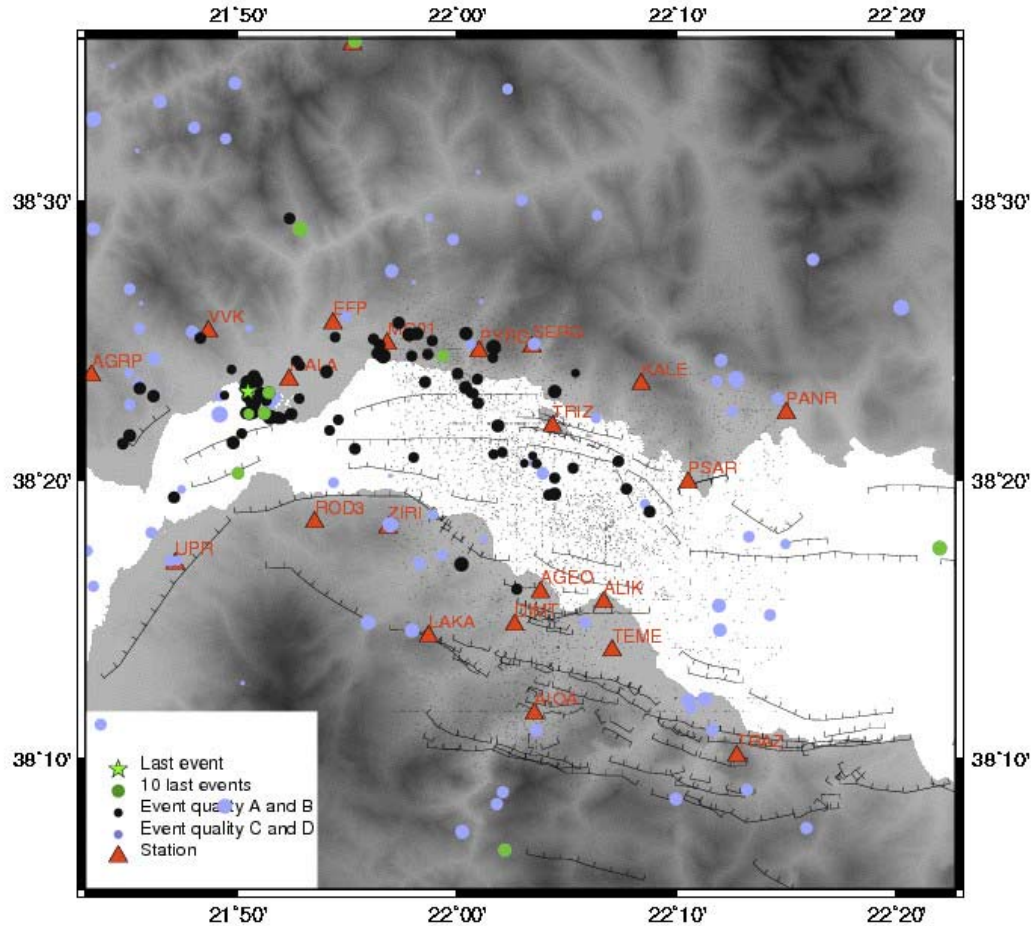


# CRL NFO : permanent GNSS networks



-  Centre National de La Recherche Scientifique – [CL](#) GNSS instruments – Stations [AIGI](#), [ALIS](#), [ANOC](#), [ARSA](#), [EYPA](#), [GALA](#), [GEYB](#), [KALA](#), [KOUN](#), [KRIN](#), [LAMB](#), [LIDO](#), [MESA](#), [MESO](#), [PATo](#), [PSAR](#), [PSAT](#), [ROD3](#), [TRIZ](#), [VALI](#), [XILI](#)
-  National Observatory of Athens – Stations [RLSO](#), [EGIO](#), [PLAT](#)
-  University of Patras & Charles University Prague – Stations [PVO](#), [RETS](#)

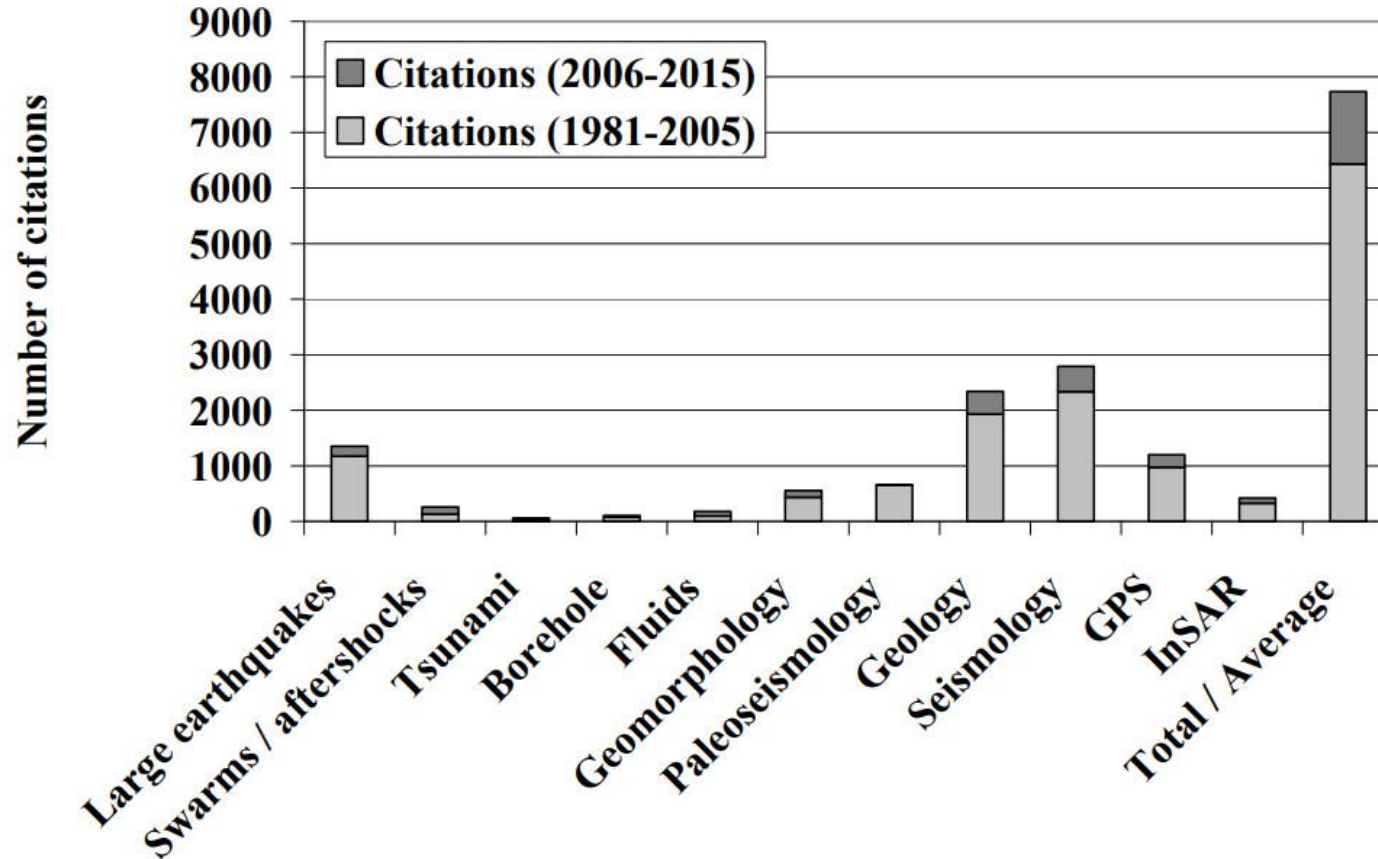
# CRL NFO : real-time seismicity and geodesy



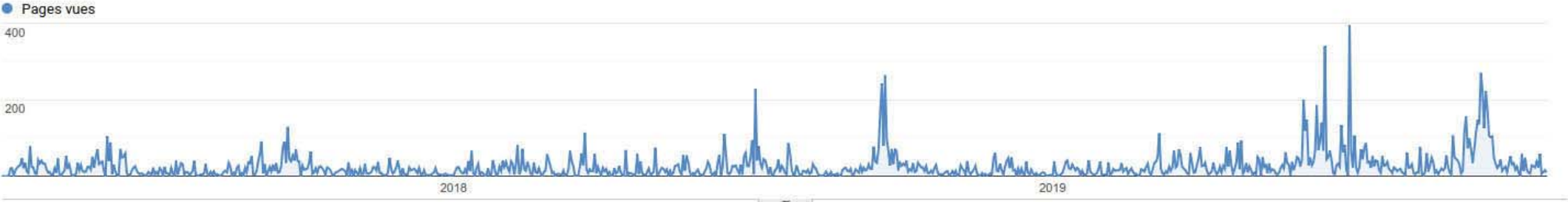
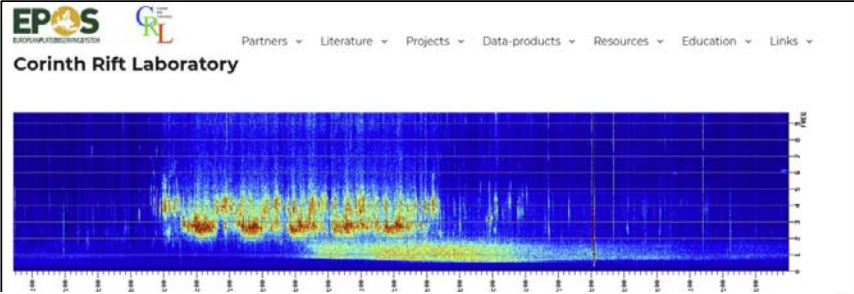


# CRL : 300+ scientific publication since 1980

Citations per scientific domain



# A web portal <http://crlab.eu> with data / products / literature / educational material



		24177	24177
		% du total: 100,00 % (24177)	% du total: 100,00 % (24177)
1.	/	6296	26,04 %
2.	/crl-school-2019	1766	7,30 %
3.	/crl-school-2018	1659	6,86 %
4.	/crl-school-2017	788	3,26 %
5.	/30s-raw-data-from-the-permanent-stations	530	2,19 %
6.	/earthquakes_catalogs	502	2,08 %
7.	/the-gnss-array	455	1,88 %
8.	/publications	453	1,87 %
9.	/crl-school-2019-instructions	432	1,79 %
10.	/interferograms	410	1,70 %

		3884	3884
		% du total: 100,00 % (3884)	% du total: 100,00 % (3884)
1.	Greece	1242	31,30 %
2.	France	519	13,08 %
3.	United States	484	12,20 %
4.	Italy	313	7,89 %
5.	United Kingdom	134	3,38 %
6.	Germany	111	2,80 %
7.	China	83	2,09 %
8.	India	82	2,07 %
9.	Bulgaria	71	1,79 %
10.	Spain	58	1,46 %



# **The CRL NFO component of the COST NFOs action**

- A real European NFO
- Added value in relation to existing efforts
- Seismological science
- Technology & computing
- Education
- Multidisciplinarity and link with the Volcano Observatories
- Best practices in the NFOs

# CRL : a real European NFO

- the facilitation of the international collaboration of the European research networks...

The CRL is a real European observatory. All the  
Observatories together constitute of an  
intense European collaborative scheme.



Corinth Rift Labo

Partners ▾

Literature ▾

Projects ▾

Data-products ▾

Resour

Governance

France

Greece

Czech Republic

United Kingdom

Italy

**Germany**

Belgium

Bulgaria



## Partners

- [France](#)
  - [CNRS-INSU](#)
  - Universities
    - Ecole Normale Supérieure – Paris Sciences et Lettres
    - University Sorbonne Paris Cité – Institut de Physique du Globe de Paris
    - University of Nice – GeoAzur
    - University of Strasbourg – EOST
    - University of Nancy – ENSG
    - University of Chambéry
  - Institut de Recherche et de Sécurité Nucléaire (IRSN)
  - Mines Paris Tech
- [Greece](#)
  - National Observatory of Athens
  - Universities
    - University of Patras
    - University of Athens
    - Harokopio University of Athens
    - Technical University of Athens
    - Aristotle University of Thessaloniki
- [Czech Republic](#)
  - Universities
    - Charles University – Prague
- [United Kingdom](#)
  - Universities
    - University of Southampton
    - University of Edinburgh
    - Brunel University
- [Italy](#)
  - Istituto Nazionale di Geofisica e Vulcanologia
- [Germany](#)
  - GeoForschungsZentrum Potsdam
- [Belgium](#)
  - Universities
    - University of Liège
- [Bulgaria](#)
  - Bulgarian Academy of Sciences, National Institute in Geophysics, Geodesy and Geography
  - Universities
    - Sofia University of Architecture, Civil Engineering and Geodesy



# COST NFOs: Added value in relation to existing efforts

- The CRL is a 30 years old story with many projects based on it

## Corinth Rift Laboratory



2005-07 GEP-TEP

2011-15 REAKT

2011-13 SISCOR

2011 Jouvence CRL

2007-09 CatTel@CRL

2005-07 3HAZ-Corinth

2001-05 AEGIS

2001-04 GDR Corinth

2001-04 ASSEM

2001-04 DG-LAB

2001-04 3F-Corinth

2000-02 CORSEIS

1996-98 CRLAB

1995-97

SeisfaultGreece

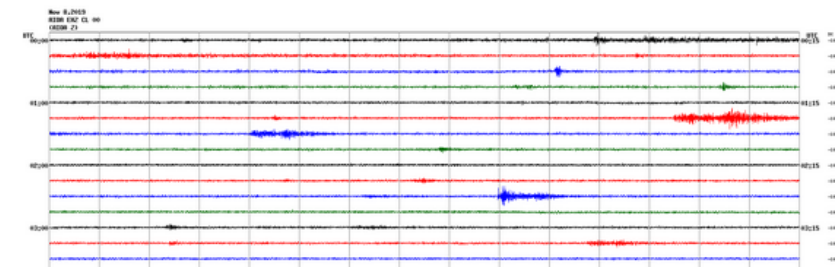


## The CRL Near Fault Ob

The Corinth Rift Laboratory (CRL-NFO; 21.35°E–22.5°E; 38°N) is located between the cities of Patras (west) and Aigion (east). It is one of the most seismically active regions in Europe. Scientists and engineers are joining their efforts to investigate fault mechanisms, fluid flow and the related hazards in the Corinth rift.

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Real time seismicity at the seismic station AIOA – See also AGEO AGRP ALIK MG00 PSAR ROD3 SERG and click [here](#) for more on real-time seismicity



# COST NFOs : Seismological science

- **Earthquakes only accommodate part of the deformation**
  - ⇒ Why/where slow (aseismic?) deformation? Consequences on the long term behavior of the area?
- **Occurrence of large earthquakes (not yet recorded...)**
  - ⇒ What is the nucleation phase of a large earthquake? Detection of quasi-static rupture growth.
- **High extension rate and faults correctly oriented toward the stress state**
  - ⇒ Why sometimes swarms and not a mainshock-aftershock sequences at CRL? Analogy with Appenines seismicity
- **Fluid implication in seismic swarms evolution**
  - ⇒ Analogy with induced seismicity in geothermal fields

# COST NFOs: Technology and computing

- **Off-shore instrumentation, optical fibers**
  - ⇒ Watching off-shore structures in the near field. Assessing how deformation and seismicity behave in the inner Corinth rift
- **Hybridation high-rate GNSS with seismology**
  - ⇒ Assessing details of the dynamics of the rupture
- **High resolution strain, tilt and gravity sensors**
  - ⇒ Watching at long period phenomena beyond the capabilities of current seismometers and GNSS instruments
- **Methodology: large catalogs and high quality data**
  - ⇒ Prediction power of machine learning algorithm,...
  - ⇒ Using localisations, waveforms, focal mechanisms, deformations, and any other set of data



# COST NFOs : Education

Since 2016 a five days Training School is being held in the CRL with multidisciplinary slots in the field and class with the trainees being students and secondary education professors of many European Countries.



Photos of  
the CRL  
School 2019



# COST NFOs: Multidisciplinary and link with the EPOS volcano observatories



Partners ▾ Literature ▾ Projects ▾ Data-products ▾ Resources ▾ Education ▾ Links ▾

Corinth Rift Laboratory

Geology	<
Macroseismic	<
Seismology	<
Borehole	<
Gravity	<
Tide gauges	<
GNSS	<
Meteorology	<
InSAR	<
HR imagery & DEM	<



- **Multidisciplinary**

- ⇒ The CRL NFO provides high level background and facilities for multi-disciplinary researches

- **Link with the EPOS VOs**

- ⇒ There are many possible links with the EPOS VOs because the sensors are the same and because many of the scientific questions are the same
  - ⇒ The management procedures of the NFOs and VOs for governance, data and products share also many aspects

The CRL Near Fault Observatory

Recherche...

# **COST NFOs: Best practices in the NFOs**

- **Sharing methodologies and solutions for the arrays of sensors in the field**
  - ⇒ This will enhance efficiency and cost-effective approaches
- **Sharing methodologies for the handling of raw data and basic products**
  - ⇒ This will enhance efficiency and the standardization of the procedures to be implemented for the more advanced products
- **Sharing educational experiences and resources**
- **Sharing products for common research purposes**
  - ⇒ Having products of common interest will enhance collaboration and common research between NFOs and VOs
- **Sharing free algorithms and software**
  - ⇒ Applying algorithms and software (even better freely available and open-source) produced by an NFO/VO can be proven extremely useful for other NFOs



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