Proposals INSU 2019

Solid Earth

Project Call 2019

Scientific & technical applications

National Services of Observation (SNO)

Magnetism	Volcanism	Slope instabilities	Geodesy & Gravimetry	Seismology
			X	X

SNO Tab title (if there is any): Corinth Rift Near Fault Observatory

Main applicant *(Family name, First name, position)*: Briole Pierre Research Director

Involved observatories (please indicate the person in charge):

France: IPGP (Pascal Bernard), Geoazur (Anne Deschamps), EOST (Sophie Lambotte)
Greece: National Observatory of Athens (Akis Tselentis)

Other involved structures (please indicate the person in charge):

France: ENS (Pierre Briole)
Greece: University of Patras (Efthimios Sokos), National and Kapodistrian University of Athens (Panayotis Papadimitriou)
Czech Republic: Charles University of Prague (Vladimir Plicka)

Management committee if any (please indicate the contact): From June 2018 to June 2019 (next coordination meeting), nine people (with two women) representative of each main partner laboratory/institute: Pascal Bernard (CNRS-IPGP), Pierre Briole (CNRS-ENS), Anne Deschamps (CNRS-GeoAzur), Panagiotis Elias (NOA-IASARS), Christos Evangelidis (NOA-IG), George Kaviris (NKUA), Sophie Lambotte (CNRS-EOST), Vladimir Plicka (CUP), Efthimios Sokos (UPAT). The members are renewable each year according to the situation and needs.

I. SCIENTIFIC AND TECHNICAL PROPOSAL

(three pages maximum, including figures, no extra pages allowed)

1. Scientific interest of observations made by the SNO and evolution with respect to new observables and new scientific challenges. Indicate short and long term strategy

Since the early 1990s the Corinth rift, due to its unique tectonic setting (*e.g.* strain rate ~10^{-6} in the centre of the rift) and excellent access to the field, has been a leading place in Europe for the study of faulting and earthquakes. The area includes the city of Patras, several large towns (*e.g.* Aigion, Agrinion), a major bridge, and dams. It hosts one of the seven Near Fault Observatories (NFO) of the European Plate Observing System (EPOS), the Corinth Rift Laboratory (CRL, http://crlab.eu). It is the result of a long term international effort of many institutions. There is an extensive description of past project and achievements on the CRL portal. CRL provides high quality multidisciplinary data aimed at improving the understanding of multi-scale, seismic and aseismic processes producing earthquakes and faulting. The main target of CRL is to investigate why, where and how earthquakes occur. Raising our understanding of those questions, which is crucial for the society, implies dense and long term monitoring of seismicity and strain. Long time series will allow constraining the mechanics of stress build up, fault fluids interaction, seismic/aseismic coupling and transient phenomena, through observations such as repeaters, seismic wave velocity variations, seismic anisotropy variations. CRL is among the few places in the world providing detailed monitoring of all the seismo-genetic factors. It is the area that produces the largest number of events in Greece and in Europe.

CRL started, as an observatory, in 2001. This was following an initial period of research in the Corinth rift (1990-2001) dominated by campaigns. The seismological community was already present in the area since the 1981 Corinth earthquakes. The 1995 M_w = 6.2 Aigion earthquake increased its effort. The data generated by the NFO CRL is collected, archived and processed in order to enable open and cross domain science. It contributes to building the long-term vision of EPOS. The observatory is focused on the western part of the rift of Corinth (Fig. 1). At the time of this document it is composed of 83 sensors installed in 70 different sites, providing real-time data fluxes through 3G or wired internet links (seismometers, GNSS, strain-meters, tide gauges, meteorological stations, water level sensors).

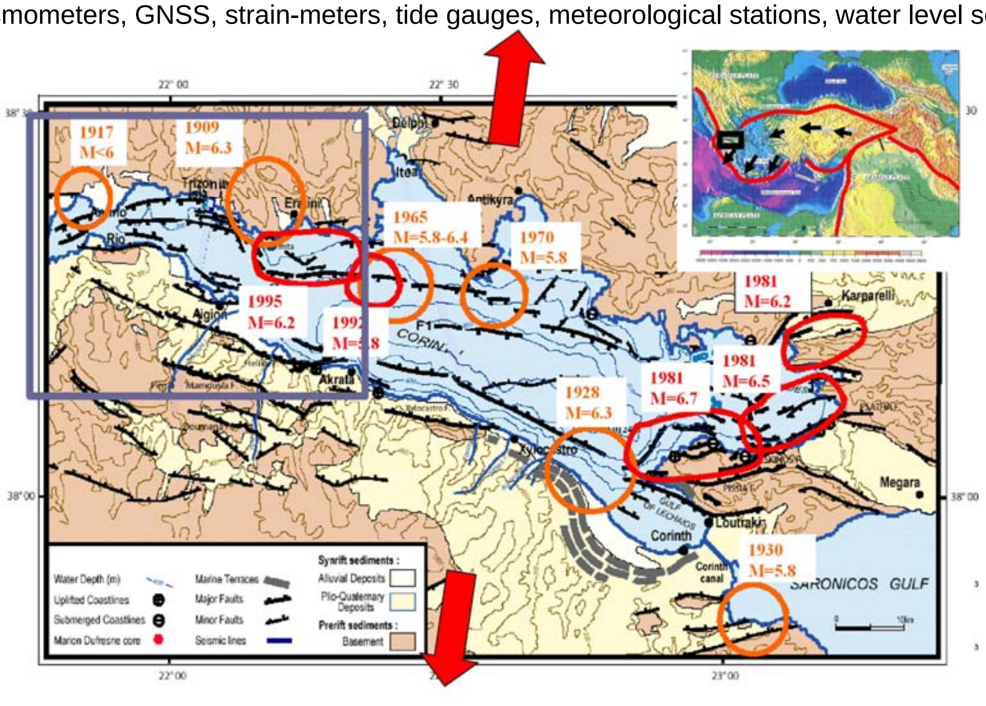

Figure 1. Seismotectonic setting of the rift of Corinth (Greece), with the major earthquakes of the last century. The extension, shown by the red arrows is larger than 10 mm yr^{-1}. The CRL area is indicated by the blue box (see also Fig. 3).

CNRS is service provider for CRL. The NFO five major data suppliers are CNRS, NOA, NKUA, UPatras, and CUP. It has other partners from various institutes and countries in particular for aspect that do not require a presence in the field e.g. SAR interferometry. The list of raw and processed data (DDSS) is reported in Annex A. The NFO CRL data volume is about 2 TB/year. The three largest components in terms of volume are seismology with the continuous waveforms acquired at the seismic stations -all recorded and archived in standard format for seismology-, satellite aperture radar interferometry (InSAR) products, and GNSS. Current users of the NFO CRL data base are mostly scientists from the Earth sciences community interested in active tectonic processes, seismicity, earthquake mechanics and triggering processes. CRL is also used for students training on field work, data processing and analysis, through summer schools. CRL data are used to develop softwares and test methodologies such as earthquake early warning and probabilistic hazard assessment, thus with potential use by local authorities and societal application. The NFO CRL provides adequate instrumentation and data for testing new instruments and data processing methods. Thirty three people are working in the NFO CRL, with a total of 84 person x month, *i.e.* 7 full time (see the man power document in annex), among them six women with 22 person x month (thus 18% and 27% respectively). Fig. 2 shows, per partner institution, the number of people and intensity of effort. There is equal distribution of "Fieldwork, raw data telemetry, storage, quality control and initial products (DDSS of first level), governance" activities (50%) and "Data analysis (DDSS of second level) and models" activity (40%). There are 12 members of observatories (NOA, CNRS-IPGP, CNRS-EOST, CNRS-Geoazur) with total effort of 32 person x month (38% of the total, mean intensity 2.7 person x month) and 21 person members of universities with total effort 52 person x month (62% of the total, mean intensity 2.5 person x month).

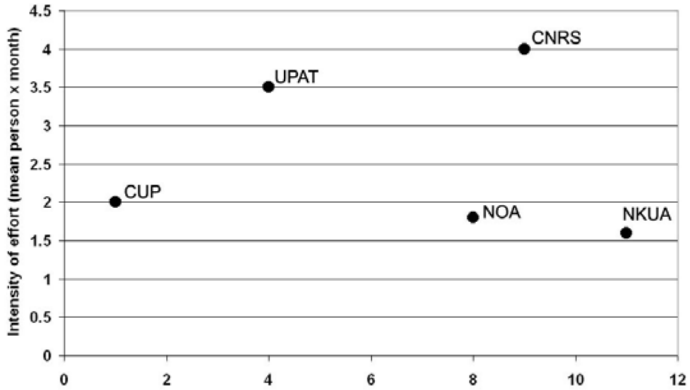

Figure 2. Number of people involved and intensity of the effort in each institution

2. Main scientific and technical progress made during the last year

The observatory started in 2001 and is evolving and progressing every year in a manner that we try to make sustainable and manageable.

2.1 Technology. We made specific efforts in two domains: strain-meters in boreholes and tide gauges. We upgraded one seismic station with broadband Nanometrics Trillium40 seismometers.

2.2 Raw data management. We made major progress in the data quality control on the real-time (or daily for GNSS) data flux, for example there are skyplot of GNSS data calculations (available in the front page of the CRL portal) made every mornings to assess the good status of the GNSS stations. Few stations that remained without "control" have recently been included in the EIDA node at NOA and RESIF (in particular strain-meters and tide gauges).

2.3 Advanced data management / models / science. Very high resolution relocated catalogs covering the last 15 years of activity provide refined structural interpretations and allow to propose a mechanical framework in which aseismic and seismic processes evidenced by transient deformation interplay (Duverger et al., 2018; Mesimeri et al., 2018). The catalogue is on-line and contains 200.000+ events for the period 2001-2018. The seismological array was used investigate dynamic triggering of seismicity by Regional Earthquakes automatically (De Barros et al., 2017). Studying seismic anisotropy in the upper crust of the CRL area (Kaviris *et al.*, 2018) provides constraints on the stress field, and temporal variations of anisotropy bring constraints on the stress accumulation and relaxation processes. Ambient noise tomography (Giannopoulos et al 2017) brings constraints on the first 2-4 km of the crust, supporting the fact that fluid circulations play an important role. This new very shallow tomography will be a base for further investigations of ambient noise and for refining former body wave tomography which lack constraints in the subsurface layers. An upper mantle tomography study at the scale of Greece is in progress (Kassaras et al., 36th ESC congress in Malta 2018) with the noticeable use of the broadband data of CRL.

2.4 Education. From the educational point of view the CRLSchool that was organized for the first time in 2016 has been organized a second time in 2017 (and a third time in 2018). This school is primarily aimed at gathering Master students and 1st year PhD students from the partners universities so as to create a team dynamics of the students (and of the science and academic staffs as well).

2.5 Compliancy with EPOS. Major efforts are made to comply with the requirements of EPOS for data and products formats and push those data and products to the EPOS repositories. At the same time we consider as a critical need for CRL, and for its long term sustainability, to keep alive the ad-hoc data bases and products bases that were developed during years so as to make them compliant with the specificities of this observatory and with the specificities of the international partnerships of this observatory, which is an unique entity in Europe in the field of solid Earth geophysics.

2.6 Interaction with other SNOs. In terms of deployed instruments, CRL share many common characteristics with the national seismological and GNSS arrays and with the volcano observatories. In consequence several technical solutions have been implemented at CRL consistently with the solutions implemented in those SNOs, *e.g.* the mobile phone telemetries, the sensors, and the WebObs. The WebObs is a very efficient management tool that was developed in the French volcano observatories and that we are also using in the CRL NFO.
Several of the CRL stations are also considered by the Greek partners, as components (or add-on) of their national arrays. In consequence the technical solutions and telemetries used for most of the Greek stations are compliant with the solutions adopted at the scale of the national-wide arrays in Greece. In Greece this interaction permits also an optimization of the manpower.

3. Data quality assessment

3.1 Measurement characterization (where, what, how) and quality control. The continuous data from seismometers (short period, broad band, accelerometers), strain-meters, tide-gauges, water level in borehole, are made discoverable as virtual network NFO_CRL by their standard metadata, through the RESIF/EIDA node and NOA/EIDA node. They benefit from the related web services. For GNSS and InSAR, data are accessible through the CRL web portal http://crlab.eu, maintained by CNRS-ENS, and in part by NOA. The percentage of good data for 2017 is 82%, as on September 20, 2018, the tendency for 2018 so far is an improvement, and our objective for 2019 is to reach 90%.

There are several steps in the data quality assessment, and we make use of the WebObs technology to facilitate part of those procedures. Data quality metrics are available at RESIF data portal (http://seismology.resif.fr), including data availability, spectrograms, etc. Data quality services at NOA: http://eida.gein.noa.gr/data_availability/metrics.html, includes user selectable plots of mean, median, max, min values, gaps availability etc.

Earthquakes catalogues and parameters are available at CNRS-EOST through a standard webservice (http://nfocrl.u-strasbg.fr/fdsnws/event/1/query?limit=10), and at http://catalogs.crlab.eu on the CRL portal as well as https://nfo.crlab.eu/seismology. The catalogue contains 200.000+ events. Double-difference catalogues will be integrated in the webservice in 2019 and regularly updated. Event parameters and focal mechanisms are also available through the NOA fdsn ws-event service or EMSC services. At http://www.geophysics.geol.uoa.gr/stations/maps/recent.html, NKUA provides event locations and focal mechanisms made by moment tensor inversion at http://www.geophysics.geol.uoa.gr/frame_en/earth/source_par/source_par_all_en.html

3.2 Data mining for new observables. We are implementing specific tools for data mining in our repositories. With the development of the EPOS databases and procedures, we are in a transitional period in terms of data repositories and access. Our databases established at the scale of the NFO since more than a decade, will be maintained during several years. They were designed to fit perfectly with the specificities of NFO and we need them because, right now, we have many automated procedures that use them. We do not have the manpower to move everything too fast, and we do not want to rush. We will progressively migrate to the EPOS databases with no abrupt transition and no discontinuity of the services, step-by-step quality and reliability control and feed-back with the quality of the raw data in the field (which it the fundamental thing at the end). We expect a lot of improvement on the long term with the EPOS databases, more global scale, technically up-to-date, and served by appropriate strong technical staff.

3.3 Data modeling for improving reference models. For seismology, the velocity model of CRL is being revisited currently and will be improved in the future. This action is scheduled for 2021 as there are several steps to achieve before that. We will work on ambient noise tomography following the PhD thesis and article of D. Giannopoulos and on combining body wave tomography with ambient noise and receiver function analysis. For strong motion seismology, we will work on path attenuation and site amplification using CRL accelerometric recordings. Ml/M_w relationships, important for seismic hazard calculations, for magnitudes ranging from 0 to 5, are being improved. Scaling laws (stress drop, corner frequency, moment magnitude) in the same magnitude range are being developed.

II. NEEDED MEANS FOR THE ACHIEVEMENT OF THIS SNO TAB

(two pages maximum, including figures, no extra pages allowed)

[*Specify the means needed for reaching objectives of the next year: this has to be compatible with the table of the first page as well as with the final financial demand.*]

The coordination meeting held in Patras on June 12, 2018 was largely dedicated to the evaluation of the needs for 2019. The discussion was also on the strategy for the following years, as from 2020 EPOS will enter in its operational phase. See more in the report of that meeting (Annex 2). The overall cost of the observatory for running steadily and replacing steadily the array was estimated at 270k€ per year. This is a coarse figure and it will be refined in the forthcoming years. It does not include the costs for any manpower, permanent or temporary, and it does not include the costs of the advanced DDSS. In the following and in the enclosed DDSS table, we have separated the DDSS in two families, those that are closely related to the field equipment and the initial data control and initial products (see previous section) and those that are more advance and do not require a direct contact with the field. Our classification can be sometimes arbitrary but it is needed for us, in the CRL NFO, to organize the practical work at all steps, and share the actions in a consistent way among the various partners. This sharing is made with a voluntary amount of overlap because this overlap is very beneficial for the data and products quality control and accuracy assessment. The array (Fig. 3) has regularly increased since its creation in 2000-2001 (Fig. 4) and there are now 83 instruments located in 70 different sites, 51 owned by CNRS, 10 by UPAT, 12 by NOA, 7 by NKUA and 3 by CUP.

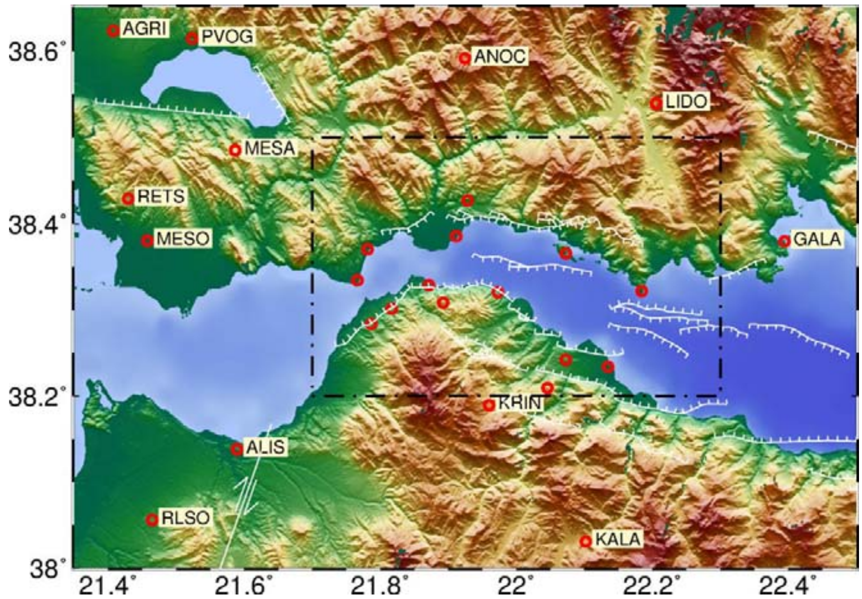

Figure 3. The stations shown are the GNSS ones (see http://crlab.eu for all maps). The seismic stations have a similar repartition. The small rectangle represents the “core area” where a higher density of sensors is concentrated. Although less numerous, the wide area is crucial to constrain both deformation and seismicity of the rift at the broad scale.

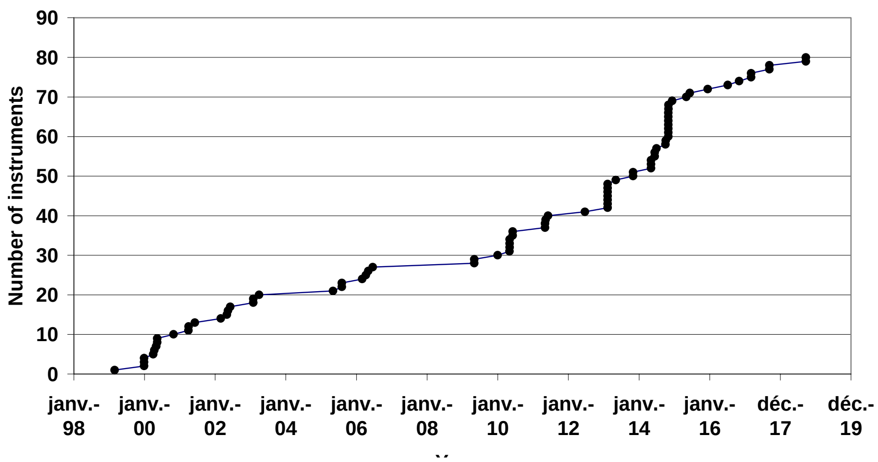

Figure 4. Evolution of the CRL observatory array (number of sensors)

The mean age of the instruments is 9 years (see Table in Annex) and their mean estimated life time is 12 years, which means that we are at the two thirds of the expected life time of array globally and that replacement of a large part of the instruments must be planned in the forthcoming years, with a well defined roadmap for those replacements. The first priority for replacement is the GNSS array because the current instruments are older than 10 years, fail more and more often, and moreover they are outdated in terms of constellations of satellites, with the need to integrate now the multi-constellation in particular GALILEO.

All the seismic stations provide real-time data and the GNSS array will provide real-time data once upgraded with new receivers (funding request in progress to the “mi-lourds” INSU). In seismology there is an effort to upgrade the stations with broadband sensors. The data loggers at several stations are old and will need replacement soon in the next few years.

Among the 270k€ of running cost, 112k€ are relevant directly to the SNO call: (1) the costs of maintenance of the instruments, data loggers, shelters, telemetries, …, (2) the costs for storage, data mirroring, data control and early products (DDSS of category 1) production and validation, (3) the costs for the management and governance of the NFO. The total of those three categories is 72 + 25 + 15 = 112k€. The agreement among CRL partners, for the year 2019 (and to be re-discussed in 2019 based on the strategic decisions to be made for the operational stage of the observatory to start in 2020), is to assign to each partner a part of the cost proportional to the instruments it owns. CNRS owns 51 of the 83 instruments (and 44 of the 65 from the core area), therefore ~65% of the total. The corresponding cost for CNRS is ~75k€ which represents 1.5k€/yr/instrument. Such yearly cost per instruments is comparable to that of other SNOs with similar arrays and sensors. In our case there is a relatively large weight for the mission costs (29%) in the total. One mission of one week costs 2k€ on average (550€ travel including metro/taxi/extra luggage, 500€ rented car, 600€ subsistence costs for 7 days, 350€ gasoline and various), and we need at least four routine missions per semester (spring and fall) (16k€) and two extra missions flexible to solve particular problems (4k€). We need also four missions per year, or five days each, in Athens (1.25k€ per mission) for work in the labs and technical meetings. The exact distribution of this budget cannot be predicted rigorously at it will depend on environmental and other elements (*e.g.* damages to instruments that might be caused by lightening during the forthcoming winter 2018-2019, so our evaluation is based on the statistical elements we have from the previous years. The orders of magnitude are the following:

- 30k€ for repairing instruments, data-loggers, shelters, modems, … (equivalent to 600€ / instrument / year)
- 25k€ for the missions in the field
- 5k€ for the missions for governance
- 5k€ for the payment of the telemetries
- 10k€ for the computer and disks costs for all actions related to the data storage, control, safety,…

We have not included the cost for publications here.

III. DATA & MODELS DISTRIBUTION & DIFFUSION REALIZATION
(four pages maximum, including figures, no extra pages allowed)

[*The Commission is particularly concerned with the open-access and real-time distribution of the data acquired by SNO to the scientific community. Please, provide detailed information on the system for data dissemination: raw data (real-time), processed data and models of this SNO as well as work-flows for these processing and modelings.*]

1. Description of data distributed by the SNO (type of raw data, processed data, models, softwares, metadata) and links of the open access distribution web sites.

Fig. 5 shows the data flow of the seismological data acquired in the NFO CRL. The data and products are then accessible through different servers. All data flow in real time to one or more data centers.

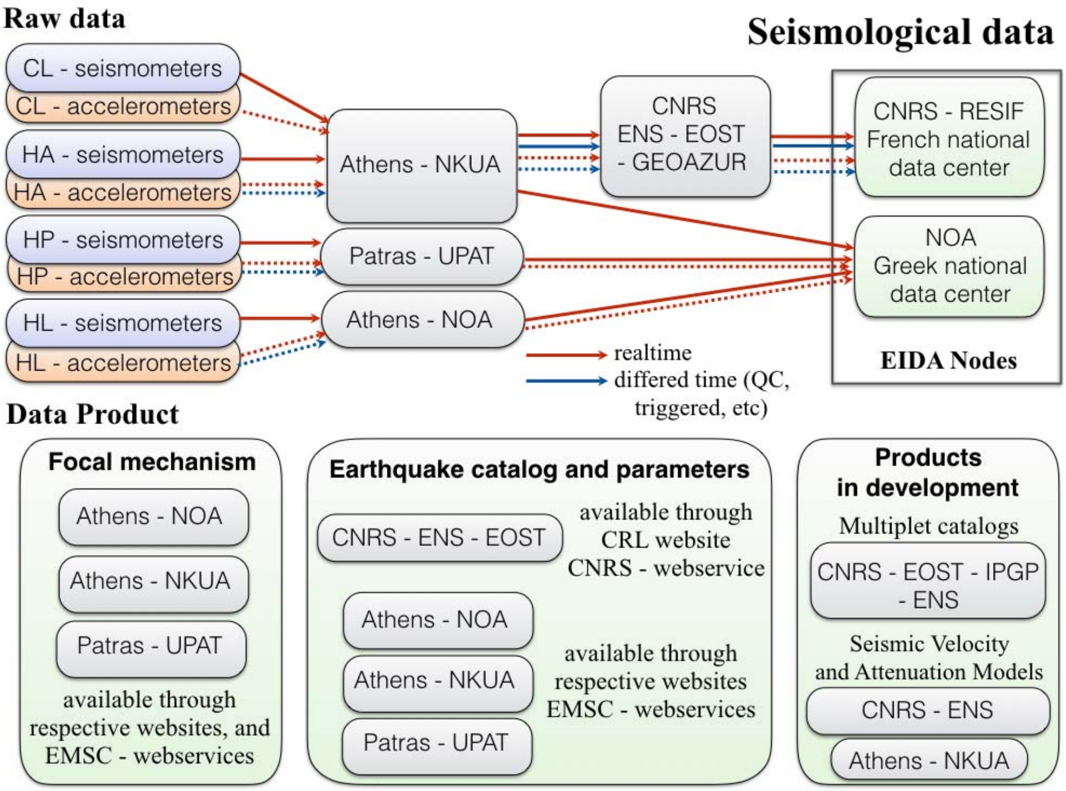

Figure 5. Data flow chart for the seismological data of the NFO CRL. Arrows for strong motion sensors are in dashed line to distinguish them, yet they share the functionalities with the seismic ones.

The portal of the SNO is http://crlab.eu. All data, products, bibliography, software, projects portals, can be accessed through this portal which is continuously maintained. Four of us have administration rights and perform supervision and update of the portal. In the frontage of the CRL portal there is the seismicity in real-time and link to access the (quasi) real-time data and real-time products (*e.g.* spectrograms).

The NFO data listed in the CRL DDSS (see annex) are freely available, some of them with an embargo period of one year, for allowing reliable quality control (event data base, strain records) and fast track publications by the CRL consortium. The events database is refreshed daily. The GNSS data and products (coordinates, tropospheric delays, skyplots of residuals) are provided daily since 2017.

The data are deposited in various databases, as detailed in Annex for the component of data supply under the responsibility of CNRS. Except for few stations that still need to being integrated, the continuous seismological data are available unrestricted through the EIDA nodes, using the related webservices. The trigger-type accelerometric data of NKUA will be available through the CRL portal

Interoperability: Continuous data produced by CRL is interoperable, according to the international and EPOS standard format for seismology, geodesy, and remote sensing (European Inspire directive).

There are also software distributed through the CRL GitHub (https://github.com/gcrlab) and this aspect will be developed in 2019.

2. Statistics of accesses to distribution sites

The CRL portal has been visited by 1600+ different users since May 2017 (Fig. 6). Half of the users of the portal are from Greece (32%) and France (16%) (Fig. 7)

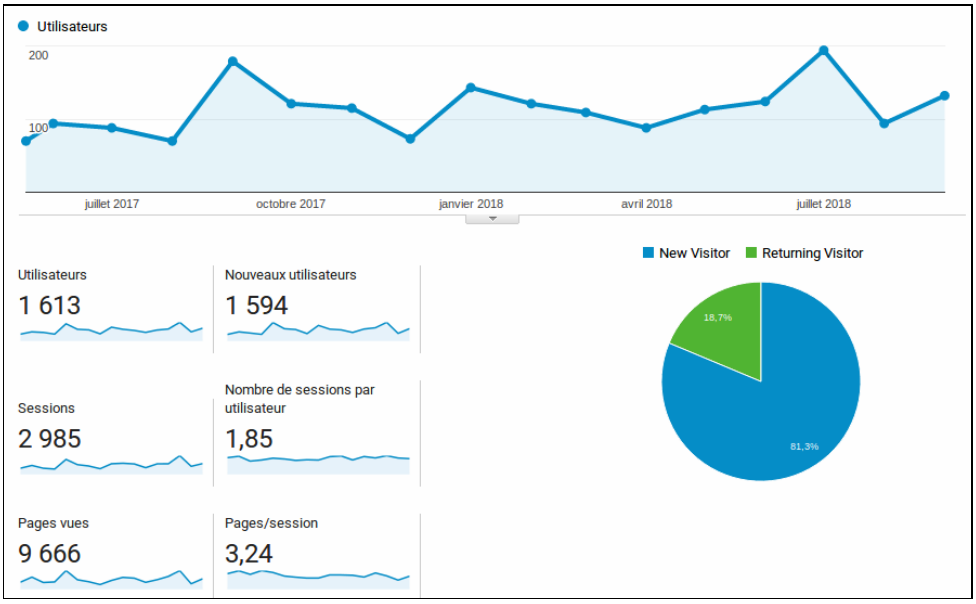

Figure 5. Number of different users of the CRL http://crlab.eu in the period May 2017 - September 2018 and number of access per day

		1 613 % du total: 100,00 % (1 613)	1 613 % du total: 100,00 % (1 613)
1.	Greece	531	32,36 %
2.	France	261	15,90 %
3.	Italy	141	8,59 %
4.	United States	136	8,29 %
5.	Germany	66	4,02 %
6.	United Kingdom	55	3,35 %
7.	China	35	2,13 %
8.	Norway	30	1,83 %
9.	Spain	23	1,40 %
10.	India	23	1,40 %

Figure 6. Origin of the users per country

A bibliographic analysis of CRL covering the whole period 1990-2016 is available at http://biblio.crlab.eu

3. List of rank A publications and thesis where the usage of data and models distributed by the SNO are explicitly mentioned (restrict list to the 2016-2017 period).

Albini, P., A. Rovida, O. Scotti, H. Lyon-Caen, 2017. Large Eighteenth-Nineteenth Century Earthquakes in Western Gulf of Corinth with Reappraised Size and Location, Bulletin of the seismological society of America, 107(4), 1663-1687, 10.1785/0120160181

Beckers A., C. Beck, A. Hubert-Ferrari, J.-L. Reyss, C. Mortier et al., 2016. Sedimentary impacts of recent moderate earthquakes from the shelves to the basin floor in the western Gulf of Corinth, Marine Geology, 10.1016/j.margeo.2016.10.018

Beckers, A., A. Hubert-Ferrari, C. Beck et al., 2018. Characteristics and frequency of large submarine landslides at the western tip of the Gulf of Corinth, Natural Hazards and Earth System Sciences, 18(5), 1411-1425

Bitharis, S., D. Ampatzidis, C. Pikridas, 2017. An optimal geodetic dynamic reference frame realization for Greece: Methodology and application, Annals of Geophysics, 60(2), S0221, 10.4401/ag-7292

Canitano A., P. Bernard, 2017. Observation and modeling of the seismic seiches triggered in the Gulf of Corinth (Greece) by the 2011 M w 9.0 Tohoku earthquake, Journal of Geodynamics, 109, pp.24 – 31, 10.1016/j.jog.2017.06.001

Chartier T., O. Scotti, H. Lyon-Caen, A. Boiselet, 2017. Methodology for earthquake rupture rate estimates of fault networks: example for the western Corinth rift, Greece, Natural Hazards and Earth System Sciences, 17 (10), 1857 – 1869, 10.5194/nhess-17-1857-2017

De Barros L., A. Deschamps, A. Sladen, H. Lyon-Caen, N. Voulgaris, 2017. Investigating Dynamic Triggering of Seismicity by Regional Earthquakes: The Case of the Corinth Rift (Greece), Geophysical Research Letters, 10.1002/2017GL075460

Devoti, R., N. D'Agostino, E. Serpelloni, G. Pietrantonio, F. Riguzzi et al., 2017. A Combined Velocity Field of the Mediterranean Region, Annals of Geophysics, 60(2), S0215, 10.4401/ag-7059

Durand V., S. Hok, A. Boiselet, Pascal Bernard, O Scotti, 2017. Dynamic rupture simulations on a fault network in the Corinth Rift, Geophysical Journal International, 208, 1611 – 1622, 10.1093/gji/ggw466

Duverger C., S. Lambotte, P. Bernard, H. Lyon-Caen, A. Deschamps et al., 2018. Dynamics of microseismicity and its relationship with the active structures in the western Corinth Rift (Greece), Geophysical Journal International, 215 (1), 196 – 221, 10.1093/gji/ggy264

Elias P, P Briole, 2018. Ground deformations in the Corinth Rift Observatory (Greece) observed by means of SAR multitemporal interferometry and GPS, G-Cubed, in revision, 2016GC006547

Evangelidis C.P., 2017. Seismic anisotropy in the Hellenic subduction zone: Effects of slab segmentation and subslab mantle flow, Earth Planet. Sci. Lett., 10.1016/j.epsl.2017.10.003

Ganas, A., P. Elias, G. Bozionelos, G. Papathanassiou, A. Avallone et al., 2016. Coseismic deformation, field observations and seismic fault of the 17 November 2015 M = 6.5, Lefkada Island, Greece earthquake, Tectonophysics, 687, 210-222, 10.1016/j.tecto.2016.08.012

Giannopoulos D., D. Rivet, E. Sokos, A. Deschamps, A. Mordret et al., 2017. Ambient noise tomography of the western Corinth Rift, Greece, Geophysical Journal International, 211(1), 284-299, 10.1093/gji/ggx298

Gkarlaouni C., S. Lasocki, E. Papadimitriou, T. George, 2017. Hurst analysis of seismicity in Corinth rift and Mygdonia graben (Greece), Chaos, Solitons and Fractals, 96, 30 – 42, 10.1016/j.chaos.2017.01.001

Kaviris G., I. Spingos, V. Kapetanidis, P. Papadimitriou, N. et al., 2017. Upper crust seismic anisotropy study and temporal variations of shear-wave splitting parameters in the western Gulf of Corinth (Greece) during 2013, Physics of the Earth and Planetary Interiors, 269, 148 – 164, 10.1016/j.pepi.2017.06.006

Kaviris G., C. Millas, I. Spingos, V. Kapetanidis, I. Fountoulakis et al., 2018. Observations of shear-wave splitting parameters in the Western Gulf of Corinth focusing on the 2014 M w = 5.0 earthquake, Physics of the Earth and Planetary Interiors, 282, 60 - 76, 10.1016/j.pepi.2018.07.005

Leptokaropoulos K.M., E. Papadimitriou, B.. Orlecla-Sikora, V. Karakostas, 2016. An Evaluation of Coulomb Stress Changes from Earthquake Productivity Variations in the Western Gulf of Corinth, Greece, Pure and Applied Geophysics, 173, 49-72, 10.1007/s00024-015-1057-2

Mangira O., R. Console, E. Papadimitriou, G. Vasiliadis, 2018. A restricted Linked Stress Release Model (LSRM) for the Corinth gulf (Greece), Tectonophysics, 723, 162-171, 10.1016/j.tecto.2017.12.011

Mangira O., G. Vasiliadis, E. Papadimitriou, 2017. Application of a linked stress release model in Corinth Gulf and Central Ionian Islands (Greece), Acta Geophysica, 65 (3), 517-531, 10.1007/s11600-017-0031-z

Mesimeri M., V. Karakostas, E. Papadimitriou, G. Tsaklidis, K. Jacobs, 2018. Relocation of recent seismicity and seismotectonic properties in the Gulf of Corinth (Greece), Geophysical Journal International, 212 (2), 1123-1142, 10.1093/gji/ggx450

Mesimeri M., V. Karakostas, 2018. Repeating earthquakes in western Corinth Gulf (Greece):

implications for aseismic slip near locked faults, Geophysical Journal International, 215 (1), 659-676, 10.1093/gji/ggy301
Michas G., F. Vallianatos, 2018. Modelling earthquake diffusion as a Continuous-Time Random Walk with Fractional Kinetics: The case of the 2001 Agios Ioannis earthquake swarm (Corinth Rift), Geophysical Journal International, 10.1093/gji/ggy282
Neokosmidis S, P. Elias, I. Parcharidis P. Briole, 2016. Deformation estimation of an earth dam and its relation with local earthquakes, by exploiting multitemporal synthetic aperture adar interferometry: Mornos dam case (Central Greece), J. Appl. Remote Sens., 10(2), 026010, 10.1117/1.JRS.10.026010.
Pérouse E., M. Sébrier, R. Braucher, N. Chamot-Rooke D. Bourlès et al., 2017. Transition from collision to subduction in Western Greece: The Katouna-Stamna active fault system, Int J Earth Sci, 1-23, 10.1007/s00531-016-1345-9
Tranos M, 2017. The seismogenic fault of the 2010 Efpalion moderate-size seismic sequence (western Corinth gulf, Central Greece), Journal of Seismology, 21 (2), 287-303, 10.1007/s10950-016-9601-9

PhDs

Clara Duverger, 2017. Sismicité, couplages sismique-asismiques et processus transitoires de déformation dans un système de failles actives : le rift de Corinthe, Grèce, IPGP, in French
Dimitris Giannopoulos, 2016, Passive Seismic Interferometry and Shear wave splitting in the investigation of the Earth’s crust: application to the Corinth Rift Greece, University of Patras, in English (http://thesis.ekt.gr/thesisBookReader/id/40799#page/1/mode/2up)
Andreas Karakonstantis, 2017. 3-D simulation of crust and upper mantle structure in the broader hellenic area through seismic tomography, PhD thesis, NKUA, 327 pp, in Greek
Nikos Roukounakis, 2018, Application of a high - resolution weather model in the area of the Western Gulf of Corinth for the tropospheric correction of InSAR interferograms, ENS, in English
Kapetanidis Vasilis, 2017. Spatiotemporal patterns of microseismicity for the identification of active fault structures using seismic waveform cross-correlation and double-difference relocation, NKUA, in English

IV. OUTREACH OF COLLECTED DATA AND PREVIOUS ANALYSIS

1. List of signed contracts in the last three years on this SNO tab (outside financial support of SNO from INSU).

It is the first time that the NFO CRL is presented to the CNRS SNO call for funding. The June 12, 2018 coordination meeting in Patras, with all the CRL partners was a prerequisite for that because there was the need of an agreement on the definition of the stations operated by each partner under the label “NFO CRL” and an agreement on the repartition keys for the support to be requested to our various national funding agencies. This is a first step valid for 2019 and it will be refined during 2019 for the future funding requests to come for 2020 and following year.

As it was not yet funded as an Observatory but as a project there are con past contracts signed based on this SNO tab. However there is a detailed list of past and current projects listed with details and links on the web portal of the CRL NFO.

2. Other outreach initiatives.

A summer school (CRLSchool, *e.g.* http://school2018.crlab.eu) is organized yearly at CRL. It was tailored firstly for students enrolled in Master in the partner universities. With the support of EGU its also welcomes each year a pool of school teachers recruited through the GIFT program of EGU. This School that benefits of the logistical support of the municipality of Nafpaktos is also open to the public during part of the sessions, and it is a yearly opportunity for publicizing the scientific and educational actions of the observatories in the local channels of information.

V. BUDGET

[*Please, detail financial information provided on the Sigap page online for a better understanding and analysis. The amounts have to be equals to the ones written on the online form and concern only 2019. Please make sure that financial information entered on the SNO database (https://insu.obspm.fr/fmi/webd/#CNRS) is up-to-date. Give a priority level to the different items.*]

V.I. INSU funding : 75k€

Travels: 30k€ (25k€ for the routine work in the observatory, 5k€ for the governance and organisation of the science council meeting). See details of cost breakdown in the section II.

Equipment (< 15kEuros HT): Not requested here. A request will be made at the mi-lourds 2019 for the renewal of the whole GNSS array.

Analyzes: 10k€ (computer costs for the initial data flux management, and data mirroring). Hard disks needed (total ~2k€ for ~10 x 2 Tbytes (data + 1 mirroring), one rack computer (4k€) at CNRS-ENS for replacement of the old one (8 years) doing the real-time seismology ("ephesite"), the new one will have the capability to calculate also the GNSS (not very expensive in CPU as we do PPP processing) and the automated routine InSAR (with the SNAP software of ESA), partial upgrade of the master server located at NKUA (4k€ and NKUA will request for the same amount).

Operating costs: 35k€ (includes maintenance of sensors and field infrastructures, telemetries, computer costs for data telemetry and storage). This is the less predictable of the running costs of the observatories as we cannot know in advance what will fail, where and when. The evaluation is an average based on the experience of the past years since the origin of the array. The cost of the telemetries is around 12€/month/station, thus for 51 stations ~7k€.

Nota: Operating cost and travel (65k€) are priority 1. Analysis (10k€) is also priority 1 as it is a fundamental part of the observatory, but this amount is easier to find and justify at the level of our four UMR.

V.II. Co-funding (requested and/or obtained):

[*Aside from the funding asked to INSU as an SNO tab, provide the financial supports related to this SNO tab at the national level as well as European and international levels. Please note that any funding related to confidential data acquisition should not be considered here.*]

We distinguish below the co-funding corresponding to activities needed for the core observatory (maintenance of the array and DDSS directly linked to the observatory data production and quality control and early real-time products) and the co-funding needed for the other activities of the observatory (education & outreach, advanced DDSS, innovation in sensors and techniques, …).

V.II.I Co-funding in France for the core observatory activities

CNRS-ENS (UMR 8538) has been supporting the core NFO actions with 3-5k€ per year in the last year (*e.g.* purchase of 3G routers, computers, servers), we foresee this support to continue in the next year, it is a small percentage but useful and the direct expression of the involvement of the UMR (beyond the involvement of 18 person x month of CNRS researcher manpower of the UMR + 3 person x month of engineer expected in 2009 and following years).

V.II.II Co-funding in Greece for the core observatory activities

As explained in the section II, the other partners of CRL are covering the running costs for their own equipment. In Greece, UPAT, NKUA and NOA receive national funding through the national infrastructure HELPOS (Hellenic Plate Observing System). All the CRL stations owned by the Greek partners and belonging also to a Greek network (HA, HL, HP, NOANET) are maintenance through HELPOS. The yearly maintenance cost for the Greek stations is the same as the one for the French stations, except that the travel between NOA and the Greek universities costs less. In section II we indicate that the missions costs is 29% for CNRS, thus 0.43k€ among the 1.5k€ needed per year and per station. For NOA and NKUA, based in Athens, the mission cost for a week is 27% less, because there is not the airplane, thus 0.3k€, thus the yearly cost in their case is 1.35k€/year/instrument. For UPAT the field intervention can be done on a daily mission basis and the colleagues go with their own car which artificially decreases the cost around 1.3k€/year/instruments, but in fact it is close to that of the others because what dominates is not the missions.

The support of the University of Patras to the permanent seismological array of UPAT, which includes the CRL stations (40% of the total) is 5k€/year, which means, in proportion, a support of 2k€/year to CRL.

V.II.III Activities accompanying the core observatory activities

Activities of education/outreach, innovation and advanced DDSS (those that are not directly connected to the flux of raw data) are not requested to the SNO call. For education part of the cost (8.5k€) is covered by the EGU in 2018 and we submitted a request for 7k€ in 2019. For the advanced DDSS we expect specific funding from EPOS for continuing and increasing this activity (according to the committed DDSS) in the next years, following the process started in the present phase of EPOS. Publication costs will be requested also as co-funding, mainly to our four UMR.

Annex 1: Details of the DDSS elements provided by the CRL consortium

Code	DDSS name	Maker	Dealer	Notes
WP09-DDSS-001	Vel. Seismic waveforms Continuous (EIDA - Virtual Network)	CNRS NOA UPAT NKUA CUP	RESIF-EOST NOA	RESIF archive also on Ephesite-ENS server NOA archives NOA-UPAT-NKUA-CUP networks
WP09-DDSS-001b	Seismic Station Information (EIDA - Virtual Network)	CNRS NOA UPAT NKUA CUP	RESIF-EOST NOA	RESIF archive also on Ephesite-ENS server NOA archives NOA-UPAT-NKUA-CUP networks
WP09-DDSS-002	Acc. Seismic waveforms Continous (EIDA - Virtual Network)	CNRS NOA UPAT NKUA CUP	RESIF-EOST NOA	RESIF archive also on Ephesite-ENS server NOA archives NOA-UPAT-NKUA-CUP networks
WP09-DDSS-006	Earthquakes parameters (location, mag, phases, moment tensor)	CNRS NKUA	CNRS-EOST NKUA	Catalogues and seismic data available at EOST (http://nfocrl.u-strasbg.fr/fdsnws/event/1/query?limit=10) and on the CRL portal at http://catalogs.crlab.eu and https://nfo.crlab.eu/seismology and at NKUA http://www.geophysics.geol.uoa.gr/stations/maps/recent.html
WP09-DDSS-007	Focal mechanisms	NKUA	NKUA	Catalogue and detailed solutions of NKUA focal mechanisms at http://www.geophysics.geol.uoa.gr/frame_en/earth/source_par/source_par_all_en.html
WP09-DDSS-010	Repeaters and multiplets catalog	CNRS	CNRS - EOST	Web services will not be running before 2021 but catalogue of selected multiplets will be available in 2019 on the CRL portal at http://catalogs.crlab.eu
WP09-DDSS-011	Seismic Velocity and Attenuation Models (1D,2D,3D,4D)	CNRS	CNRS - ENS	Will be implemented in 2019-2020
WP09-DDSS-013	GNSS Daily Data (30/15/1 second)	CNRS, NOA, UPAT, CUP	CNRS - ENS	25 stations belonging to CNRS, 10 stations belonging to the other CRL team members - 30s at all stations & 30s/1s at PAT0 station which is also contributing to the EUREF network (http://www.epncb.oma.be) The upgrade of the GNSS array of CRL is needed as the current instruments are outdated Data available through the CRL portal at http://gnssdata.crlab.eu and upgrade to GLASS in 2019. The CRL campaign data will also be available through the CRL GLASS server Nota: Data also available through the NOA GSAC http://194.177.194.238:8080/noanetgsac/gsacapi/ that will also migrate to a NOA GLASS in 2019
WP09-DDSS-	InSAR LOS Displacement	NOA, CNRS	CNRS - ENS	For currently acquired data (SENTINEL) this will not be done immediately. Not before 2021.

018	Time series			There will be a preparatory phase in 2019 and 2020 with CNRS-ENS and NOA jointly involved. This is a product that will evolved with the improvement of the InSAR algorithms and the tropospheric modelling thus successive version of this product will exist. Various external (DLR, TerraDue, IREA) with different software for redundancy and accuracy assessment
WP09-DDSS-019	Strain rate time series from GNSS	CNRS	CNRS - ENS	Available through the CRL web portal http://crlab.eu Made by combining GNSS and InSAR. In the case of CRL this product is not relevant everywhere as the deformation is too localized in several places to be captured with GNSS and expressed in terms of strain rates. This also because of the time variations of the strain resulting of the effect of the 1990-2018 earthquakes in the geodetic archive
WP09-DDSS-020	InSAR mean LOS velocity	NOA, CNRS	CNRS - ENS	For ENVISAT, information accessible through the CRL web portal http://crlab.eu from various original sources (e.g. IREA SBAS processing). Will be done for SENTINEL in 2020-2021 upon implementation of WP09-DDSS-018 and with long enough time series then Nota: NOA will also distribute InSAR mean LOS velocities, and there is already an access to ENVISAT LOS velocities at https://doi.org/10.5281/zenodo.1205496 that will be open and soon
WP09-DDSS-025	Meteorological parameters	NOA, CNRS	CNRS - ENS or CNRS-GeoAzur	This DDSS is built in close collaboration between CNRS and NOA Continuous flux of raw data from a station (PSAM) is are already available through the CRL portal, see http://meteo.crlab.eu Nota: there are external providers of meteorological data that can be used at CRL (link available in the CRL meteorological pages) yet not optimized for the co-location with the GPS geophysical observations of observations. There are also meteorological parameters derived from the models made by the meteorological agencies and research centres
WP09-DDSS-029	Historical EQ Catalogue	CNRS	CNRS - ENS	SISCOR (http://siscor.crlab.eu) produced a historical EQ catalogue If needed its format will be migrated to e EPOS-compliant format
WP09-DDSS-031	Geological maps	CRL team	CNRS - CRPG	Available at CRPG. Will be linked to the CRL portal in 2019 Nota: Greek CRL partners may distribute also geological maps
WP09-DDSS-034b	Trans National Access	The various core members of the consortiu	CNRS	“Field access” TNAs will be offered to teams willing to perform field work (yet not before 2021, once rules well established, inheriting for the experience of TNAs on volcanoes) Starting in 2019 “Lab access” TNAs will be developed for teams willing to benefit of TNA

		m (CNRS-NOA-UPAT-NKUA)		access through missions in the CRL partners laboratories from CNRS for data processing, modelling activities, and development of sensors and innovation. There is no fund available for TNA yet, so the activity will be performed base on the best efforts from the host and guest teams, but the concept of TNAs is considered as very promising for enabling aggregation of other teams and multi-disciplinarity.
WP09-DDSS-035	Strainmeter (water level, pressure)	CNRS	EOST - RESIF IPGP	Continuous available through the RESIF. Water level (ground and sea) and air pressure are measured on site for correcting the strain records from these influences, therefore this DDSS is connected with DDSS-025
WP09-DDSS-036	Seismological data	CNRS	CNRS - ENS	See WP09-DDSS-002
WP09-DDSS-037	GNSS Site and Station information	CNRS	CNRS - ENS	Exists since more than 10 years, available though the CRL WebObs (http://webobs.ens.fr) also hosted at the GPSCOPE-RESIF (http://gnsssite.crlab.eu) Will be updated by using the GLASS software in 2019
WP09-DDSS-038	GNSS daily-solutions (PPP,DD)	CNRS	CNRS - ENS	Routinely operational (PPP solutions) since late 2016, access through the CRL portal at http://gnssproducts.crlab.eu Additional products (tropospheric delays, sky-plots for visual quality inspection, see bottom of http://crlab.eu homepage) available every day at 9am for the previous day data (daily processing) Nota: NOA will also produce routinely and distribute GNSS solutions. It is crucial to have the GNSS data processed within different analysis centres with different software and/or software tuning.
WP09-DDSS-039	GNSS coordinate time-series (PPP,DD)	CNRS	CNRS - ENS	Routinely available since 2017 through http://gnssproducts.crlab.eu, from PPP solutions. Visualisation of plots will be implemented in 2019
WP09-DDSS-040	GNSS velocity fields (PPP,DD)	CNRS	CNRS - ENS	Will be derived from the previous and implemented in 2019. Trivial to derive from WP-DDSS-039 Note that the concept of velocity is not adequate in the centre of the CRL array where there are temporal variations induced by earthquakes, variable creep, variable subsidence, …
WP09-DDSS-046	Ground water level	CNRS	RESIF - EOST	Presently limited to WP09-DDSS-035
WP09-DDSS-051	Seismogenic Fault	CNRS and the whole CRL consortiu m	CNRS - ENS	There is detailed information already accessible through the CRL web portal at http://faults.crlab.eu Will be upgraded in 2019-2020 with vector fault maps in various GIS formats and naming convention (glossary for CRL faults) to be discussed within the CRL consortium. List, map and characteristics of faults is an evolving material so there will be periodic

				releases of this faults inventory (foresee to be updated every 5 years typically) Nota: NOA maintains a catalogue of active faults at the scale of Greece, this catalogue and the CRL catalogue will be harmonized (action planned in 2019 and 2020)
WP09-DDSS-052	GNSS Real-Time Data (high-rate)	CNRS, NOA	CNRS - ENS	Operational at PAT0 since 2016, made in collaboration with CNES (real-time PPP wizard), available at http://pat0live.crlab.eu Will be developed jointly with NOA and support of CNES (PPP-wizard) for other stations after the deployment of the new GNSS array expected in 2019 (funding requested to CNRS) Nota: NOA will lead the aspects related to high-rate GNSS, 1s. To be useful at CRL for events starting at magnitude 5-5.2 (e.g. Efpalio 2010) high rate GNSS must be performed at 10Hz at least. Nota: there is also the contribution and support of private GNSS companies from Greece who share their data with us
WP09-DDSS-053	Wrapped Differential Interferograms (Phase and Amplitude)	NOA, CNRS	CNRS - ENS	Available for 2015-2017 on the CRL portal at https://nfo.crlab.eu/interferograms There will be also wrapped interferograms corrected from the tropospheric delays derived from the combination of the GNSS delays and meteorological models at 1km grid size). Will be implemented jointly by NOA and CNRS in 2019-2020 following the PhD of N. Roukounakis, and in connexion with the NISAR project of NASA. CRL has been proposed as validation/calibration pilot site in that project (http://nisar.crlab.eu)

ANNEX 2: Corinth Rift Observatory – http://crlab.eu

Coordination meeting - Patras, June 12, 2018 (10:30-18:00)
The meeting was held at the Department of Physics of the University of Patras

Version of the document: v20180703a

Participants

- UPAT: Vassilis Anastassopoulos (vassilis@upatras.gr), Georgia Koukiou (gkoukiou@upatras.gr), Anna Serpetsidaki (annaserp@upatras.gr), Efthimios Sokos (esokos@upatras.gr)
- CNRS: Pascal Bernard (bernard@ipgp.fr), Pierre Briole (briole@ens.fr), Anne Deschamps (deschamps@geoazur.unice.fr) in visio-conference, Sophie Lambotte (sophie.lambotte@unistra.fr) in visio-conference, Alexandre Nercessian (nerces@ipgp.fr), Alexis Rigo (alexis.rigo@ens.fr)
- NOA: Panagiotis Elias (pelias@noa.gr), Christos Evangelidis (cevan@noa.gr), Athanassios Ganas (aganas@noa.gr)
NKUA: Iannis Fountoulakis (fountoul@geol.uoa.gr), George Kaviris (gkaviris@geol.uoa.gr) Christos Millas (cmillas@geol.uoa.gr), Varvari Tsironi, NKUA (barbara.tsir@gmail.com)
CUP: Vladimir Plicka (vp@karel.troja.mff.cuni.cz)

Presentations

Introduction made by V. Anastassopoulos. Presentations made by E. Sokos, C. Evangelidis, A. Ganas, P. Bernard to show the context and the connection with EPOS and HELPOS.
An inventory of the stations is made by each team who is operating stations in the field, mostly seismological, broadband and GNSS. There is also tide gauges, strain-meters, meteorological stations and other various sensors operated in the array. See maps and description on the CRL portal http://crlab.eu
The international character of the CRL Observatory is something unique among all NFO and VO of EPOS. It represents a complexity, especially from the organisational point of view, but it constitutes also a great strength for the Europeans and the seismological community. There is a document of 2016 that analyses the impact of CRL in the literature, see http://biblio.crlab.eu

Sensors & Field equipment

Tides gauges should be more visible within the Observatory array and well integrated with the existing arrays in particular the one operated by the tsunami centre at NOA (see http://83.212.99.53/TAD_server).

Need of inventory of underground facilities within the perimeter of the Observatory, for possible future installation of sensors (*e.g.* technical galleries made for the highway and train line tunnels).

Strong motions sensors: need of inventory and better integration within the observatory.

Need of clear visibility of the sensors and data that belong to the Corinth Rift Observatory, so the corresponding data are properly cited by the science community who uses it.

Owner of stations must provide supply letters for EPOS.

The Observatory includes also meteorological sensors and the need of strong meteorological monitoring and modelling. This is needed for all remote sensing observations (*e.g.* GNSS or InSAR) and also for all aspects related to the sea level and strain changes produced by the sea level changes at high sensitivity sensors like strain-meters and tiltmeters.

Need for the whole “maintenance” team to have access to all stations for maintenance, this implies in particular sharing the keys of the stations.

Telemetry, data, data storage, mirroring

There is need of better quality control on the data that arrive from the field. There is a need of long term strategy for the payment of the 3G/4G telemetries to the mobile phone operators.
The stations are accessible in the field via a VPN. There is a need also of long term strategy for VPN in the CRL array for both the sensors and the computers used for the maintenance and automated data download.

Data should be duplicated / mirrored in an appropriate way that warrants the long term existence and safety of the data. Products should not be duplicated when they are made with same software (or method) in the partner institutions, and at the same time it is good if the partner institutions make products using different approaches, allowing better assessment of the variability of the products. The EPOS structures should be used (*e.g.* EIDA or GLASS, see more at https://www.epos-ip.org/data-services/community-services-tcs/gnss-data-and-products and https://www.epos-ip.org/tcs/gnss-data-and-products/news/glass-unique-open-access-platform-earth-sciences-research).
NOA GSAC (http://194.177.194.238:8080/noanetgsac/gsacapi/) will be kept operational until 2020 and probably later and it will continue hosting also campaign data. The Corinth Rift Observatory data can be retrieved on that portal (daily push of all CRL GNSS data to a NOA ftp repository at ftp://egelados.noa.gr)

Products

Products should comply with the EPOS guidelines. However, products can be also in a “proprietary” format that fits best with the specificities of CRL, if needed (in between the raw data and the final products). The CRL web portal is already providing many data and products.

Web portal

CRL web site to be used more by the CRL team and by the science community. It implies more publicity to be made. The CRL portal includes an intranet (called **WebObs**) for the CRL team. This WebObs permits to document, for each station, the visit and actions made at the station. To be used systematically by those who go to the field at CRL stations. The WebObs is not accessible automatically for security reasons, so you must add in your file /etc/hosts (or C:\WINDOWS\system32\drivers\etc\hosts in Windows OS) the line: **129.199.70.53 webobs.ens.fr**
Each partner involved in maintenance in the field should be able to access the WebObs. Login/Password to be requested to Alexandre Nercessian.

Governance

Yearly coordination meeting: Need of a yearly coordination meeting like that one. It could be every month of June in Patras like this time. June is better than September because it is the right time to evaluate the costs for the year N+1 and communicate those costs by early September for the preparation of the budget of year N+1. Coordination meeting in September (at the same time of the CRL School) would be too late to preparer the year N+1.

Science Council: Need of creation of a Science Council, composed of ~8 people external from the science team of the NFO. Suggestions:

- parity men/women
- one or two members from another Near Fault Observatory
- one member from a Volcano Observatory
- one member from outside the EU

In routine mode (not at the beginning) this science council could gather during the CRL Schools (September) and with possibility of visio-conferences, rather that gathering during the yearly coordination meeting of June (this to leave to the June meeting their main task which is the technical coordination).

Overall value of the Observatory

60 stations x 15k€ per station = 900k€; Computer resources in the partners laboratories (for the data management and initial products only): 60k€

Running cost of the Observatory

Yearly maintenance of the stations: 1.2k€/station (aligned on the costs for RESIF & RENAG stations): 60 * 1.2k€ = 72k€/year (this includes the cost for telemetries, consumables at the stations, and travel expenses)
The cost is globally proportional to the number of stations and some optimization is possible by collocating sensors when possible and by performing multi-sensors maintenance during visits in the field. This implies that those who go to the field know enough about the instruments of the others and the problems to be solved.

Replacement of equipment 12% per year of the total cost of equipment: 0.12 * 900k€ = 108k€/year

Computer & hard disks in the partner laboratories (at data mirroring and products realisation level): 25k€/year (the other consumable costs are included in the cost/station evaluated above).

Education / outreach (e.g. CRL Schools): 20k€/year

Support for new and specific Observatory actions: 30k€/year (this is expected to trigger funds raising for new projects)

Costs related to science council and overall governance: 15k€/year

Field campaigns: not evaluated within the Observatory costs

Publication costs: not evaluated within the Observatory costs

According to the above evaluation, the running cost of the Corinth Rift Observatory is ~270k€/year + overheads (variable between 12 and 20% depending on the partner institutions). This is without counting any manpower and this is what is needed to ensure an Observatory operational on the long term (with the broken/obsolete instruments replacements and no evolution of the overall number of instruments/stations).
EPOS and the national agencies associated to EPOS -and supporting its activity- must be aware of this cost and establish mechanisms to provide this support to the CRL partner laboratories on a recurrent basis.

<u>Human costs for the Observatory:</u> 2 full time for maintaining the array + 0.5 full time for quality control and early data management and backups + 0.5 full time for governance (web activity include in the activity of the last two). All this manpower is for the basic Observatory work, not for the realisation of the products.

The costs of the “services” (EPOS “services” and others) are not included in the above evaluation.

Trans National Access to the Corinth Rift Observatory

Trans National Access (TNA): The Corinth Observatory should propose TNA access to the science community. The team is strong enough for that and can provide very efficient logistical support to new teams by various means

Forthcoming actions

- This document to be presented at the NFO meeting early July in Patras
- Funding request for 2019 to be finalized and submitted to the EPOS funding partners
- Science council to be set-up and first meeting to take place in late 2018 or early 2019.
- Next coordination meeting in June 2019 with each partner presenting the state of the art of its contribution to the observatory during the elapsed year and proposed actions for the forthcoming one.

Notes & suggestions

The meeting room in the Physics Department was excellent for this kind of meeting.
It would be good to have a review of science impact and costs and economic models of all NFO and VO of EPOS to analyse the similarities / differences between the various observatories and their strengths and weaknesses.

Glossary

CNRS: Centre National de la Recherche Scientifique; CRL: Corinth Rift Laboratory; CUP: Charles University Prague; EIDA: European Integrated Data Archive; EPOS: European Plate Observing System (http://www.epos-ip.org); GLASS: Geodetic Linking Advanced Software System; GNSS: Global Navigation Satellite System; HELPOS: Hellenic Plate Observing System; InSAR: Interferometric Synthetic Aperture Radar; NFO: Near Fault Observatory; NKUA: National and Kapodistrian University of Athens; NOA: National Observatory of Athens; RENAG: Réseau National GPS; RESIF: Réseau Sismologique & Géodésique Français; TNA: Trans-National Access
UPAT: University of Patras; VO: Volcano Observatory; VPN: Virtual Private Network

Proposals INSU 2019

Solid Earth

Project Call 2019

Scientific & technical applications

National Services of Observation (SNO)

Corinth rift observatory (NFO CRL http://crlab.eu)

Last name	First name	Status	Employer	Laboratory	Person x month	Percentage of time for	
					Person x month (same as in the web submission site)	Fieldwork, raw data telemetry, storage, quality control and initial products (DDSS of first level), governance	Data analysis (DDSS of second level) and models
Aissaoui	El Madani	Research Engineer	CNRS	IPGP	**3**	100	
Bernard	Pascal	Physicien	IPGP	IPGP	**4**	50	50
Briole	Pierre	Research Director	CNRS	ENS - Laboratoire de Géologie	**8**	70	30
Charalambakis	Marinos	Scientific staff	NOA	Institute of Geodynamics	**1**	50	50
Chousianitis	Konstantinos	Associate Researcher	NOA	Institute of Geodynamics	**1**	50	50
Deschamps	Anne	Research Director (emeritus)	CNRS	GeoAzur	**6**	70	30
Elias	Panagiotis	Scientific staff	NOA	IAASARS	**6**	50	50
Evangelidis	Christos	Associate Researcher	NOA	Institute of Geodynamics	**2**	50	50
Ganas	Athanassios	Research Director	NOA	Institute of Geodynamics	**1**	50	50
Germenis	Nikos	Technician	UPAT	Seismological Laboratory	**3**	80	20
Giannaraki	Georgia	Reseacher - Msc of Seismology	NKUA	Seismological Laboratory	**1**		100
Kapetanidis	Vasilis	Reseacher - Dr. of Seismology	NKUA	Seismological Laboratory	**1**		100
Karakonstantis	Andreas	Reseacher - Dr. of Seismology	NKUA	Seismological Laboratory	**1**		100
Kassaras	Ioannis	Assistant Professor	NKUA	Seismological Laboratory	**3**	50	50
Kaviris	George	Assistant Professor	NKUA	Seismological Laboratory	**3**	50	50
Kontakos	Kiriakos	Technical Staff	NOA	Institute of Geodynamics	**1**	100	
Ktenidou	Olga-Joan	Associate Researcher	NOA	Institute of Geodynamics	**1**	20	80
Lambotte	Sophie	Physicien Adjoint	EOST	EOST	**3**	40	60
Lyon-Caen	Hélène	Researc Director	CNRS	ENS - Laboratoire de Géologie	**6**	50	50
Millas	Christos	Research - Msc Student of Seismology	NKUA	Seismological Laboratory	**1**	50	50

Last name	First name	Status	Employer	Laboratory	Person x month	Percentage of time for	
Nercessian	Alexandre	Physicien Adjoint	IPGP	IPGP	**1**	100	
Papadimitriou	Panayotis	Professor	NKUA	Seismological Laboratory	**2**	50	50
Paraskevopoulos	Paraskevas	EDIP	UPAT	Seismological Laboratory	**3**	60	40
Pavlou	Kyriaki	EDIP	NKUA	Seismological Laboratory	**2**	33	67
Plicka	Vladimir	Research geophysicist	CUP	Seismological Laboratory	**2**	50	50
Rigo	Alexis	Researcher	CNRS	ENS - Laboratoire de Géologie	**4**	35	65
Sakkas	George	Reseacher - Dr. of Seismology	NKUA	Seismological Laboratory	**1**	50	50
Serpetsidaki	Anna	EDIP	UPAT	Seismological Laboratory	**4**	33	67
Sokos	Efthimios	Associate Professor	UPAT	Seismological Laboratory	**4**	67	33
Spingos	Ioannis	Research - Msc Student of Seismology	NKUA	Seismological Laboratory	**1**	50	50
Triantafyllis	Nikos	IT Staff	NOA	Institute of Geodynamics	**1**		100
Vidal	Maurin	Engineer	CNRS	GeoAzur	**1**	100	
Voulgaris	Nicholas	Professor	NKUA	Seismological Laboratory	**2**	50	50
Total					**84 person x month**	**50%**	**50%**

Proposals INSU 2019

Solid Earth

Project Call 2019

Scientific & technical applications

National Services of Observation (SNO)

Corinth rift observatory (NFO CRL http://crlab.eu)

List of instruments (as on September 24, 2018)

N°	Site	Station (all stations have telemetry)	Lat	Long	Date of creation	Network code	Type of sensor	Current sensor model (or GNSS antenna)	Current data logger model	Belongs to Core CRL area	Owner
1	Agios Georgios	**AGEO**	38.2649	22.0635	15/05/2000	CL	Seismometer	L22	Taurus	Y	CNRS
2	Agrapidokampos	**AGRP**	38.3959	21.7228	20/06/2012	CL	Seismometer	CMG40T	Guralp	Y	CNRS
3	Agios Ioannis	**AIOA**	38.1939	22.0587	15/05/2000	CL	Seismometer	L22	Taurus	Y	CNRS
4	Aliki	**ALIK**	38.2605	22.1114	04/04/2000	CL	Seismometer	L22	Taurus	Y	CNRS
5	Ano Chora	**ANX**	38.5933	21.9209	06/06/2010	HP	Seismometer	CMG3T	Guralp	N	CUP
6	Dimitropoulo	**DIMT**	38.2468	22.0436	03/04/2001	CL	Seismometer	L22	Taurus	Y	CNRS
7	Efpalio	**EFP**	38.4269	21.9058	20/06/2006	HP	Seismometer	Trillium40	Trident	Y	UPAT
8	Kalithea	**KALE**	38.3911	22.1398	05/05/2005	HA	Seismometer	CMG-3T/120 H	Guralp CMG-DM24	Y	NKUA
9	Kalavrita	**KLV**	38.0435	22.1504	08/04/2009	HL	Seismometer	STS2	Earthdata PS6-24	N	NOA
10	Lakka	**LAKA**	38.2401	21.9785	05/05/2002	HA	Seismometer	CMG-3T/120 H	Guralp CMG-DM24	Y	NKUA
11	Magoula antenna	**MAG0**	38.4145	21.9467	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
12	Magoula antenna	**MAG2**	38.4150	21.9470	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
13	Magoula antenna	**MAG3**	38.4141	21.9460	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
14	Magoula antenna	**MAG4**	38.4142	21.9481	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
15	Magoula antenna	**MAG5**	38.4155	21.9458	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
16	Magoula antenna	**MAG6**	38.4129	21.9462	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
17	Magoula antenna	**MAG7**	38.4155	21.9488	10/02/2013	CL	Seismometer	Trillium40	Guralp	Y	CNRS
18	Malamata	**MALA**	38.3934	21.8726	01/11/2014	CL	Seismometer			Y	CNRS
19	Monastiraki	**MOKI**	38.40337	21.9252	03/05/2010	CL	Seismometer		PC Linux	Y	CNRS
20	Panormos	**PANR**	38.3735	22.2497	08/06/2001	CL	Seismometer	L22	Reftek	Y	CNRS
21	Psaromita	**PSAM**	38.3218	22.1844	04/04/2001	CL	Seismometer		Reftek	Y	CNRS

N°	Site	Station (all stations have telemetry)	Lat	Long	Date of creation	Network code	Type of sensor	Current sensor model (or GNSS antenna)	Current data logger model	Belongs to Core CRL area	Owner
22	Psaromita	**PSAR**	38.3319	22.1752	16/04/2000	CL	Seismometer	L22	Reftek	Y	CNRS
23	Paravola	**PVO**	38.6167	21.5259	05/05/2009	HP	Seismometer	Trillium120	Trident	N	UPAT
24	Pyrgos	**PYRG**	38.4102	22.0168	30/10/2000	CL	Seismometer	L22	Reftek	Y	CNRS
25	Riolos	**RLS**	38.0558	21.4647	03/03/2006	HL	Seismometer	KS2000	Teledyne	N	NOA
26	Rodini	**ROD3**	38.3081	21.892	12/05/2011	CL	Seismometer	Guralp CMG40T	Reftek	Y	CNRS
27	Sergoula	**SERG**	38.4133	22.0566	05/08/2005	HP	Seismometer	CMG3T	Guralp	Y	UPAT
28	Temeni	**TEME**	38.2316	22.1181	01/01/2000	CL	Seismometer	L22	Reftek	Y	CNRS
29	Trizonia	**TRIZ**	38.3654	22.0727	01/01/2000	CL	Seismometer		Reftek	Y	CNRS
30	Univ Patras	**UPR**	38.2837	21.786	02/02/2003	HP	Seismometer	GEOSIG 1Hz	Earthdata	Y	UPAT
31	Vomvokou	**VVK**	38.4223	21.8115	01/01/2010	HP	Seismometer	Trillium40	Geobit	Y	UPAT
32	Ano Ziria	**ZIRI**	38.3052	21.9476	01/11/2014	CL	Seismometer	CMG40	Reftek	Y	CNRS
33	Aigion - Municipality	**AIGI**	38.2503	22.0878	02/03/1999	HA	Accelerometer	Kinemetrics FBA 2g	Guralp CMG-DM24	Y	NKUA
34	Agrapidokampos	**AGRP**	38.3959	21.72277	05/05/2013	CL	Accelerometer	Guralp CMG5T	Guralp	Y	CNRS
35	Ano Chora	**ANX**	38.5933	21.9209	06/06/2010	HP	Accelerometer	Guralp CMG5T	Guralp	N	UPAT
36	Antirio	**ARIA**	38.3336	21.7621	08/12/2010	HL	Accelerometer	Guralp CMG5T	Guralp	Y	NOA
37	Lakka	**LAK1**	38.2401	21.9785	03/04/2003	HA	Accelerometer	Kinemetrics FBA 2g	Guralp CMG-DM24	Y	NKUA
38	Nafpaktos - Akti	**NAF1**	new	new	20/09/2018	HA	Accelerometer	Kinemetrics FBA 2g	Guralp CMG-DM24	Y	NKUA
39	Nafpaktos - west	**NAF2**	new	new	20/09/2018	HA	Accelerometer	Kinemetrics FBA 2g	Guralp CMG-DM24	Y	NKUA
40	Patras	**PATC**	38.2693	21.76	05/05/2010	HL	Accelerometer	Guralp CMG5T	Guralp	Y	NOA
41	Patras	**PATG**	38.2387	21.7266	12/07/2015	HL	Accelerometer	Guralp CMG5T	Guralp	Y	NOA
42	Paravola	**PVO**	38.6167	21.5259	05/05/2009	HP	Accelerometer	Guralp CMG5T	Guralp	N	UPAT
43	Rio	**RIOA**	38.2959	21.7912	08/12/2010	HL	Accelerometer	Guralp CMG5T	Guralp	Y	NOA
44	Sergoula	**SERG**	38.4139	22.0572	05/05/2000	HA	Accelerometer	Kinemetrics FBA 2g	Guralp CMG-DM24	Y	NKUA
45	Sergoula	**SERG**	38.4133	22.0566	05/08/2005	HP	Accelerometer	Guralp CMG5T	Guralp	Y	UPAT
46	Univ Patras	**UPR**	38.2837	21.786	02/02/2003	HP	Accelerometer	Guralp CMG5T	Guralp	Y	UPAT
47	Rodini	**ROD3**	38.3082	21.8924	31/10/2013	CL	Accelerometer	Guralp CMG5T		Y	CNRS
48	Trizonia	**TRIZ**	38.3654	22.0727	01/01/2000	CL	Accelerometer			Y	CNRS
49	Delfi	**DFLA**	38.4784	22.4958	05/05/2011	HL	Accelerometer	Guralp CMG5T	Guralp	N	NOA
50	Aigion	**AIGI**	38.242	22.0727	11/12/2015	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
51	Ano Alissos	**ANOA**	38.1	21.5	10/12/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
52	Ano Chora	**ANOC**	38.5914	21.9246	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
53	Platani	**ARSA**	38.3012	21.8167	12/06/2014	CL	GNSS	Topcon PG_A1	Topcon Net-G3	Y	CNRS
54	Aigion	**EGIO**			31/10/2016	NOANET	GNSS	Choke Ring	Topcon Net-G5	Y	NOA
55	Efpalio	**EYPA**	38.4268	21.9284	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
56	Galaxidi	**GALA**	38.3795	22.3943	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS

N°	Site	Station (all stations have telemetry)	Lat	Long	Date of creation	Network code	Type of sensor	Current sensor model (or GNSS antenna)	Current data logger model	Belongs to Core CRL area	Owner
57	Gefyra building	**GEYB**	38.3342	21.7665	05/05/2011	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
58	Kalavrita	**KALA**	38.0305	22.1022	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
59	Kounika	**KOUN**	38.2094	22.0458	03/03/2002	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
60	Krini	**KRIN**	38.1893	21.96	04/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
61	Lambiri	**LAMB**	38.3204	21.9731	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
62	Lidoriki	**LIDO**	38.539	22.2057	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
63	Mesarista	**MESA**	38.485	21.5868	01/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
64	Messologhi	**MESO**	38.3801	21.4578	31/10/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	N	CNRS
65	Platadinis	**NAFP**	38.3701	21.7812	01/07/2014	NOANET	GNSS	Choke Ring	Topcon Net-G3	Y	UPAT
66	Patras	**PAT0**	38.2836	21.7867	10/04/2006	EUREF	GNSS	Choke Ring	Topcon Net-G3	Y	CNRS
67	Psaromita	**PSAM**	38.3217	22.1843	08/06/2002	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
68	Psathopirgos	**PSAT**	38.3287	21.8714	12/06/2014	CL	GNSS	Topcon PG_A1	Topcon Net-G3	Y	CNRS
69	Paravola	**PVOG**	38.6138	21.5233	05/05/2014	CL	GNSS	Leica AR10	Leica GR10	N	CUP
70		**RETS**	38.4288	21.4294	05/05/2014	CL	GNSS	Trimble Zephyr	Septentrio PolaRx2	N	CUP
71	Riolos	**RLSO**	38.0558	21.4647	04/06/2006	NOANET	GNSS	LEIAX1203+GNSS	Leica GMX902	N	NOA
72	Ano Rodini	**ROD3**	38.3082	21.8924	31/10/2013	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
73	Trizonia	**TRIZ**	38.3653	22.0729	16/05/2002	CL	GNSS	Topcon PG_A1	Topcon Net-G3	Y	CNRS
74	Valimitika	**VALI**	38.2337	22.1349	10/06/2015	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
75	Xiliadou	**XILI**	38.3852	21.9117	05/05/2014	CL	GNSS	Topcon PG_A1	Topcon GB-1000	Y	CNRS
76	Riza	**RIZA**			03/03/2017	CL	Strainmeter			Y	CNRS
77	Trizonia marina	**TRIE**	38.3703	22/0738	05/05/2006	CL	Dilatometer			Y	CNRS
78	Psaromita	**PSAM**			06/06/2011		Meteorological			Y	CNRS
79	Makinia	**MAKI**			03/03/2017		Tide gauge			Y	CNRS
80	Monastiraki	**MONA**			06/07/2016		Tide gauge			Y	CNRS
81	Aigion	**NOA-06**	38.26	22.08	10/10/2016		Tide gauge	Geonica - VEGA RADAR 6115 SENSOR	Geonica - DAS 3000CP	Y	NOA
82	Itea	**NOA-05**	38.43	22.42	11/10/2016		Tide gauge	Geonica - VEGA RADAR 6115 SENSOR	Geonica - DAS 3000CP	N	NOA
83	Panormos	**IDSL-24**	38.36	22.25	03/04/2017		Tide gauge	JRC-IDSL	JRC-IDSL radar	Y	NOA
Moy											

Site	Station (all stations have telemetry)	Percentage of data January 2017 - August 2018	Year of and price (k€) of sensor purchase		Expected life time (yr)	Maintained by	Operated by	Notes
Agios Georgios	**AGEO**	98				CNRS	CNRS	borehole (100m)
Agrapidokampos	**AGRP**	99				CNRS	CNRS	
Agios Ioannis	**AIOA**	98				CNRS	CNRS	
Aliki	**ALIK**	98				CNRS	CNRS	borehole (100m)
Ano Chora	**ANX**	59	2003	10	20	UPAT/CUP	UPAT	surface
Dimitropoulo	**DIMT**	30				CNRS	CNRS	borehole (100m)
Efpalio	**EFP**	58	2000	8	20	UPAT	UPAT	surface
Kalithea	**KALE**	25		5		NKUA	NKUA	
Kalavrita	**KLV**	99		20		NOA	NOA	
Lakka	**LAKA**	91		5		NKUA	NKUA	
Magoula antenna	**MAG0**	99		8		CNRS	CNRS	
Magoula antenna	**MAG2**	99		8		CNRS	CNRS	might be moved in 2019
Magoula antenna	**MAG3**	99		8		CNRS	CNRS	might be moved in 2019
Magoula antenna	**MAG4**	99		8		CNRS	CNRS	might be moved in 2019
Magoula antenna	**MAG5**	99		8		CNRS	CNRS	might be moved in 2019
Magoula antenna	**MAG6**	99		8		CNRS	CNRS	might be moved in 2019
Magoula antenna	**MAG7**	87		8		CNRS	CNRS	might be moved in 2019
Malamata	**MALA**	99				CNRS	CNRS	borehole
Monastiraki	**MOKI**					CNRS	CNRS	borehole
Panormos	**PANR**	92				CNRS	CNRS	
Psaromita	**PSAM**					CNRS	CNRS	Lighthouse

Site	Station (all stations have telemetry)	Percentage of data January 2017 - August 2018	Year of and price (k€) of sensor purchase		Expected life time (yr)	Maintained by	Operated by	Notes
Psaromita	**PSAR**	94				CNRS	CNRS	borehole (100m)
Paravola	**PVO**	94	2000	10	20	UPAT/CUP	UPAT	surface vault
Pyrgos	**PYRG**	94				CNRS	CNRS	
Riolos	**RLS**					NOA	NOA	
Rodini	**ROD3**	92				CNRS	CNRS	replaces since 2012 a station "Rodini" previously located elsewhere
Sergoula	**SERG**	75				UPAT	UPAT	3 m deep vault
Temeni	**TEME**	93				CNRS	CNRS	borehole (100m), rebuilt on 29/10/2014
Trizonia	**TRIZ**	94				CNRS	CNRS	
Univ Patras	**UPR**	98	1998	5	15	UPAT	UPAT	surface
Vomvokou	**VVK**	77	2000	8	20	UPAT	UPAT	surface
Ano Ziria	**ZIRI**	95				CNRS	CNRS	
Aigion - Municipality	**AIGI**	5				NKUA	NKUA	
Agrapidokampos	**AGRP**	99		5		CNRS	CNRS	
Ano Chora	**ANX**	95	2005	5	12	UPAT/CUP	UPAT	
Antirio	**ARIA**	10	2009	5	12	NOA	NOA	
Lakka	**LAK1**	0	2012	5	12	NKUA	NKUA	
Nafpaktos - Akti	**NAF1**		2012	5	12	NKUA	NKUA	
Nafpaktos - west	**NAF2**		2012	5	12	NKUA	NKUA	
Patras	**PATC**	99	2009	5	12	NOA	NOA	
Patras	**PATG**	93	2009	5	12	NOA	NOA	
Paravola	**PVO**	95	2009	5	12	UPAT	UPAT	
Rio	**RIOA**	99	2009	5	12	NOA	NOA	
Sergoula	**SERG**	5	2010			NKUA	NKUA	
Sergoula	**SERG**	97	2005	5	12	UPAT	UPAT	
Univ Patras	**UPR**	97	2003	5	12	UPAT	UPAT	
Rodini	**ROD3**		2010	5	12	CNRS	CNRS	
Trizonia	**TRIZ**		2008			CNRS	CNRS	
Delfi	**DFLA**	99	2009	5	12	NOA	NOA	
Aigion	**AIGI**	96	2008	5	12	CNRS	CNRS	Aigion hospital
Ano Alissos	**ANOA**	15	2006	5	12	CNRS	TreeComp	
Ano Chora	**ANOC**	100	2007	5	12			
Platani	**ARSA**	95	2013	8	12	CNRS	CNRS	
Aigion	**EGIO**	15	2015	10	12	NOA	NOA	
Efpalio	**EYPA**	98	2006	5	12	CNRS	CNRS	
Galaxidi	**GALA**	90	2007	5	12	CNRS	CNRS	

Site	Station (all stations have telemetry)	Percentage of data January 2017 - August 2018	Year of and price (k€) of sensor purchase		Expected life time (yr)	Maintained by	Operated by	Notes
Gefyra building	**GEYB**	100	2011	5	12	CNRS	Gefyra	
Kalavrita	**KALA**	94	2006	5	12	CNRS	CNRS	
Kounika	**KOUN**	94	2006	5	12	CNRS	CNRS	
Krini	**KRIN**	100	2008	5	12	CNRS	CNRS	
Lambiri	**LAMB**	94	2007	5	12	CNRS	CNRS	
Lidoriki	**LIDO**	98	2010	5	12	CNRS	CNRS	
Mesarista	**MESA**	98	2009	5	12	CNRS	CNRS	
Messologhi	**MESO**	100	2007	5	12	CNRS	CNRS	
Platadinis	**NAFP**	25	2014	8	12	NOA	NOA	previously named PLAT
Patras	**PAT0**	100	2011	7	12	CNRS	UPAT	
Psaromita	**PSAM**	98	2007	5	12	CNRS	CNRS	
Psathopirgos	**PSAT**	99	2014	8	12	CNRS	CNRS	
Paravola	**PVOG**	94	2014	8	12	CUP	UPAT	
	RETS	80	2014	9	12	CUP	UPAT	
Riolos	**RLSO**	30	2006	10	12	NOA	NOA	called RSL_ until 2009
Ano Rodini	**ROD3**	85	2008	5	12	CNRS	CNRS	stolen and replaced by a new one in 2015
Trizonia	**TRIZ**	97	2012	7	12	CNRS	CNRS	
Valimitika	**VALI**	88	2008	5	12	CNRS	CNRS	
Xiliadou	**XILI**	99	2008	5	12	CNRS	CNRS	
Riza	**RIZA**					CNRS	CNRS	borehole
Trizonia marina	**TRIE**					CNRS	CNRS	
Psaromita	**PSAM**	98	2012	5	10	CNRS	CNRS	
Makinia	**MAKI**	40	2016	10	10	CNRS	CNRS	
Monastiraki	**MONA**	50	2016	10	10	CNRS	CNRS	
Aigion	**NOA-06**	90	2016	15	10	NOA	NOA	
Itea	**NOA-05**	90	2016	15	10	NOA	NOA	
Panormos	**IDSL-24**	80	2017	5	5	JRC	NOA	
		82	**2009**					