"TELEMACHOS": Operational Seismic Risk Management System of the Ionian Islands Region

Ionian University
Department of Informatics

REGION of IONIAN ISLANDS

HELLENIC REPUBLIC
National and Kapodistrian University of Athens
EST. 1837

E.P.P.O.

INSTITUTE OF GEODYNAMICS
NATIONAL OBSERVATORY OF ATHENS

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης

ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ ΙΟΝΙΑ ΝΗΣΙΑ 2014-2020

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

ΕΣΠΑ 2014-2020

Beneficiaries of the "TELEMACHOS" Project

Project Team Coordinator:

Tsoukas Dionysios – Vice Governor of Regional Energy and Environment

Lead partner:

Region of the Ionian Islands - Independent Civil Protection Directorate: Head Konstantinos Karidis

Partners:

Ionian University: Associate Professor Markos Avlonitis

National & Kapodistrian University of Athens: Professor N. Voulgaris

National Observatory of Athens – Geodynamic Institute: Research Director G. Drakatos

Earthquake Planning & Protection Organization: Dr. A. Kourou

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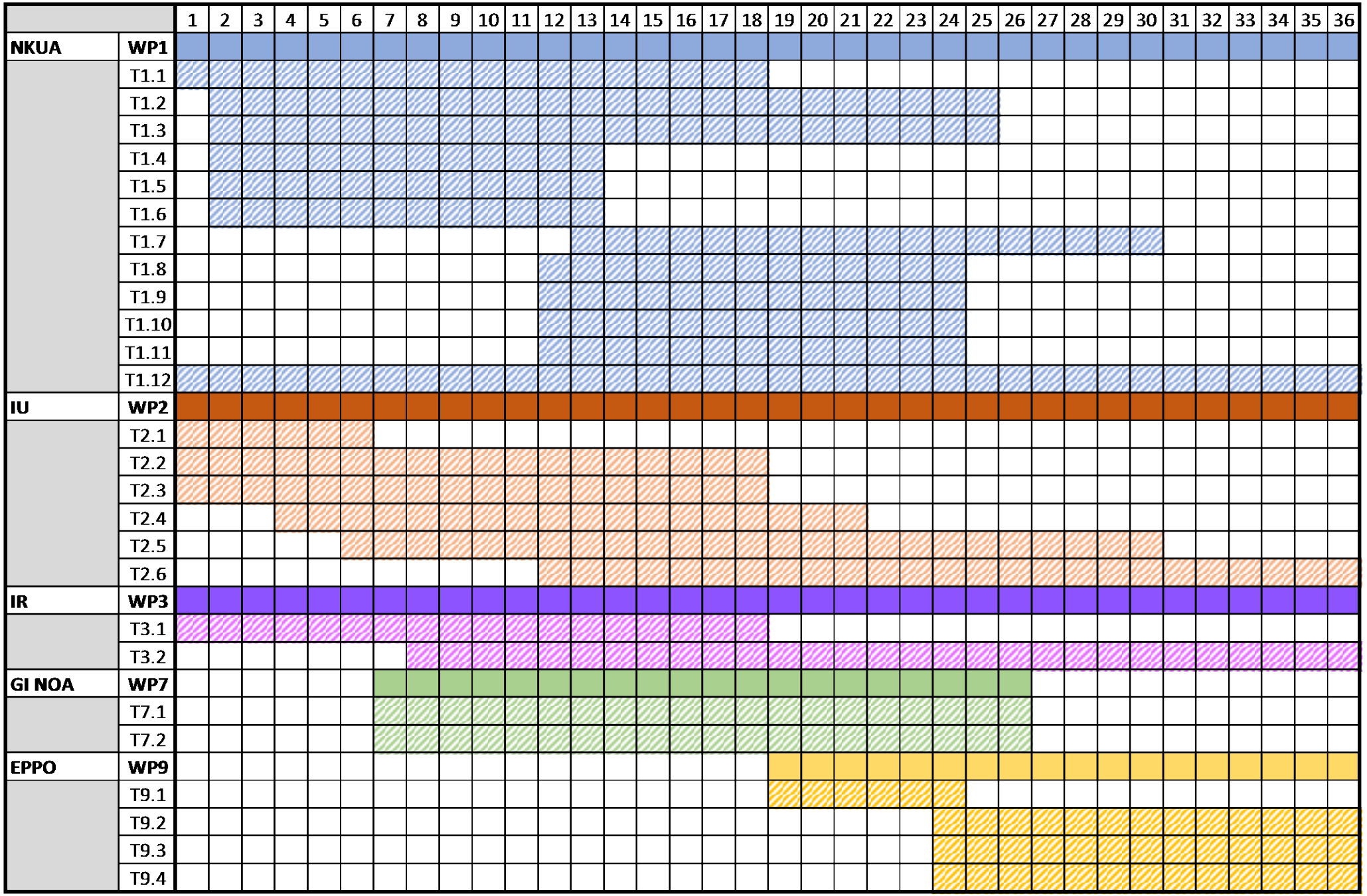
ΕΣΠΑ 2014-2020

WP Structure

- WP1 Risk Analysis and Evaluation (NKUA)
- WP2 Development of Innovative System (IU)
- WP3 Structuring of Operational Response System (IIR)
- WP5 Procurement & Installation of Scientific Instruments (IU)
- WP7 Monitoring of precursors (NOA)
- WP8 Procurement of Specialized Software (NKUA)
- WP9 Educational & Public Awareness Actions (EPPO)
- WP10 Procurement & Installation of Operational Response Equipment (IIR)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NKUA WP1
T1.1
T1.2
T1.3
T1.4
T1.5
T1.6
T1.7
T1.8
T1.9
T1.10
T1.11
T1.12
IU WP2
T2.1
T2.2
T2.3
T2.4
T2.5
T2.6
IR WP3
T3.1
T3.2
GI NOA WP7
T7.1
T7.2
EPPO WP9
T9.1
T9.2
T9.3
T9.4

WP1 Risk Analysis and Evaluation (NKUA)

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- T 1.1. Processing of Topography Satellite & GIS Basement data
- T 1.2. Geological maps
- T 1.3. Neotectonic maps
- T 1.4. Seismicity maps
- T 1.5. Maps of associated Geodynamic phenomena
- T 1.6. Soil response maps
- T 1.7. Seismic hazard assessment
- T 1.8. Response of traditional and historical buildings
- T 1.9. Building stock vulnerability assessment
- T 1.10. Network and infrastructure vulnerability assessment
- T 1.11. Vulnerability assessment of monuments and cultural landmarks
- T 1.12. Data management and updating

T 1.1. Processing of Topography Satellite & GIS Basement data
T 1.2. Geological maps T 1.3. Neotectonic maps

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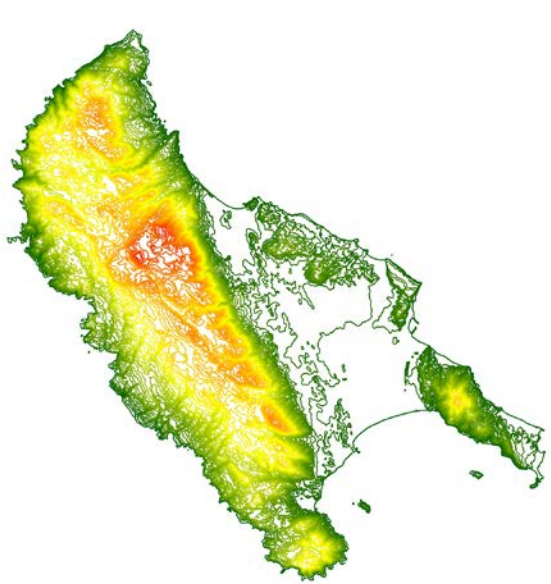
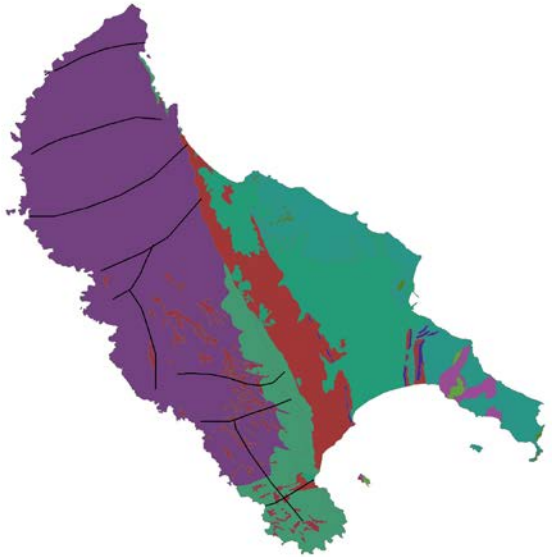
- Geodatabase including vector and raster layers

<u>Vector layers</u>

- o Topographic data
- o Geology formations
- o Road networks
- o Building stock
- o …….



Contours



Geological Formations

Geodatabase Raster Data

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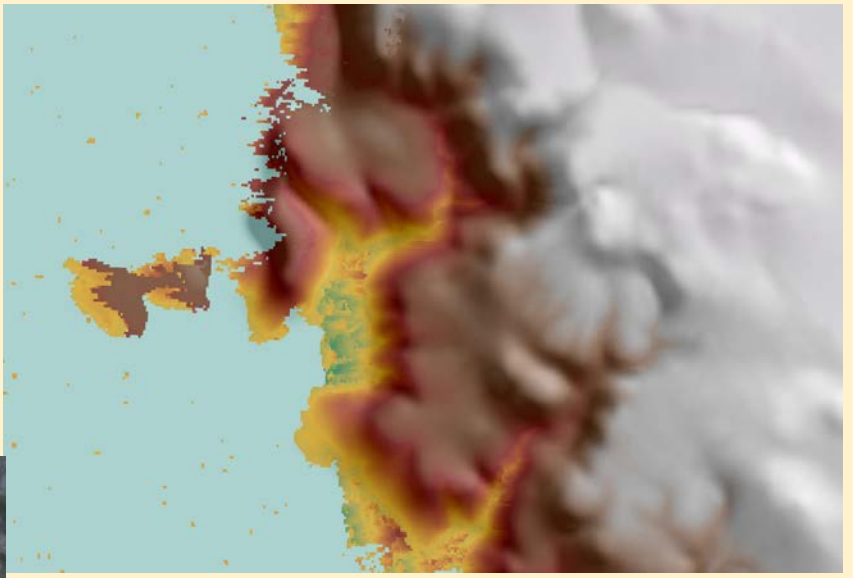
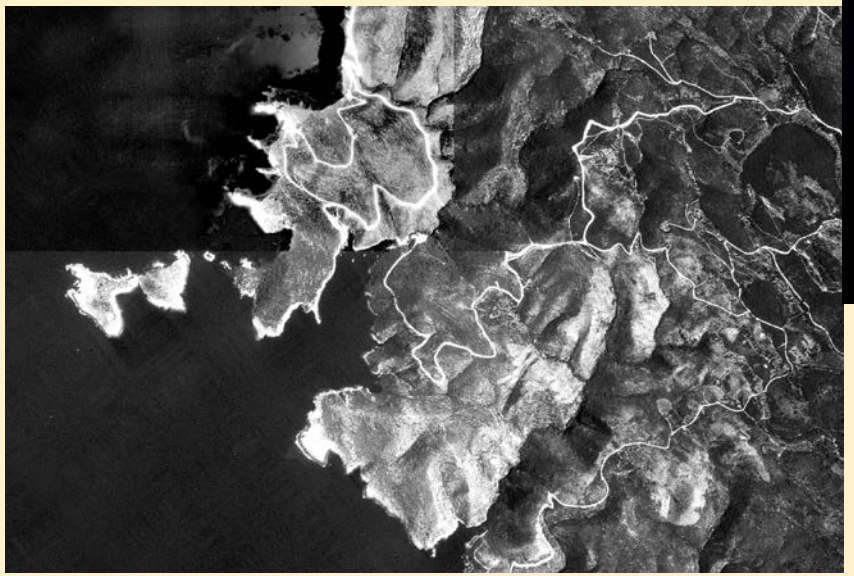
Color aerial photograph mosaic (2010) resolution 0.5m

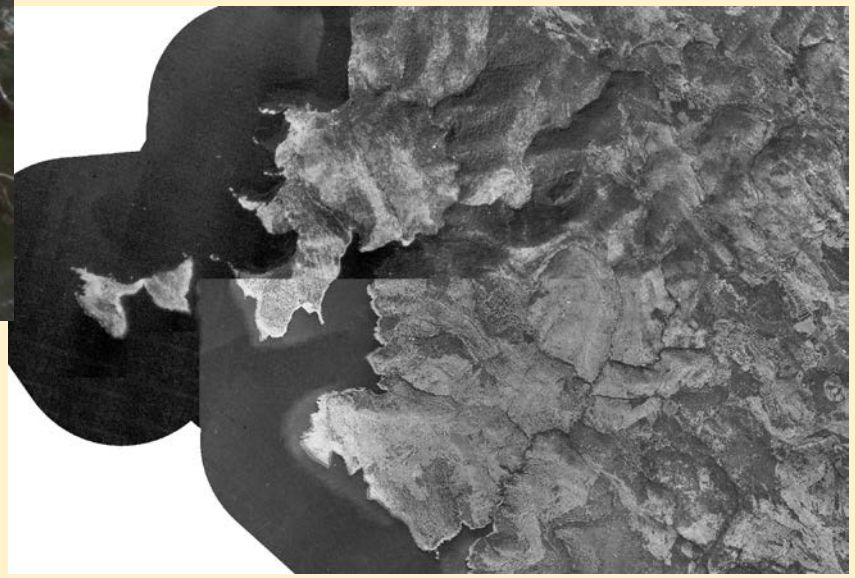


DEM resolution 5m

Satellite images Planet resolution 3m



Panchromatic aerial photograph mosaic (1996) resolution 1m



Panchromatic aerial photograph mosaic (1945) resolution 1m

T 1.1. Processing of Topography Satellite & GIS data

PS Interferometry Velocity Field

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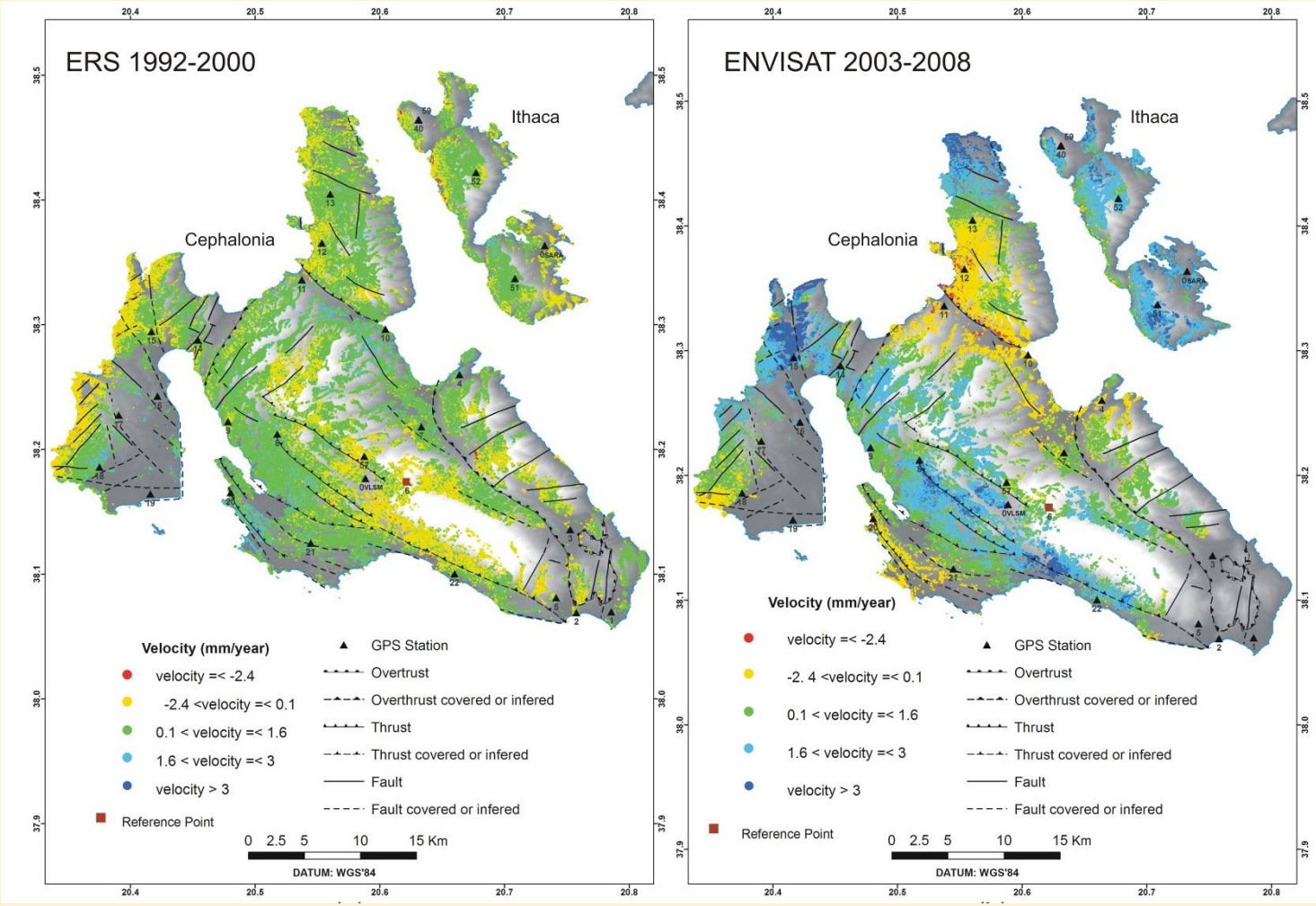

T 1.5. Maps of associated geodynamic phenomena

Co-seismic ground deformation

Continuous GNSS/GPS stations in Western Greece
(Daily processing by NKUA)

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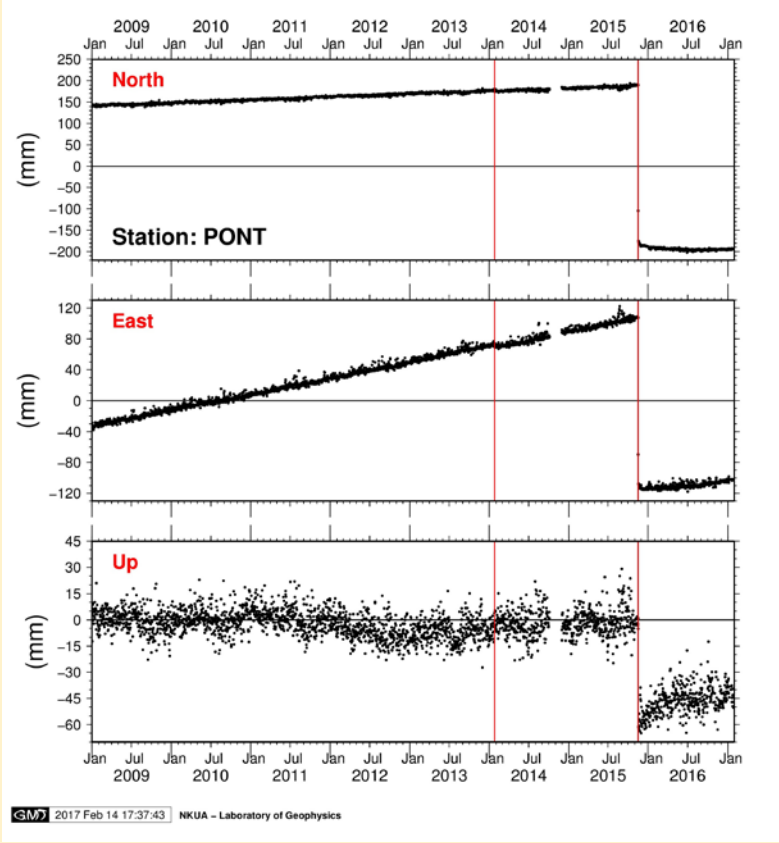
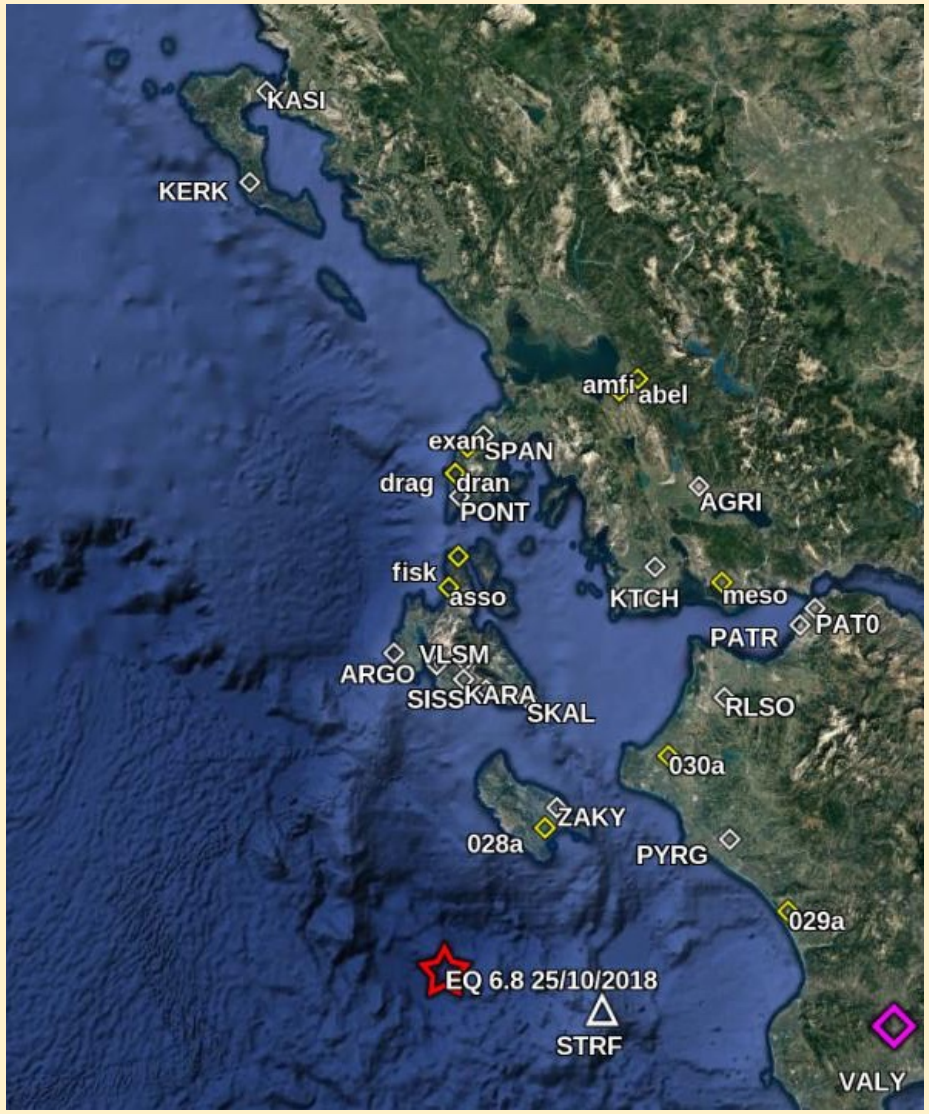
Networks:

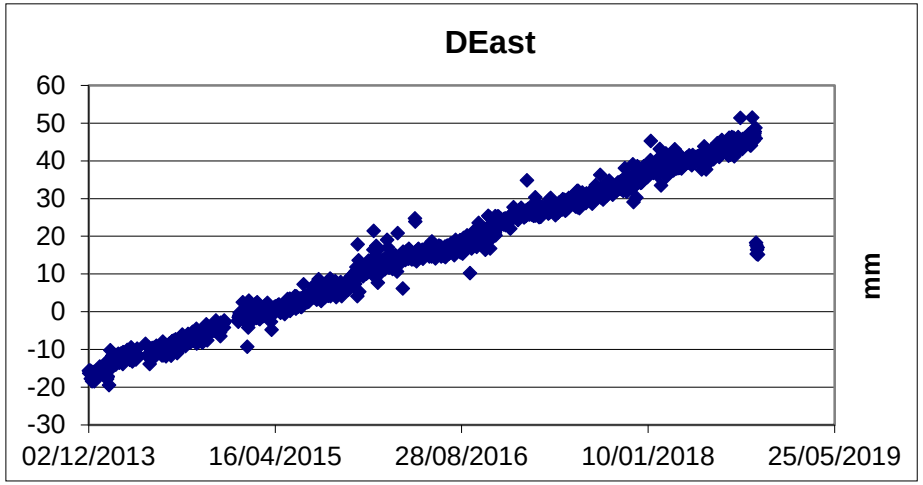
- NKUA
- NOA
- CRL
- Metrica SA
- Hellenic Cadastre

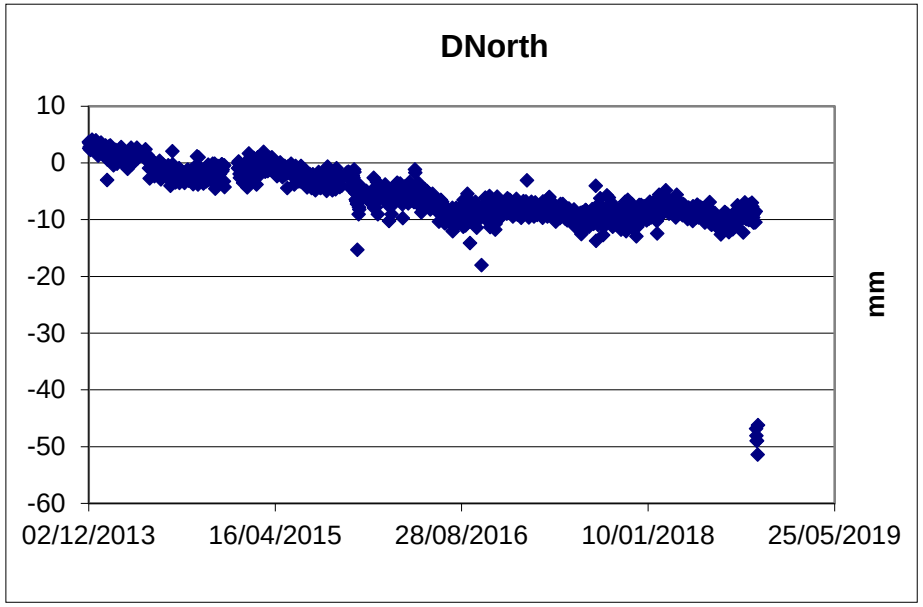
Time Series from PONT GNSS site (Lefkas island)





T 1.5. Maps of associated geodynamic phenomena
Co-seismic ground deformation





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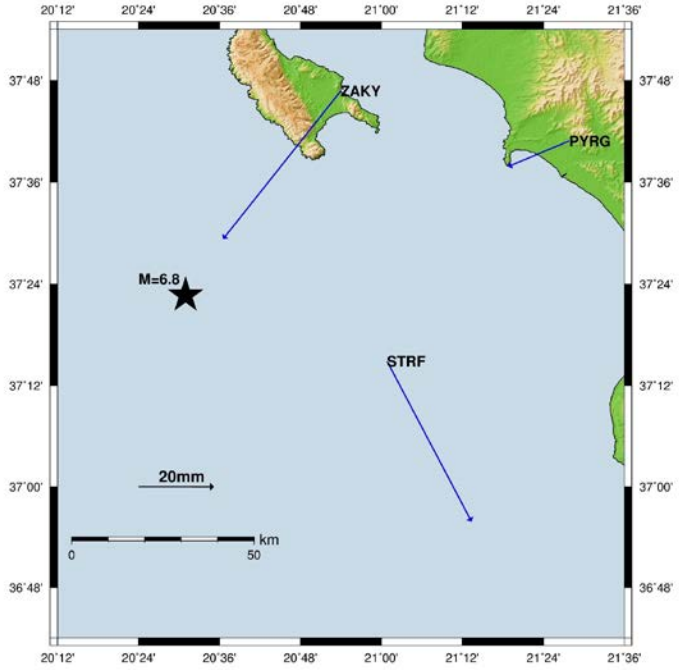
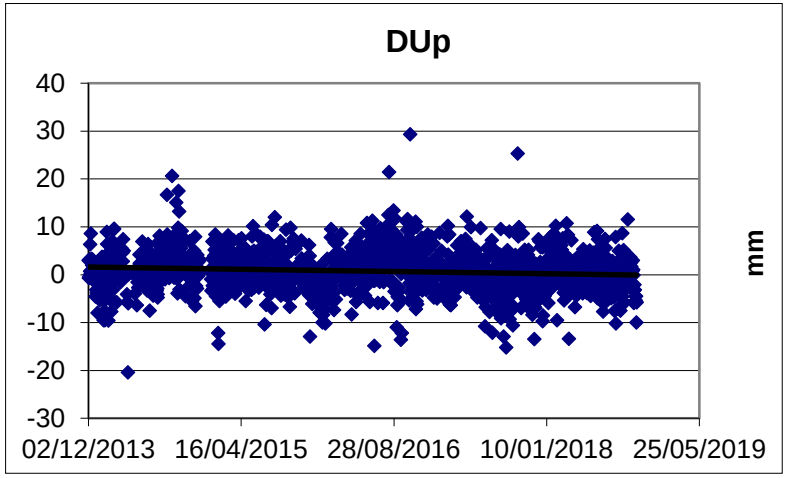
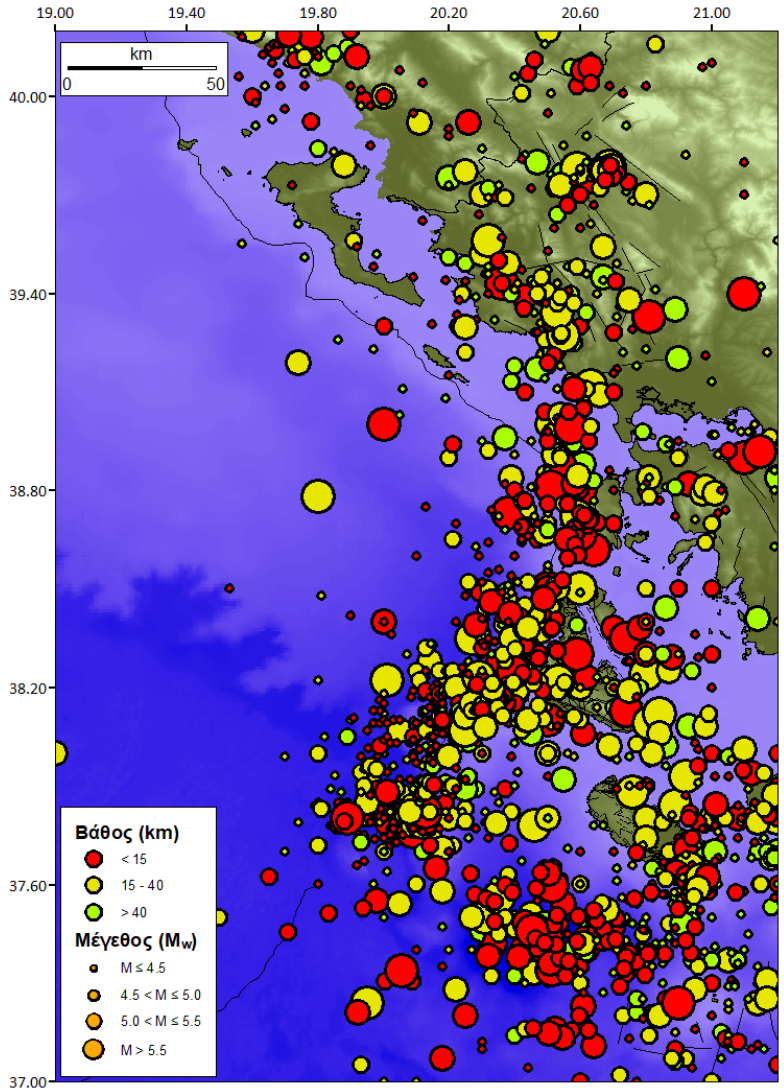
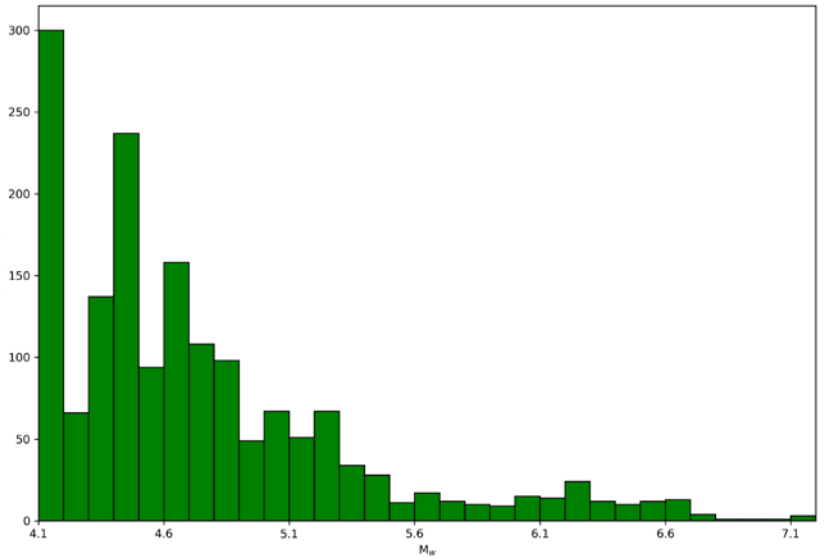
Oct, 25 2018 Zakynthos Eq





T 1.4. Seismicity maps – General seismicity





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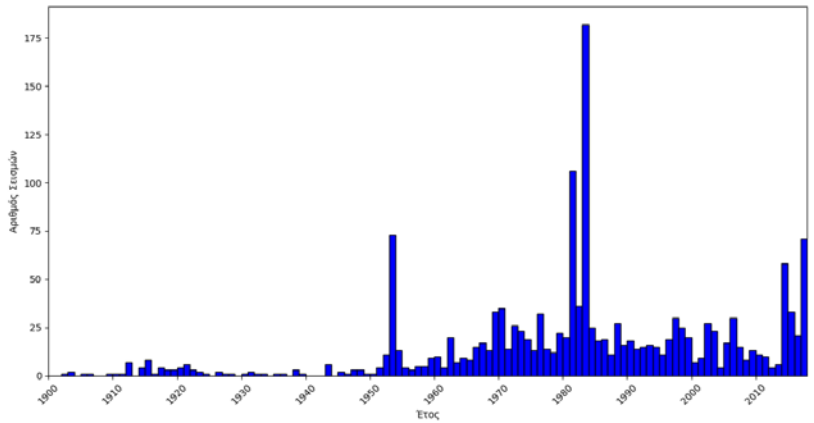
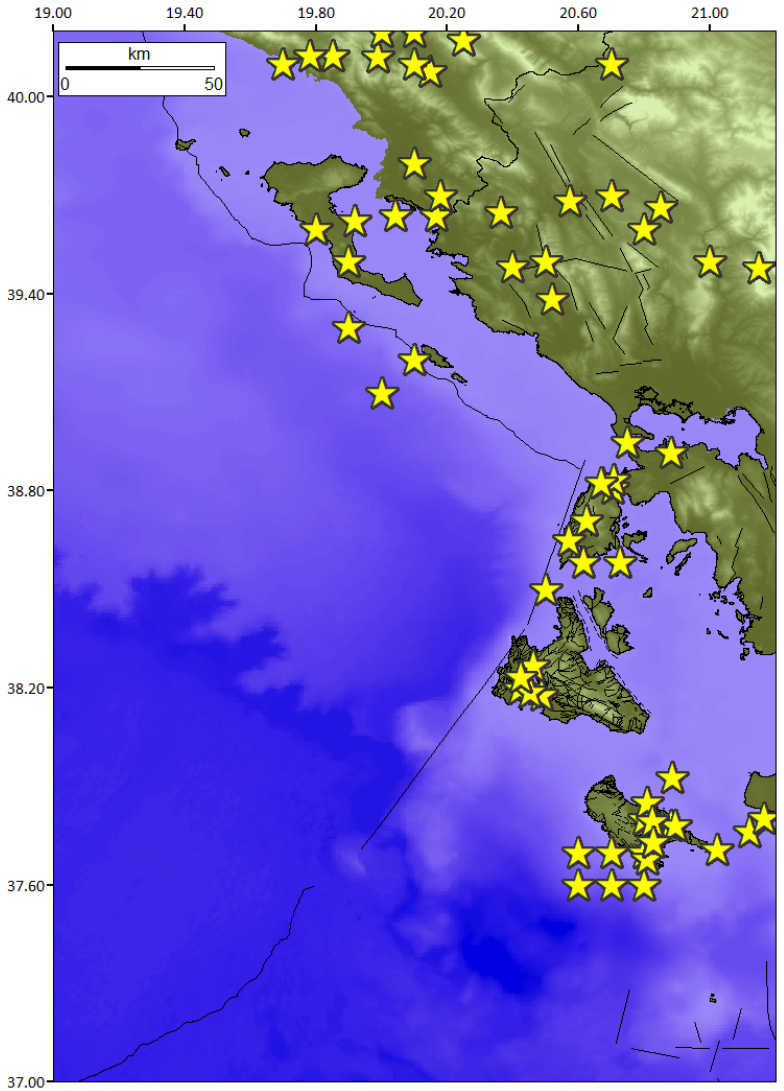
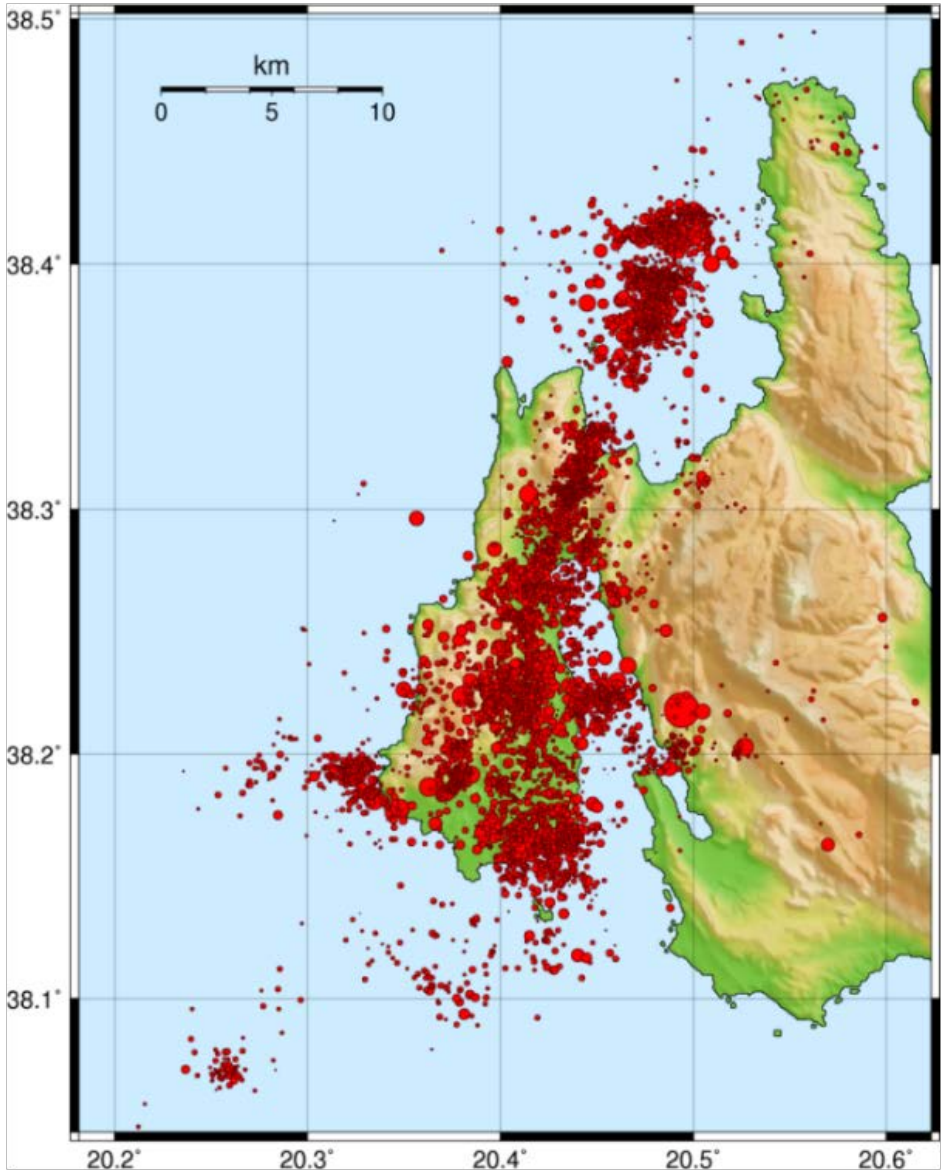




T 1.4. Seismicity maps – Earthquake sequences



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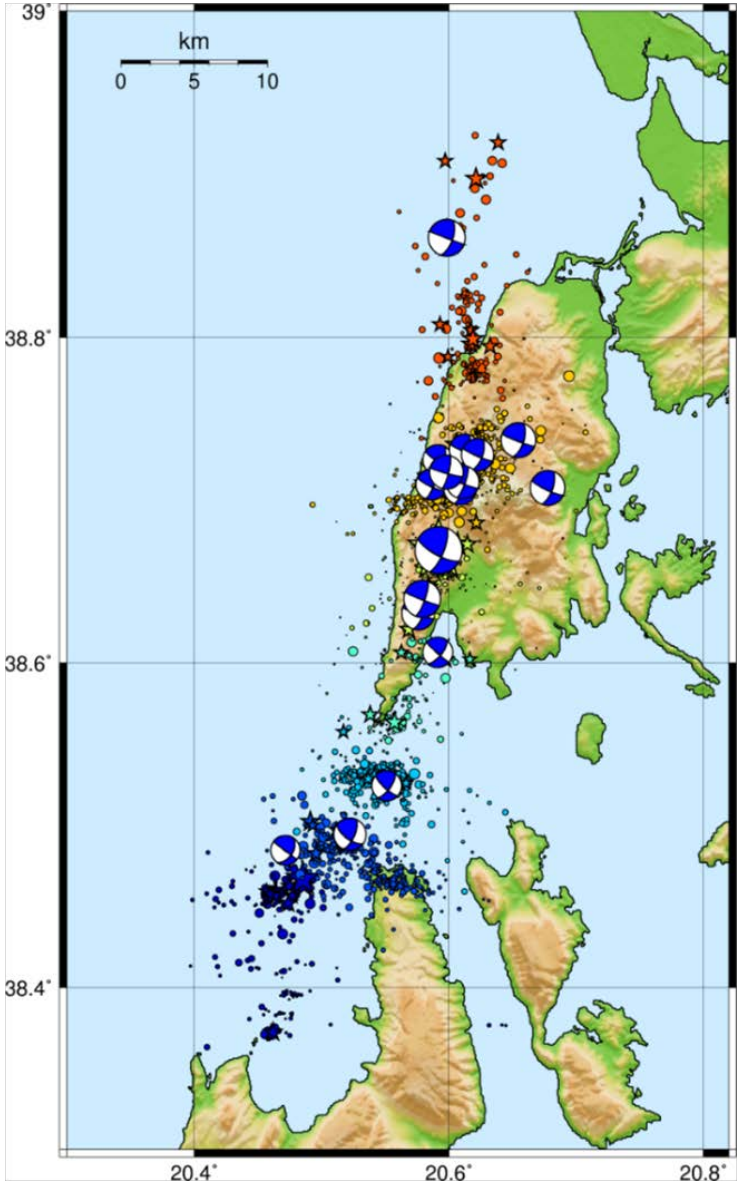
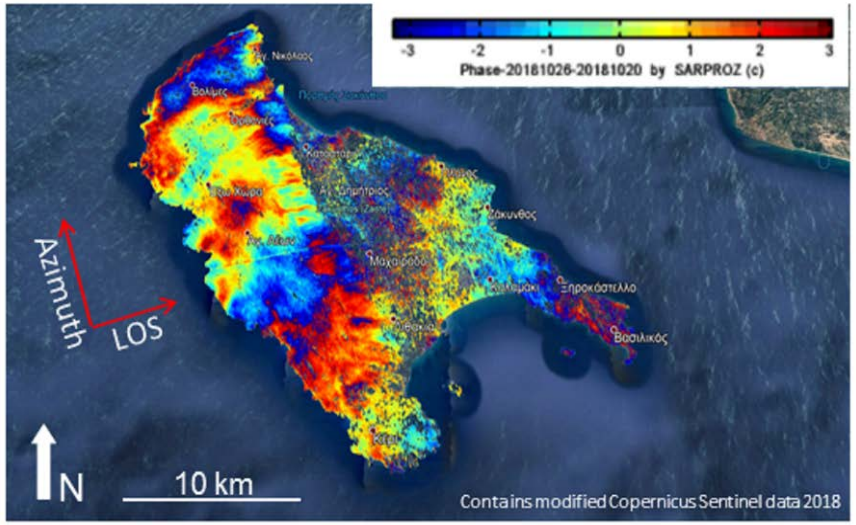
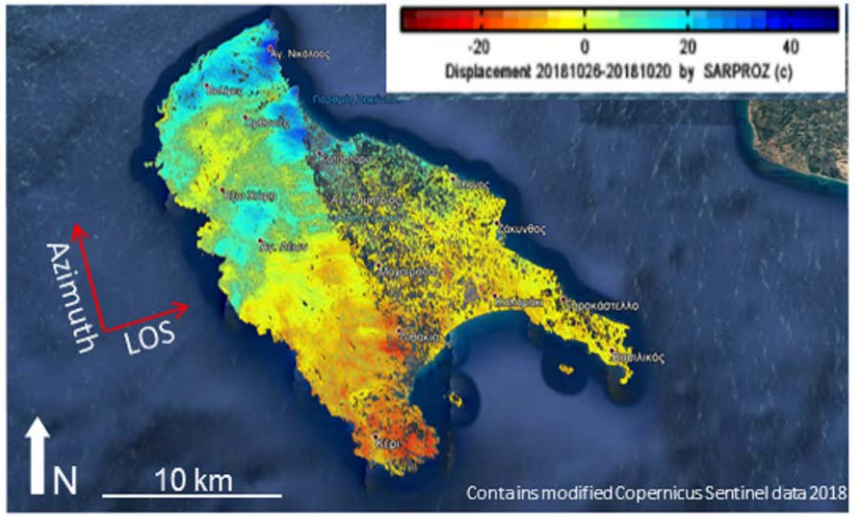


T 1.5. Maps of associated geodynamic phenomena

Co-seismic ground deformation



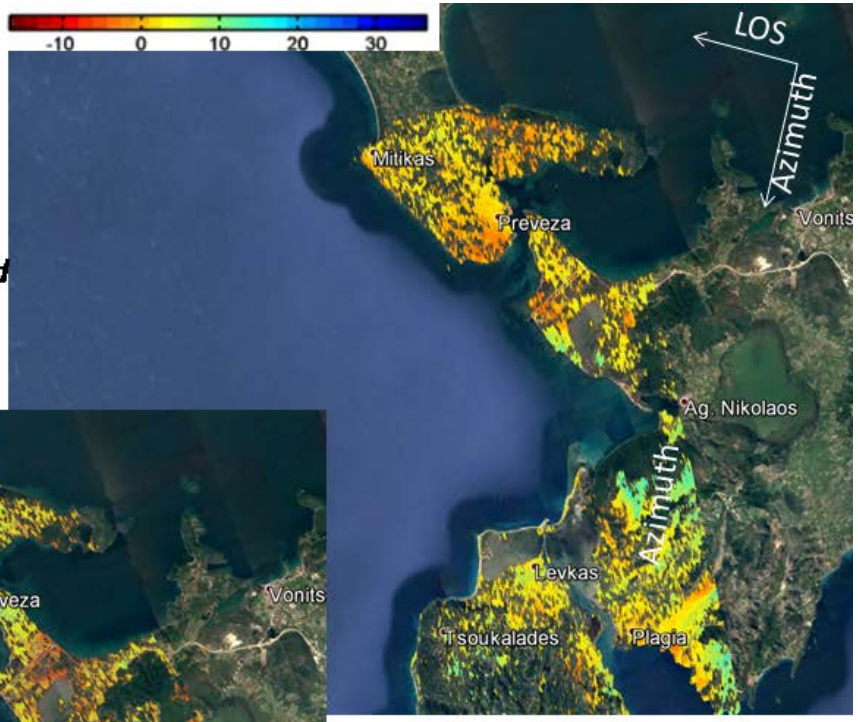
a

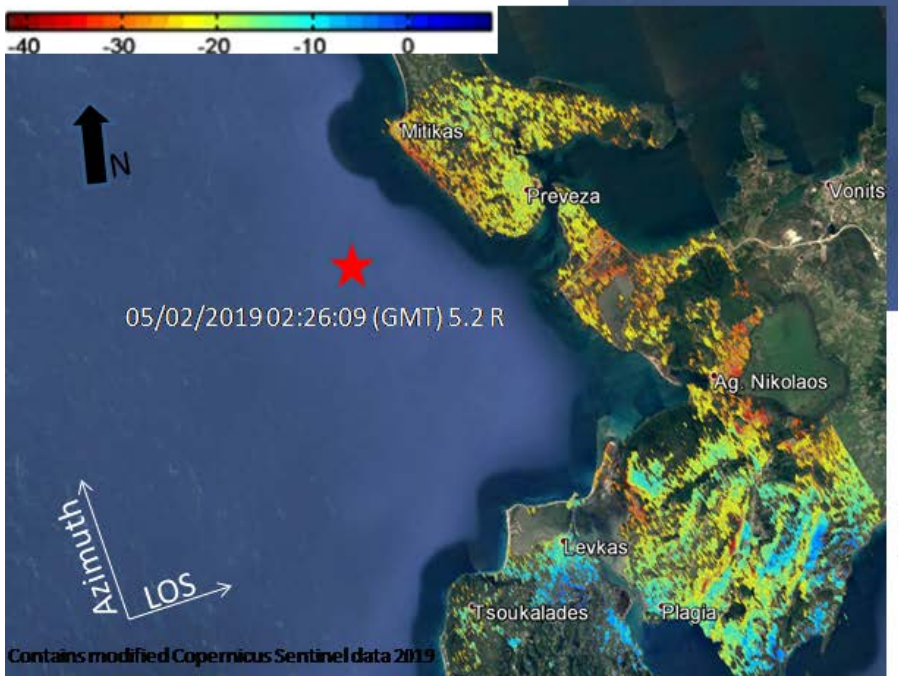


b

Co-seismic displacement maps (in mm) of 5/2/2019 earthquake event using Sentinel 1 IW SLC pairs of both orbital mode

Descending pair 30/01/2019 and 05/02/2019





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Department of Geography

Ascending pair 30/01/2019 and 05/02/2019

Epicenter

WP2 Development of Innovative System (IU)

- T 2.1. Definition of the Innovative System Specifications
- T 2.2. Design and Development of a low cost strong and weak ground motion monitoring network
- T 2.3. Design and Development of a seismological data management system for a large array of sensors
- T 2.4. Development of stochastic algorithms for real time seismological data processing
- T 2.5. Software development for seismic risk mitigation decision support
- T 2.6. Standardized information dissemination system for authorities, stakeholders and general public

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T 2.2 Design and Development of a low cost strong and weak ground motion monitoring network

- A low-cost system for detection and monitoring
- Innovative by using low cost mems of accelerometer sensors and velocity sensors
- Easily expandable - Easy to use
- Portable (easily transported to the measurement field)
- Energy autonomous
- Data storage on usb stick
- Ability to compress and send data for remote monitoring

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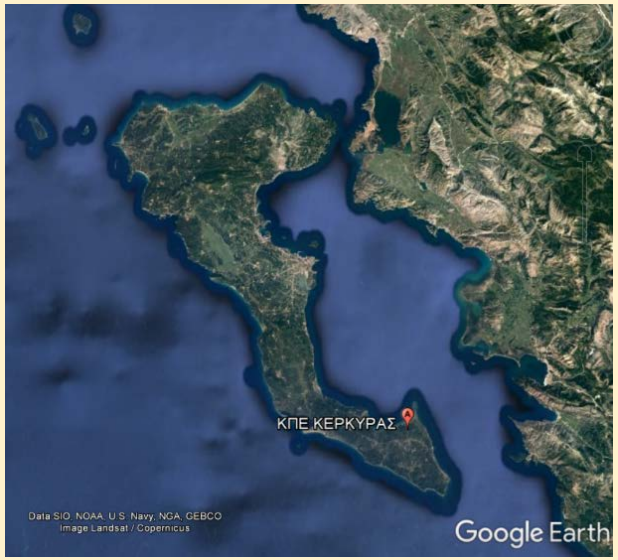
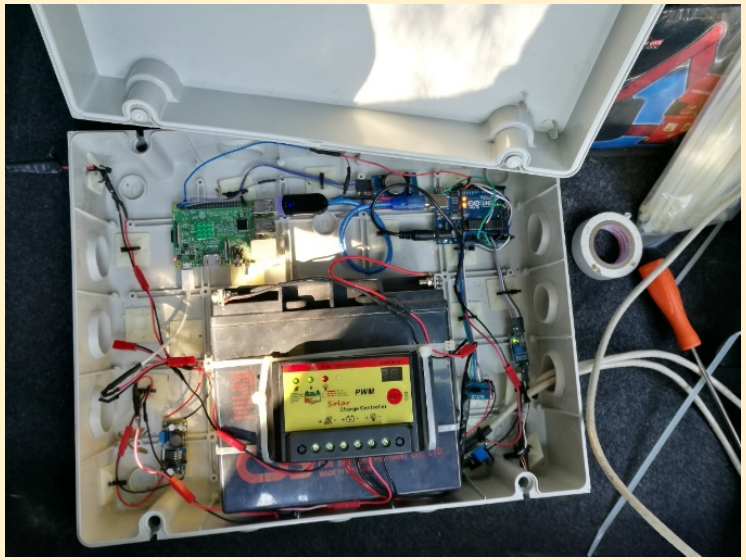
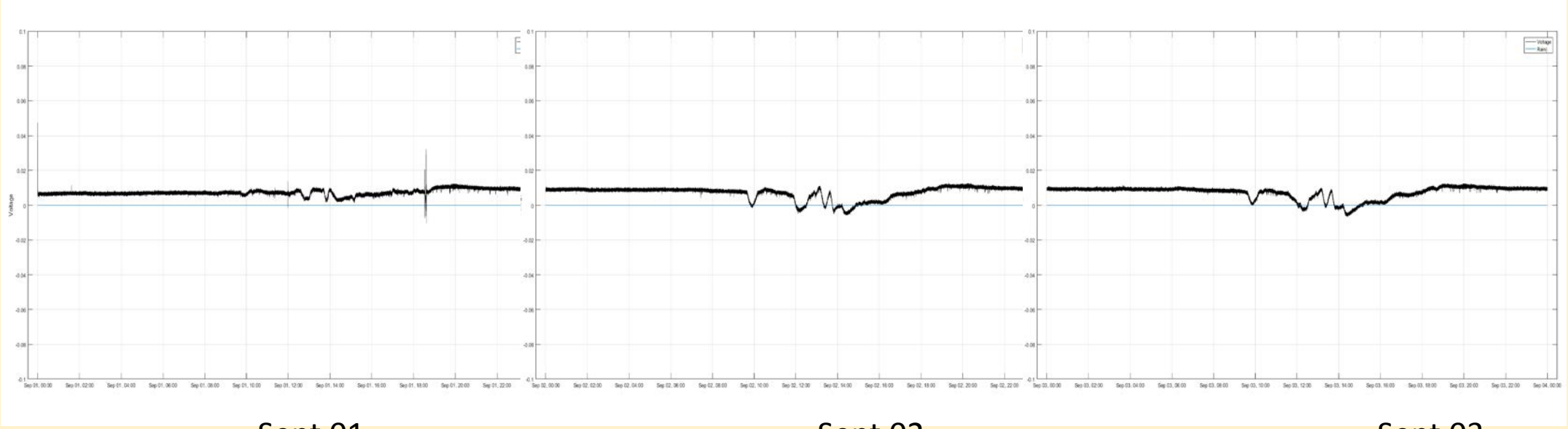
Low cost strong and weak ground motion monitoring field tests

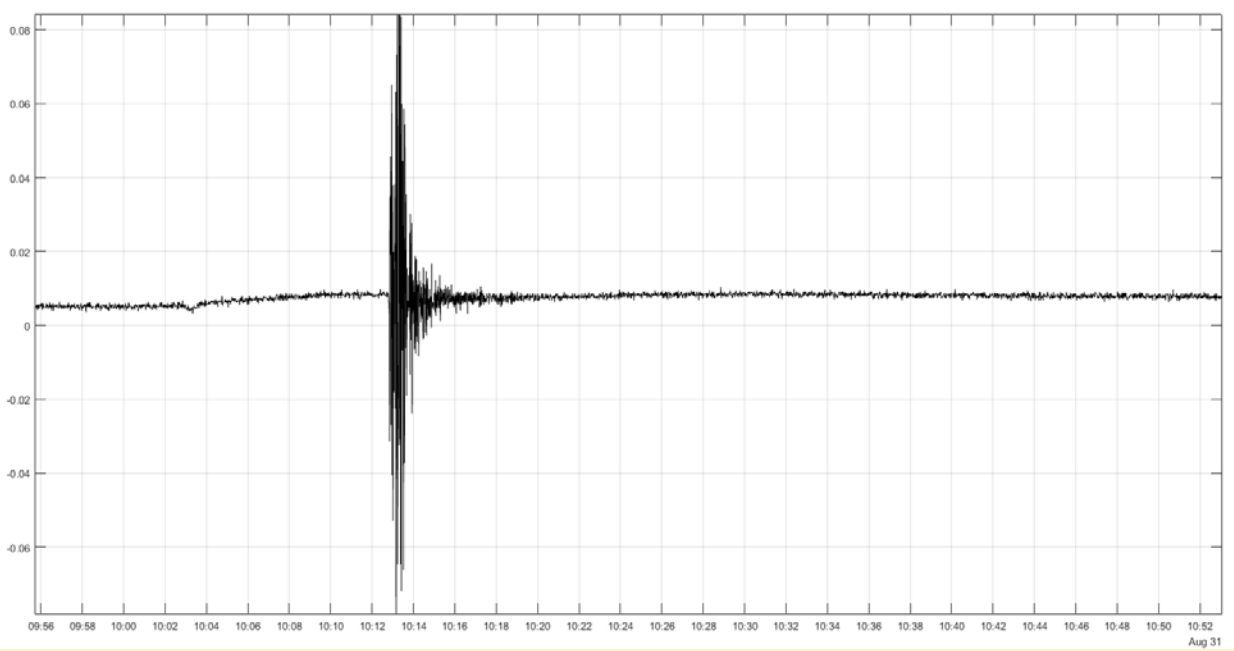






Sept 01 Sept 02 Sept 03

Earthquake record (31-08-2018 10:12 - 31 km SSW of Trikala)



Current recording systems have great configuration and parameterization features, such as:

- Changing Arduino UNO R3 microcontroller with Raspberry Pi (model b+)
- Use a faster and a higher A/D converter (at least 24bit - sampling rate> 1Khz)
- Using a better low cost acceleration sensor aiming at more accurate measurements.
- Adding a lead component battery charged by a solar panel for almost complete energy autonomy.

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WP3 Structuring of Operational Response System (IIR)

- T 3.1. Drafting of Operational Response Plans
- T 3.2. Emergency Response Drills and Simulations

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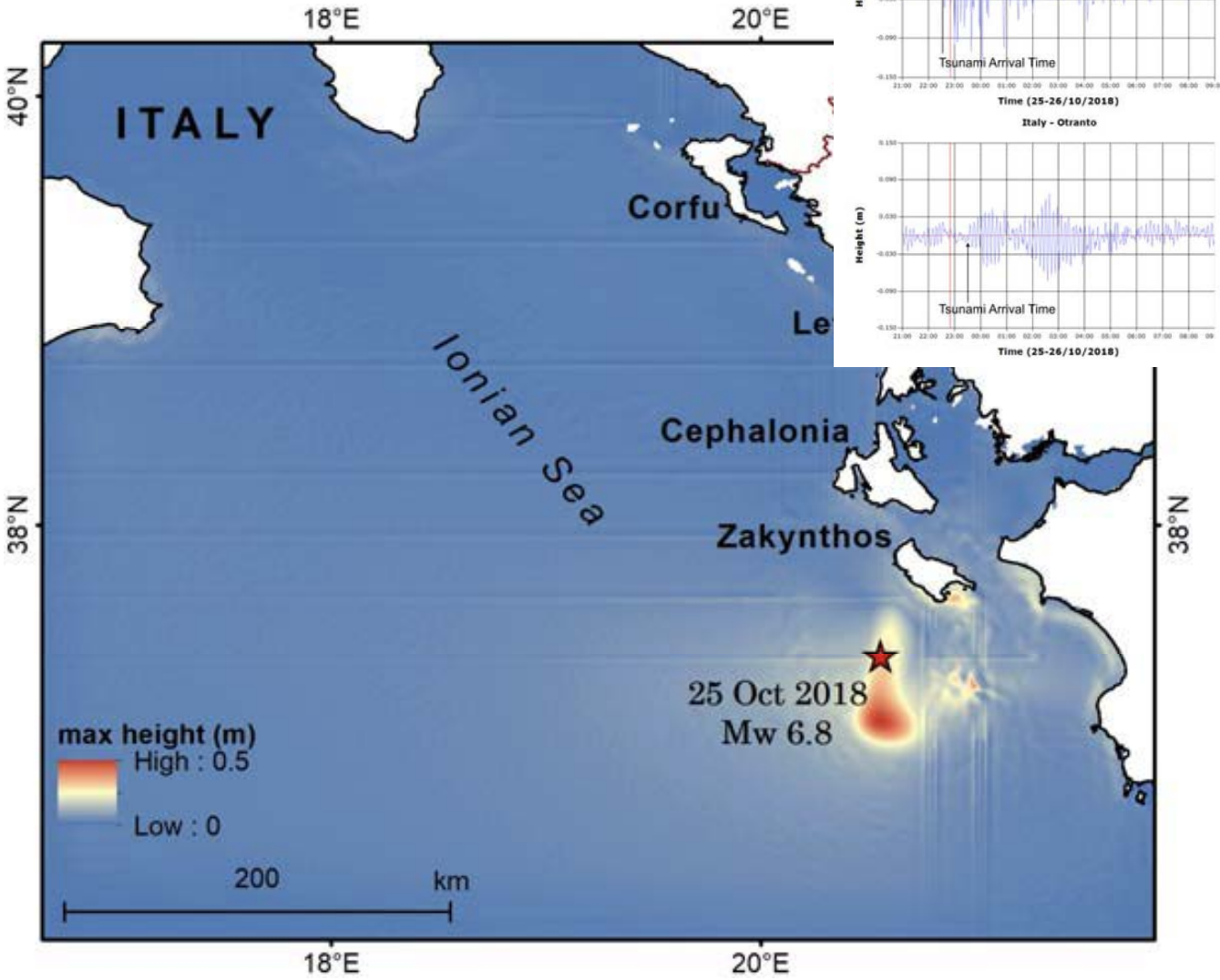
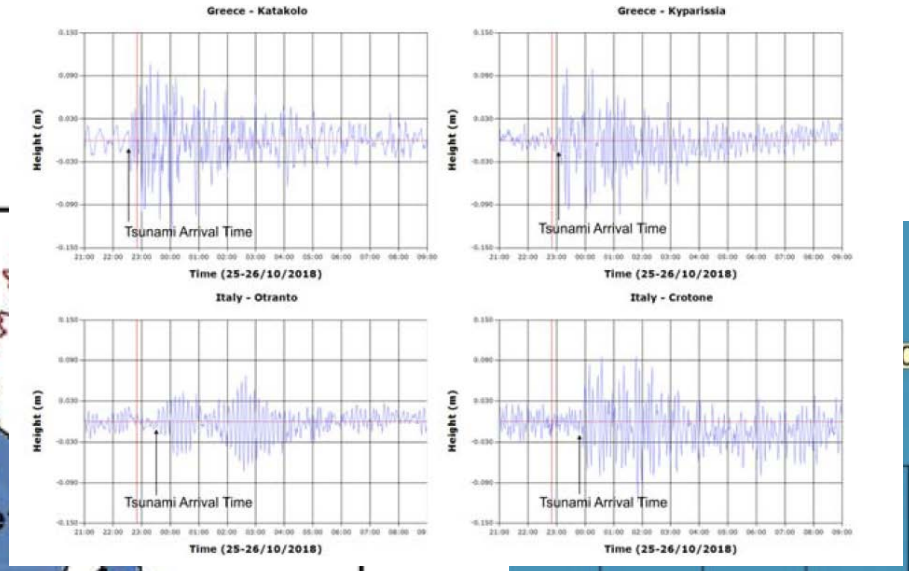
IONIAN ISLANDS

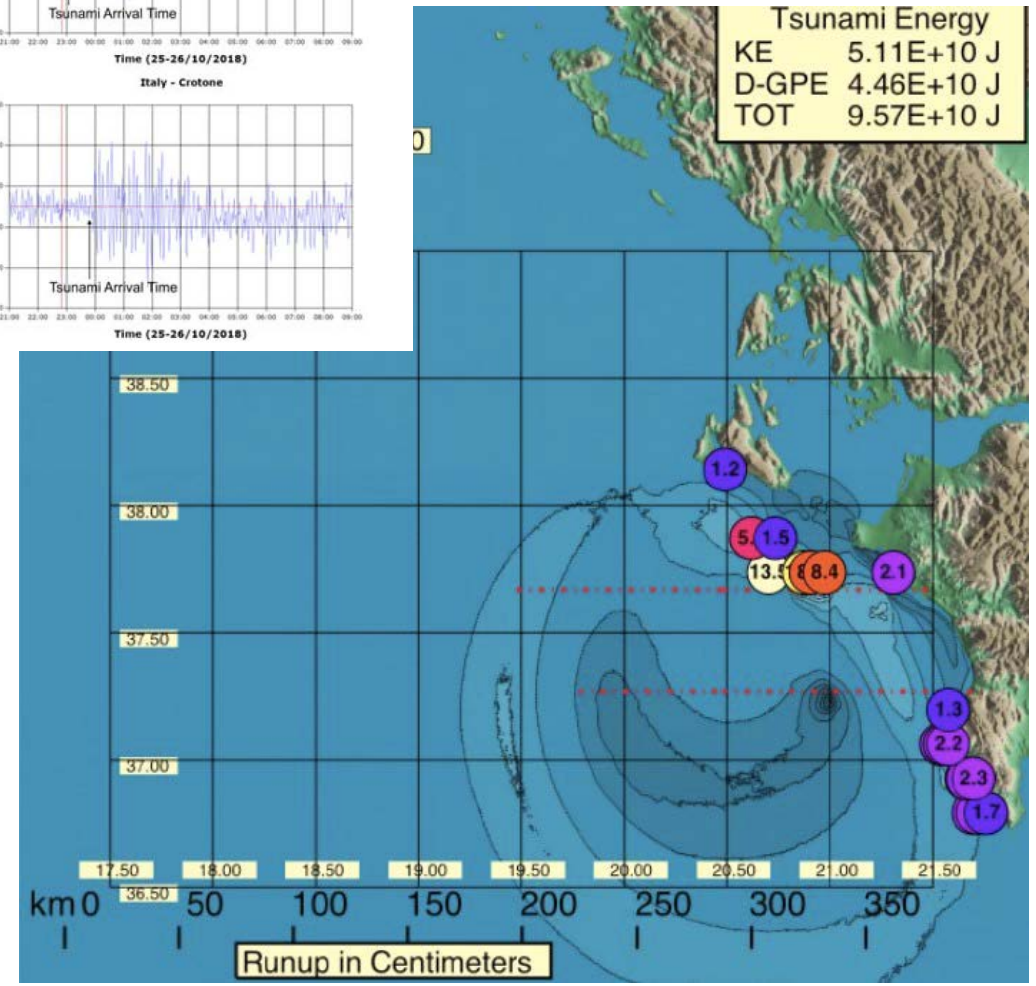
WP7 Monitoring of precursors (NOA)

- T 7.1. Tsunami hazard maps and simulations
- T 7.2. Radon emission monitoring

Zakinthos October 26, 2018 Mw 6.8 Tsunami







WP9 Training & Public Awareness Actions (EPPO)

- T 9.1. Development of standardized training and information material
- T 9.2. Training activities for agencies and stakeholders
- T 9.3. On site and e-learning training of instructors
- T 9.4. Training and tutoring focused on the tourist industry

WP5, WP8 & WP10 Infrastructure Procurement

WP5 (IU)

- 7 Complete seismic stations to be distributed in the Ionian islands
- 1 GPS station to be installed in Ithaca

WP8 (NKUA)

- GIS Server and extensions software to support the development and operation of the innovative system

WP10 (IR)

- Computing equipment for Data Center support
- Communication equipment for Field operations support
- Equipment and tools for NGO's and Agencies

Statue of Telemachus carved by Ludwig Cauer in 1890, displayed in a niche at the foot of the Trillertreppe in the old part of Saarbrücken