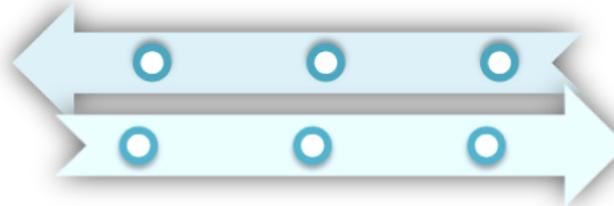




# The EU Copernicus Program and the importance of Earth Observation The European Center of Satellite Remote Sensing BEYOND in Disaster Management, and Civil Protection

**Dr. Charalampos (Haris) Kontoes**

**Head of the Research Center of Excellence BEYOND  
Research Director – National Observatory of Athens NOA**



**Center of Excellence BEYOND ([www.beyond-eocenter.eu](http://www.beyond-eocenter.eu))  
Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing  
National Observatory of Athens**

# World hunger in numbers

(Source : United Nations )

- **11.3% of the world's population suffers from hunger**
- **805 millions of people consume less than 2100 calories per day**
- **25,000 die from hunger every day**
- **9.1 millions of people die worldwide each year because of hunger**
- **4 children die from hunger every minute**

**Poverty** is the main cause of hunger

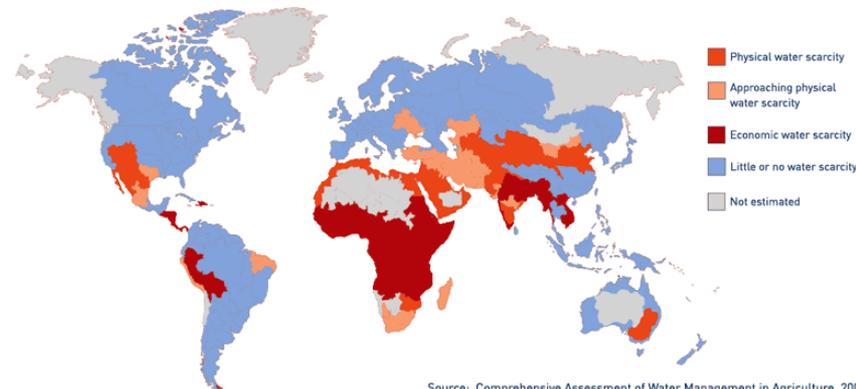
**Poor land-use**, over-exploitation of resources, and **lack of knowledge** in supporting the agricultural policy are factors that opposed to food security, rural economy and environmental/ ecological protection



# Water scarcity

(Source: United Nations)

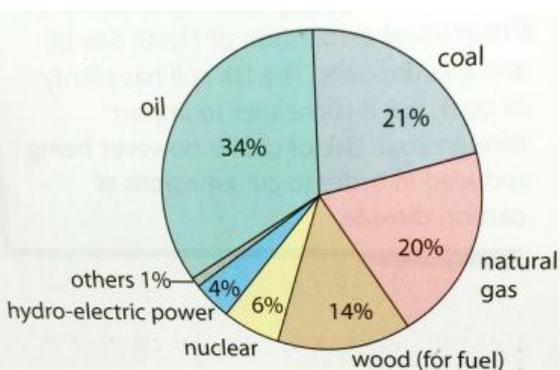
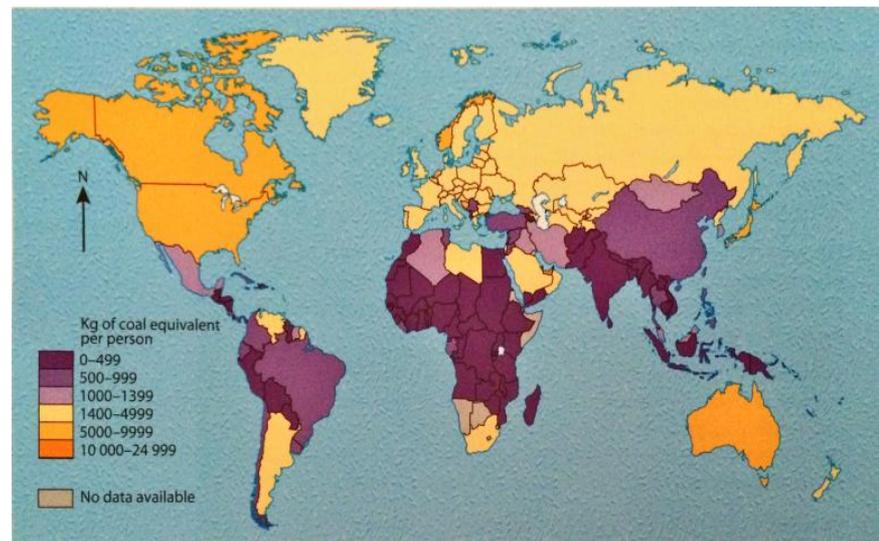
- **2.8 billion people around the world** suffer from water scarcity for at least one month every year
- **1.2 billion people** lack access to clean drinking water
- **2.4 billion people** are exposed to diseases such as **cholera, typhoid fever** and others due to water scarcity
- **The absence of clean water and drainage systems contribute to infectious diseases**, with a huge impact on deaths worldwide
- **The irrational use, and the inability to know the water balance**, combined with **climate change** are the main water scarcity factors



Source: Comprehensive Assessment of Water Management in Agriculture, 2007

## Energy

- **The demand for energy is rising and** is linked to the development of countries
- **Europe and N. America consume 70%** of the world's energy stock, although it accounts for 20% of the world's population
- **Negative energy balance** has been noted worldwide
- Energy is produced from **coal, petroleum, natural gas**, and a small amount of renewable energy resources (solar/ wind energy, water resources)

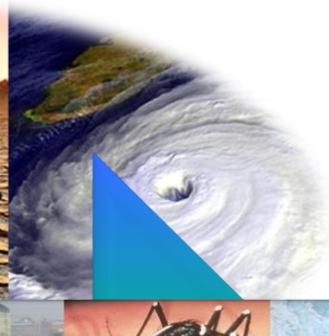
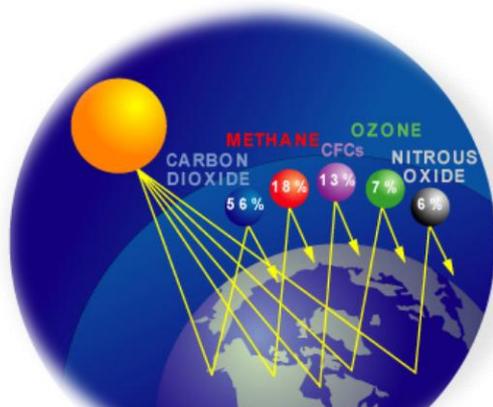


**EC: Year 2030,  
27% of energy  
from  
renewable  
sources**

**Egypt: Negative  
energy balance 2022**

# Climate change

- 1 in 9 people are forced to migrate due to climate change
- 220 million people are expected to migrate in 2020 due to the climate change phenomenon
- 1 billion will be forced to leave Africa in the next 30 years due to drought and desertification



Effects of Global Wa

# ANALYSIS OF THE FLOOD EVENT 15/11/2017 IN WEST ATTICA USING SATELLITE REMOTE SENSING

FloodHub

**BEYOND**  
[www.beyond-eocenter.eu](http://www.beyond-eocenter.eu)



## MANDRA WEST ATTICA



**15 November  
2017**

**The 3<sup>rd</sup> worst  
flooding disaster  
in Attica History  
(based on the  
number of  
deaths)**

**FireHub**



**MATI  
EAST  
ATTICA**

**10 August 2018**

**Deadly  
fire**



## **Peloponnese 2007 – The worst wildfire in forest ecosystems of recent decades**



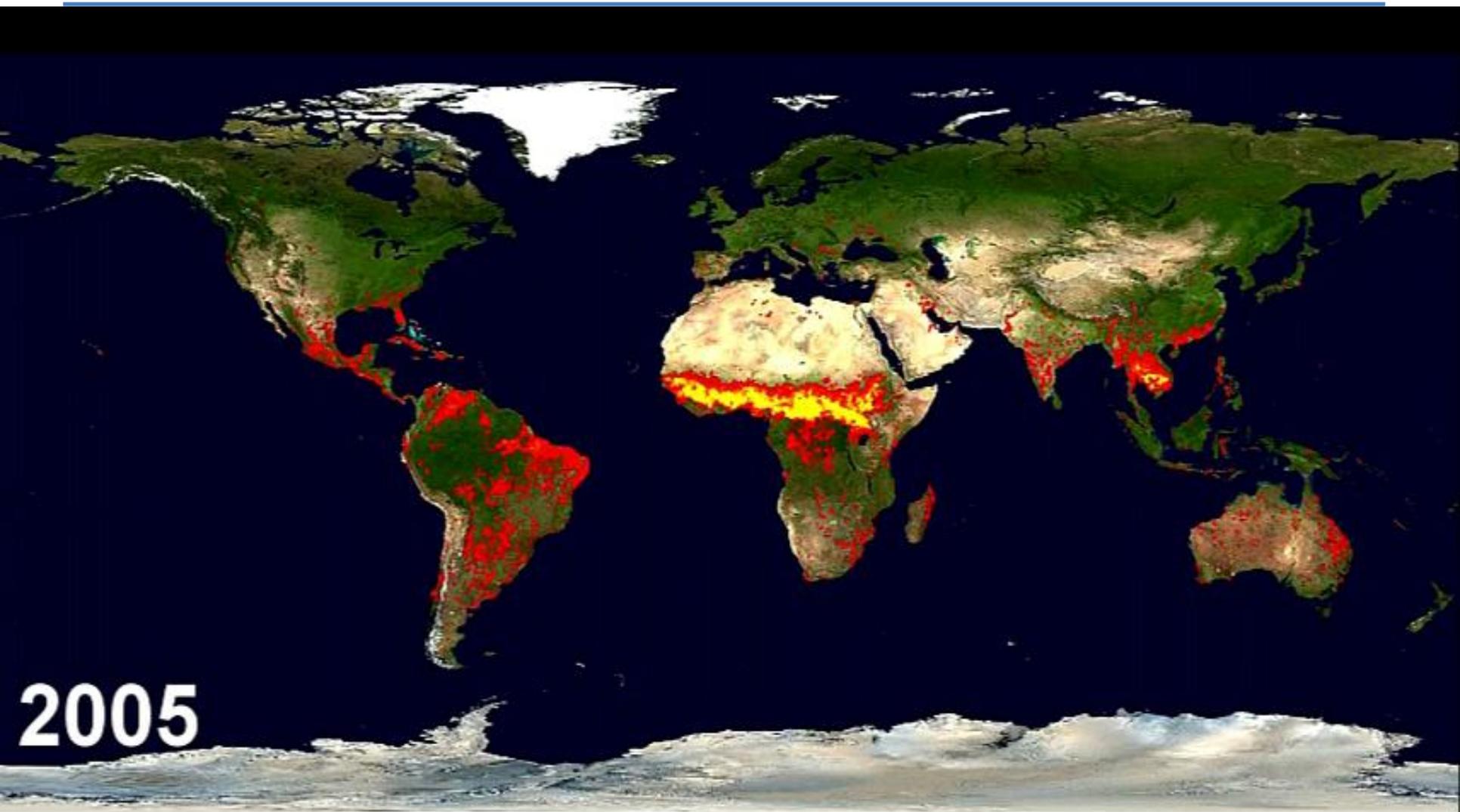
## Peloponnese 2007 – The worst wildfire in forest ecosystems of recent decades

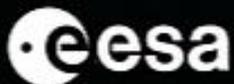


## Peloponnese 2007 – The worst wildfire in forest ecosystems of recent decades

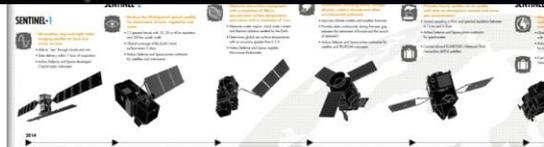


## Global Satellite Fire Detection System





**POLAR ORBIT SATELLITES SENTINELS –  
COPERNICUS PROGRAM**

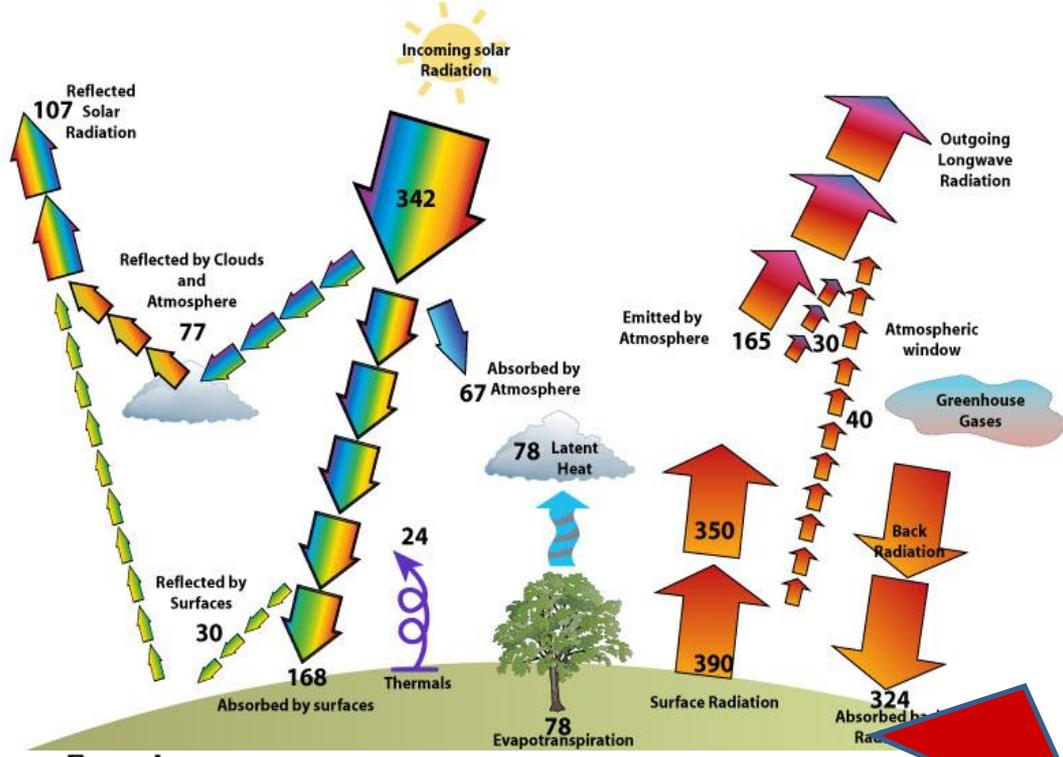
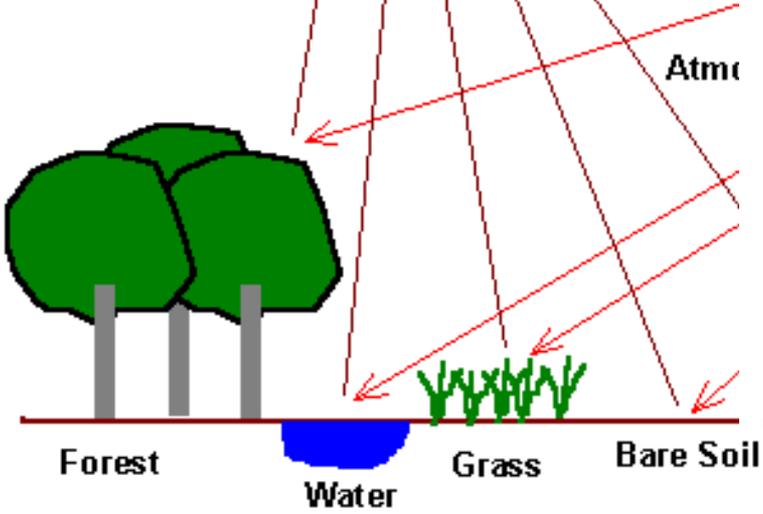


**Sensors technology**

**Satellites**



**Reflected Solar Radiation**



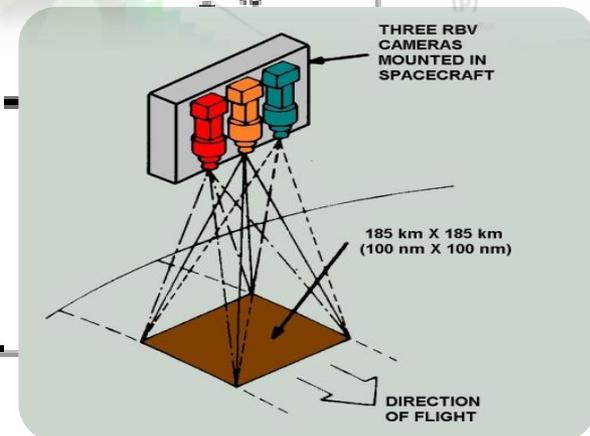
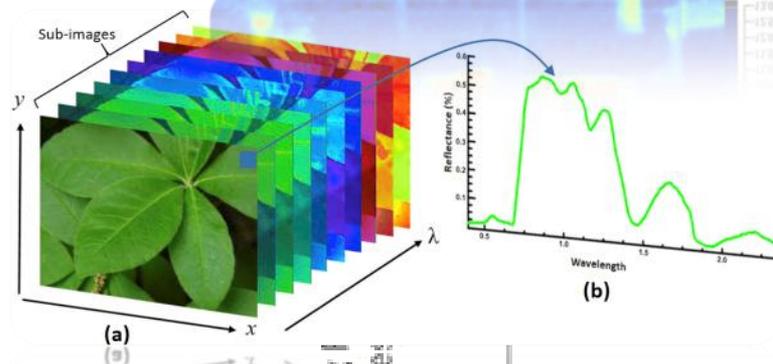
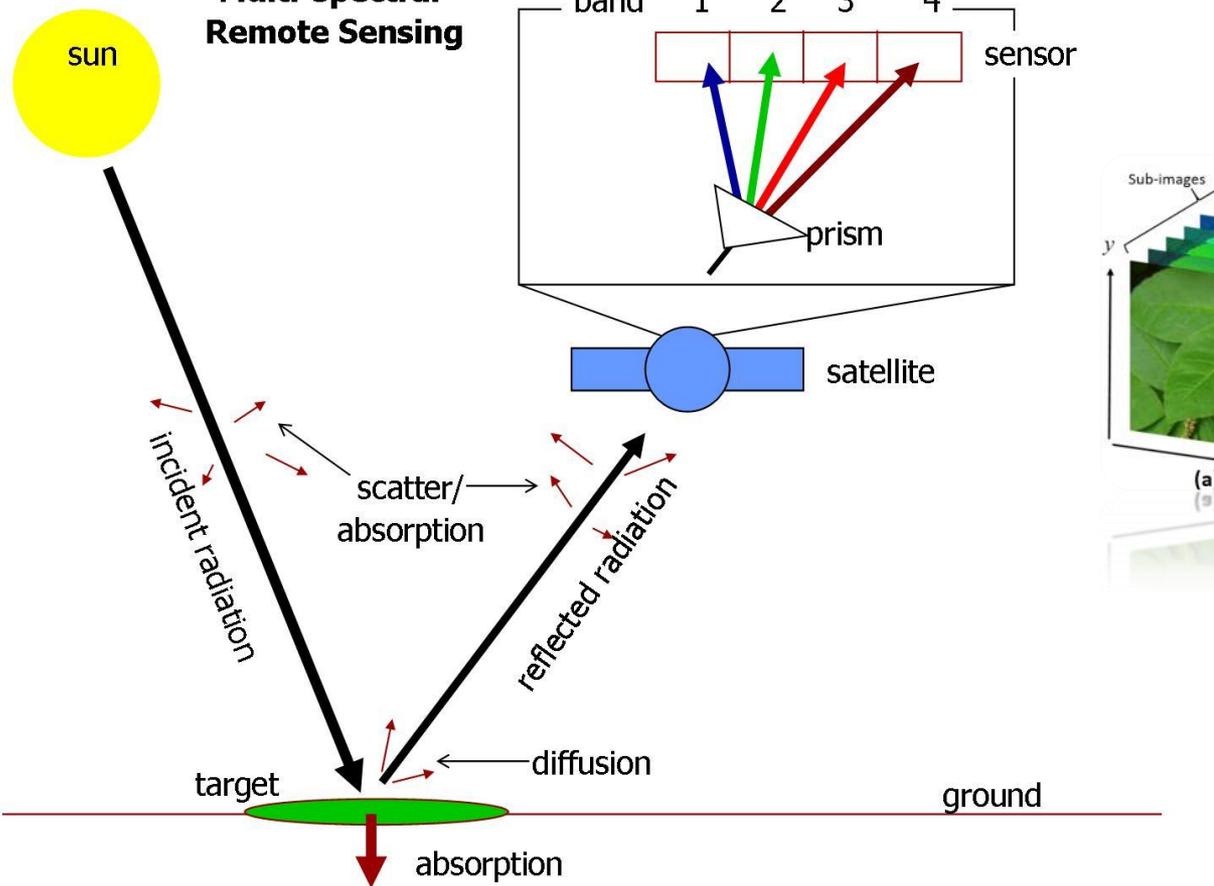
**Electromagnetic energy is emitted from all objects that have a temperature greater than absolute zero (0 K or -273°C).**



### Sensors technology

#### Satellite

#### Multi-spectral Remote Sensing





Flood



Landslide



Earthquake  
Erosion



Fire



Extreme  
Phenomena



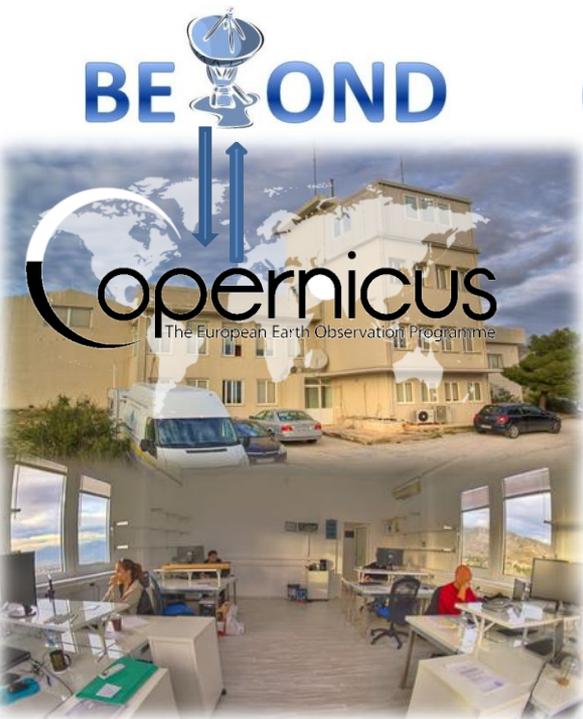
Volcano



Industrial  
pollution



Tsunami



**Aim**

Natural Disasters  
Monitoring

Area of interest:

Southeast  
Europe,  
Mediterranean,  
Middle East,  
North Africa

**Aim**

Risk and disaster  
assessment and  
protection measures

Area of interest:

Global scale

## Monitoring Systems

Satellites  
Polar Orbit  
X-/L-band  
Station  
Sentinel  
Mirror Site

DATA

ANALYSIS/  
PROCESSING

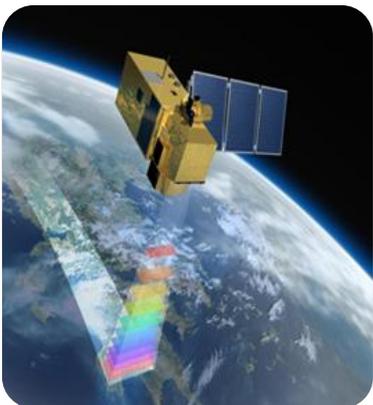
INFORMATION/  
RESULTS

Satellites  
Geostationary  
Orbit  
MSG Seviri

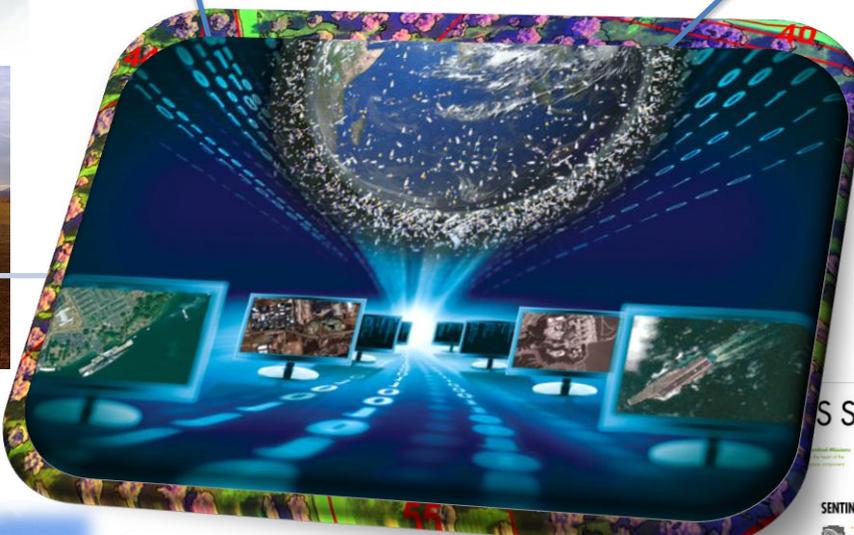


in-sITU

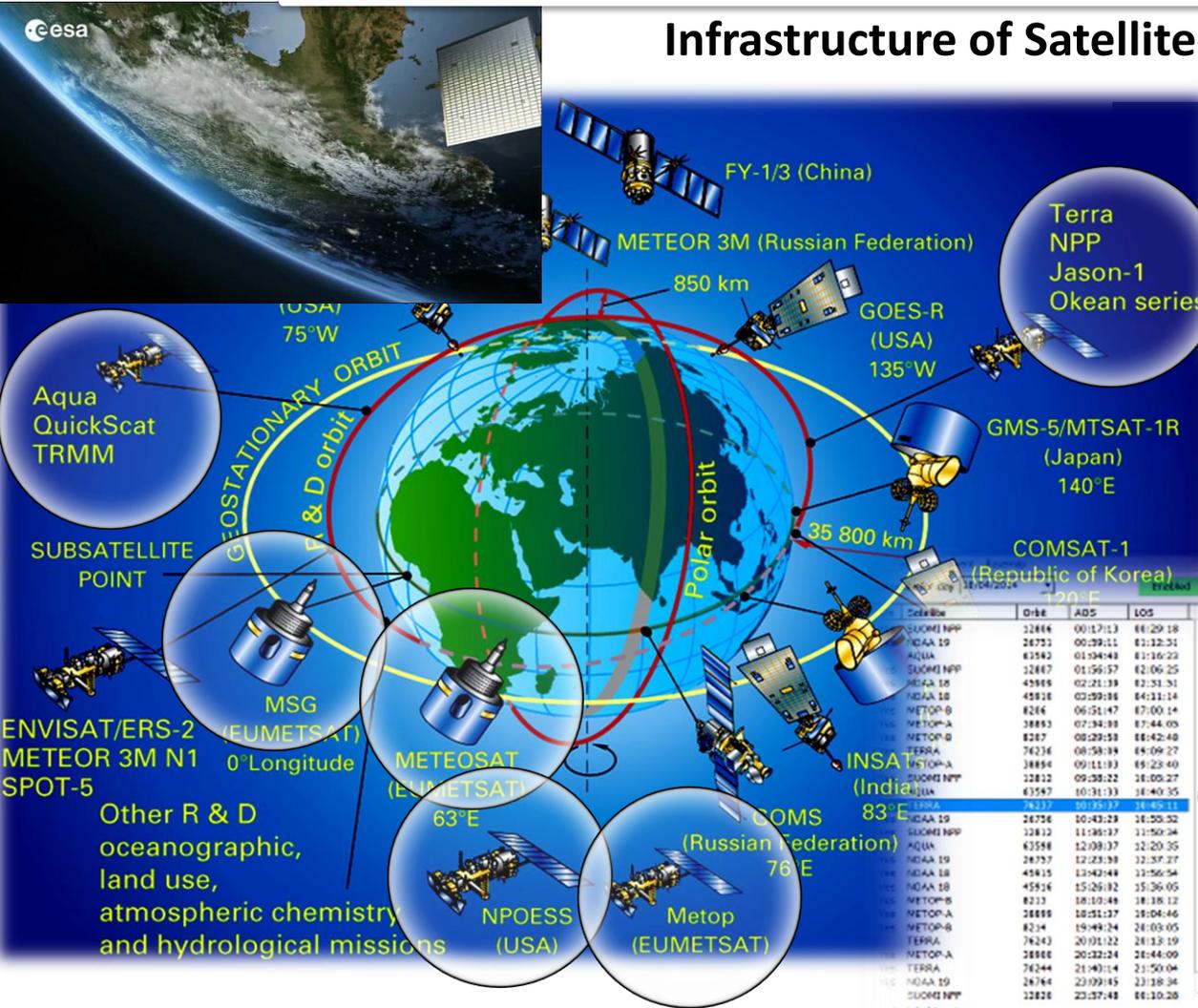
Terrestrial  
Platforms and  
Networks



Aerial Vehicle  
or Unmanned  
Aerial Vehicle



## Infrastructure of Satellite EO Data Collection

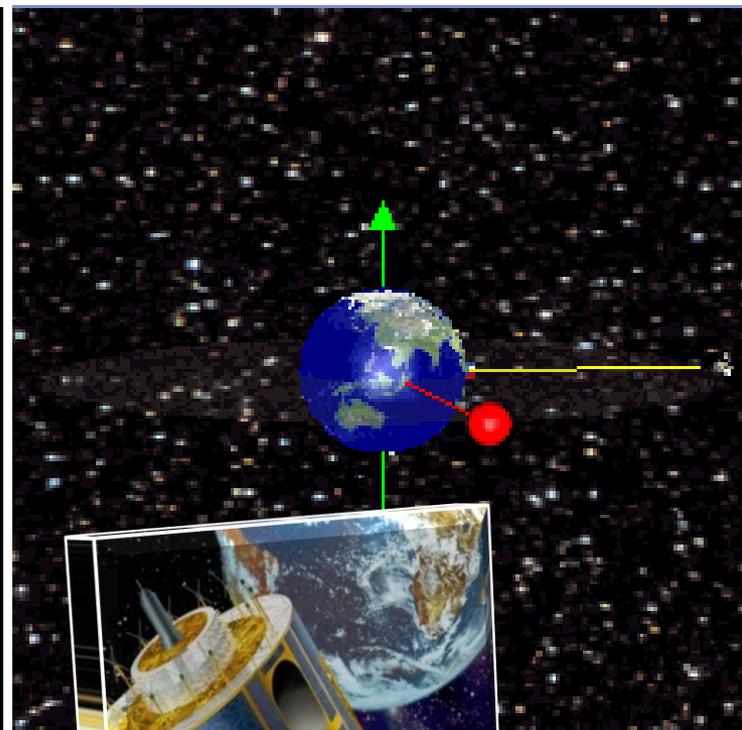
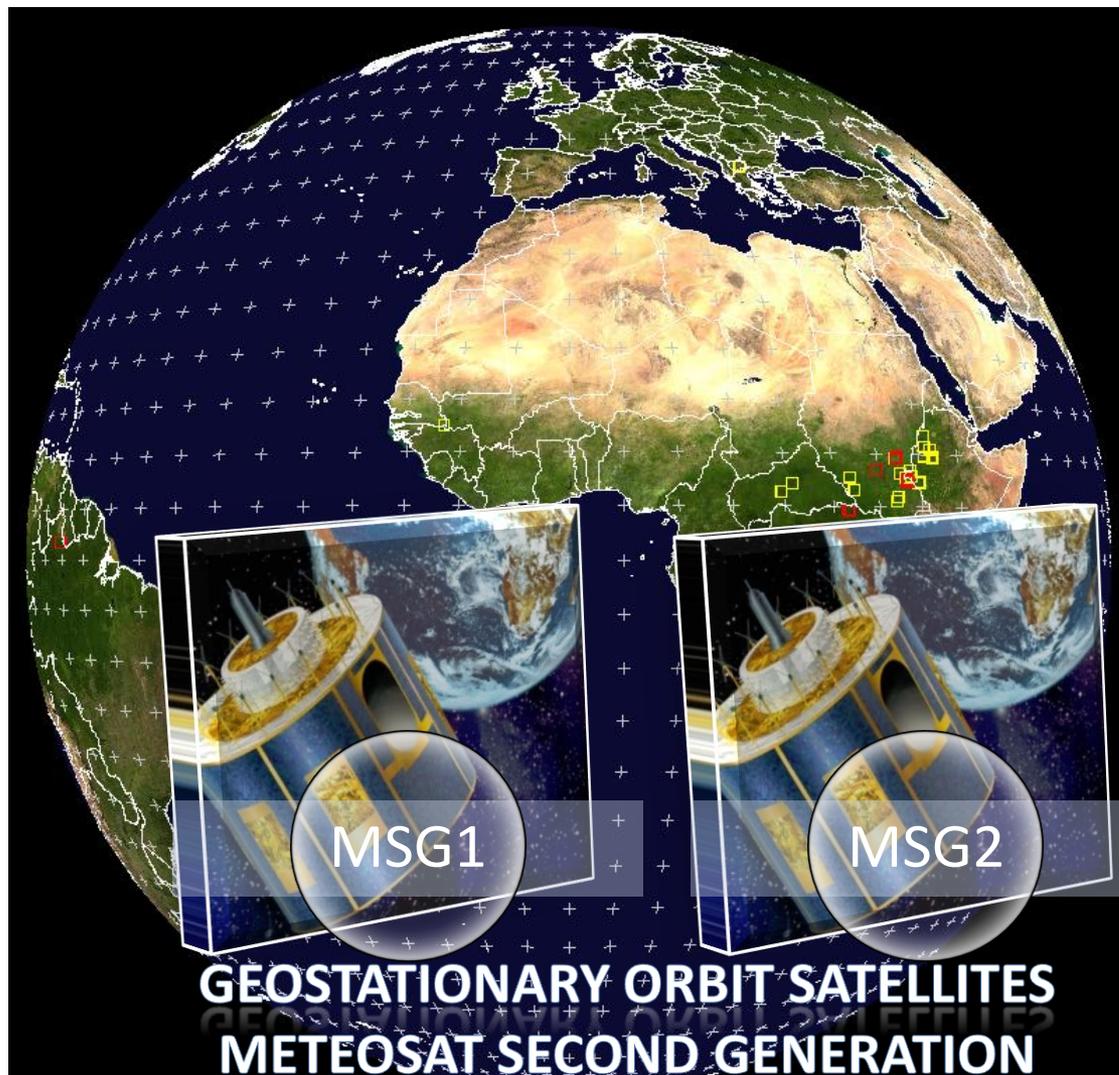


Orbit	AOS	LOS
SUOMI NPP	00:17:13	01:29:18
NOAA 19	00:29:11	01:32:31
AQUA	01:34:48	01:36:22
SUOMI NPP	01:56:57	02:06:25
NOAA 18	02:21:39	02:31:31
NOAA 18	02:59:36	04:11:14
METOP-B	06:51:47	07:00:14
METOP-A	07:34:39	07:44:05
METOP-B	08:29:58	08:42:48
TERRA	08:58:38	09:09:27
METOP-A	09:11:33	09:23:40
SUOMI NPP	09:28:22	10:05:27
NOAA 17	10:31:33	10:40:35
NOAA 19	10:43:29	10:50:32
SUOMI NPP	11:36:37	11:50:34
AQUA	12:08:37	12:20:35
NOAA 19	12:23:38	12:37:27
NOAA 18	13:42:48	13:56:54
NOAA 18	15:26:32	15:36:05
METOP-B	18:10:46	18:18:12
METOP-A	18:51:37	19:04:46
METOP-B	19:49:24	20:03:05
TERRA	20:01:22	20:13:19
METOP-A	20:22:24	20:44:09
TERRA	21:40:14	21:50:04
NOAA 19	23:09:15	23:18:34
SUOMI NPP	23:37:48	00:10:28



**SATELLITES OF POLAR ORBIT, X-/L-BAND  
300TB ARCHIVE – SERVICE 24/7**

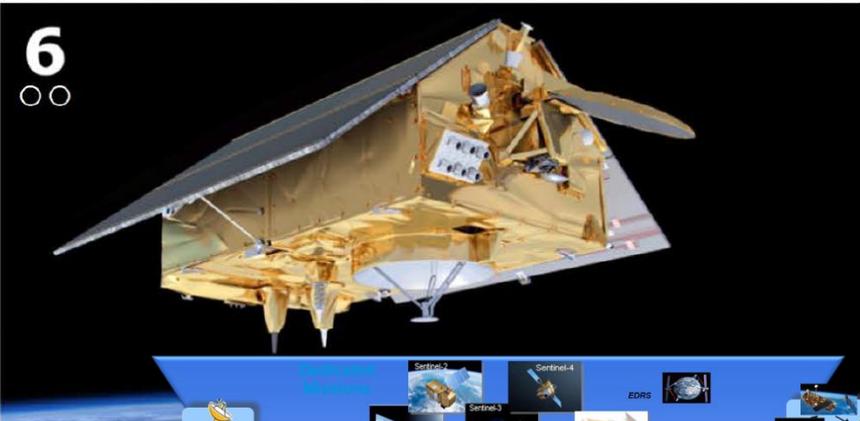
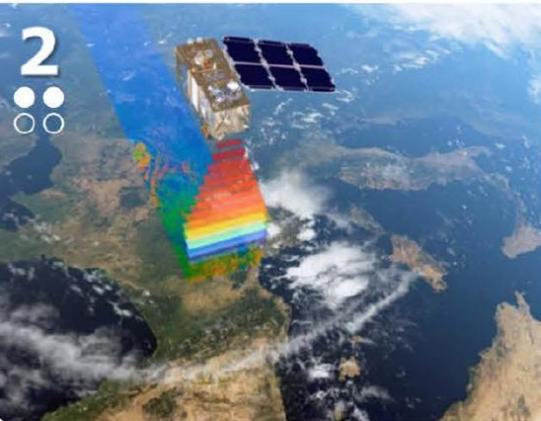
## Infrastructure of Satellite EO Data Collection



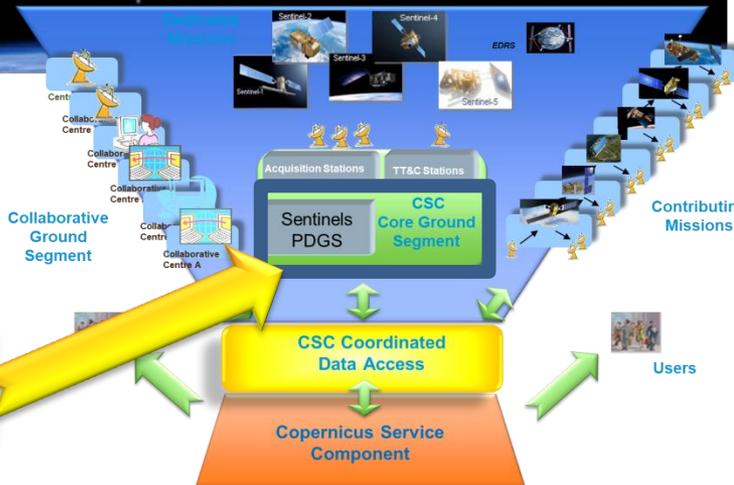
MSG3

**GEOSTATIONARY ORBIT SATELLITES  
METEOSAT SECOND GENERATION**





# Copernicus Sentinel Missions and Data Access



## COPERNICUS and its SENTINELS

**OBSERVING OUR PLANET FOR A SAFER WORLD**

Copernicus follows and greatly expands the work of the European Envisat Programme with a global, continuous and high quality Earth observation capacity, by providing accurate, timely and easily accessible Earth Observation data. The EO data that are constantly collected by the Copernicus Sentinel satellites are used to address the monitoring of six main thematic areas: Atmosphere, Marine Environment, Land, Climate, Emergency and Security.

**SENTINEL-1**

All-weather, day-and-night radar imaging satellite for land and ocean services

- Able to "see" through clouds and rain
- Main Instrument: C-Band Synthetic Aperture Radar (SAR)

**SENTINEL-2**

Medium resolution multispectral optical satellite for the observation of land, vegetation and water

- 13 spectral bands with 10, 20 or 60m resolution and 200km swath width
- Main Instrument: MultiSpectral Instrument (MSI)

**SENTINEL-3**

Measures sea-surface topography with a resolution of 300m, sea and land surface temperature and soil moisture with a resolution of 1km

- Measures water vapour, cloud water content and thermal radiation emitted by the Earth
- Determines global sea surface temperatures with an accuracy greater than 0.3K
- Main Instrument:
  - Ocean and Land Color Instrument (OLCI)
  - Sea and Land Surface Temperature Radiometer (SLSTR)
  - SAR Radar Altimeter (SRAL)

**SENTINEL-5P**

Global observation of key atmospheric constituents, including ozone, nitrogen dioxide, sulphur dioxide and other environmental pollutants

- Improves climate models and weather forecasts
- Provides data continuity during the five-year gap between the retirement of Envisat and the launch of Sentinel-2
- Main Instrument: TROPOMI (TROPOspheric Monitoring Instrument)

**SENTINEL-4**

Provides hourly updates on air quality with data on trace gas concentrations and aerosols in the atmosphere

- Provides information on air quality and supports modelled forecasts
- Main Instrument: METOP - A Advanced Third Generation

## COPERNICUS DATA HUB Operations Center

The dashboard features several key components:

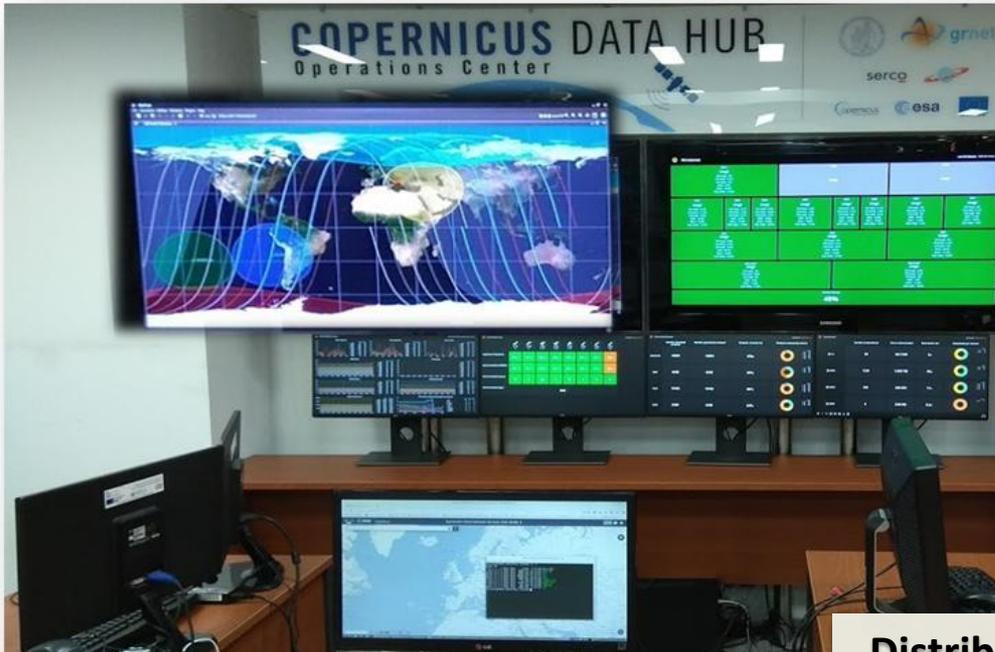
- Top Left:** A large grid of colored boxes (green and purple) representing system status or data feeds, with a 67% indicator at the bottom.
- Top Right:** A world map showing satellite coverage paths and ground stations.
- Bottom Row:** A series of smaller monitors displaying detailed data tables, charts, and system health indicators.

Logos for partner organizations are visible in the top right corner: grnet, serco, Copernicus, esa, and the European Union flag.

### Sentinels Greek Hub | Operations bridge

## Sentinel DataHub PARTNERSHIP ESA – NOA – GRNET S

## COPERNICUS DATA HUB Operations Center



- INTHUB #1
- COLHUB #3
- DIASHUB #3
- AfricaCastHub
- S-5p PreOps Hub
- S-5p Expert Users Hub
- TMPHUB #1
- HNSDMS

**Distributes 55 TB Data/ Day  
Operations 24/7/365  
Speed GEANT 500-700 Mbps**

**60 VMs  
storage: 800 TiB,  
680 CPU cores,  
2.2 TiB RAM**



<http://sentinels.space.noa.gr>

A 550 TB network filesystem for storing > 500 thousand Sentinel products at any time



A high-resolution aerial satellite image of a fjord system. The water is a vibrant blue, contrasting with the brown and tan rocky terrain. The fjord has several narrow channels and inlets. In the upper part of the image, there are patches of white snow or ice. The overall scene is rugged and mountainous.

# Copernicus Overview

# Copernicus – the European EO programme



## European Earth Observation System, led by the EU

### European response to global needs:

- to manage the environment
- to mitigate the effects of climate change
- to ensure civil security

FULL, FREE AND OPEN  
ACCESS TO DATA



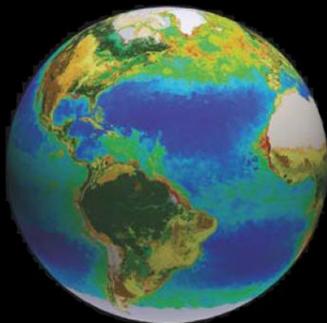
- ATMOSPHERE MONITORING
- MARINE ENVIRONMENT MONITORING
- LAND MONITORING
- CLIMATE CHANGE
- EMERGENCY MANAGEMENT
- SECURITY

**Copernicus**  
Europe's eyes on Earth

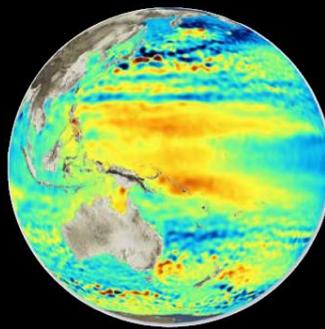
# Global & System View by Copernicus



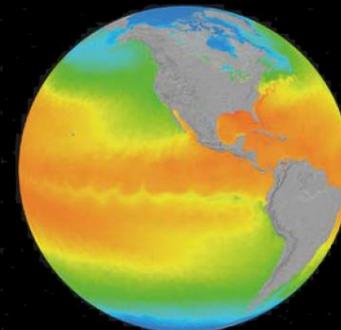
**Chlorophyll**



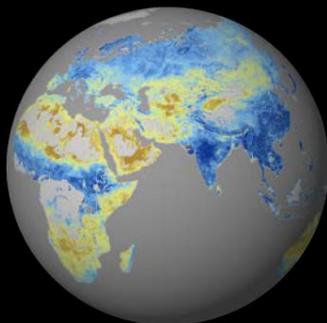
**Sea Level Height**



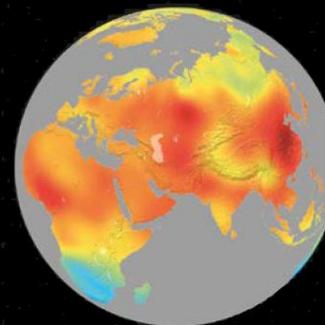
**Sea Surface Temperature**



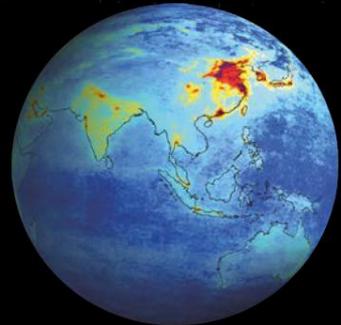
**Soil Moisture**



**Carbon Dioxide**



**Nitrous Oxide**



## Copernicus Core Services

# War - Burning Oil Wells

Al Qayyarah

Iraq

3 November 2016

Sentinel-2A



**Copernicus Core Services**

# Marine Life

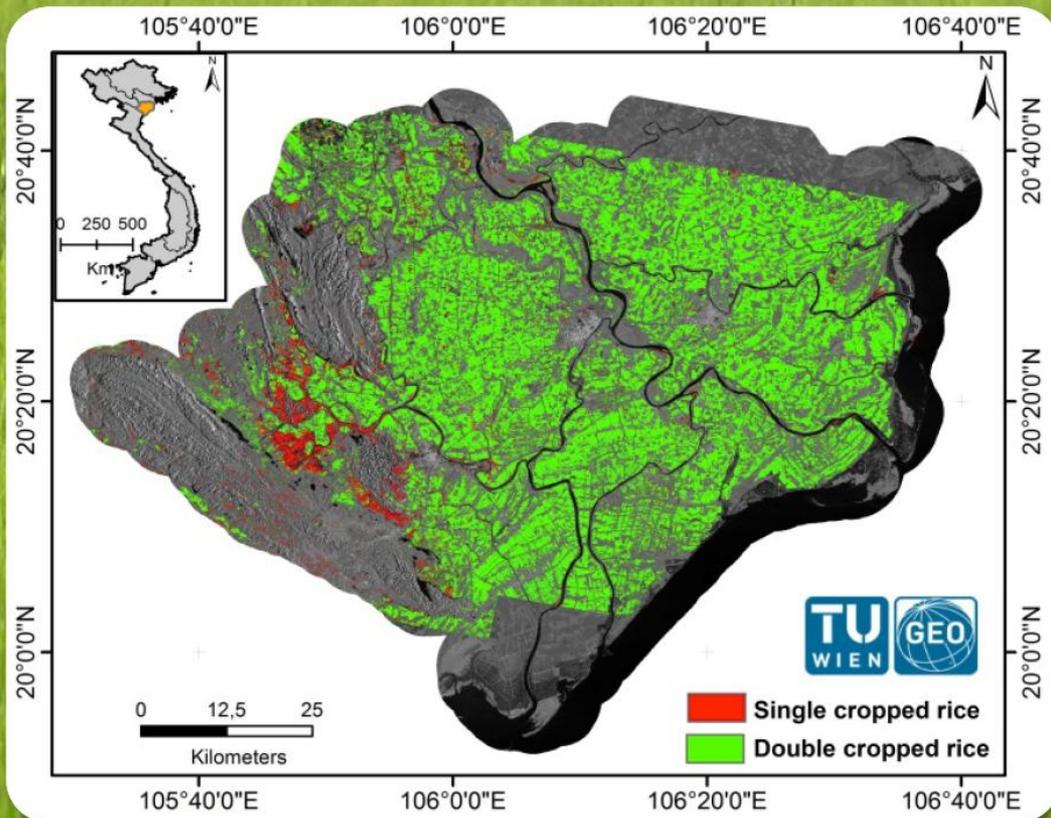


## Fiji – South Pacific

Sentinel-2B  
28 Sep 2017

# Copernicus Core Services

# Monitoring Rice Yields



**Copernicus Core Services**



Flood



Landslide



Earthquake  
Erosion



Fire



Extreme  
Phenomena



Volcano



Industrial  
pollution



Tsunami

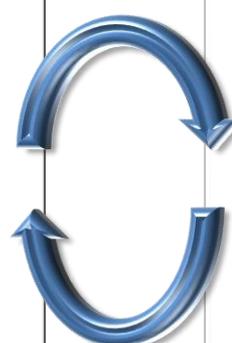


**Aim**

**Natural Disasters  
Monitoring**  
Area of interest:  
**Southeast  
Europe,  
Mediterranean,  
Middle East,  
North Africa**

**Aim**

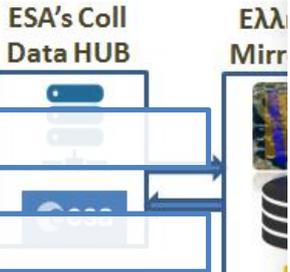
**Risk and disaster  
assessment and  
protection measures**  
Area of interest:  
**Global scale**



## Role of Center of Excellence BEYOND in Global Emergency Management Program Copernicus



- Regulation (EU) No 377/2014 - Copernicus
- Program of work Copernicus
- Sendai Framework – UN Agenda 2015-2030



Home | What is Copernicus | EMS - Mapping | EMS - Early Warning System | News

LATEST NEWS - 2017-03-08 | [EMSN038] Post-disaster situation analyses of flood and landslides in Lima, Peru

**EMS - MAPPING**

- Service Overview
- Who can use the service
- How to use the service
- Products: Rapid Mapping
- Products: Risk and Recovery
- Quality control / Feedback
- User Guide

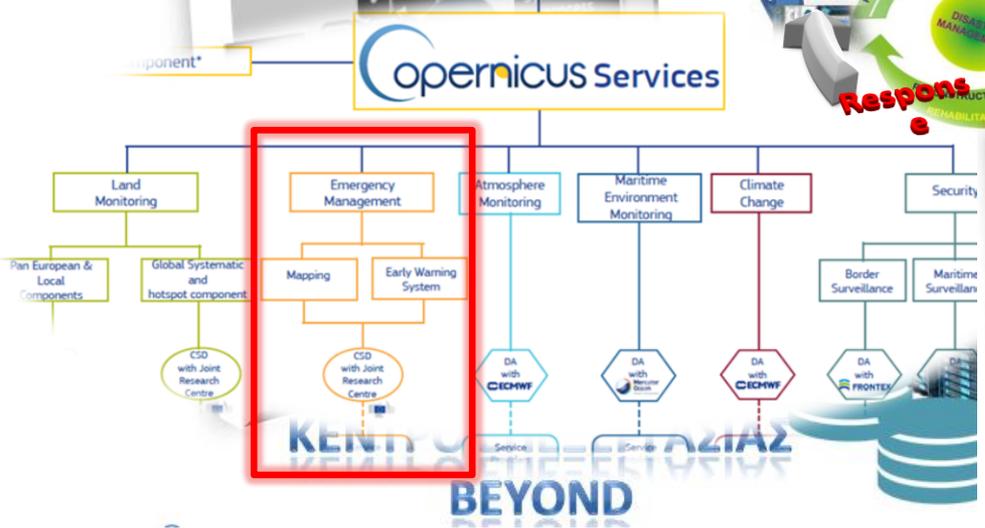
**RAPID MAPPING**

- Activations
- Map of Activations
- GeoRSS Feed

**List of EMS Risk and Recovery Mapping Activations**

Title	Event Type	Event Date (UTC) Start date	End date	Affected Countries
Contains	Drought Epidemic Extreme temperature Humanitarian Infestation Mass movement	E.g., 2017-10-08	E.g., 2017-10-08	Afghanistan Albania Australia Austria Bangladesh Belgium Bermuda

Act. Code	Title	Country/Terr.	Feed
EMSN043	Tsunami risks assessment in Southern Italy	Italy	📍
EMSN041	Forest fire risks assessment in Croatia	Croatia	📍
EMSN040	Nation-wide asset mapping Finland	Finland	📍
EMSN039	Seismic risk assessment in Croatia	Croatia	📍
EMSN038	Post-disaster situation analyses of flood and landslides in Lima, Peru	Peru	📍
EMSN037	Multiple natural hazards risk assessment for UNESCO in three	Chile, Peru,	📍



ESA's Coll Data HUB ↔ Ελληνικό Mirror Site

FloodHub Σύστημα  
GeoHub Σύστημα  
FireHub Σύστημα

Επεξεργασίες - Συστήματα Πληροφοριών

Ground Station, Servers, Synchronizer process, Web users, Outcenter

Activation of BEYOND in the Copernicus Emergency Management Service EMS  
Prevention – Preparedness – Assessment – Response – Recovery

## ACTIVATIONS OF CIVIL PROTECTION 2017-2018



## Copernicus EMS Risk & Recovery Activations

Azores islands, Portugal

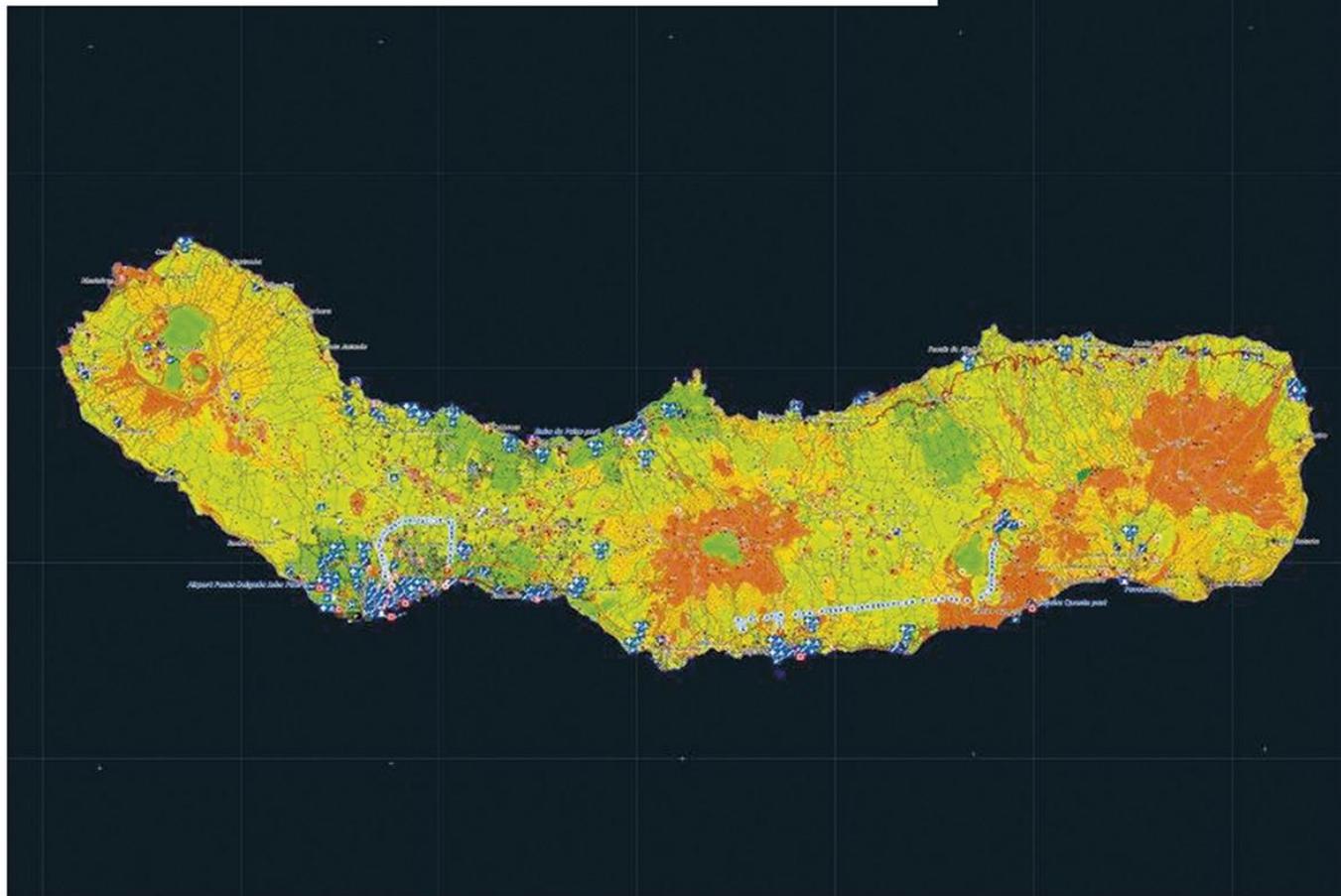
[EMSN018](#)

Multiple natural hazards:

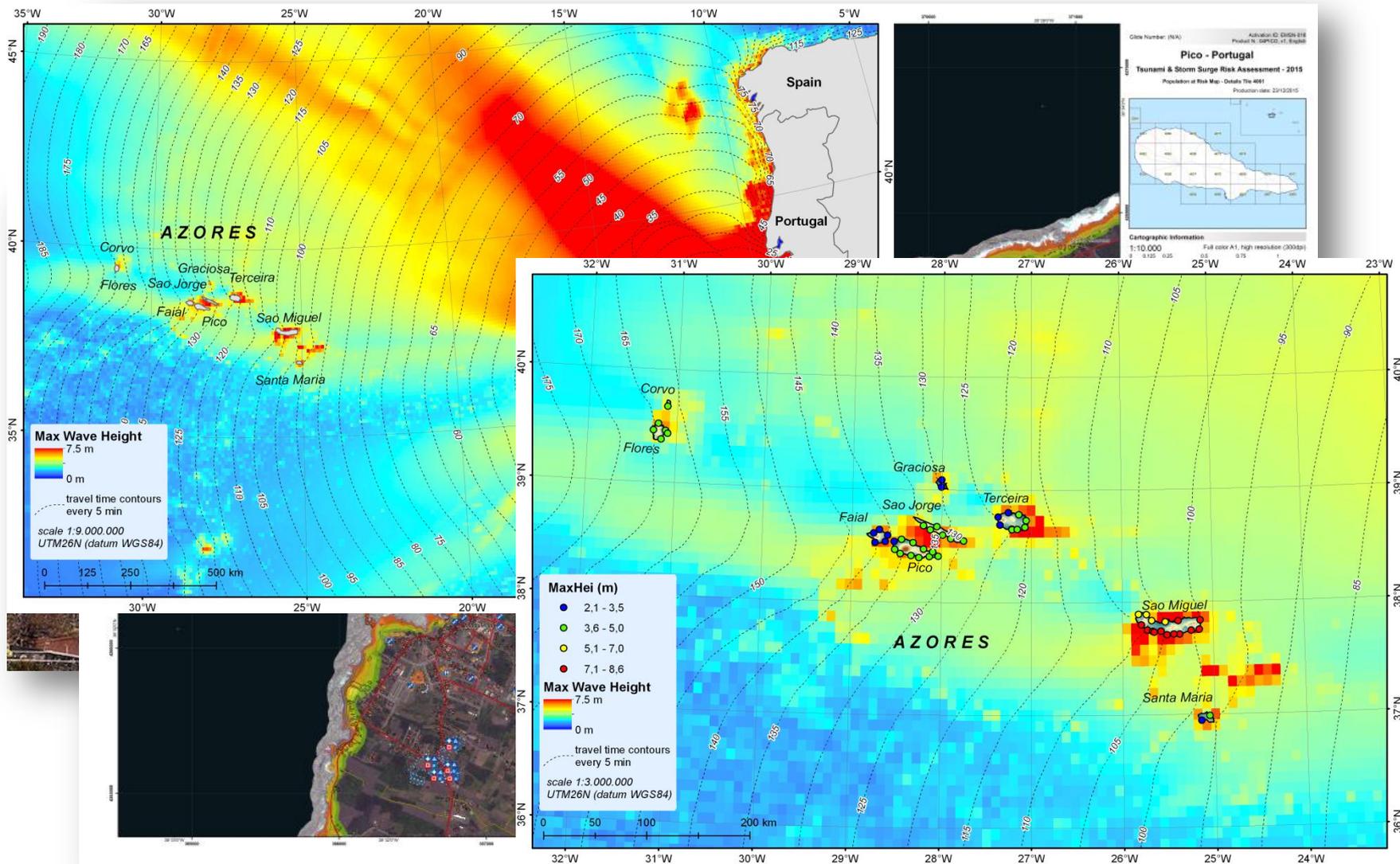
- Seismic
- Flash Flood
- Tsunami & Storm Surges
- Landslide & Erosion
  - Lava Flow
- Coastal Erosion

### Σάο Μιγκελ - Πορτογαλία

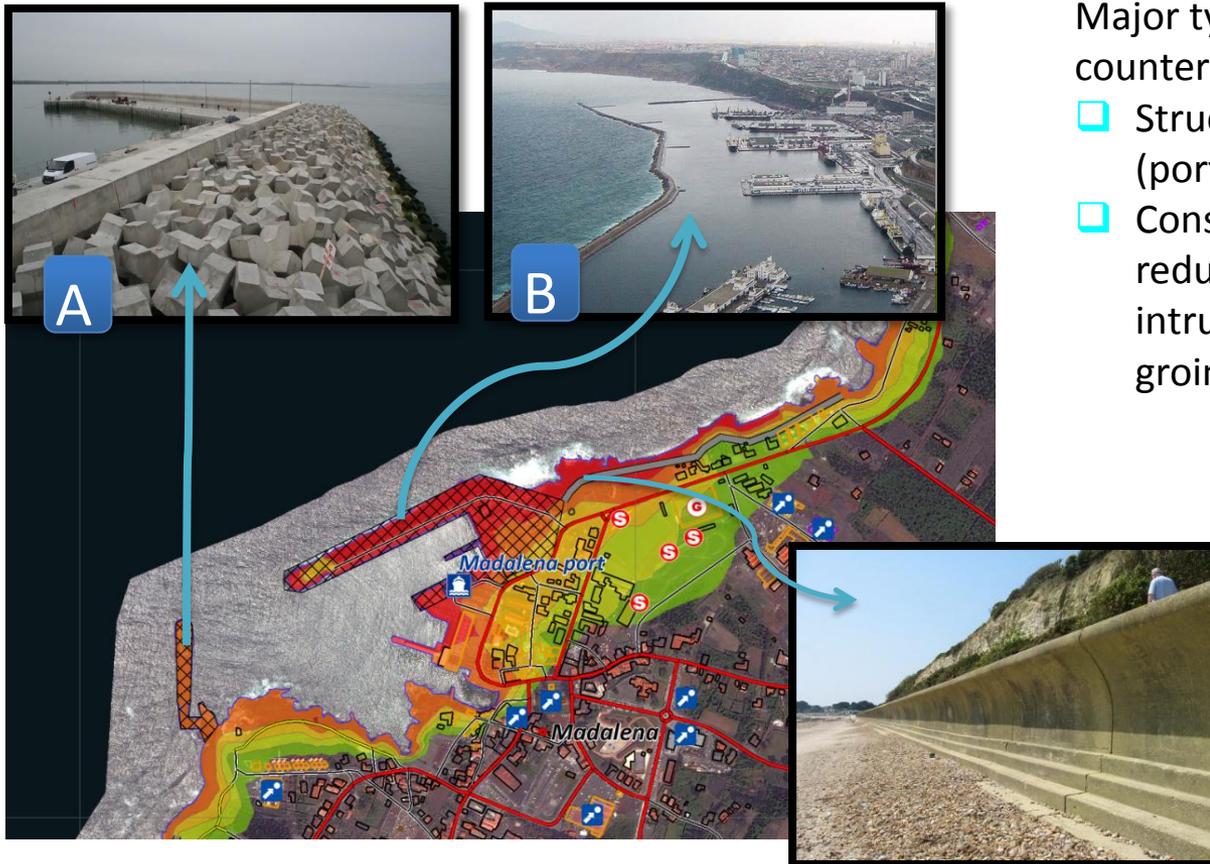
Εκτίμηση κινδύνου για ισχυρές βροχοπτώσεις - κατολισθήσεις, 2015



### Azores activation Tsunami



## Azores activation Tsunami

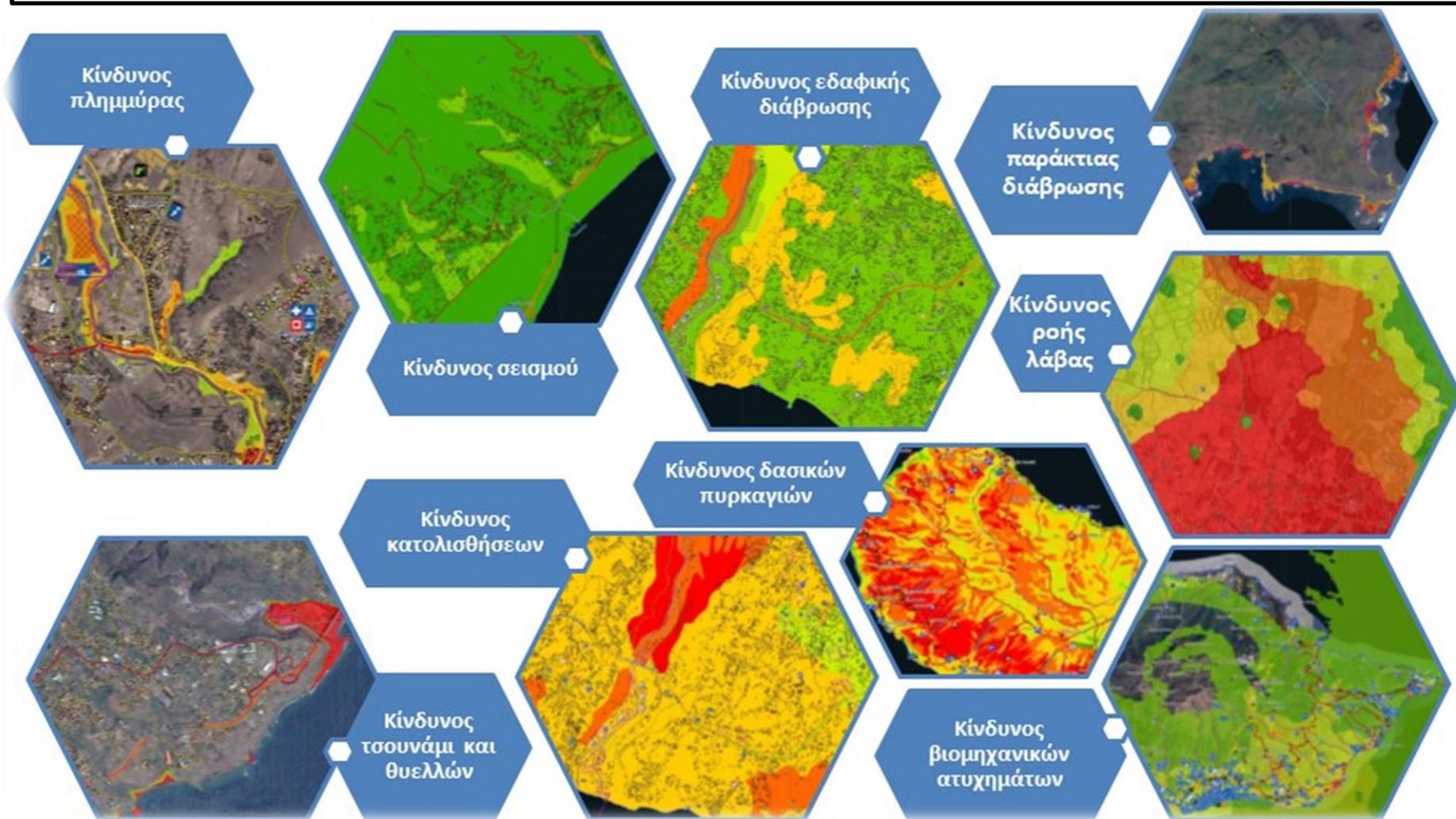


Major types of structural countermeasures:

- ❑ Structural reinforcement of assets (ports & other on-land facilities) [A]
- ❑ Construction of defences in order to reduce tsunami & storm surges intrusion (Breakwaters, seawalls, groins, quays, dykes / levees) [B]

Activation of BEYOND in the Copernicus Emergency Management Service EMS  
Prevention – Preparedness – Assessment – Response – Recovery

**Models that produce thousands of estimates and maps at the critical time**



## Activation of BEYOND in the framework of the European Fire Information System Program Real time EFFIS – Collaboration NOA - DLR-e-GEOS-SERTIT

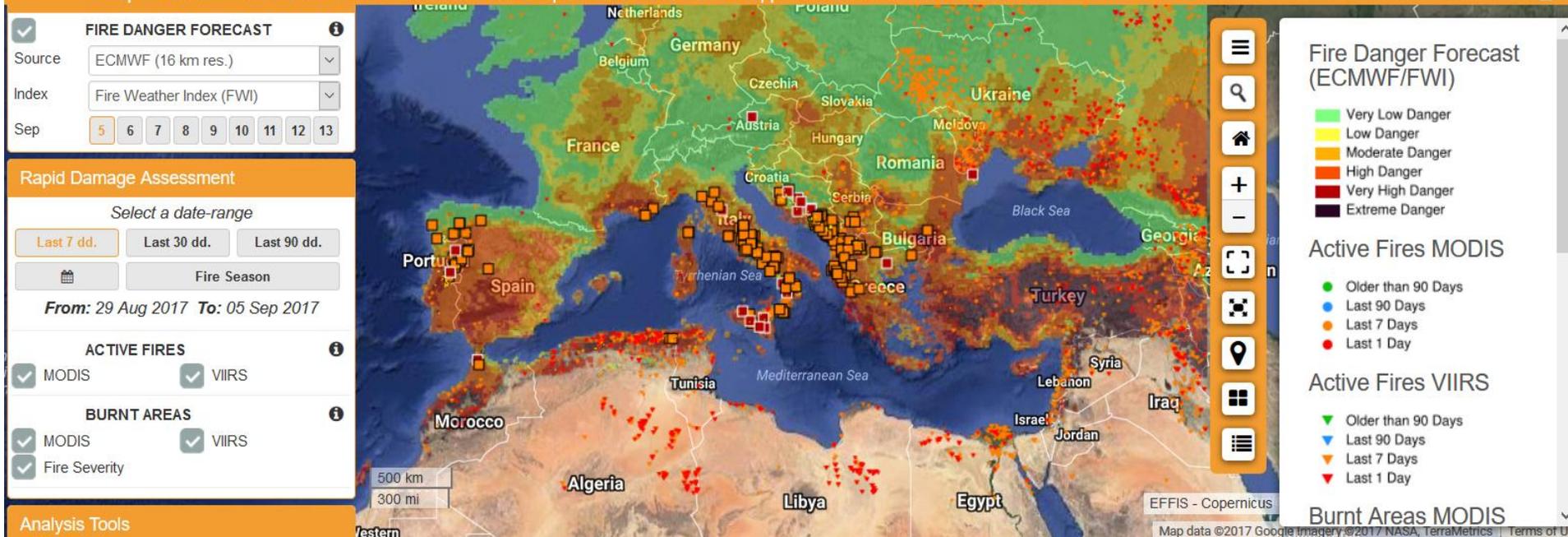


COPERNICUS

Emergency Management Service

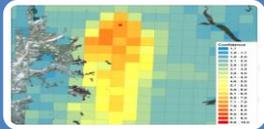


European Commission > JRC EU Science Hub > DRM > Copernicus EMS > EFFIS > Applications > Current Situation Viewer



**Area(s) of responsibility Europe, N. Africa, M. East, Balkans**

# FIREHUB: A SPACE BASED HUB OF FIRE MANAGEMENT SERVICES



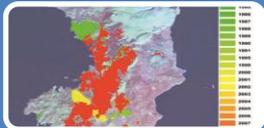
Early fire detection and real-time fire monitoring



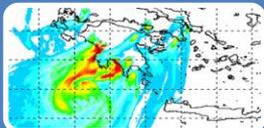
Rapid Burnt Scar and Fire Severity Mapping during crisis



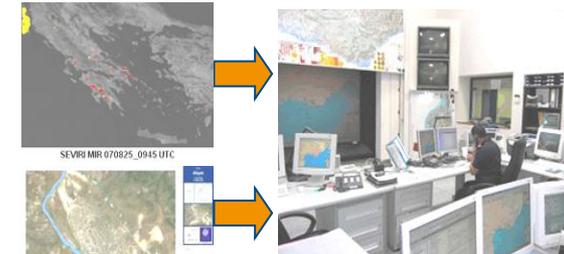
Detailed Burnt Area Mapping and Damage Assessment



Diachronic Burnt Area Mapping and Damage Assessment



Hourly Forecasting of Fire Smoke Dispersion during crisis

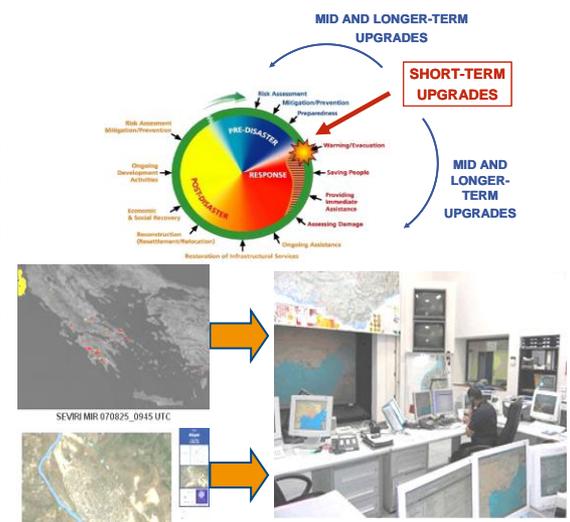


# FIREHUB: A SPACE BASED HUB OF FIRE MANAGEMENT SERVICES

**PATENT  
INDUSTRIAL  
PROPERTY  
ORGANISATION**

10:00 AM  
12:00 AM  
4:00 AM

BEOND  
FireHub



## Regional Real Time Fire Monitoring - NOA's MSG SEVIRI Station – Raw Resolution mode

**Zaharo Fire**

**Aliveri Euboea Fire**

**Olympia site Fire**

**Korinthos Fire**

**Stira Euboea Fire**

**Parnon Mt Fire**

**Taygetos Mt Fire**

**Megalopolis Fire**

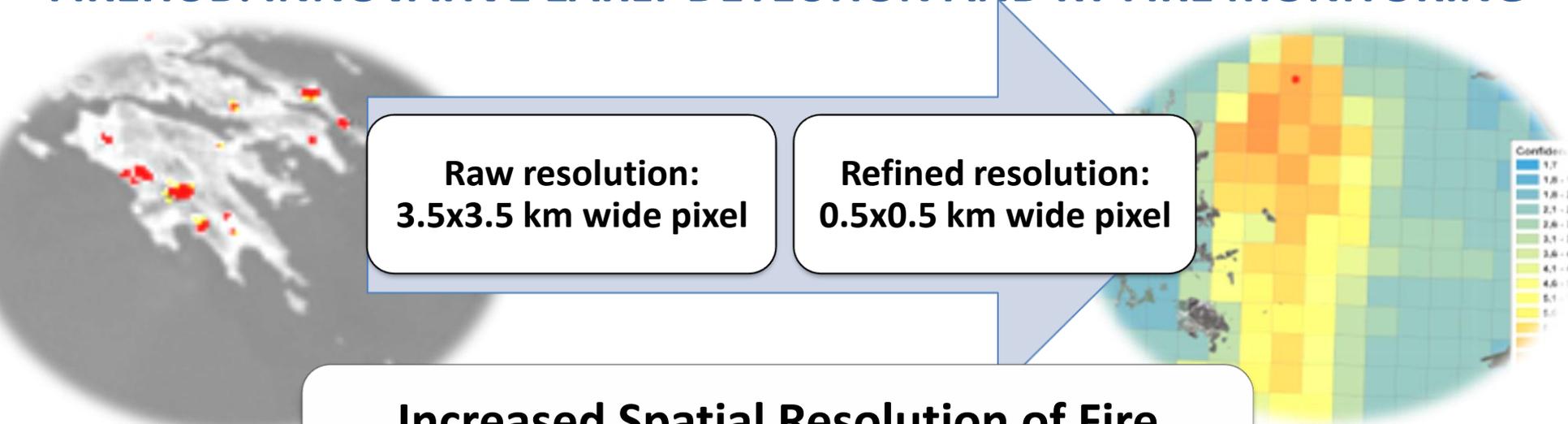
**Oitilon Fire**

**EMERGENCY**

SEVIRI MIR 070823\_1030 UTC

	POTENTIAL FIRE
	CONFIRMED FIRE

## FIREHUB: INNOVATIVE EARLY DETECTION AND RT FIRE MONITORING



**Raw resolution:  
3.5x3.5 km wide pixel**

**Refined resolution:  
0.5x0.5 km wide pixel**

**Increased Spatial Resolution of Fire Monitoring by 50 Times – (500mx500m)**  
– Multi Source Multi Resolution EO Data Fusion in RT

**Meteo Data**  
(Wind Forecasts direction, speed)

**Detailed Fuel Maps & Historical Assessments of Fuel Vulnerability**

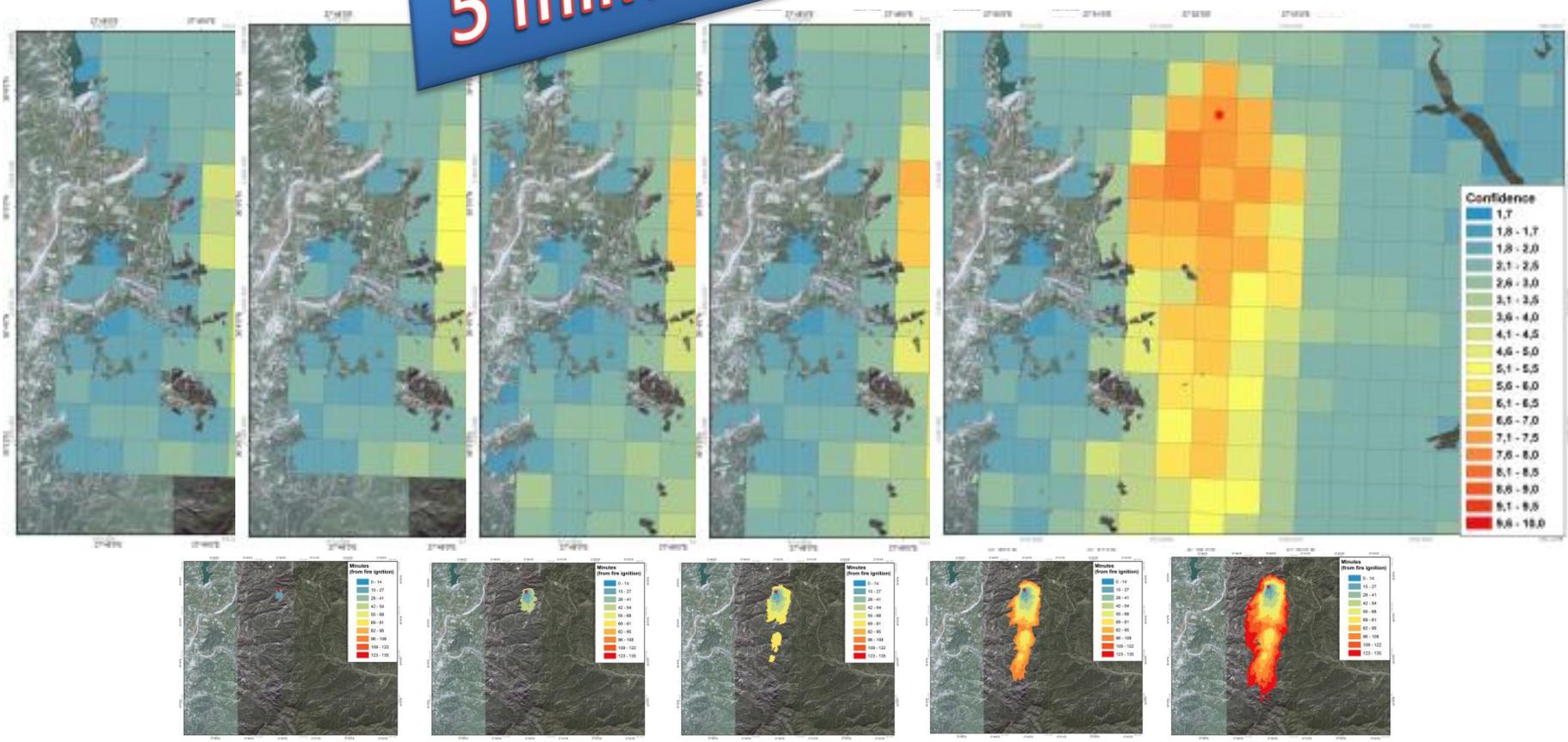
**Geographic Aspects:**  
Altitudinal Zones, Slope/Aspect

**Fire Spread Modelling**  
Assimilation with RT SEVIRI Observations

## Results @ 150 minutes after fire ignition



**5 minutes basis**





SEVIRI Monitor - NOAA-GES

ocean.space.noaa.gov/seviri/ferid\_new/index.php

Google

Google Earth  
L80V/L80  
Toponyms  
Opacity Slider  
CORINE LC 2000

SWoFS  
emeo  
straban

EUMETSAT

Status Info:  
Mode: Archive  
Beginning Time: 2013-07-27 09:00:00 GMT  
End Time: 2013-07-27 10:00:00 GMT  
Total Hot Spots: 377  
Latest Hot Spots: 2013-07-27 10:00:00

Demonstration of the "Real-time fire detection" functionality

Local Time: 27-07-2013 13:10

ID	RANK	Municipality	Date	Sensor	Conf.
757001	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.968319
757011	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.900032
757021	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.968444
757001	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.900032
756991	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.900032
756981	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.753441
757031	96	Δ. Πάφου	2013-07-27 13:10:00	MSG2_RSS	1.968488

Fire Monitoring Service based on MSG SEVIRI

Detected Hotspots - Snapshot

Hotspot: 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 1.0

Year: 2013 Month of Reference: July

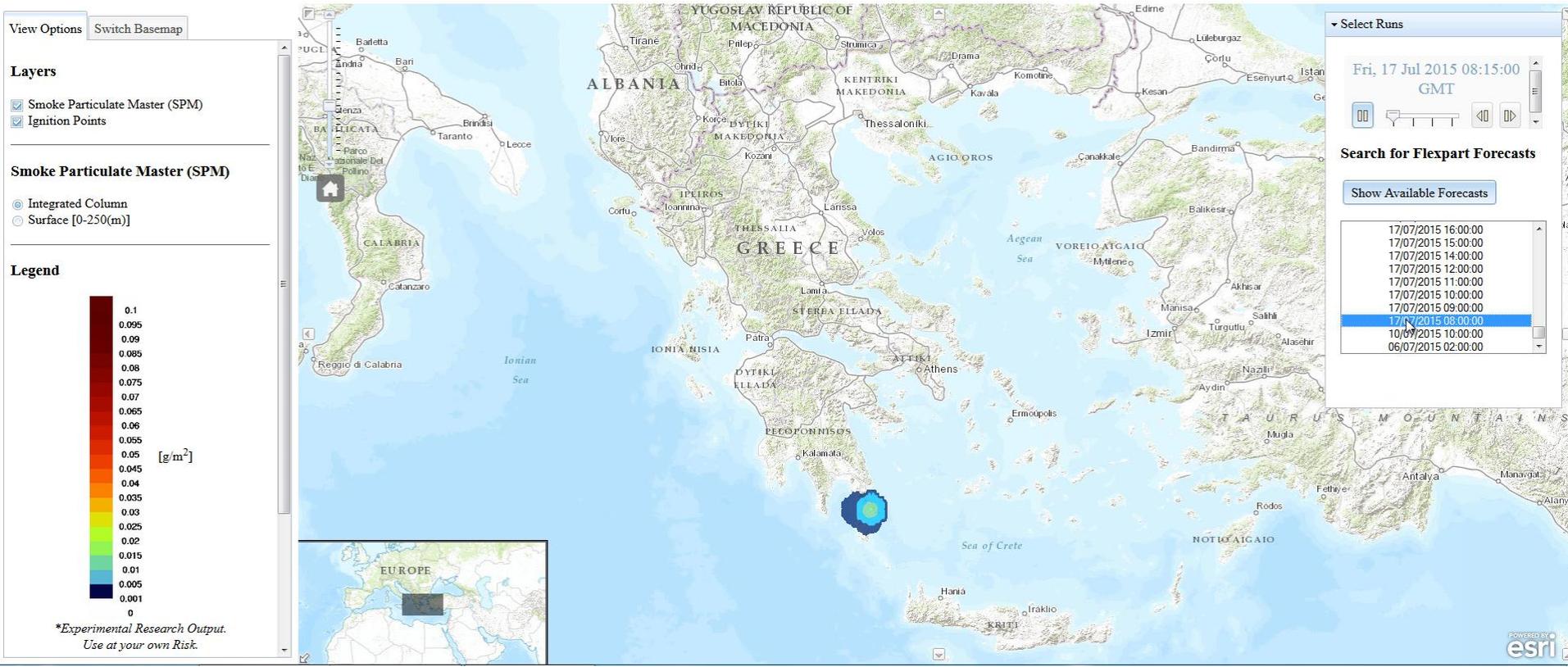
Subtract: 0 1 2 3 4 5 6 7 8 9 10

NOA Implementation Team: [Harris Karim](#), [Theodoros Haniotis](#), [Dimitris Moutakas](#), [Konstantinos Papadopoulos](#), [Anastasios Argyrakis](#), [Theodoros Vassilakis](#)

Contact Email: [fire@noa.gr](mailto:fire@noa.gr)

**Rhodes Island**  
**27/7/2013**

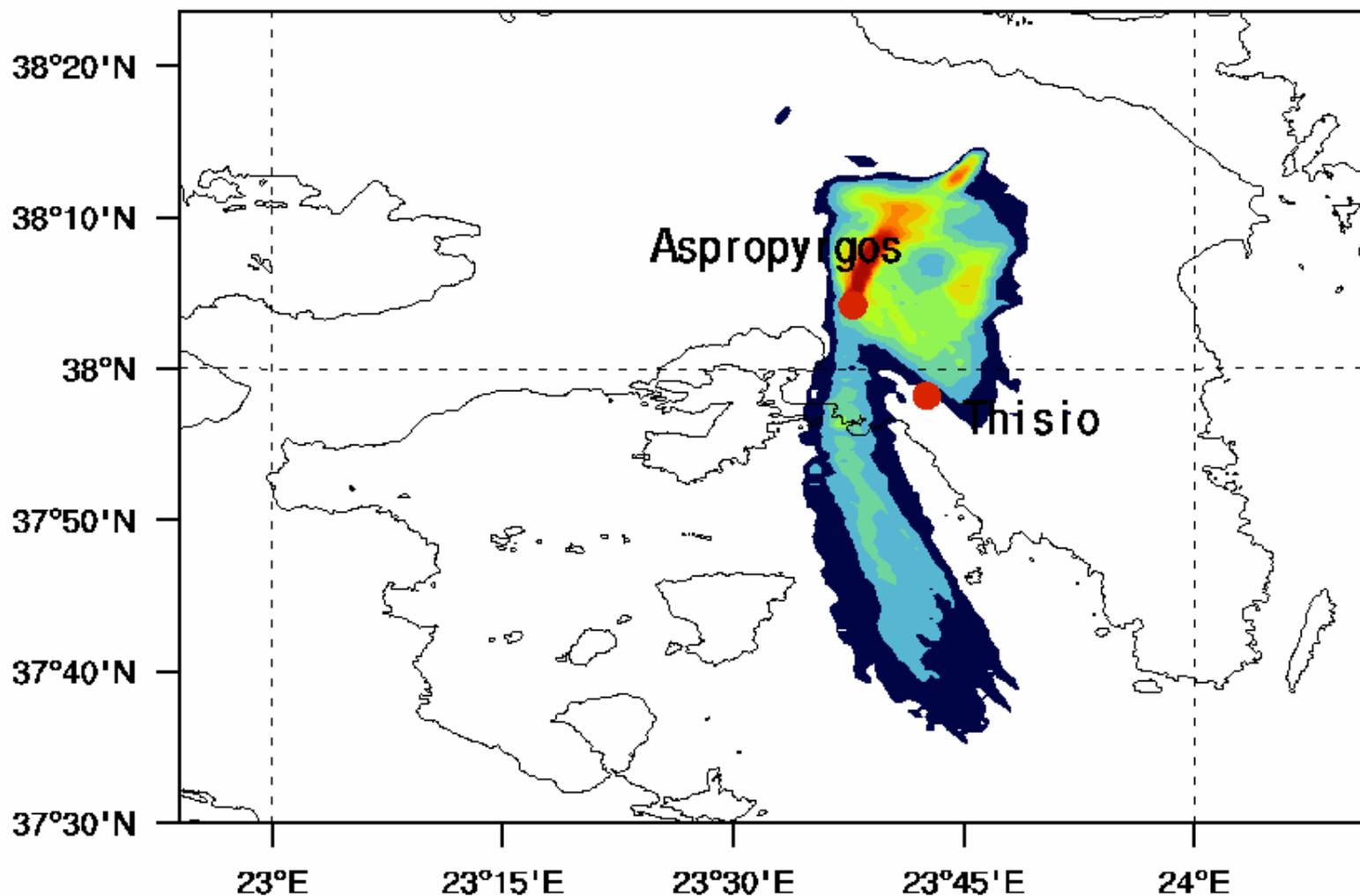




## Spatial and temporal smoke dispersion of the smoke from wild fires

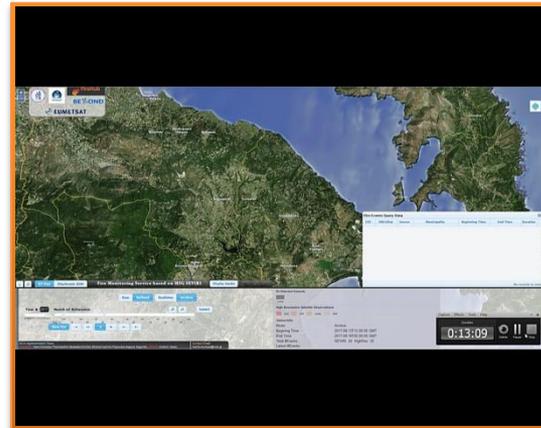
**BEYOND / NOA FLEXPART**  
**Smoke Integrated Column**

**valid:09-06-2015 1300 UTC**  
**(Arbitrary Values)**



## FireHub

First fire detection  
in 10'



Meteosat SG –SEVIRI

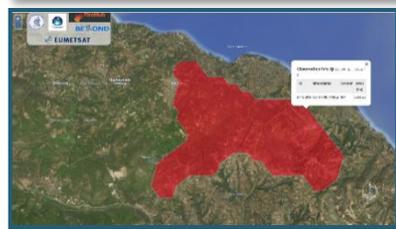
Day #1  
NPP-VIIRS  
MR=375m  
20170817 11:14



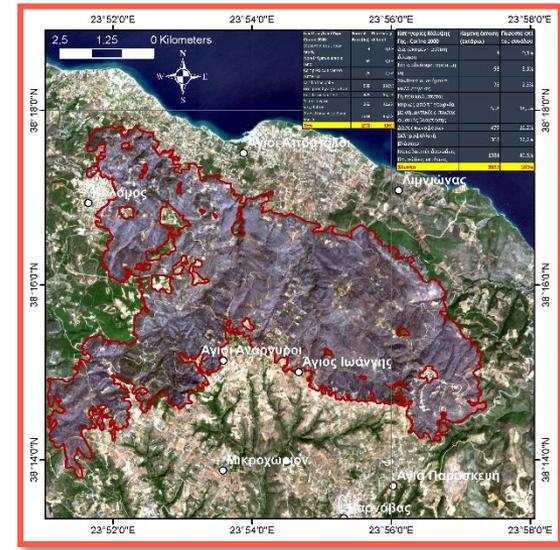
Day #2  
MODIS-Terra  
MR=250m  
20170818\_1055



Day#3  
NPP-VIIRS  
MR=375m  
20170819\_1057



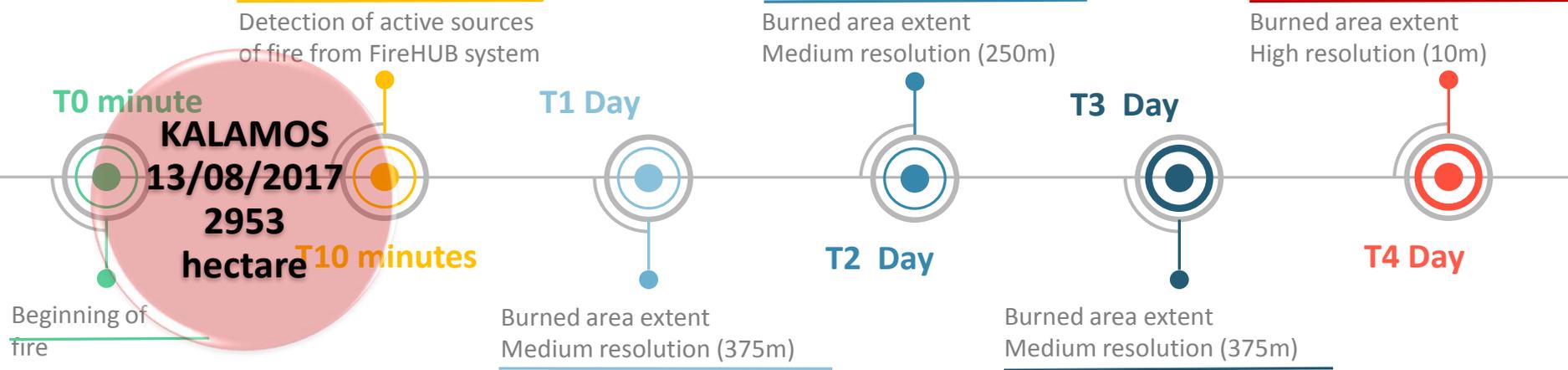
Day #4 Sentinel-2 HR-10 m



**P1** Detection - Fire Monitoring  
- Resolution 500 m/5 minute

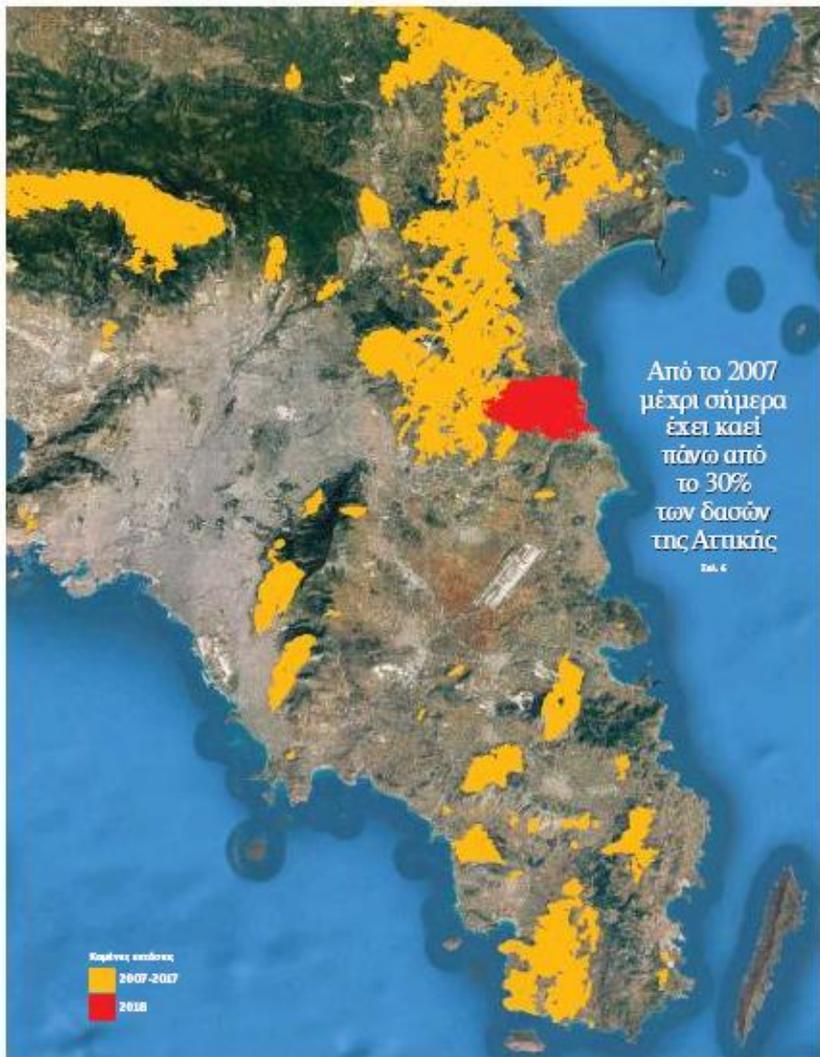
**P2** Rapid daily Mapping at Medium  
Resolution - 2-3 times /day

**P3** Rapid Mapping at High Resolution/  
5 days



FireHub

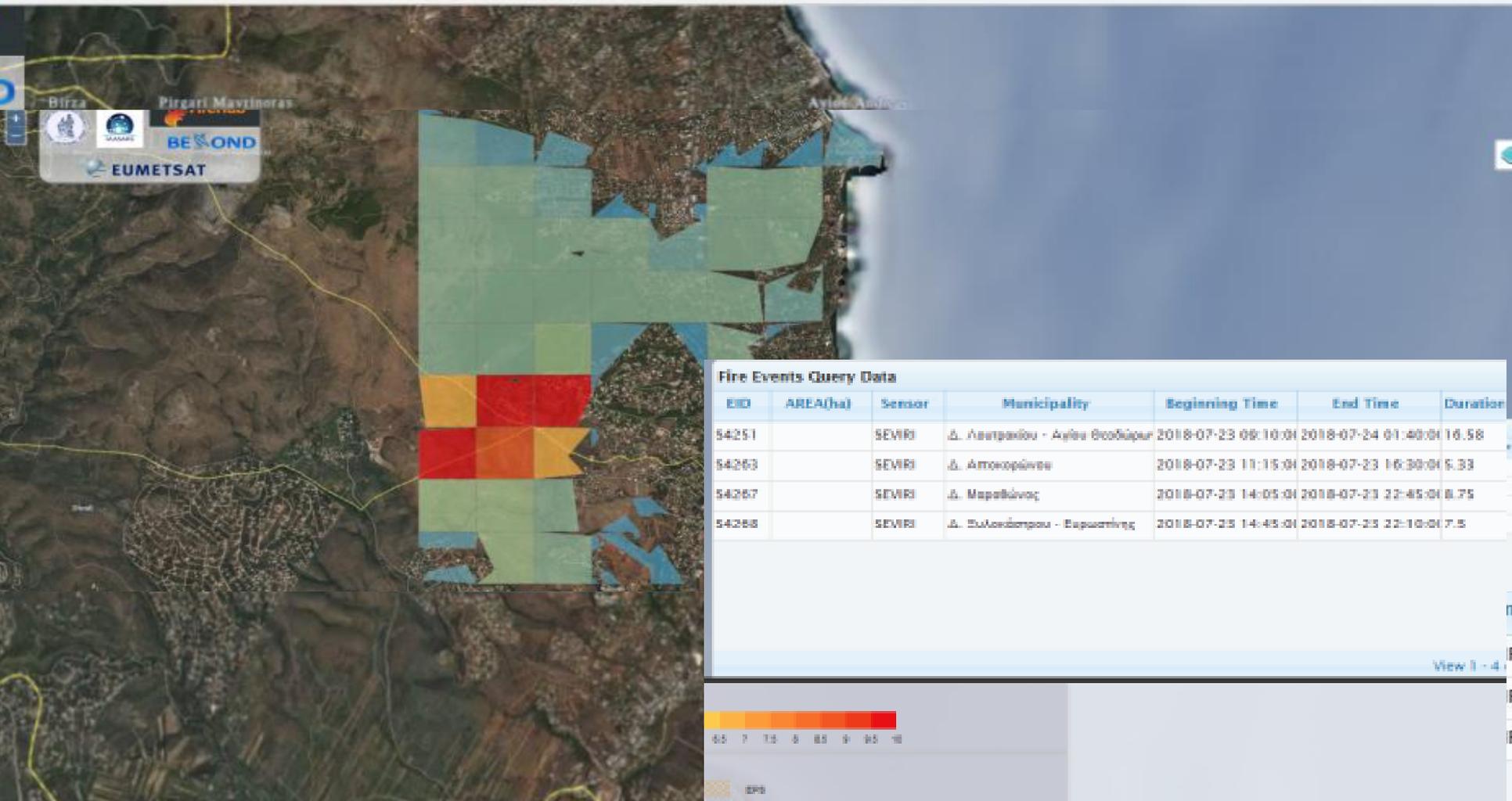
Η ΚΑΘΗΜΕΡΙΝΗ  
Ημερήσια Πολιτική και Οικονομική Εφημερίδα  
57 ΕΚΔΟΣΗ  
Σάββατο 24 Ιουνίου 2017 11:00 π.μ. Αθήνα, ΣΥΡΙΑ 23 ΑΥΓΟΥΣΤΟΥ 2018 www.ekathimerini.gr - 2103497000



## FireHub

On 23/07/2018 at 17:05, FireHub detected source of fire in the Municipality of Marathon, above Mati.

1.203.238/seviri/

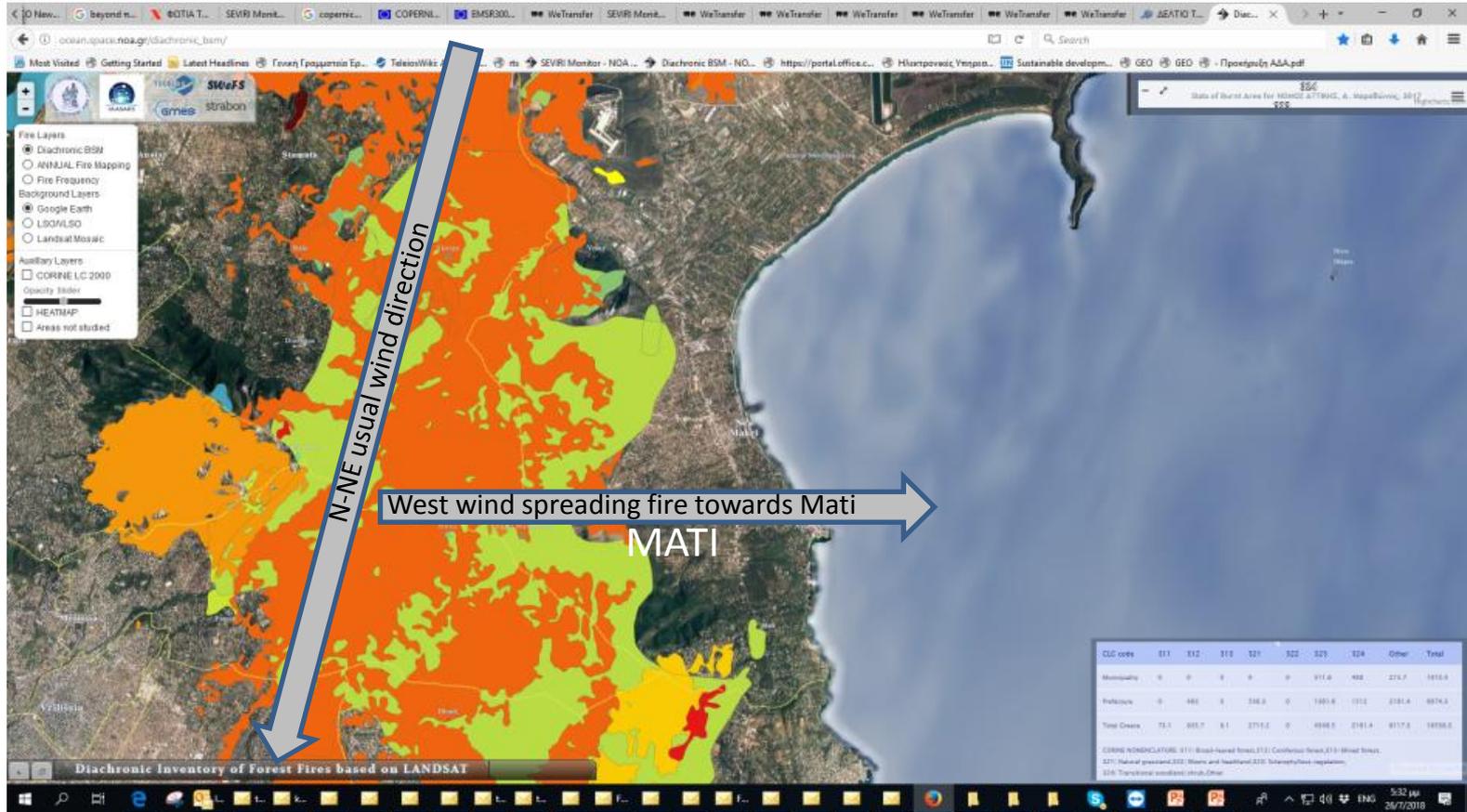


Fire Events Query Data						
EID	AREA(ha)	Sensor	Municipality	Beginning Time	End Time	Duration
54251		SEVIRI	Δ. Ανατολικού - Αγίου Θεοδώρου	2018-07-23 09:10:01	2018-07-24 01:40:01	16.58
54263		SEVIRI	Δ. Αποκορώνος	2018-07-23 11:15:01	2018-07-23 16:30:01	5.33
54267		SEVIRI	Δ. Μεσσήνης	2018-07-23 14:05:01	2018-07-23 22:45:01	8.75
54268		SEVIRI	Δ. Συκεδώνου - Ελασσίνης	2018-07-23 14:45:01	2018-07-23 22:10:01	7.5

View 1 - 4

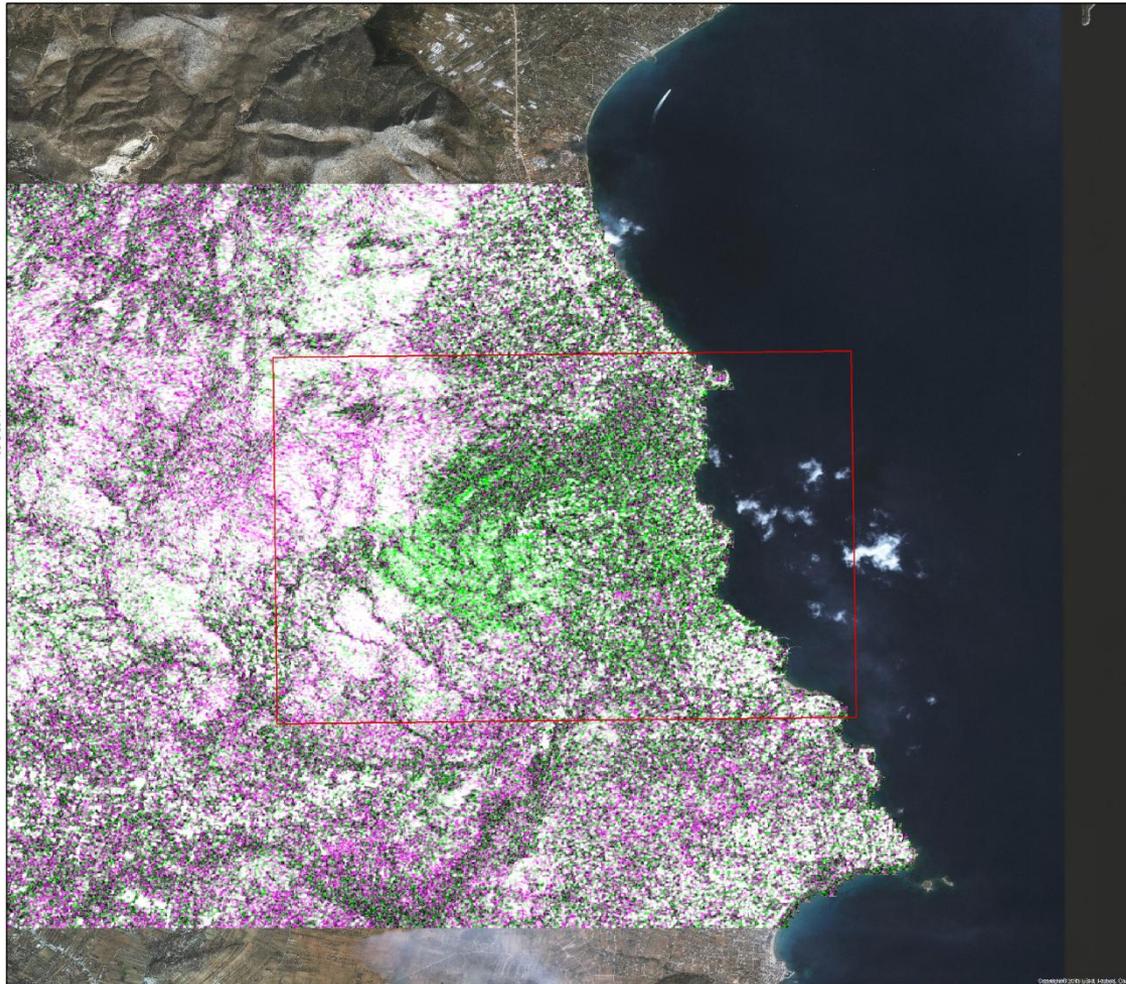


EPS



- This map shows the diachronic mapping of fire over the last 35 years in Attica. Different colours indicate fires in different years. Detailed information for each fire polygon can be found at [http://ocean.space.noa.gr/diachronic\\_bsm/](http://ocean.space.noa.gr/diachronic_bsm/)
- The site provides also information on the frequency of fire occurrence, therefore depicts areas around Athens that have been burned twice or three times over the years. The important element is that the fires over the years have a N-S distribution because of the usual N-NE winds affecting Athens (grey arrow). The black arrow shows the direction of the unusual wind pattern that facilitated the spread of the devastating fire towards Mati (the dramatically affected area-the circled one). Because of the non occurrence of fires towards Mati the last years, that is the undisturbed forest development in the area, and the high mixture of forested lands with the residential uses largely developed over the last years, resulted in the dramatic casualties in only a few hours.

Satellite SAR images Sentinel-1A acquisition date 12-7-2018 & 19-5-2018 (pre-event) and 24-7-2018 (post-event).



### Μάτι (Ανατολική Αττική) Πρώτη εκτίμηση των καμμένων εκτάσεων με χρήση τηλεοπτικής τηλεπισκόπησης 24-07-2018

Ημερομηνία Παραγωγής: 25/07/2018



#### Χαρτογραφικές Πληροφορίες

1:32.847 Grid: WGS 1984 Coordinate System

#### Υπόμνημα

- Περιοχή εκτίμησης καμμένων εκτάσεων
- Sentinel-1A SLC (VV polarization)**
- RGB Pseudocolor**
- Red: Coherence\_12-07-2018 & 24-07-2018 (μετά-γεγονότος)
- Green: Coherence\_12-07-2018 & 19-05-2018 (προ-γεγονότος)
- Blue: Coherence\_12-07-2018 & 24-07-2018 (μετά-γεγονότος)

#### Πληροφορίες Χάρτη

Ο χάρτης έχει δημιουργηθεί από το Κέντρο Αριστίας BEYOND της ΙΑΑΔΕΤ/ΕΑΑ. Ο σκοπός του προϊόντος αυτού είναι να δώσει μία πρώτη εκτίμηση για την επφάνεια των καμμένων εκτάσεων της πυρκαγιάς που έλαβε χώρα στις 23 Ιουλίου 2018 στην ευρύτερη περιοχή γύρω από τον οικισμό Μάτι στην Ανατολική Αττική.

#### Πηγές Δεδομένων

Ενέτες χάρτης με βάση ESRI Imagery World 2D, Πνευματικά δικαιώματα: © 2013 ESRI, i-cubed, GeoEye, Επεξεργασμένες Δορυφορικές Εικόνες Sentinel 1 SAR SLC (VV) που αποκτήθηκαν στις 19-05-2018, 12-07-2018 & 24-07-2018.

#### Παραγωγή Χάρτη

Χρησιμοποιήθηκαν δεδομένα Sentinel-1A SLC (Single Complex Look), κατά της πολωσης (VV) με καθόλη τη φορά λήψης με ημερομηνίες λήψης 12-07-2018 & 19-05-2018 (προ-γεγονότος) και 24-07-2018 (μετά-γεγονότος). Η πρώτη εκτίμηση των καταστροφών υλοποιήθηκε εφαρμόζοντας την τεχνική της συμβολομετρικής συνθέσεως σε δυο ζευγή εικόνων, με το πρώτο ζεύγος να αφορά τις δυο προ-γεγονότος εικόνες (12-07-2018 & 19-05-2018) και το δεύτερο τις εικόνες μετά-γεγονότος (24-07-2018) και προ-γεγονότος (12-07-2018). Ειδικότερα, οι αλλαγές του τοπίου ανιχνεύονται μέσω της δημιουργίας μιας μευδερχημής εικόνας και εντοπίζονται στις περιοχές που απεικονίζονται με πράσινο χρωματισμό.

#### Δημοσίευση

Το προϊόν διατίθεται μέσω της ιστοσελίδας του BEYOND στην ακόλουθη διεύθυνση URL: <http://beyond-eccenter.eu/index.php/fires>

#### Πλαίσιο

Ο χάρτης εκπονήθηκε από το Κέντρο Αριστίας BEYOND. Όλες οι γεωγραφικές πληροφορίες έχουν περιορισμούς λόγω της κλίμακας, της ανάλυσης και της ημερομηνίας των αρχικών δεδομένων.

#### Στοιχεία Επικοινωνίας

Δρ. Χάρης Κοντοές, Διευθυντής Ερευνών ΕΑΑ  
E-mail: [kontoes@noa.gr](mailto:kontoes@noa.gr)

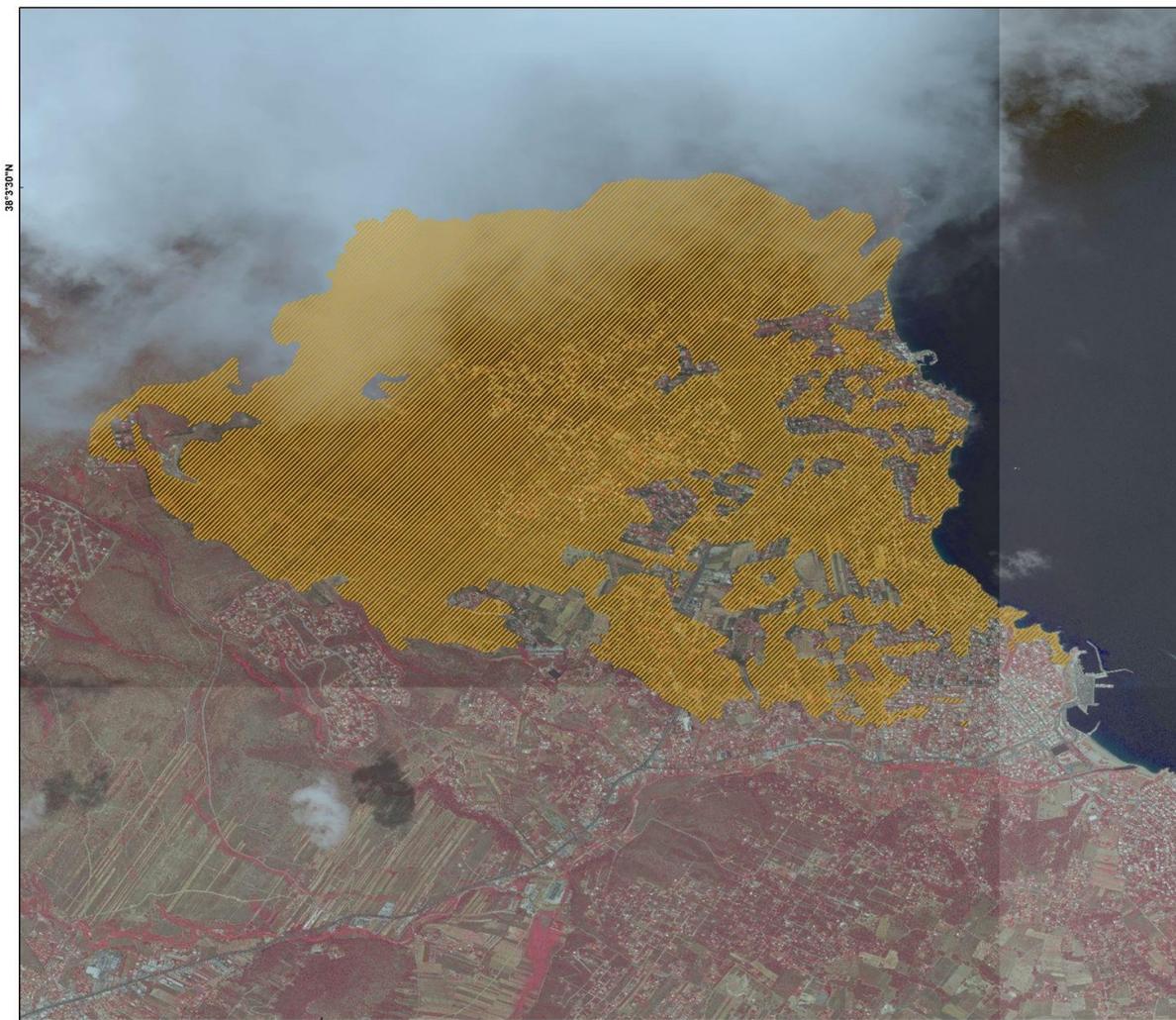


Satellite image WORLDVIEW-3 very high spatial resolution (30 cm), sponsored by TotalView.



### FireHub

**Μάτι (Ανατολική Αττική)**  
**Λεπτομερής εκτίμηση των καμμένων**  
**εκτάσεων 26-07-2018**



Ημερομηνία Παραγωγής: 27/07/2018



#### Χαρτογραφικές Πληροφορίες

1:15.000  
 Grid: WGS 1984 Coordinate System

#### Υπόμνημα

Περιοχή εκτίμησης καμμένων εκτάσεων 26-07-2018, συνολικής έκτασης της τάξης των 1260 ha

#### Πληροφορίες Χάρτη

Ο χάρτης έχει δημιουργηθεί από το Κέντρο Αριστίας BEYOND του ΙΑΔΕΤ/ΕΑΑ. Ο σκοπός του προγράμματος αυτού είναι να δώσει την επικαιροποίηση της προηγούμενης εκτίμησης της επιφάνειας των καμμένων εκτάσεων της πυρκαγιάς που έλαβε χώρα στις 23 Ιουλίου 2018 στην ευρύτερη περιοχή γύρω από τον οικισμό Μάτι στην Ανατολική Αττική, η οποία βασίστηκε σε δορυφορικά δεδομένα υψηλής ανάλυσης. Η νέα εκτίμηση είναι της τάξης των 1260 ha.

#### Πηγές Δεδομένων

Επιτελεσμένη δορυφορική Εικόνα WORLDVIEW-3 πολύ υψηλής χωρικής ανάλυσης (30 εκ.) ημερομηνίας λήψης 26/07/2018, χορηγία της εταιρείας TotalView.



#### Παραγωγή Χάρτη

Πραγματοποιήθηκε φωτομετρία της δορυφορικής εικόνας WORLDVIEW-3, η οποία ελήφθη 3 ημέρες μετά το γεγονός. Η λεπτομερέστερη εκτιμώμενη έκταση των καμμένων περιοχών είναι της τάξης των 1260 ha. Θα ακολουθήσουν ακριβέστερες εκτιμήσεις υπερψηφικής ανάλυσης με χρήση UAV.

#### Δημοσίευση

Το προϊόν διατίθεται μέσω της ιστοσελίδας του BEYOND στην ακόλουθη διεύθυνση URL: <http://beyond-eocenter.eu/index.php/fires>

#### Στοιχεία Επικοινωνίας

Δρ. Χάρης Κοντοές, Διευθυντής Ερευνών ΕΑΑ  
 E-mail: [kontoes@noa.gr](mailto:kontoes@noa.gr)



## FireHub

Orthographic map with detailed hazard assessment at building block level using Drones / UAV (Falcon type) very high spatial resolution (3,5 cm)  
(DAEFK - YPOMEDI)

**Δημοσίευση**  
Το προϊόν διατίθεται μέσω της ιστοσελίδας του BEYOND στην ακόλουθη διεύθυνση URL: <http://beyond-eocenter.eu/index.php/fires>

**Στοιχεία Επικοινωνίας**  
Δρ. Χάρης Κοντοές, Διευθυντής Ερευνών ΕΑΑ  
E-mail: [konfoes@noa.gr](mailto:konfoes@noa.gr)

BEYOND funded under: FP7-REGPOT-2012-2013-1

DIACHRONIC MAPPING 1984-2017  
~900 HIGH RESOLUTION SATELLITE IMAGES  
LANDSAT TM, SPOT, IKONOS, SENTINEL-2

**Fire Layers**

Diachronic BSM

ANNUAL Fire Mapping

Fire Frequency

**Background Layers**

Google Earth

LSO/VLSO

Landsat Mosaic

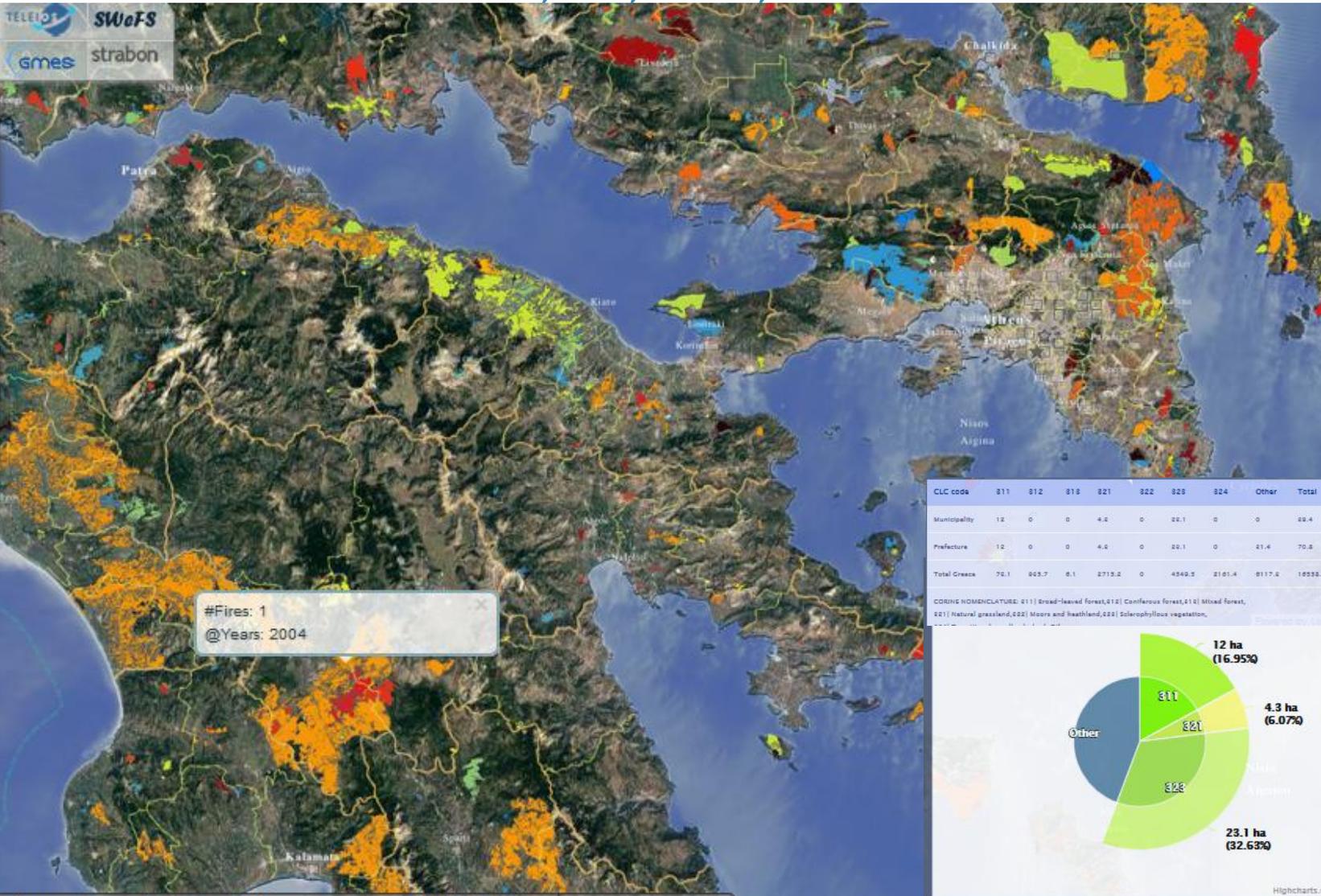
**Auxillary Layers**

CORINE LC 2000

Opacity Slider

HEATMAP

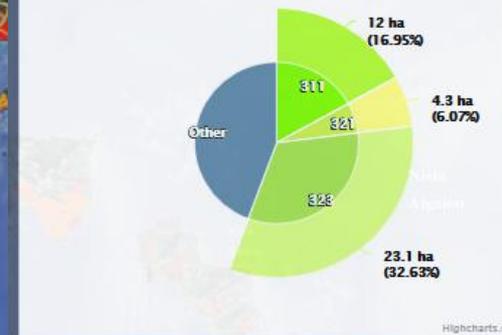
Areas not studied



#Fires: 1  
@Years: 2004

CLC code	011	012	018	021	022	028	024	Other	Total
Municipality	12	0	0	4.3	0	20.1	0	0	36.4
Prefecture	12	0	0	4.3	0	20.1	0	0	36.4
Total Greece	70.1	803.7	8.1	2715.2	0	4349.3	2101.4	8117.0	16533.8

CORINE NOMENCLATURE: 011) Broad-leaved forest, 012) Coniferous forest, 018) Mixed forest, 021) Natural grassland, 022) Moors and heathland, 028) Sclerophyllous vegetation, ...



**DIACHRONIC MAPPING 1984-2017**

**A FEW THOUSANDS OF HIGH RESOLUTION SATELLITE IMAGES**



**National Observatory of Athens**

*Continuous offer to the Scientific Research since 1842*

Greek General Secretariat for Research and Technology

**Event  
Logo**

<http://ocean.space.noa.gr/bsm>

**DIACHRONIC INVENTORY OF FOREST FIRES OVER  
GREECE FROM 1984 TO PRESENT, WITH USE OF  
LANDSAT 4,5,7 SATELLITE DATA**

URL: <http://www.noa.gr>

**Fire  
Monitoring  
Service  
based on  
MSG SEVIRI  
of F.B.**



# ANALYSIS OF THE FLOOD EVENT 15/11/2017 IN WEST ATTICA USING SATELLITE REMOTE SENSING

FloodHub

**BE OND**  
[www.beyond-eocenter.eu](http://www.beyond-eocenter.eu)



## MANDRA – WEST ATTICA

15 November 2017

The 3<sup>rd</sup> worst flooding disaster in  
Attica History  
(based on the number of deaths)



Time of concentration:

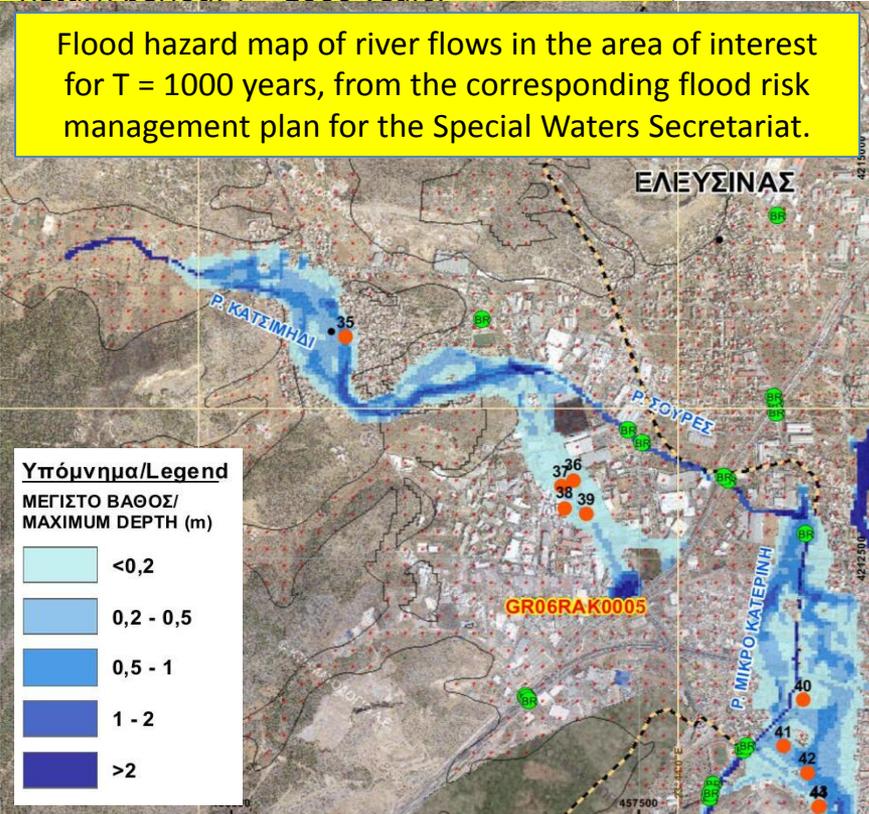
- 5h Giandotti (formula), as recommended by the specifications of hydraulic works (PD 696/1974),
- 3h after a decrease, as demonstrated in the framework of the project "DEUKALION".

$$t_c = \frac{4\sqrt{A} + 1.5L}{0.8\sqrt{\Delta H}}$$

$$t_c(T) = t_c \sqrt{i(5)/i(T)}$$

Return period: T = 1000 years.

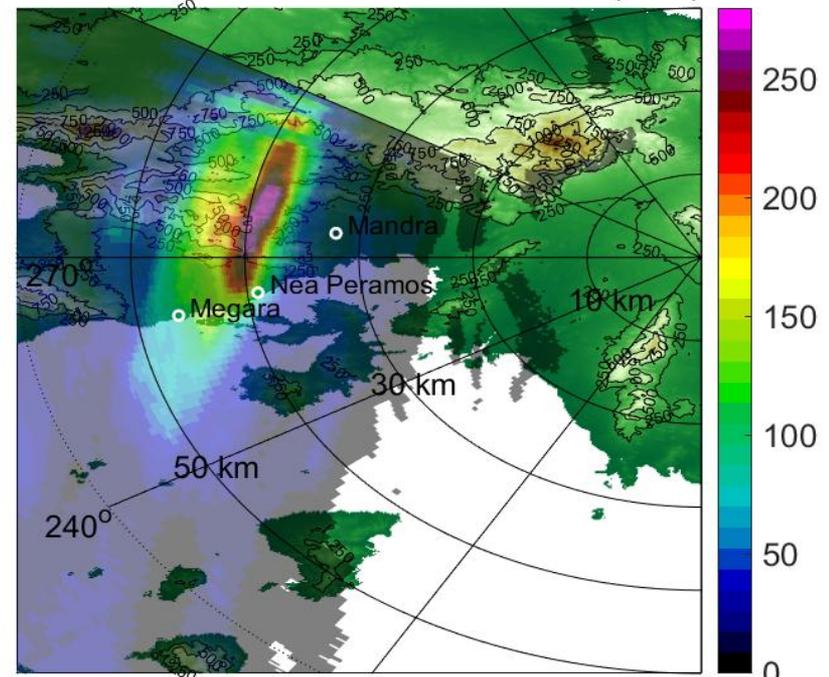
Flood hazard map of river flows in the area of interest for T = 1000 years, from the corresponding flood risk management plan for the Special Waters Secretariat.



## Simulation of maximum flood extent

Total rainfall at the core of the event > 200 mm over a period of 6 h.

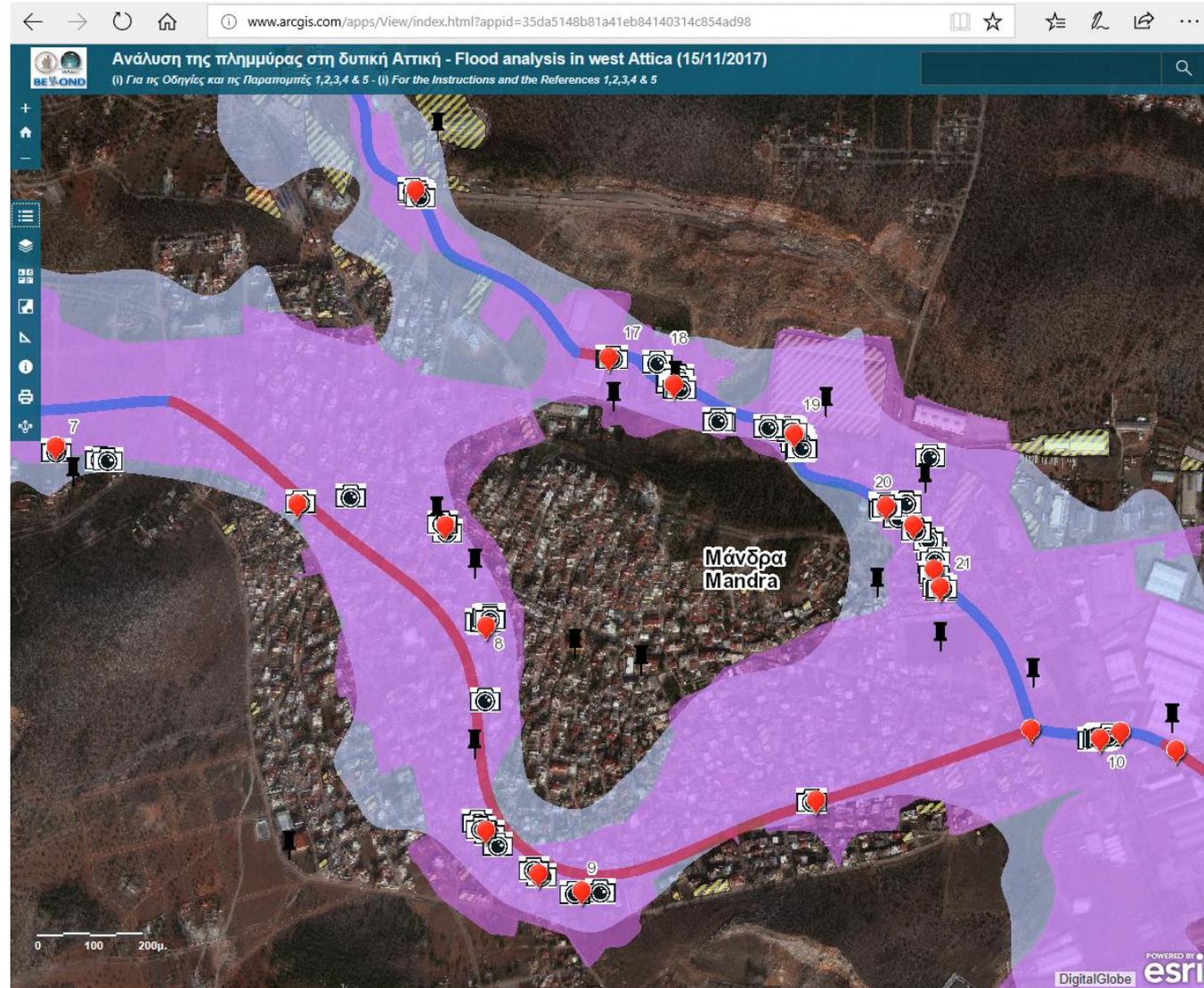
## XPOL-NOA accumulated rainfall (mm)



14-Nov-2017 13:49 to 15-Nov-2017 12:00 UTC

High resolution analysis (150 m) of the total rainfall from the XPOL meteorological radar (2 min time analysis) of the Institute for Environmental Research and Sustainable Development of the National Observatory of Athens.

## Simulation of maximum flood extent



The result of the model appears to be well-approached by the flood extent mapping using satellite remote sensing, and furthermore depicts flooded areas upstream

The simulation is obviously affected by the level of precision of the input data and is subject to a series of assumptions, but it provides a first map of the maximum flood extent that is reasonably approaching the real scenario.

# ANALYSIS OF THE FLOOD EVENT 15/11/2017 IN WEST ATTICA USING SATELLITE REMOTE SENSING

FloodHub

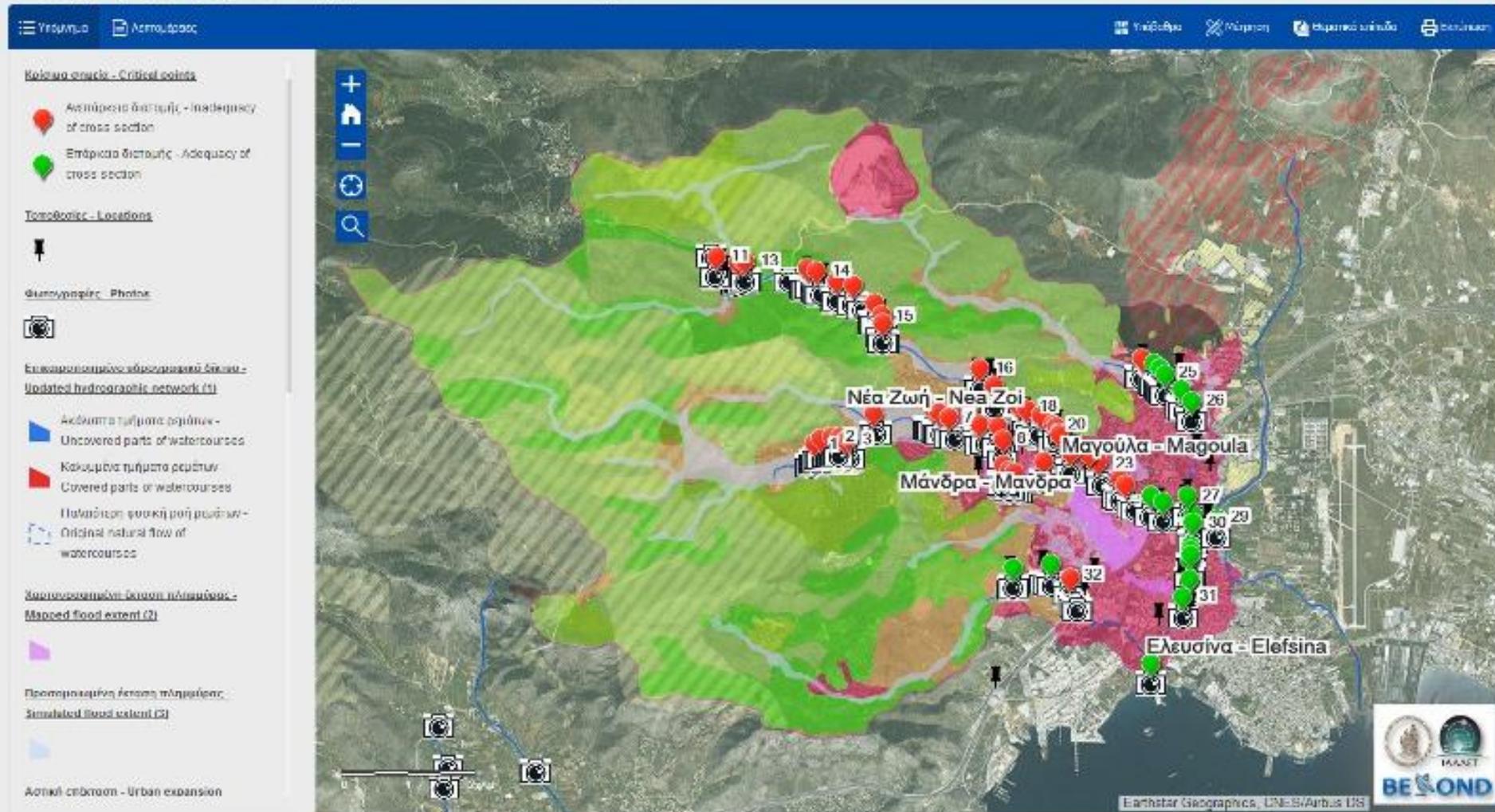
**BE OND**  
[www.beyond-eocenter.eu](http://www.beyond-eocenter.eu)



## Ανάλυση της πλημμύρας στη δυτική Αττική στις 15/11/2017 Analysis of the flood in west Attica on 15/11/2017

Για τις Οδηγίες και τις Παραπομπές 1,2,3,4 & 5 βλ. Ασφαλισμός. For the Instructions and the References 1,2,3,4 & 5 see Details

Interactive Web Application



# ANALYSIS OF THE FLOOD EVENT 15/11/2017 IN WEST ATTICA USING SATELLITE REMOTE SENSING

FloodHub

**BE OND**  
[www.beyond-eocenter.eu](http://www.beyond-eocenter.eu)



## Ανάλυση της πλημμύρας στη δυτική Αττική στις 15/11/2017 Analysis of the flood in west Attica on 15/11/2017

Για τις οδηγίες και τις Παραπομπές 1,2,3,4 & 5 βλ. Απομνημόνιο - For the Instructions and the Reference 1,2,3,4 & 5 see Details

### Critical points and proposed measures

**Κρίσιμα σημεία - Critical assets** 66

- Κρισιμότητα θέσους - Importance of asset location
- Επιτόπια θέσους - Addressing of asset location

**Επισημασμένα υδραυλικά δίκτυα - Marked hydraulic network (H)**

- Ακάλυπτα τμήματα ροών - Uncovered parts of watercourses
- Καλυμμένα τμήματα ροών - Covered parts of watercourses
- Πρωτότυπη ροή σε σημεία - Original natural flow of watercourses

**Σημεία κλεισίματος - Waterclosed locations**

**Πομπή (1 από 5)**

**Περιγραφή:** Κτίσματα και συμβολή υδραυλόμετρος με έργο με κλειστό υδραυλικό έργο. Υπάρχει και καταστροφή κτιρίων.

**Description:** buildings and junction of watercourse with road with closed hydraulic work. Overflow and destruction of buildings.

**Προτεινόμενα μέτρα:** Άνοιξη αυλάκις της θέσους του κλάστος υδραυλικού έργου (π.χ. διαμόρφωση, καθαρισμοί).

DigitGlobe

# BEYOND geObservatory: Timely InSAR assessment of surface deformation due to geohazards

*Centre of Excellence for  
EO-based monitoring of Natural Disasters*

Fires & Floods

Geophysical hazards

Atmospheric disasters

Urban environment



# geObservatory | In a nutshell

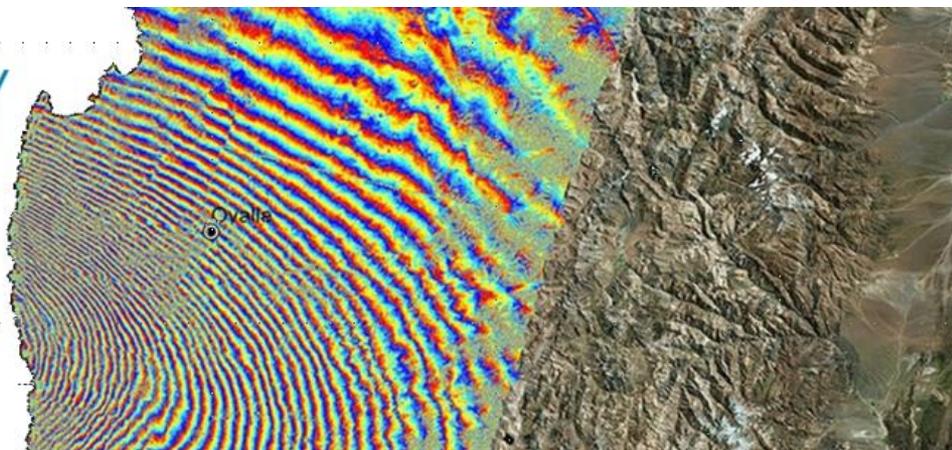
GeObservatory is activated in major geohazard events (earthquakes, volcanic activity, landslides, etc.) and automatically produces a series of Sentinel-1 based co-event interferograms (DInSAR) to map the surface deformation associated with the event.

<http://beyond-eocenter.eu/geohub/>

geObservatory



BEOND



# geObservatory | Application orchestrator

HOME

HOW DOES IT WORK?

SENTINEL DATA

DISCLAIMER

Recent Events

Historic Events

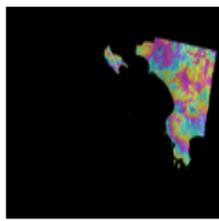


Leaflet, © OpenStreetMap contributors

Recent event (Last 90 days)

Historic event

## Last 5 events



[IONIAN SEA \(2018-10-25 22:54:51\)](#)

# HAITI REGION (2018-10-07 00:11:48)

Earthquake location: HAITI REGION

Magnitude: 5.8

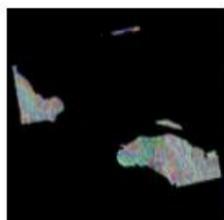
Depth: 10 km

Time: 2018-10-07 00:11:48

Coordinates: 19.98 , -73.03



## Interferograms



Type: co-seismic

Master: 2018-09-26 23:01:42

Slave: 2018-10-08 23:01:42

Orbit Number: 4

Mode: ASCENDING

[Download \(TIF\)](#) [Download \(Low Resolution\)](#) [Preview](#)

# IONIAN SEA (2018-10-25 22:54:51)

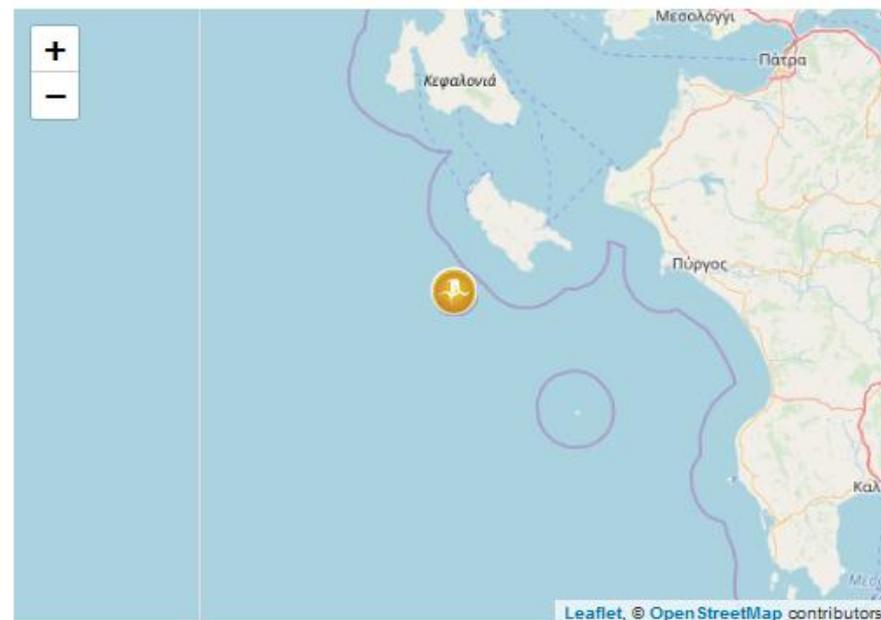
Earthquake location: IONIAN SEA

Magnitude: 6.6

Depth: 10 km

Time: 2018-10-25 22:54:51

Coordinates: 37.52 , 20.57



## Interferograms



Type: co-seismic

Master: 2018-10-20 04:39:26

Slave: 2018-10-26 04:40:08

Orbit Number: 80

Mode: DESCENDING

[Download \(TIF\)](#) [Download \(Low Resolution\)](#) [Preview](#)

## GeoHUB: Earthquake deformation mapping

### Data

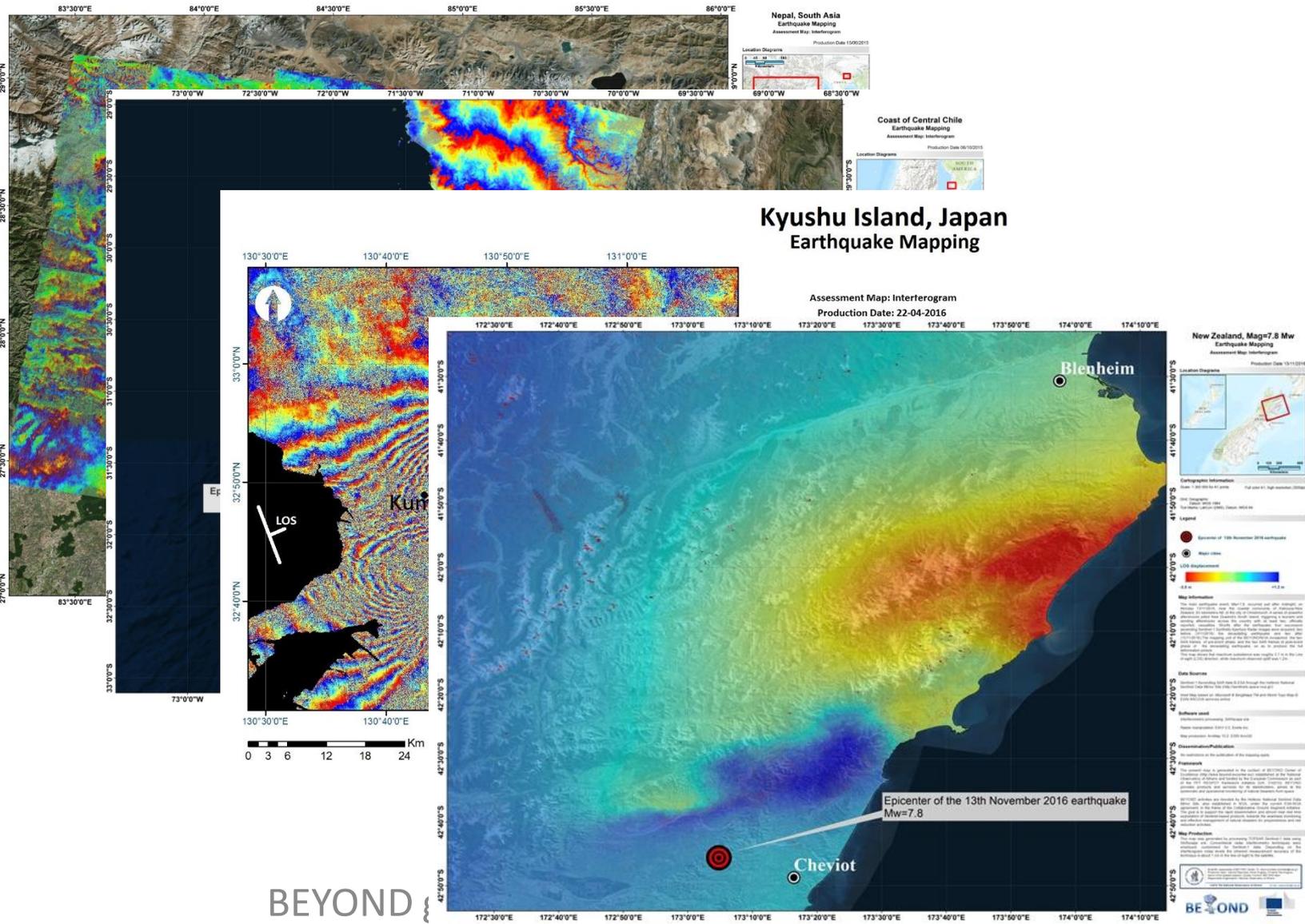
- CollGS
- NOANET
- ENIGMA
- In-situ

### Services

- Geodesy
- Modeling
- Hazard Ass.
- Large Proc.

### Applications

- Tectonics
- Volcanoes
- Landslides
- Subsidence



Data

NSN

NOANET

ENIGMA

In-situ

Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

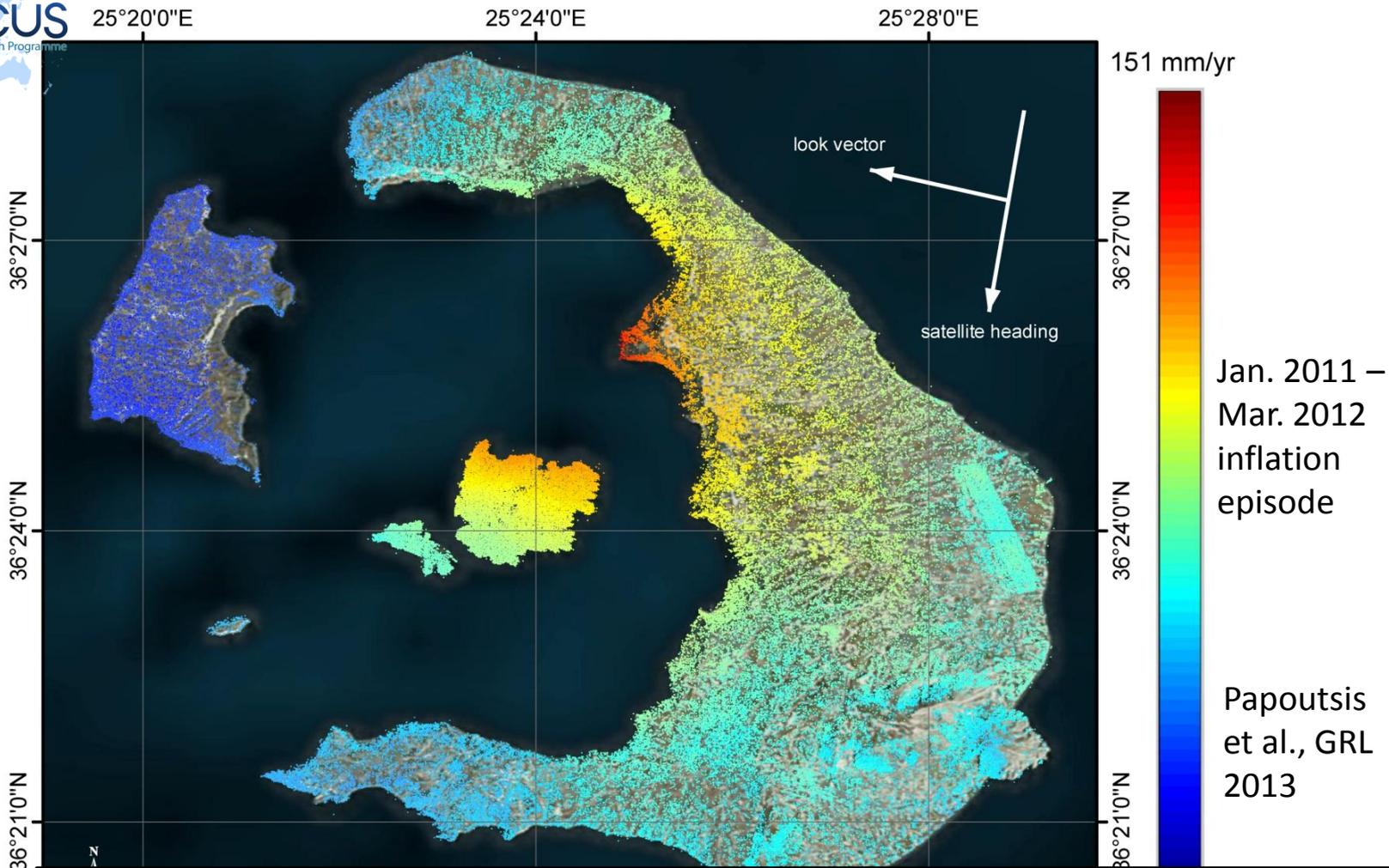
Applications

Tectonics

Volcanoes

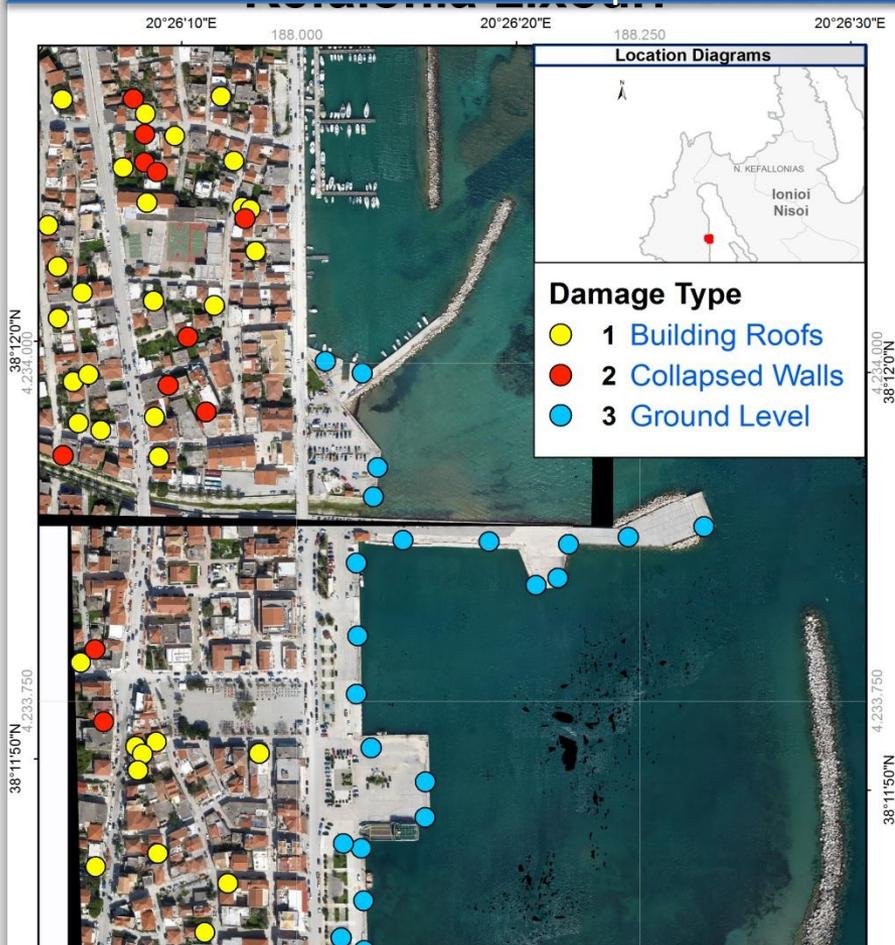
Landslides

Subsidence



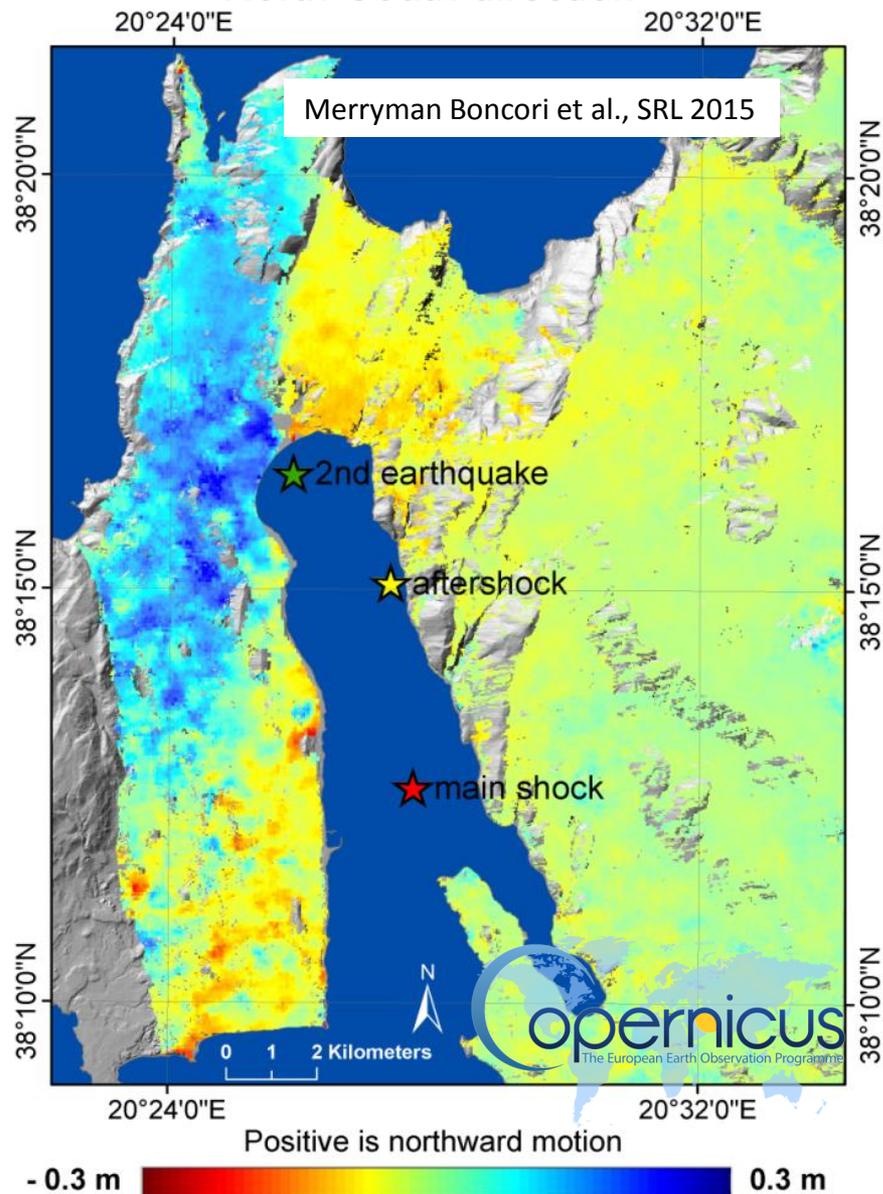
**GREEK CIVIL PROTECTION , GREECE  
VELOCITY DEFORMATION VOLCANO SANTORINI mm/year**

## Cephalonia Island



**CIVIL PROTECTION OASP – NATIONAL  
CADASTRE & MAPPING AGENCY SA  
LAND DEFORMATION AND FAULT  
PARAMETER ASSESSMENT**

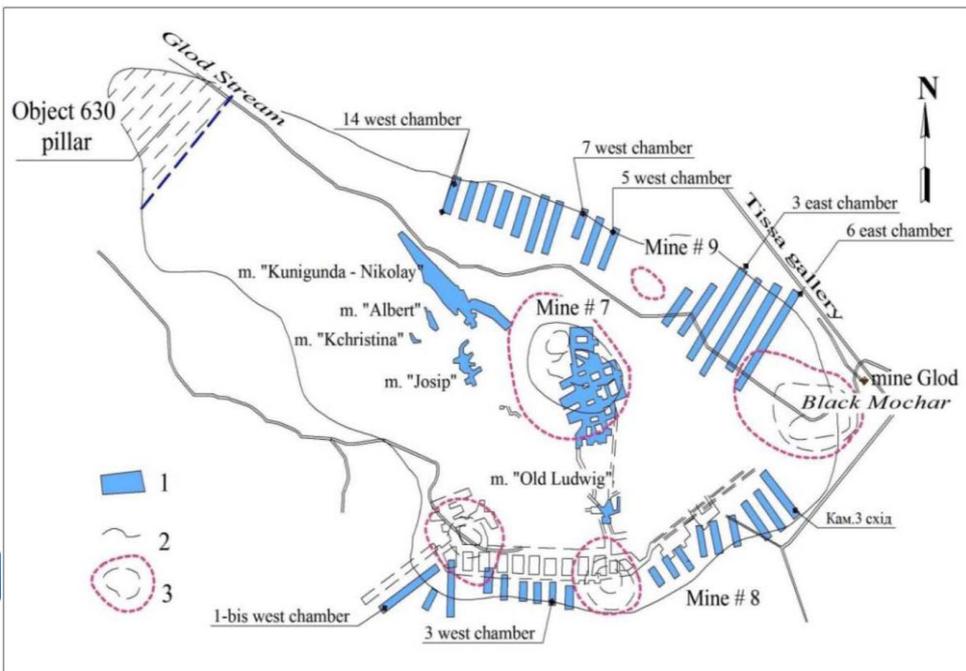
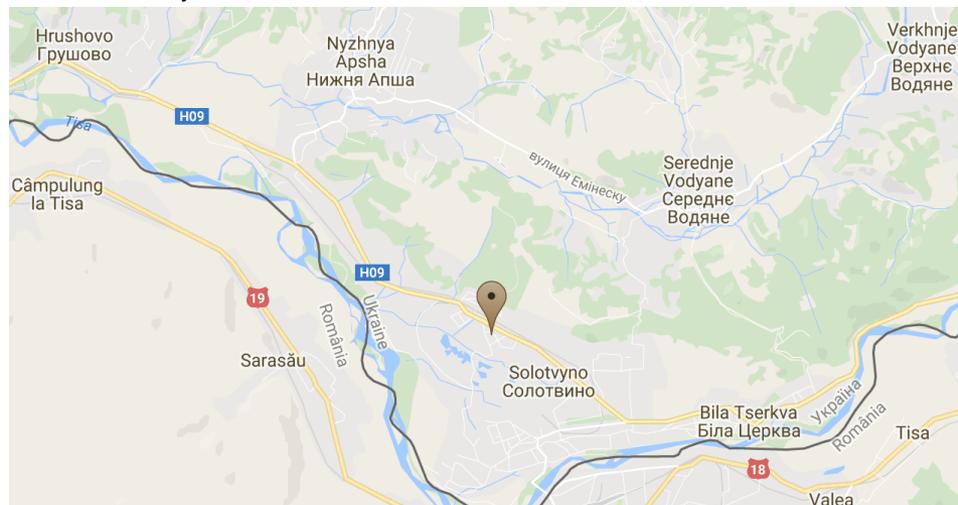
## North-South direction



## Copernicus EMS | Solotvyno activation, Ukraine

### The location

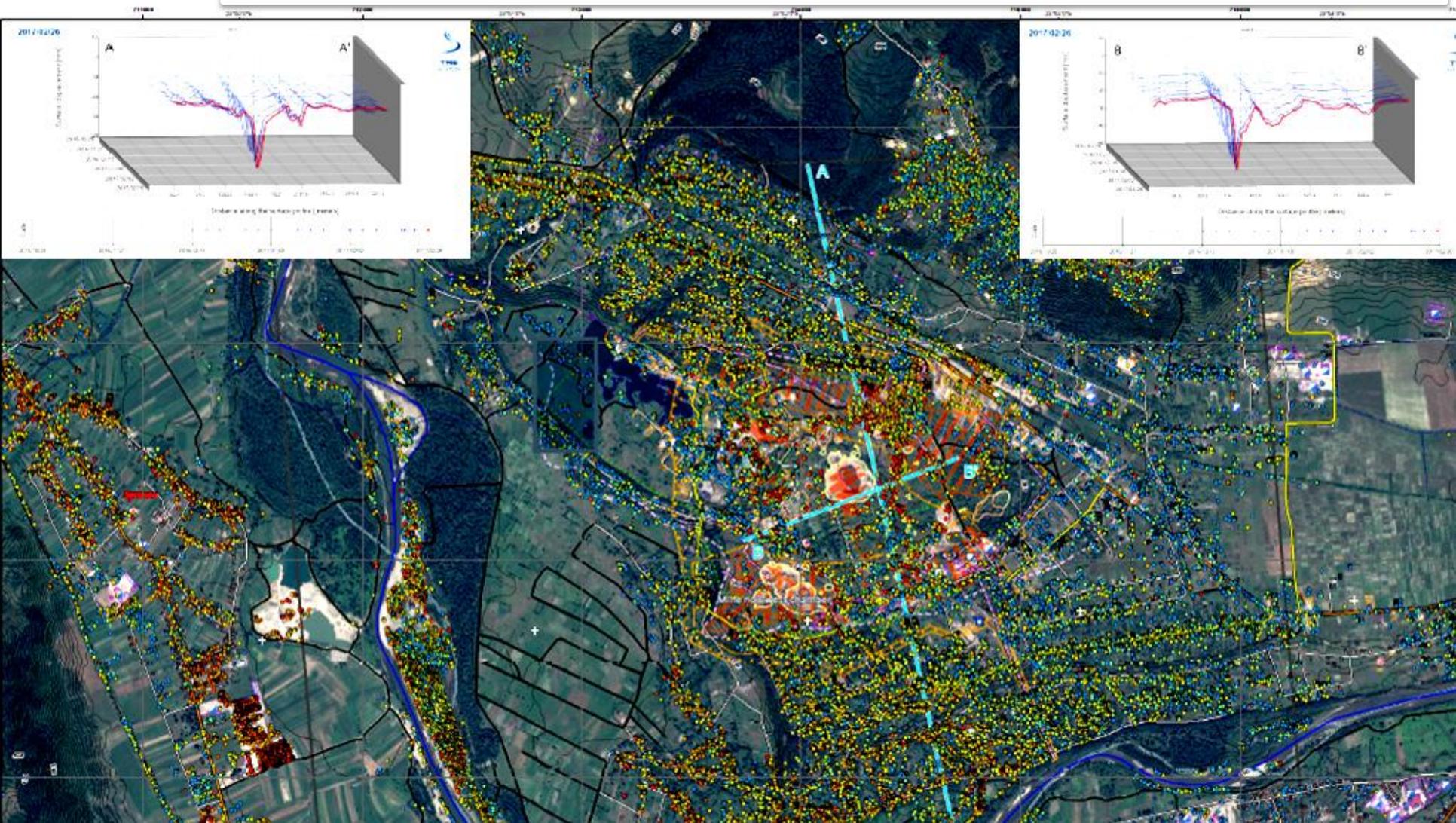
Authorized User: National Directorate  
General for Disaster Management,  
Hungary



## Copernicus EMS | Solotvyno activation, Ukraine

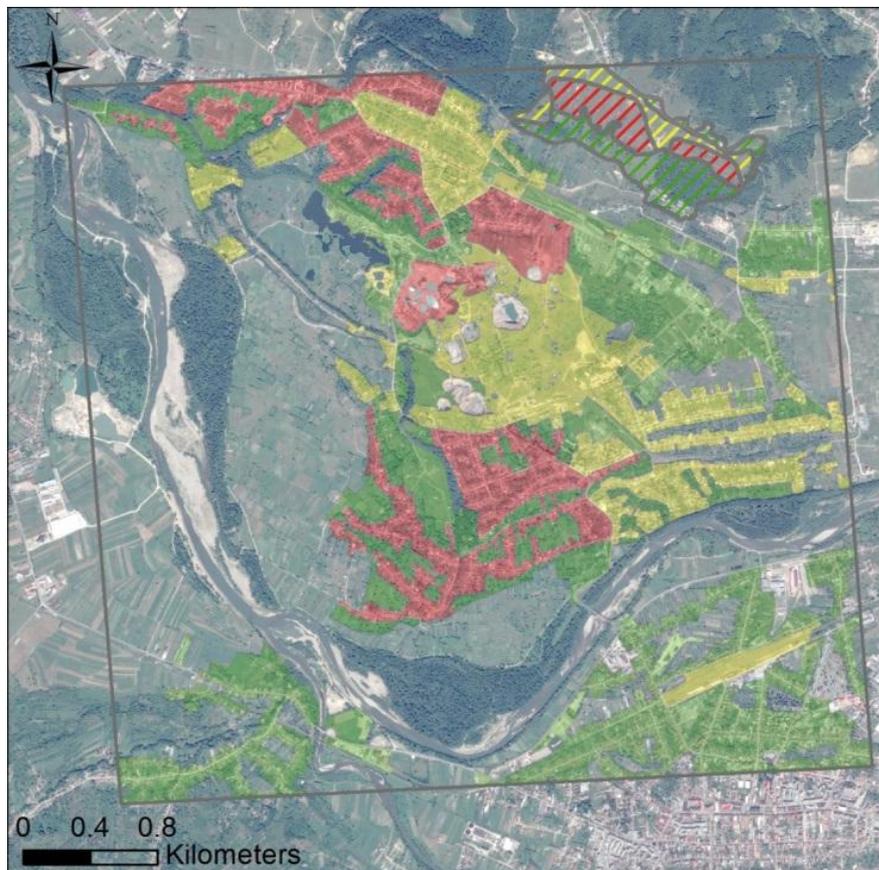
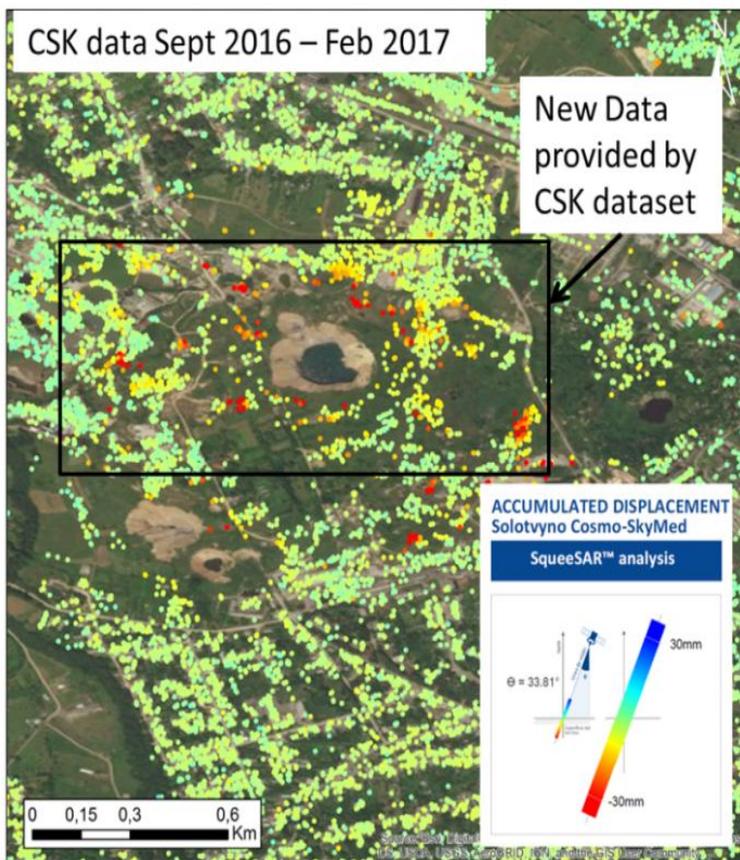
**The problem!**





# Copernicus EMS | Solotvyno activation, Ukraine

## The products: Monitoring



# GeoHUB: Urban deformation monitoring Thessaloniki

Svigkas et al., Engineering Geology 2016  
Svigkas et al., Environmental Earth Sciences 2017

## Data

NSN

NOANET

ENIGMA

In-situ

## Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

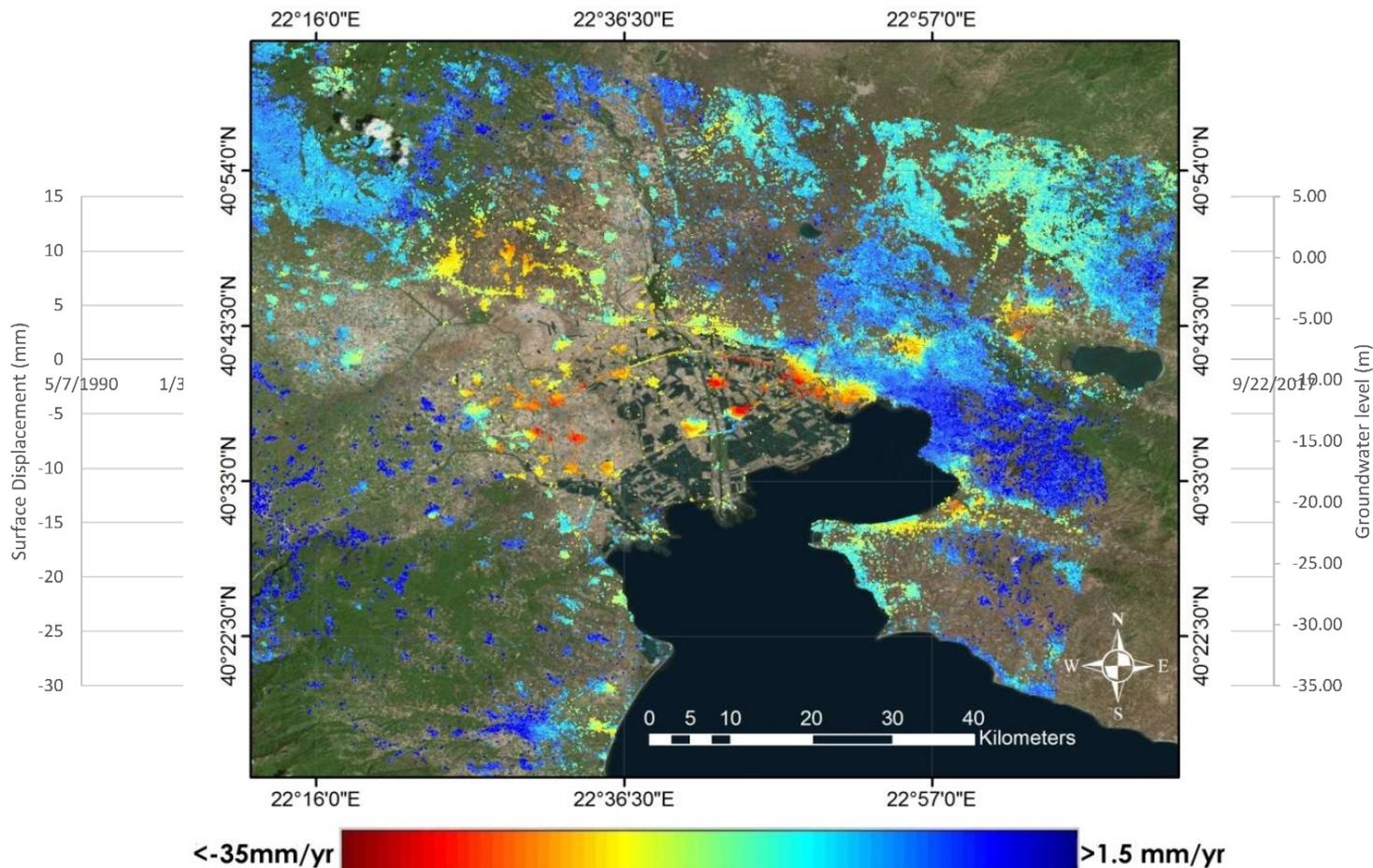
## Applications

Tectonics

Volcanoes

Landslides

Subsidence



# GeoHUB: Urban deformation monitoring Volos

Kaskara et al., GRSG 2015

## Data

NSN

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## Services

Geodesy

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Large Proc.

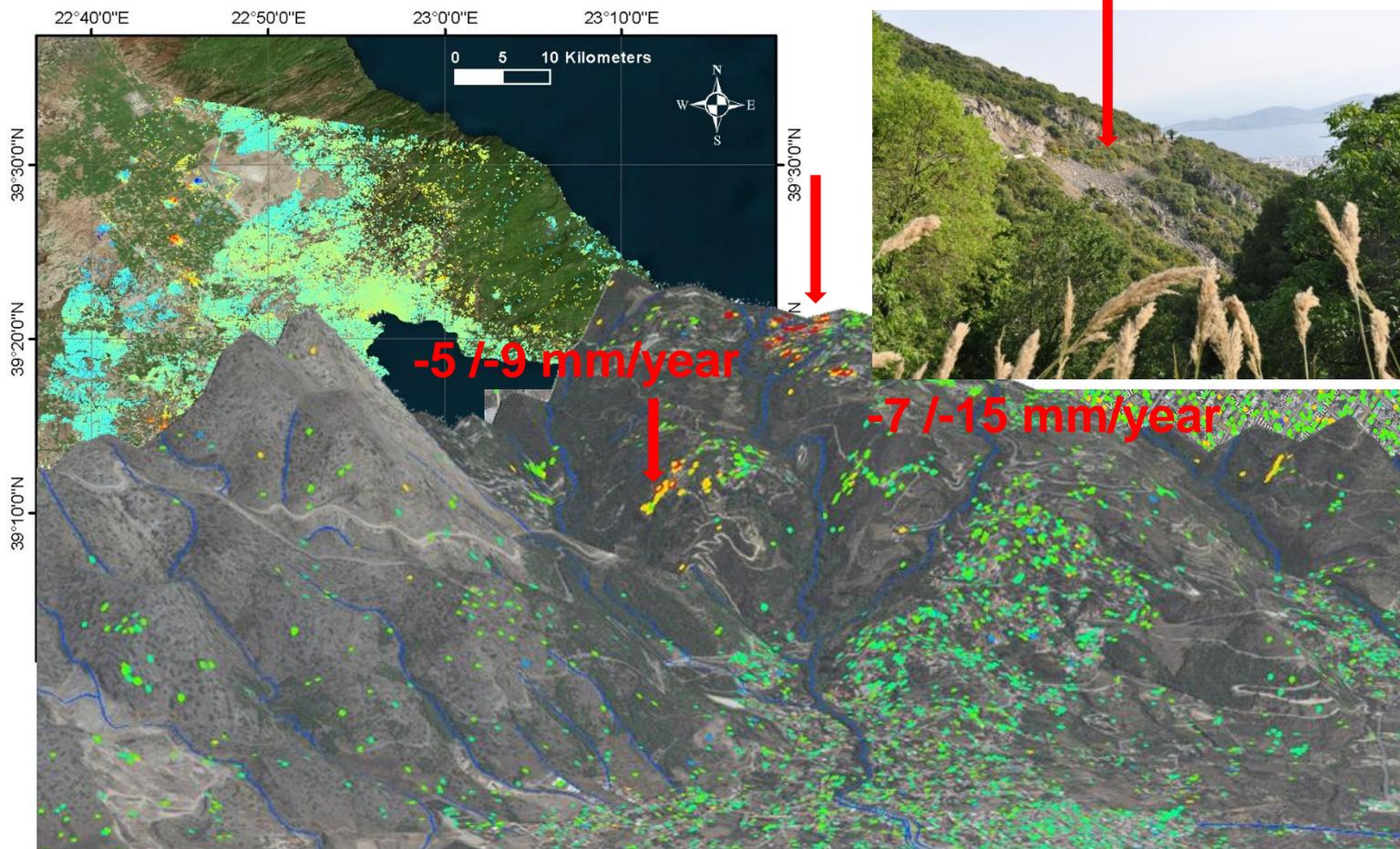
## Applications

Tectonics

Volcanoes

Landslides

Subsidence



# GeoHUB: Urban deformation monitoring

## Igoumenitsa

Kaskara et al., GRSG 2015

### Data

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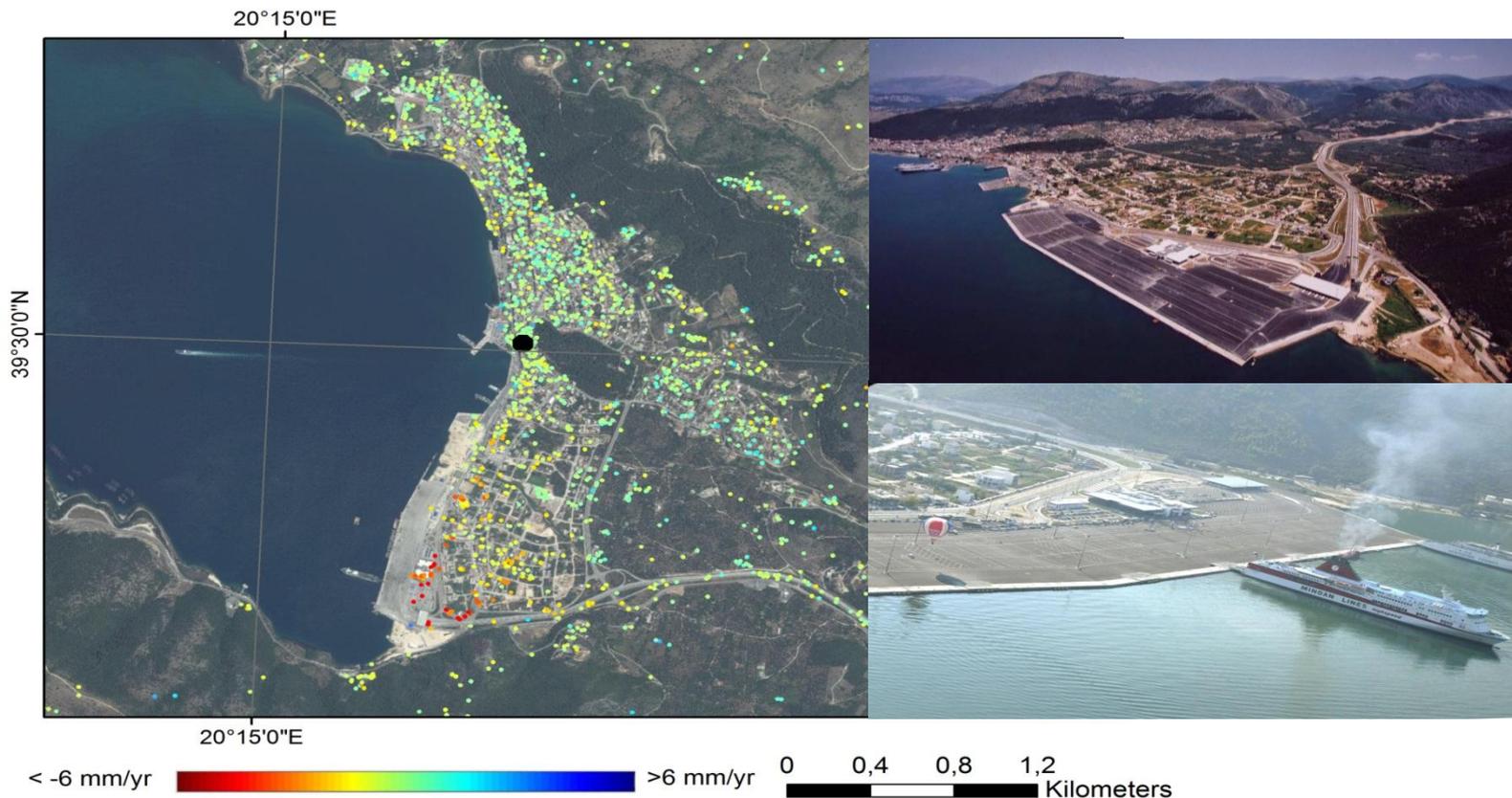
### Applications

Tectonics

Volcanoes

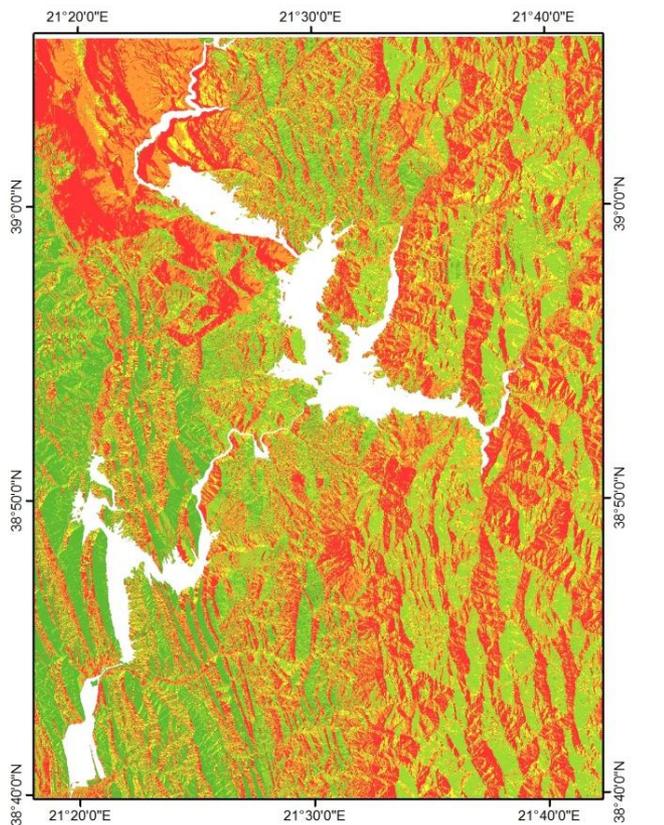
Landslides

Subsidence



# GeoHUB: Regional landslide susceptibility assessment

**Landslide Susceptibility map**

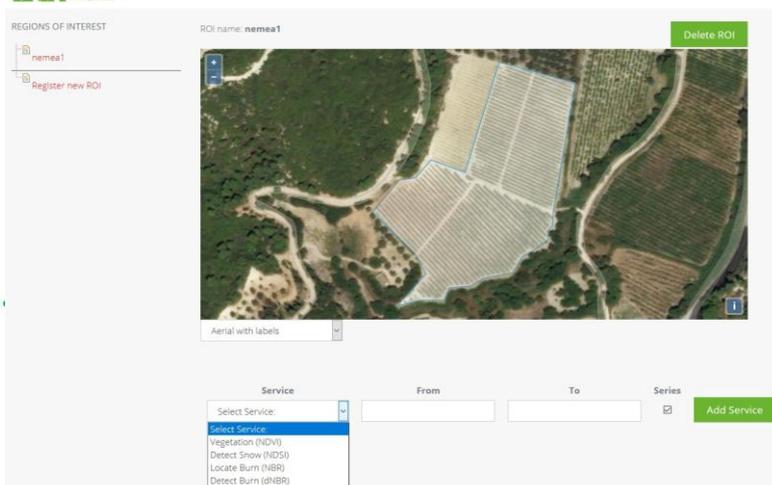
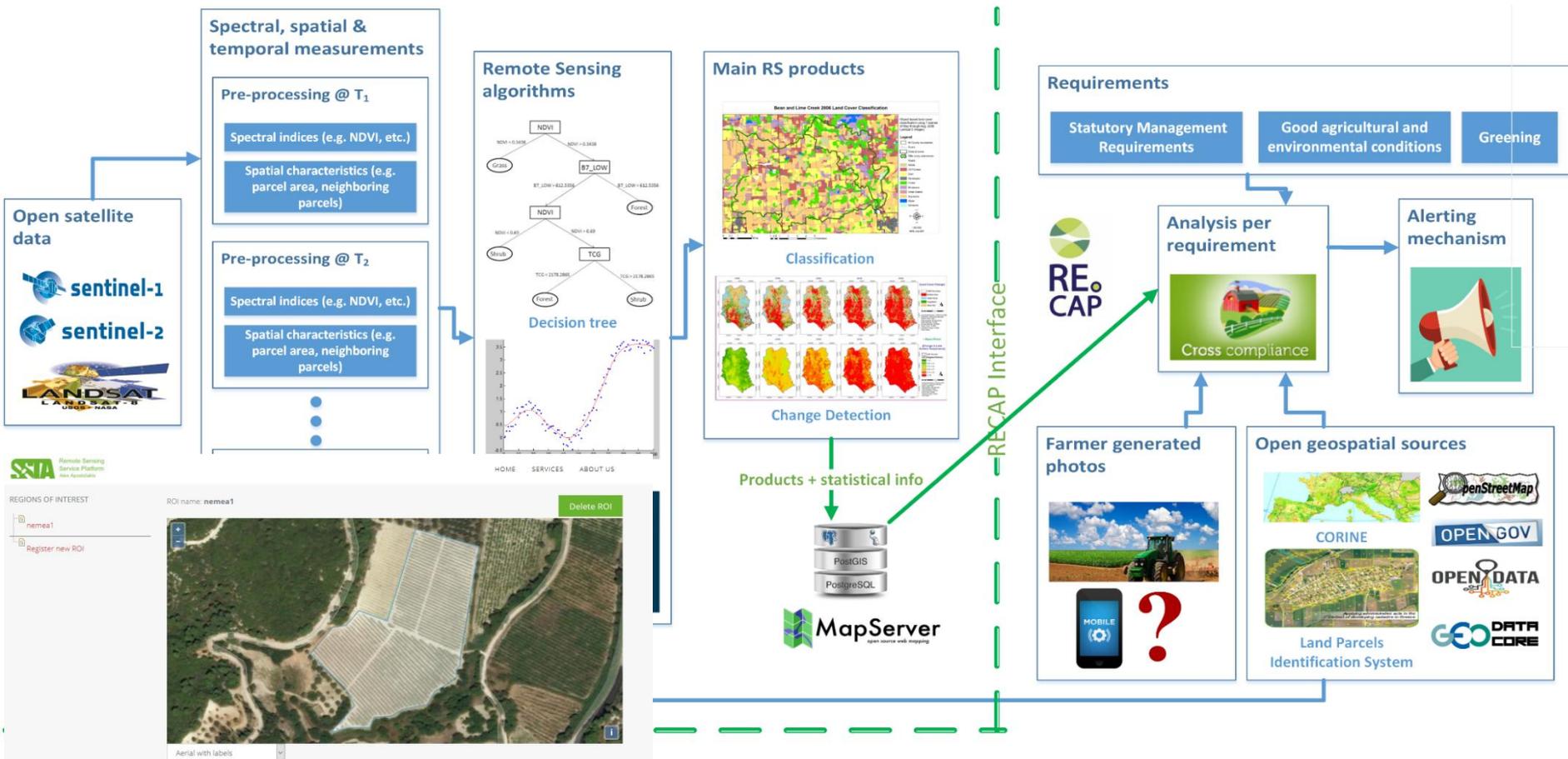


**Landslide Susceptibility**

- Very low
- Low
- Medium
- High
- Very high

0 3 6 12 Kilometers





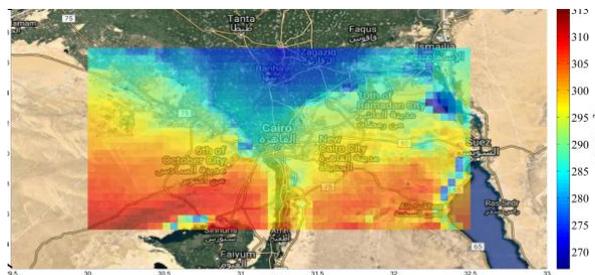
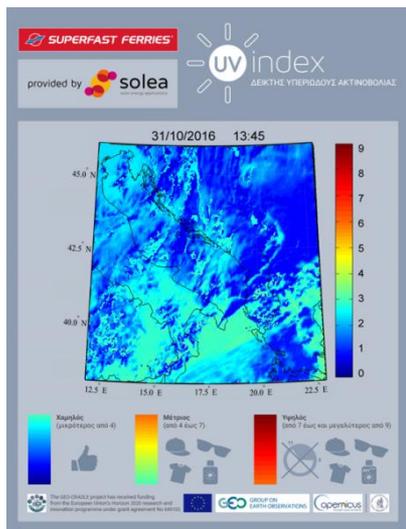
The RECAP platform offers services to the European Agricultural Paying Agencies and informs about full compliance with the regulations and best agricultural practices of the CAP at parcel level across Europe

- Live @ <http://www.recap.space.noa.gr/>

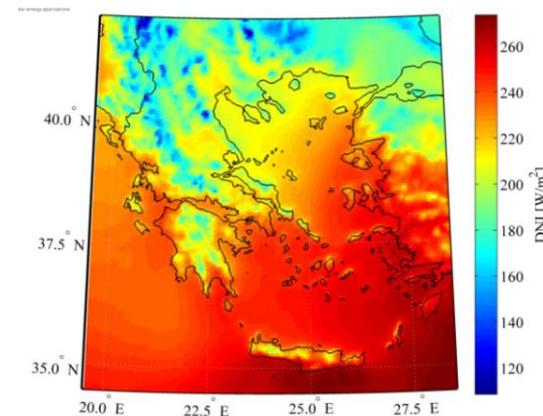
The SOLEA platform provides real-time services related to current as well as directly anticipated solar radiation potential and solar energy equivalent across Southeast Europe, North Africa, the Middle East and the Balkans

It also produces health-related radiation such as UV Index (melanoma), DNA damage, Vitamin D efficiency, agriculture (photosynthesis)

## Solar Atlases Energy Maps



## Solar Energy now-casting



Solar radiation related products



- Συντονισμός δικτύου 262 φορέων από 21 χώρες της Ευρώπης και NAMEBA
- Συντονισμός του Περιφερειακού Κέντρου Υποστήριξης Μεταφοράς Τεχνογνωσίας των Ηνωμένων Εθνών (Regional Support Office, UN-Spider)
- Ανάπτυξη και τήρηση πύλης (portal) ελεύθερης πρόσβασης χρηστών σε χιλιάδες γεωχωρικά δεδομένα (Regional Data Hub – GEOSS Portal Gateway)
- Διοργάνωση 16 διεθνών συνεδρίων ενημέρωσης και εκπαίδευσης νέων επιστημόνων και χρηστών (Capacity Building Regional Workshops)



06/10/2018

**COORDINATION AND EDUCATION ON  
SPACE APPLICATIONS ~300 BODIES IN 29  
COUNTRIES OF N. AFRICA, M. EAST,  
BALKANS**

Master of  
Science in  
“Space  
Science  
Technologies  
and  
Application”  
NATIONAL  
OBSERVA  
TORY OF  
ATHENS  
&  
UNIV. OF  
PELOPON  
NESE



## Information



All courses in Athens, IAASARS National Observatory of Athens, Penteli.



English



<http://space.uop.gr>



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thank you!

<http://www.beyond-eocenter.eu/index.php/ems>