



# BEYOND, European Center of Excellence for EO based Disaster Management

## The European Centre of Excellence BEYOND for Earth Observation based monitoring of Natural Disasters in South-Eastern Europe



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

*Funded under FP7-REGPOT-2012-2013-1*

*Activity: 4.1 Unlocking and developing the research potential of  
research entities established in the EU's Convergence regions and  
Outermost regions*



Dr Haris KONTOES

Research Director of IAASARS/NOA

Project Coordinator



SciNetNatHazPrev - XANTHI, 6 October 2015 - ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝ ΘΡΑΚΗΣ





# BEYOND, European Center of Excellence for EO based Disaster Management

The European Centre of Excellence for Earth Observation based monitoring of Natural Disasters in the South-Eastern Region



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SciNetNatHazPrev - XANTHI, 6 October 2015 - ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝ ΘΡΑΚΗΣ

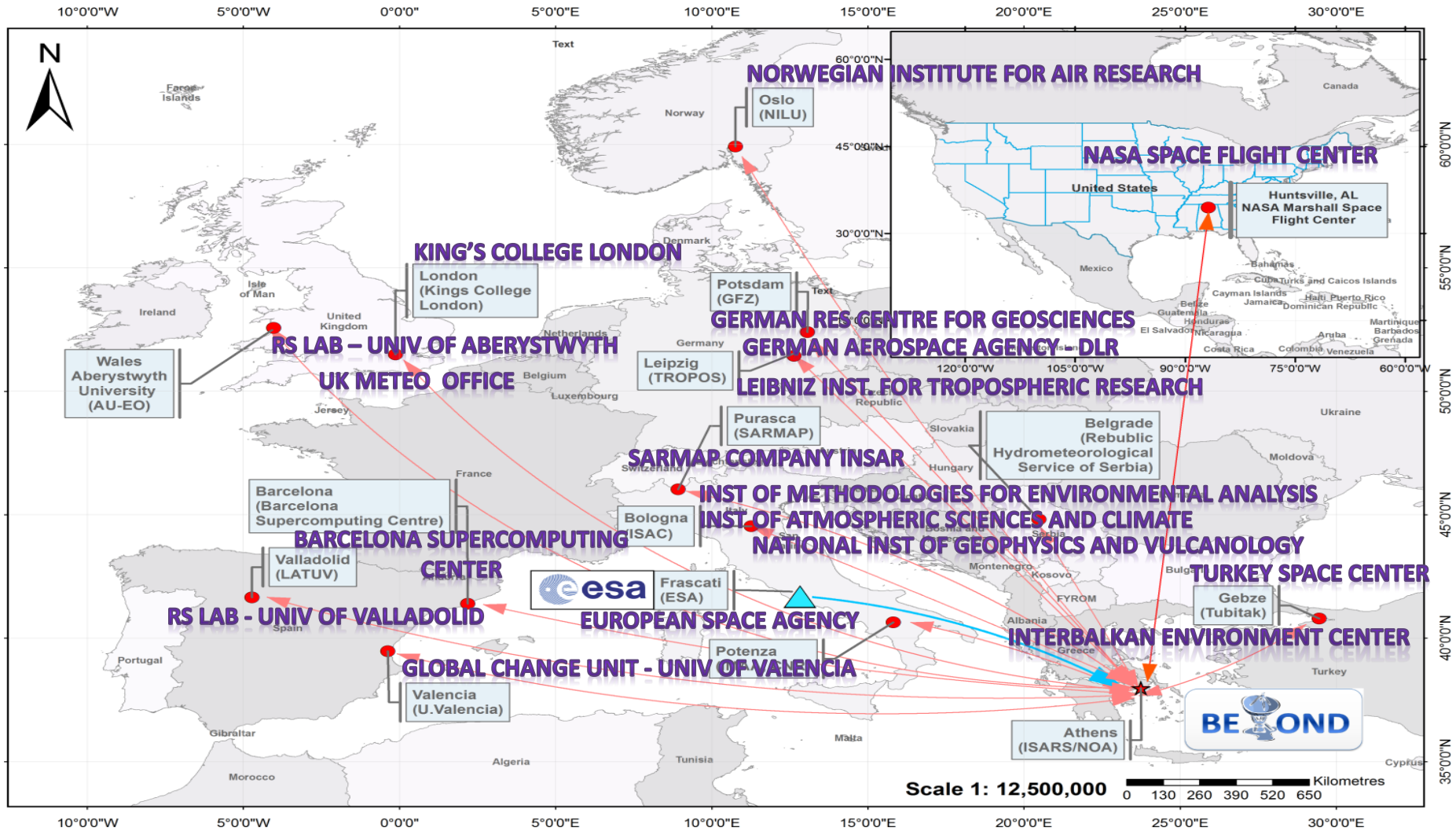


## Highly ranked priorities in **BEYOND**

➤ **BEYOND** aims to maintain and expand the existing state-of-the-art and interdisciplinary research potential in EO, by **Building a Centre of Excellence for Earth Observation based monitoring of Natural Disasters**

➤ **BEYOND** addresses societal needs of south-eastern Europe, with a prospect to increase its access range to the wider Mediterranean region through the integrated cooperation with more than **20 twining organizations**

# BEYOND, European Center of Excellence for EO based Disaster Management



- **BEYOND** aspires to setting up innovative solutions for EO, allowing to a multitude of monitoring networks (space borne and in-situ) available over the region to operate in a complementary, unified, and coordinated manner
- **BEYOND** builds innovative research and skills capacity in the domain of EO through scientific exchange with European and regional partnering organisations
- **BEYOND** transforms the observations to added value products ready for down-streaming to specific societal needs in the domain of environmental monitoring and Natural Disasters
- **BEYOND** delivers online observations and higher level EO products and services to stakeholders, and international scientific and End User communities

**Funding: 2.3 MEuros EC Contribution**

**Additional funding from Structural Funds ~270KEuros**

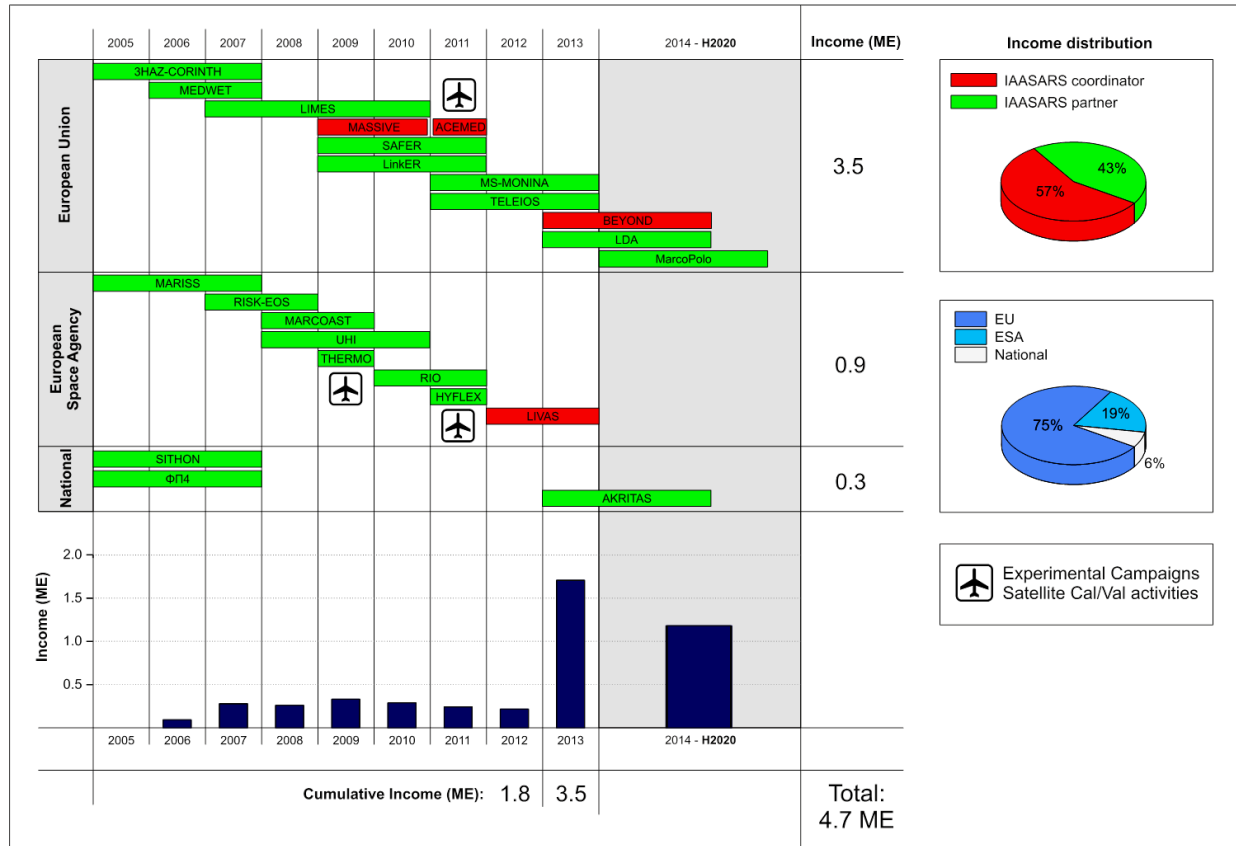
# BEYOND, European Center of Excellence for EO based Disaster Management

LDA Large-scale demonstrators in support of GMES and GNSS based services in Athens, Greece, GMES/DG ENTR

MASSIVE: Mapping Seismic Vulnerability and Risk of Cities, European Commission - DG ENV A.3 – Civil Protection

TELEIOS—Virtual Observatory Infrastructure for Earth Observation Data, FP7-ICT-2009-5

LIMES (Land and Sea Integrated Monitoring for European Security/GMES / EC DG Enterprise



LinkER - Supporting the implementation of an operational GMES service in the field of emergency management, Invitation to Tender No: ENTR/08/028

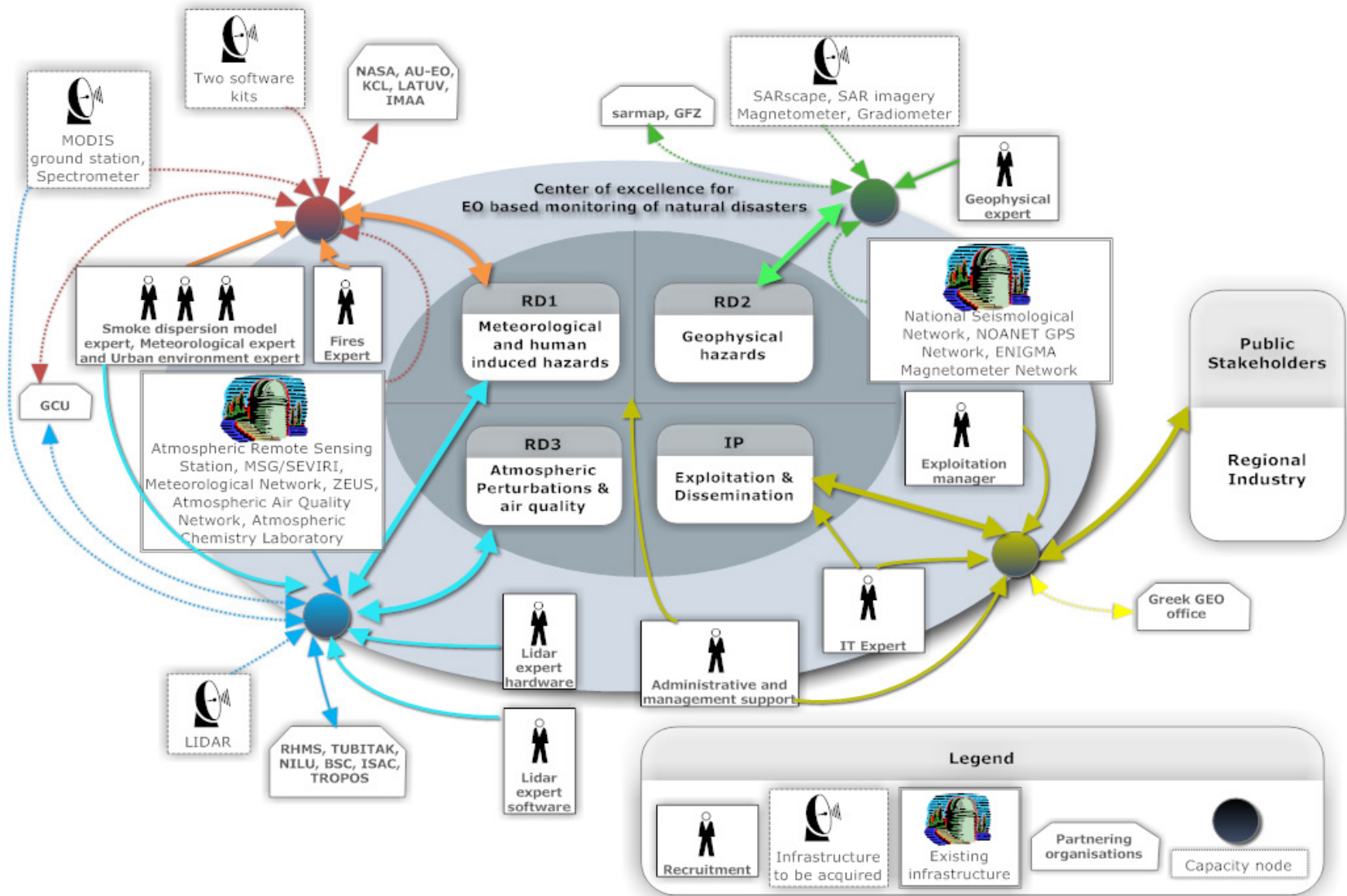
SAFER – EMERGENCY: Building Emergency Response Core Service, FP7-2007-SPACE-1/ GMES Collaborative Project

RISK-EOS Extension to Greece - Promotion of the GSE RISK-EOS fire services portfolio in Greece, EarthWatch GMES Services Elements, ESA/GSE

MARCOAST/ISSUE-OS - Integrated system for suspect vessels emergency tracking – OIL SPILLS



# BEYOND, European Center of Excellence for EO based Disaster Management



## Setting up integrated satellite based observational solutions

➤ **X-/L- band** acquisition station for (EOS Aqua and Terra, NPP, JPSS, NOAA, Met Op, FengYun) **(part of the DB network)**



IAASARS/NOA X-/L-band Acquisition station



Infrastructure Capacity Building



## Setting up integrated satellite based observational solutions

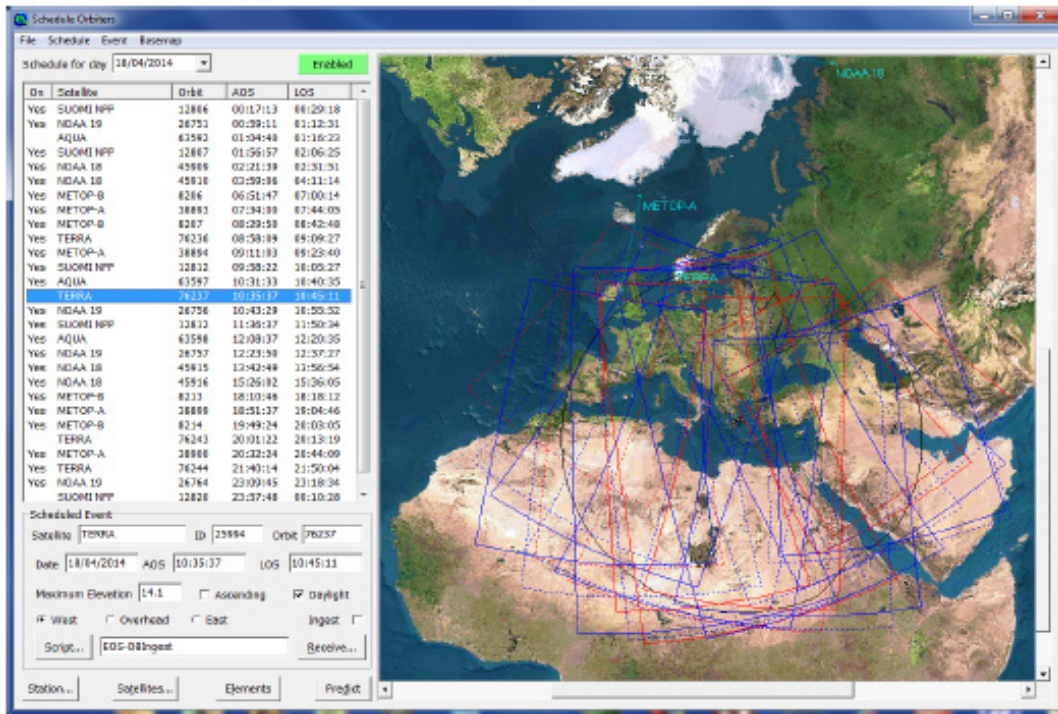
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IAASARS/NOA X-/L-band Acquisition station



Infrastructure Capacity Building



## Setting up integrated satellite based observational solutions

➤ **MSG SEVIRI acquisition stations of DVB-S & DVB-S2 systems exploiting high throughput provided with the new EUMETCast Europe service, based on using the EUTELSAT 10A (part of EUMETSAT's network)**

➤ **Access to NOA's in-situ monitoring seismological, magnetometer, and GPS networks**



**IAASARS/NOA MSG SEVIRI Acquisition station DVB-S2**

➤ **Develop and Operate of NOA's Collaborative Ground Segment (Hellenic Sentinel Data Hub-Mirror Site) dedicated to ESA Sentinel missions (Copernicus), allowing near real time acquisition of S-1, S-2, and future S3, S5P satellite missions**

## Setting up integrated satellite based observational solutions

➤ **MSG SEVIRI acquisition stations of DVB-S & DVB-S2 systems exploiting high throughput provided with the new EUMETCast Europe service, based on using the EUTELSAT 10A (part of EUMETSAT's network)**

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**IAASARS/NOA MSG SEVIRI Acquisition station DVB-S2**

➤ **Develop and Operate of NOA's Collaborative Ground Segment (Hellenic Sentinel Data Hub-**

**Activity in the framework of the  
COPERNICUS PROGRAM**  
**The EUROPEAN EARTH OBSERVATION FLAGSHIP  
PROGRAM (EU/ESA)**

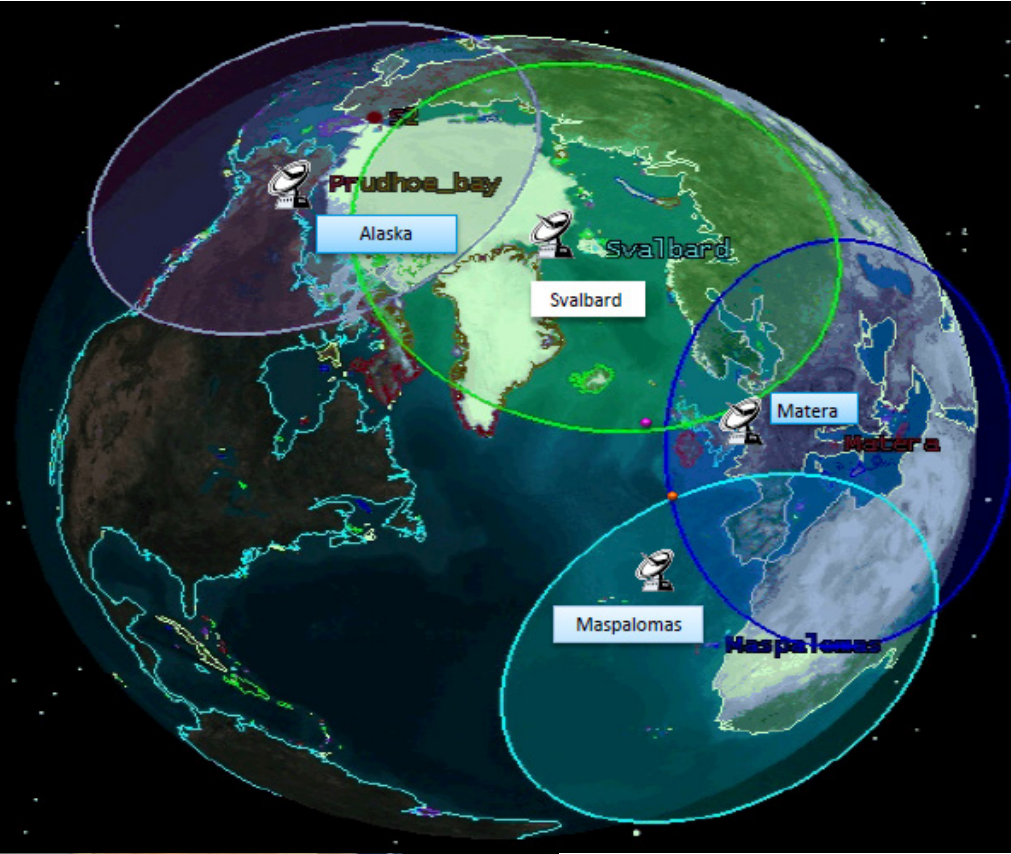
<http://www.copernicus.eu/>

Infrastructure Capacity  
Building

# BEYOND, European Center of Excellence for EO based Disaster Management

➤ a **GSC Core Ground Segment**, with **GSC-funded Functions and Elements**, providing :

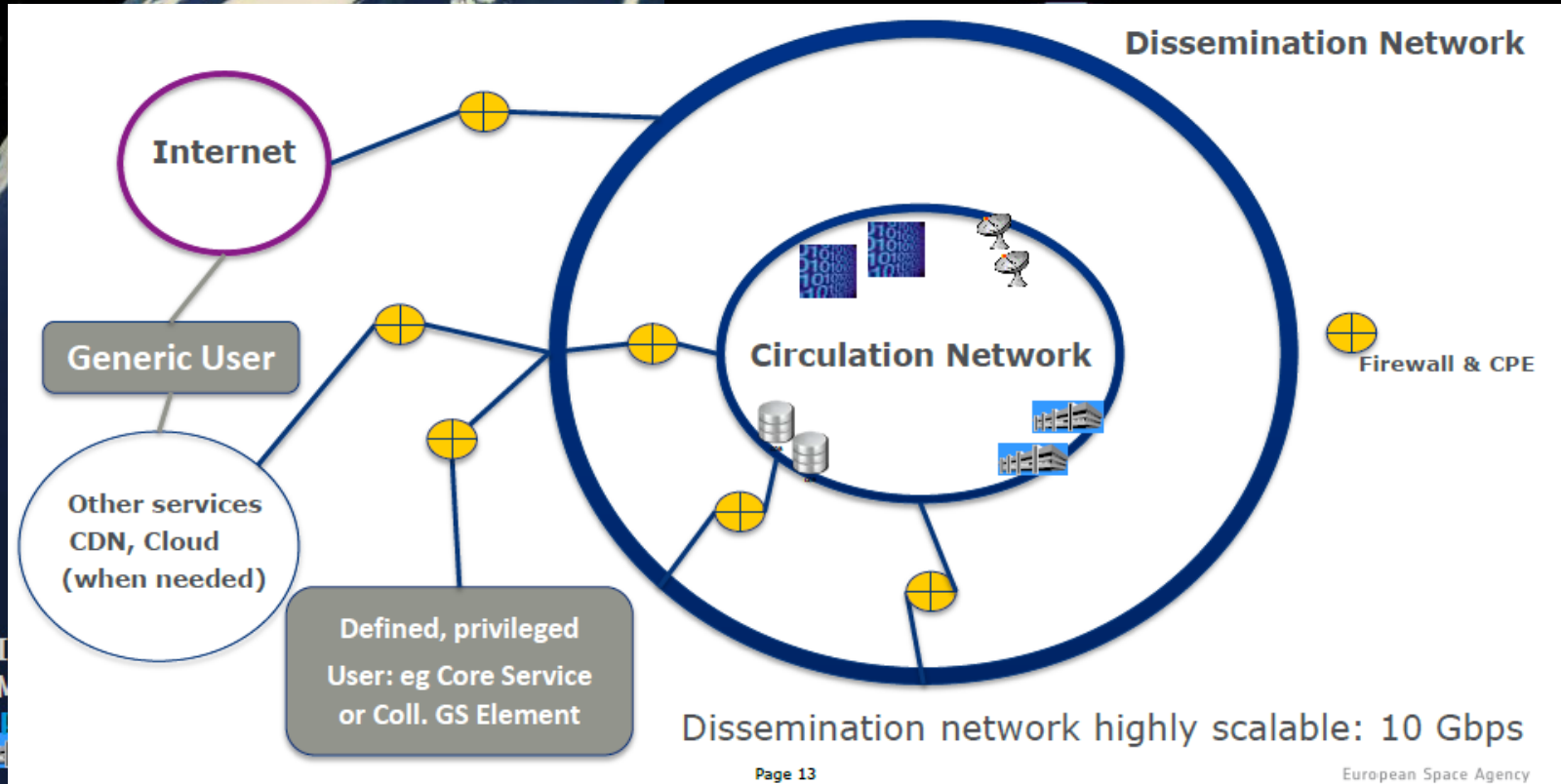
- the primary access to Sentinel Missions data as well as
- the coordinating access functions to Contributing Missions data



# BEYOND, European Center of Excellence for EO based Disaster Management

➤ a **GSC Core Ground Segment**, with **GSC-funded Functions and Elements**, providing :

- the primary access to Sentinel Missions data as well as
- the coordinating access functions to Contributing Missions data



**Hellenic Sentinel Data Hub- Mirror Site**

# Sentinel-1A/2A passes in IWS mode (250 km swath)



**OFFICIAL ANNOUNCEMENT OF  
HELLENIC MIRROR SITE  
ATHENS SPACE EXPO:  
28 MARCH – 5 APRIL**

**[HTTP://SENTINELS.SPACE.NOA.GR](http://sentinels.space.noa.gr)**

# BEYOND, European Center of Excellence for EO based Disaster Management



Operation of the mobile lidar of ESA by IAASARS



Development of a state-of-the-art multi-wavelength lidar to be installed in Crete (FKL), in the framework of the BEYOND project, part of the EARLINET network.



Infrastructure Capacity Building

# ACHIEVEMENTS – EO SERVICES



# BEYOND, European Center of Excellence for EO based Disaster Management

Service	Status	End Users	Scale	
<b>EMERGENCY RESPONSE/EMERGENCY SUPPORT-METEO RELATED HAZARDS</b>				<b>Delivered</b>
<b>Real Time Fire Monitoring</b>	<b>Operational GMES Standard</b>	<b>Fire Brigades, Civil Protection, Public, Private Sector</b>	<b>National Regional</b>	
<b>Rapid Fire Mapping</b>	<b>Operational GMES Standard</b>	<b>Fire Brigades, Civil Protection, Forestry Services, Min of Env</b>	<b>Regional Local</b>	
<b>Disaster Event Mapping &amp; Damage Ass.</b>	<b>Operational GMES Standard</b>	<b>Forestry Services, Min of Env (DG for Nat. Vegetation/Forest Protection)</b>	<b>Local</b>	
<b>Seasonal/Diachronic Fire Mapping &amp; Damage Ass.</b>	<b>Operational GMES Standard</b>	<b>Forestry Services, Min of Env (DG for Nat. Vegetation/Forest Protection, Cadastral Org, Fire Brigades)</b>	<b>National</b>	
<b>Wild Fire Smoke Dispersion</b>	<b>Research/ Preoperational</b>	<b>Fire Brigades, Civil Protection, Min of Env</b>	<b>Regional Local</b>	
<b>Saharian Dust Episodes</b>	<b>Research/ Preoperational</b>	<b>Civil Protection, Min of Env, Public</b>	<b>National</b>	
<b>Flood Risk</b>	<b>Research/ Preoperational</b>	<b>National Electric Power Org, Min of Development, Local Authorities, Civil Protection</b>	<b>Regional Local</b>	
<b>Heat Waves Risk</b>	<b>Research/ Preoperational</b>	<b>Min of Public Health, Local Authorities, Medical Science</b>	<b>Local</b>	
				<b>To be Delivered as V1.0 in 2014</b>
				<b>To be Delivered as V1.0 in 2015-2016</b>

Web service

Web service



# BEYOND, European Center of Excellence for EO based Disaster Management

EMERGENCY RESPONSE/EMERGENCY SUPPORT- GEO- HAZARDS			
Earthquake related crustal deformation field	Operational GMES Standard	Anti-seismic Planning & Protection Org, EQ Scientists	Local
Volcano related surface velocity field	Operational GMES Standard	Anti-seismic Planning & Protection Org, Local Authorities, EQ Scientists	Local
Landslide related surface velocity field	Research	Anti-seismic Planning & Protection Org, Local Authorities, Entrepreneurs, Civ. Eng, Geologists	Local
ATMOSPHERIC DISTURBANCES - CLIMATOLOGY			
3D-Climatology	Operational GMES Standard	Cal/Val Industry, Global Atm Monitoring Networks	Global
Atmospheric Episodes	Research	Cal/Val Industry, Global Atm Monitoring Networks,	Local
LULC CHANGE MONITORING – UAV / AIRBORNE / SATELLITE			
Urban Mapping	Operational GMES Standard	World Bank, EIB, Min of Env, Cadastral Org	Local
UAV Damage Recording	Research/ Preoperational	Anti-seismic Planning and Protection Organisation	Local
Ecosystem Monitoring and Mapping (Forests/Wetlands)	Operational	Min of Env, Hellenic Biotope & Wetlands Center, Cadastral Org	National Regional

Delivered

To be Delivered as V1.0 in 2014

To be Delivered as V1.0 in 2015-2016

Web service



# “FireHub: A Space Based Fire Management Hub “



**BE OND**  
**FireHub**



**“FireHub: A Space Based Fire Management Hub “**





BE  
FireHub

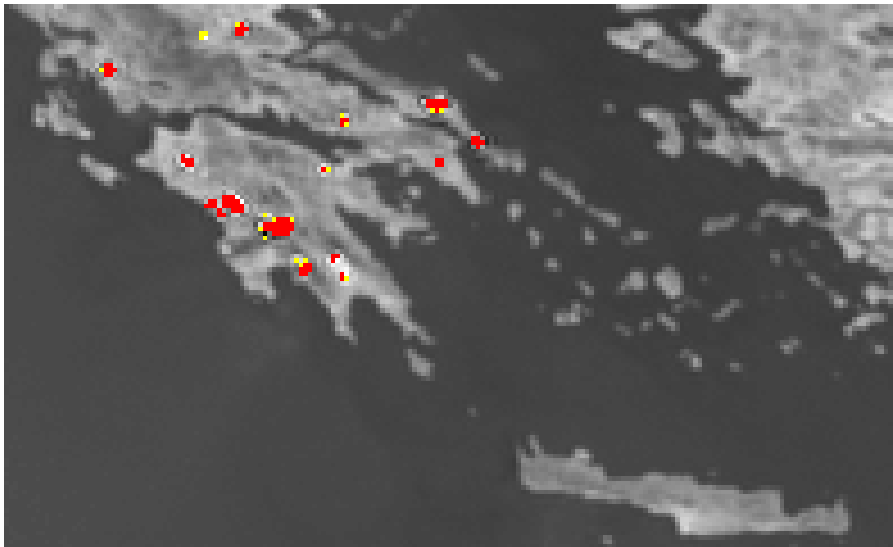
“FireHub: A  
Space Based  
Fire  
Management  
Hub “



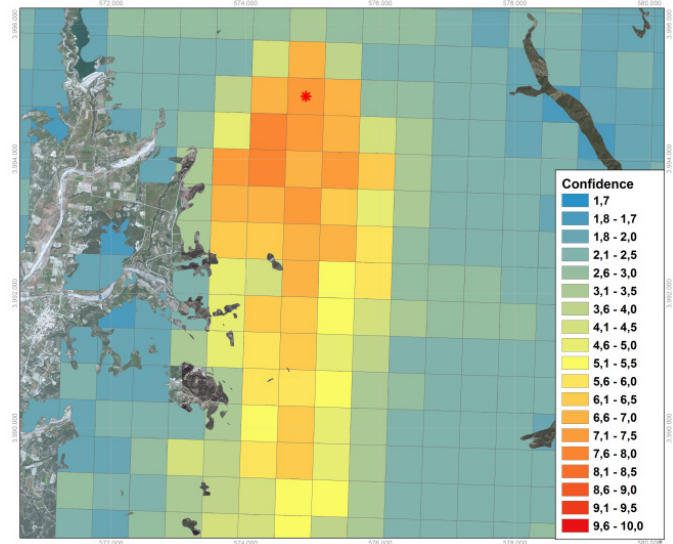
# “FireHub: A Space Based Fire Management Hub “

The service consists of three pillars:

1. The real-time fire detection and monitoring application
2. The large scale Burnt Scar Mapping during and after wildfires and the Diachronic BSM
3. The fire smoke dispersion forecasting tool



Raw resolution: 3.5x3.5 km wide pixel over entire



Refined resolution: 0.5x0.5 km wide pixel over entire Greece

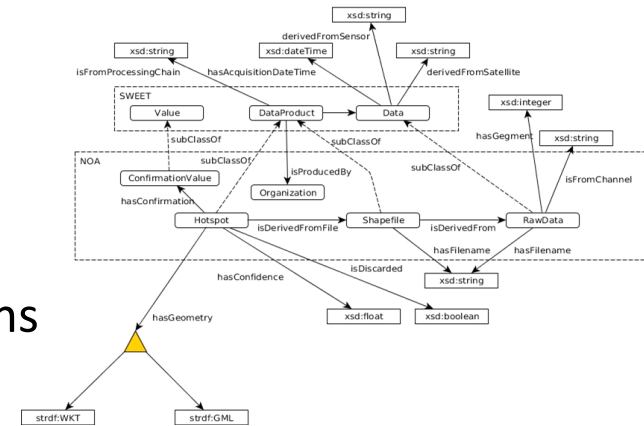
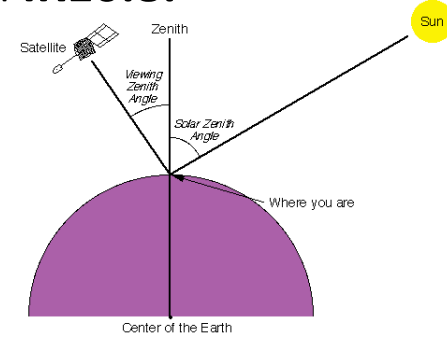
## CLASSIFICATION PROCESS

**Classification #1:** The EUMETSAT Fire mapping algorithm (FIR) based on fixed thresholding approach, applied on the spectral bands **IR 3.9** and **IR10.8**.

**Classification enhancement # 1:** The thresholds are dynamically changing calculated for each image and every pixel location on the basis of the seasonally variations and time depended Solar Zenith Angle.

**Classification enhancement # 2 :** Create and integrate classification evidence through geo-spatial ontology schemes and reasoning queries, accounting for the

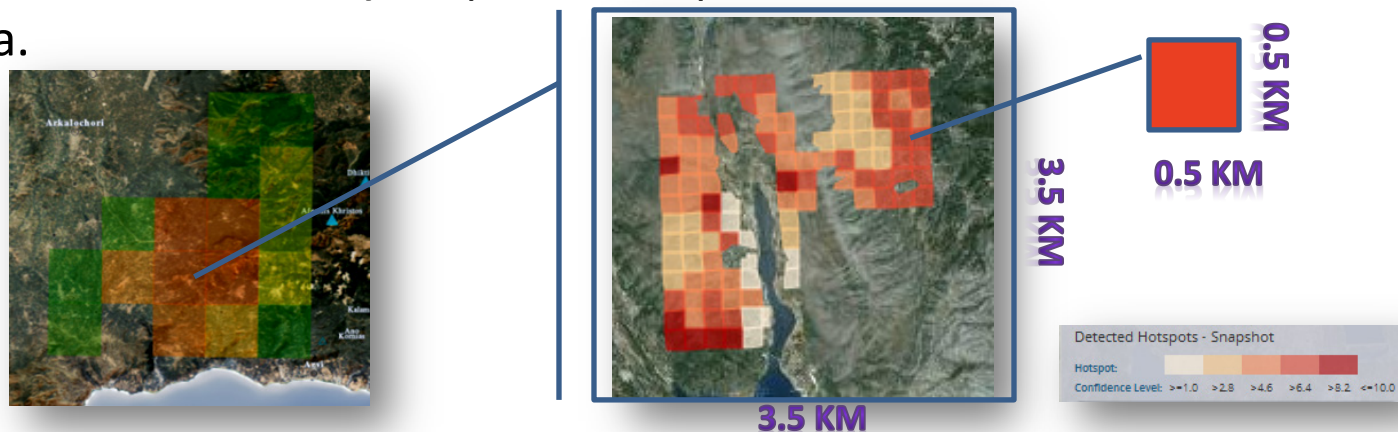
- a) thematic consistency by eliminating false alarms, and
- b) account for the time persistence of the fire observations



## CLASSIFICATION PROCESS

**Classification enhancement # 3:** Downscaling the first classification output and calculate the fire occurrence probability in sub-areas of 500 m x 500 m wide, inside the initial observation area of 3.5km x 3.5 km, accounting for the real meteorological, physical / ecological, and morphological conditions in the affected area such as,

**a)** Wind conditions (speed/direction), **b)** Fuel types and fuel type's proneness to fire, **c)** Altitudinal zone, **d)** Slope and Aspect elements of each of the 500m x500m area.





Regional Real Time Fire Monitoring - NOA's MSG SEVIRI Station

IAASARS

Zaharo Fire

Olympia site Fire

Aliveri Euboea Fire

Korinthos Fire

Stira Euboea Fire

Parnon Mt Fire

Taygetos Mt Fire

Megalopolis Fire

Otilon Fire

EMERGENCY

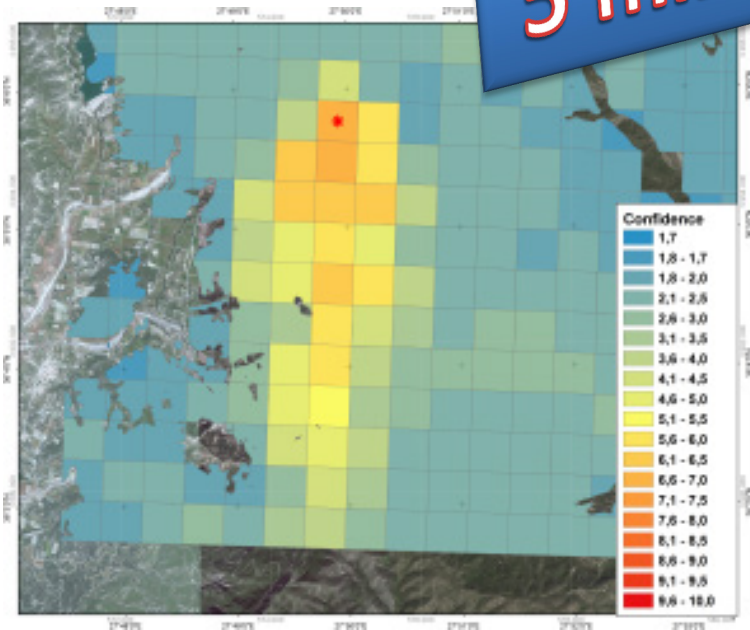
SEVIRI MIR 070823\_1030 UTC

	POTENTIAL FIRE
	CONFIRMED FIRE

## Results @ 150 minutes after fire ignition



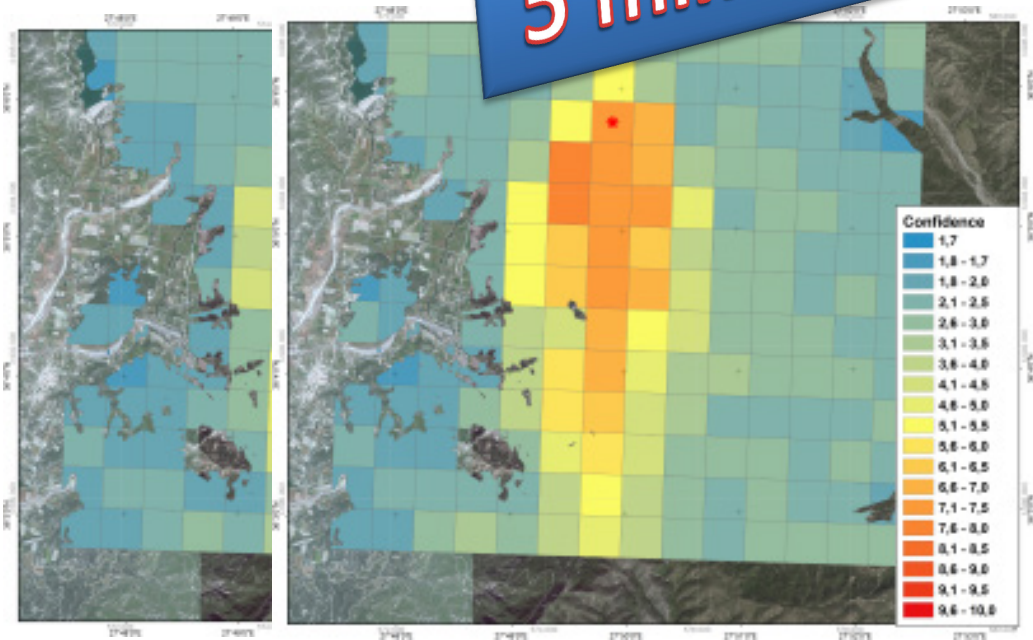
**5 minutes basis**



## Results @ 150 minutes after fire ignition



**5 minutes basis**



Results @ 150 minutes after fire ignition

+30'

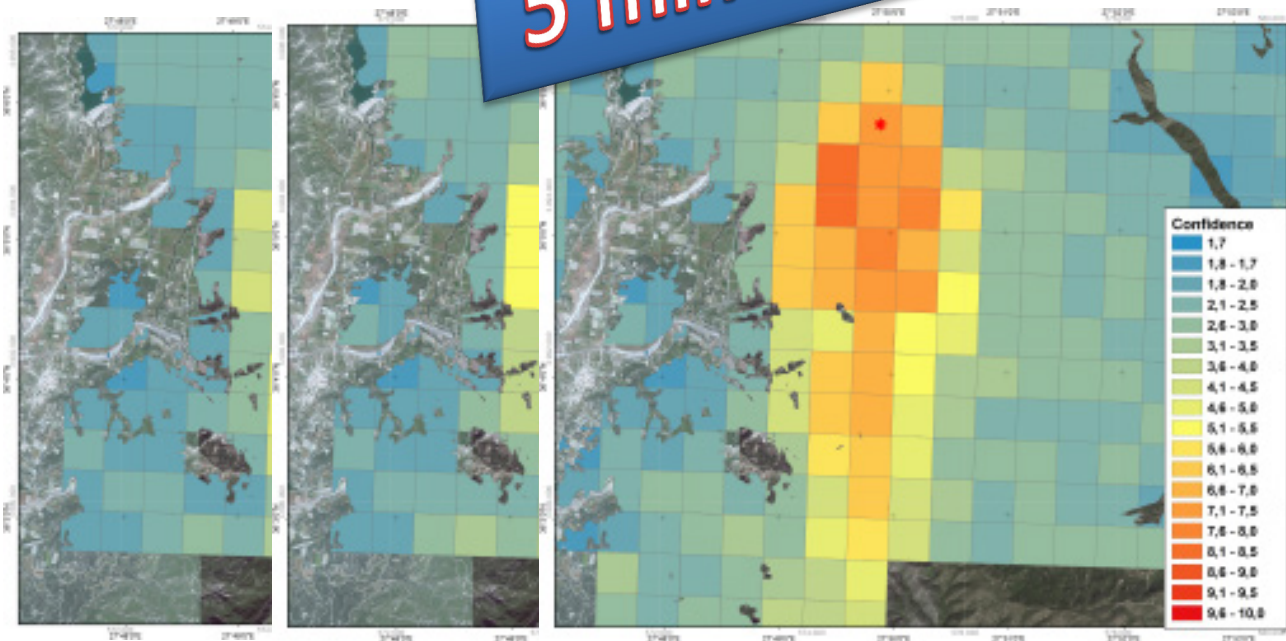
+35'

+40'

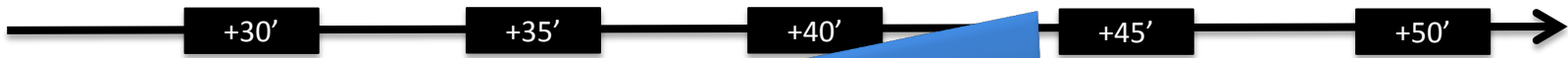
+45'

+50'

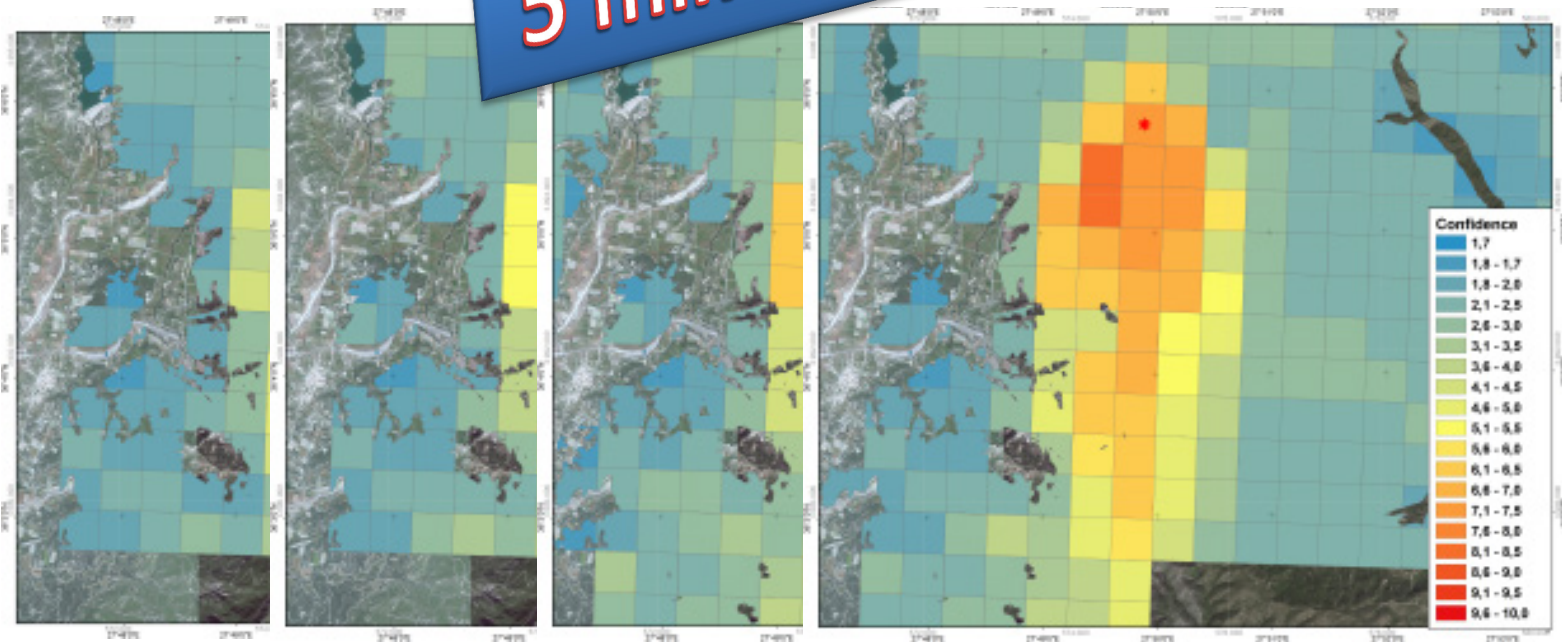
5 minutes basis



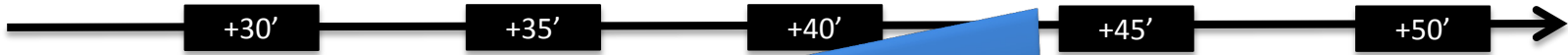
## Results @ 150 minutes after fire ignition



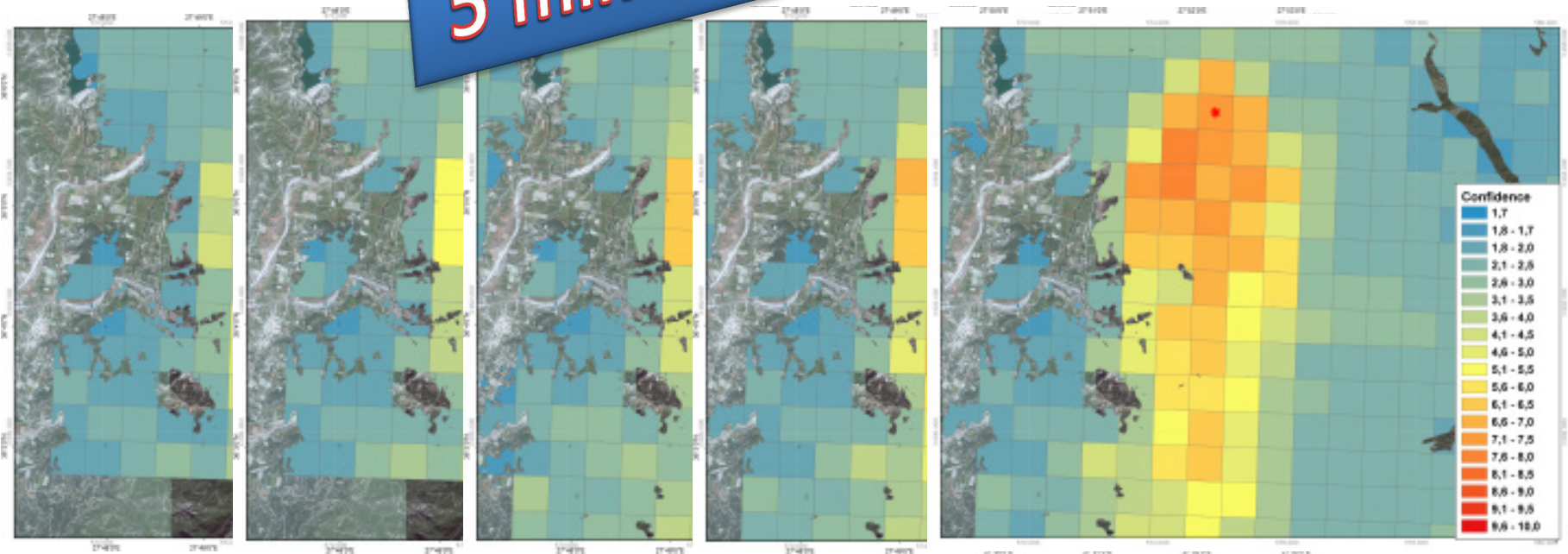
**5 minutes basis**



## Results @ 150 minutes after fire ignition



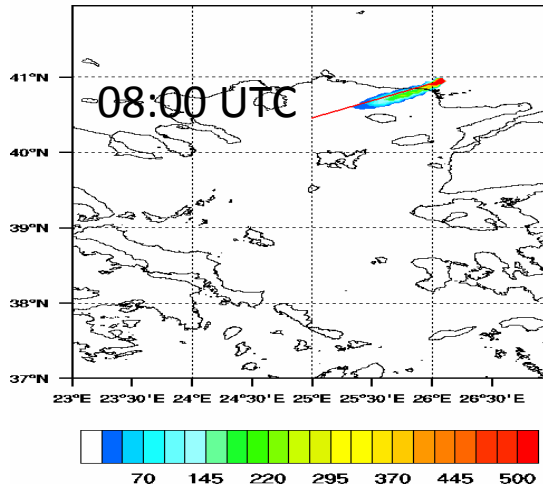
**5 minutes basis**





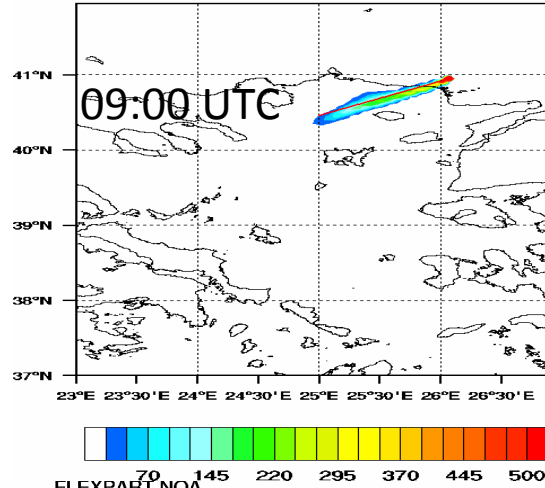
**FLEXPART - NOA**  
Biomass Burning (Organic Carbon -OC)

valid date:24-08-2011 08UTC  
Model layer: Integrated Column (ng m<sup>-3</sup>)



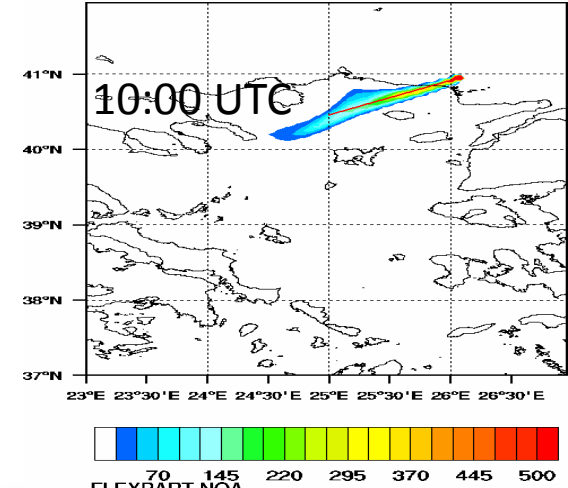
**FLEXPART - NOA**  
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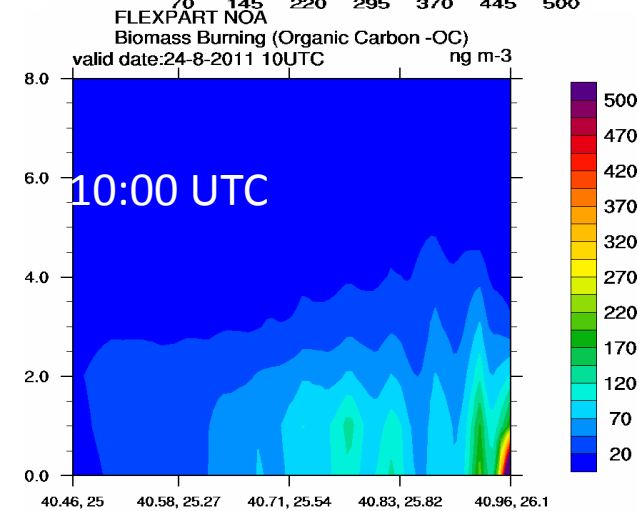
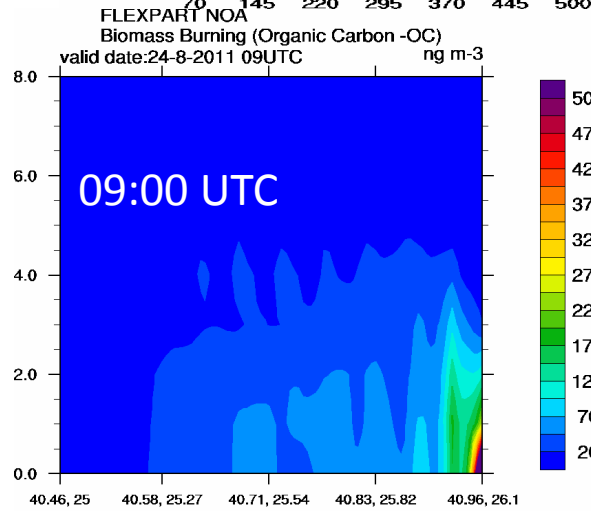


**FLEXPART - NOA**  
Biomass Burning (Organic Carbon -OC)

valid date:24-08-2011 10UTC  
Model layer: Integrated Column (ng m<sup>-3</sup>)



**Forecasting Vertical structure of smoke plume Cross section of Organic Carbon concentration (ng m<sup>-3</sup>)**





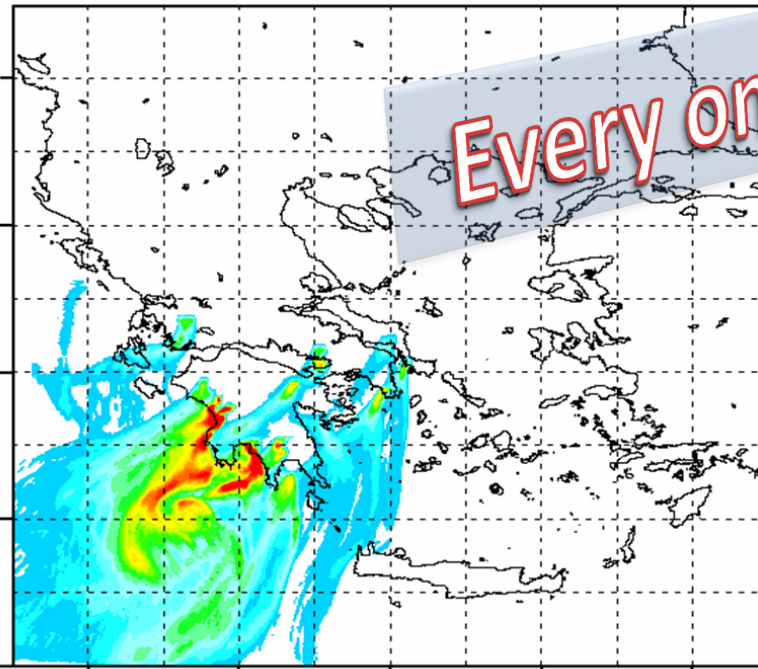
## FLEXPART - NOA

Biomass Burning (Organic Carbon - OC)

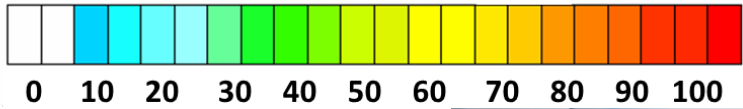
Valid Date: 26-08-2007 0900UTC

Model layer: Integrated Column

(ng m<sup>-3</sup>)



20°E 22°E 24°E 26°E 28°E

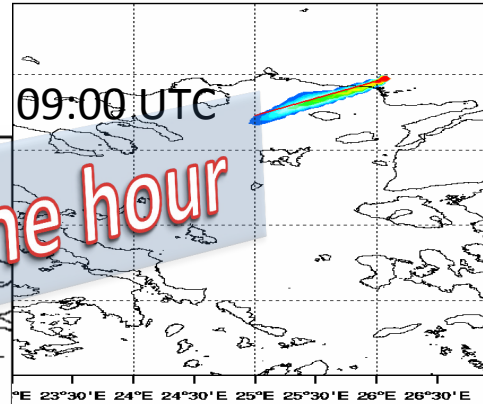


## FLEXPART - NOA

Biomass Burning (Organic Carbon -OC)

valid date: 24-08-2011 09UTC

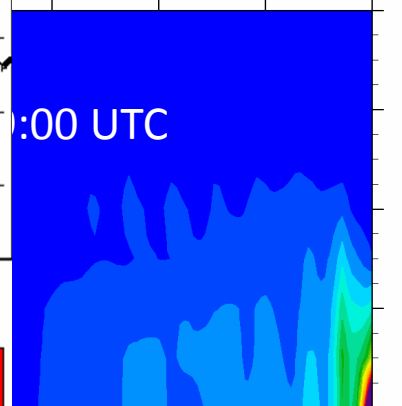
Model layer: Integrated Column (ng m<sup>-3</sup>)



23°30'E 24°E 24°30'E 25°E 25°30'E 26°E 26°30'E



FLEXPART NOA  
Biomass Burning (Organic Carbon -OC)  
valid date: 24-8-2011 09UTC



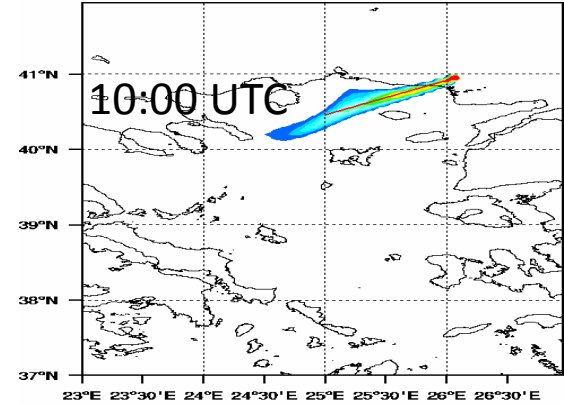
40.58, 25.27 40.71, 25.54 40.83, 25.82 40.96, 26.1

## FLEXPART - NOA

Biomass Burning (Organic Carbon -OC)

valid date: 24-08-2011 10UTC

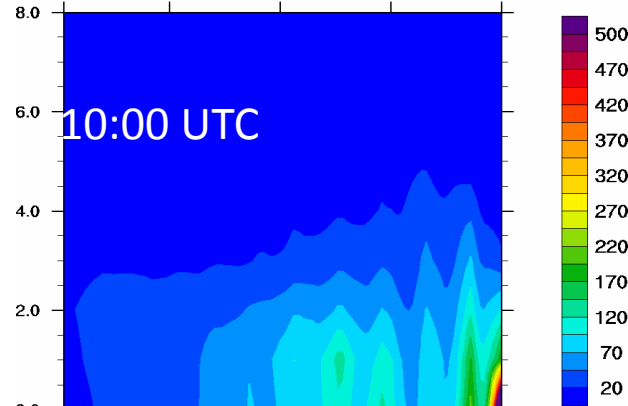
Model layer: Integrated Column (ng m<sup>-3</sup>)



23°E 23°30'E 24°E 24°30'E 25°E 25°30'E 26°E 26°30'E

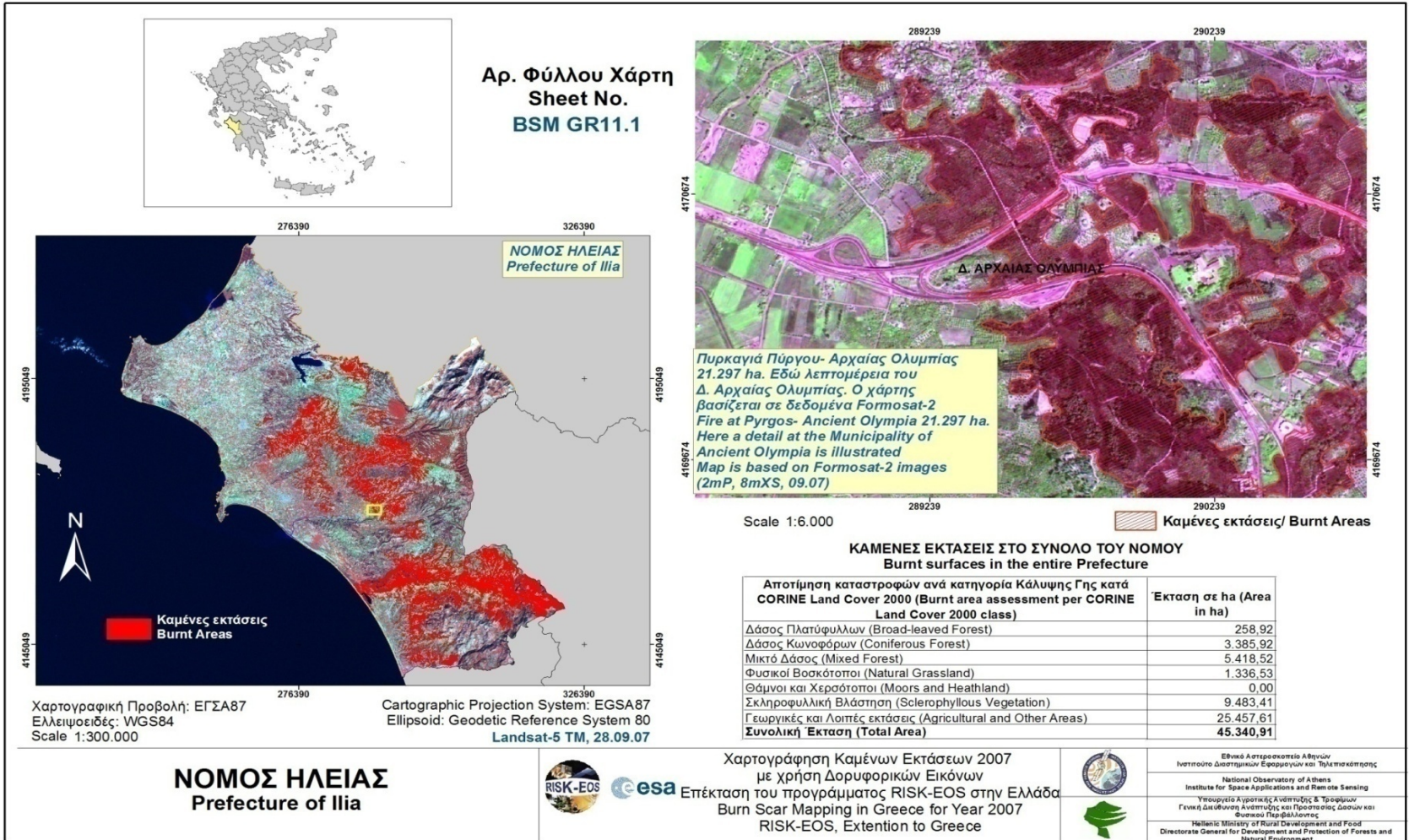


FLEXPART NOA  
Biomass Burning (Organic Carbon -OC)  
valid date: 24-8-2011 10UTC



40.46, 25 40.58, 25.27 40.71, 25.54 40.83, 25.82 40.96, 26.1

# BEYOND, European Center of Excellence for EO based Disaster Management



**ΚΑΜΕΝΕΣ ΕΚΤΑΣΕΙΣ ΣΤΟ ΣΥΝΟΛΟ ΤΟΥ ΝΟΜΟΥ**  
Burnt surfaces in the entire Prefecture

Αποτίμηση καταστροφών ανά κατηγορία Κάλυψης Γης κατά CORINE Land Cover 2000 (Burnt area assessment per CORINE Land Cover 2000 class)	Έκταση σε ha (Area in ha)
Δάσος Πλατύφυλλων (Broad-leaved Forest)	258,92
Δάσος Κωνοφόρων (Coniferous Forest)	3.385,92
Μικτό Δάσος (Mixed Forest)	5.418,52
Φυσικοί Βοσκότοποι (Natural Grassland)	1.336,53
Θάμνοι και Χερσότοποι (Moors and Heathland)	0,00
Σκληροφυλλική Βλάστηση (Sclerophyllous Vegetation)	9.483,41
Γεωργικές και Λοιπές εκτάσεις (Agricultural and Other Areas)	25.457,61
<b>Συνολική Έκταση (Total Area)</b>	<b>45.340,91</b>

**ΝΟΜΟΣ ΗΛΕΙΑΣ**  
Prefecture of Ilia



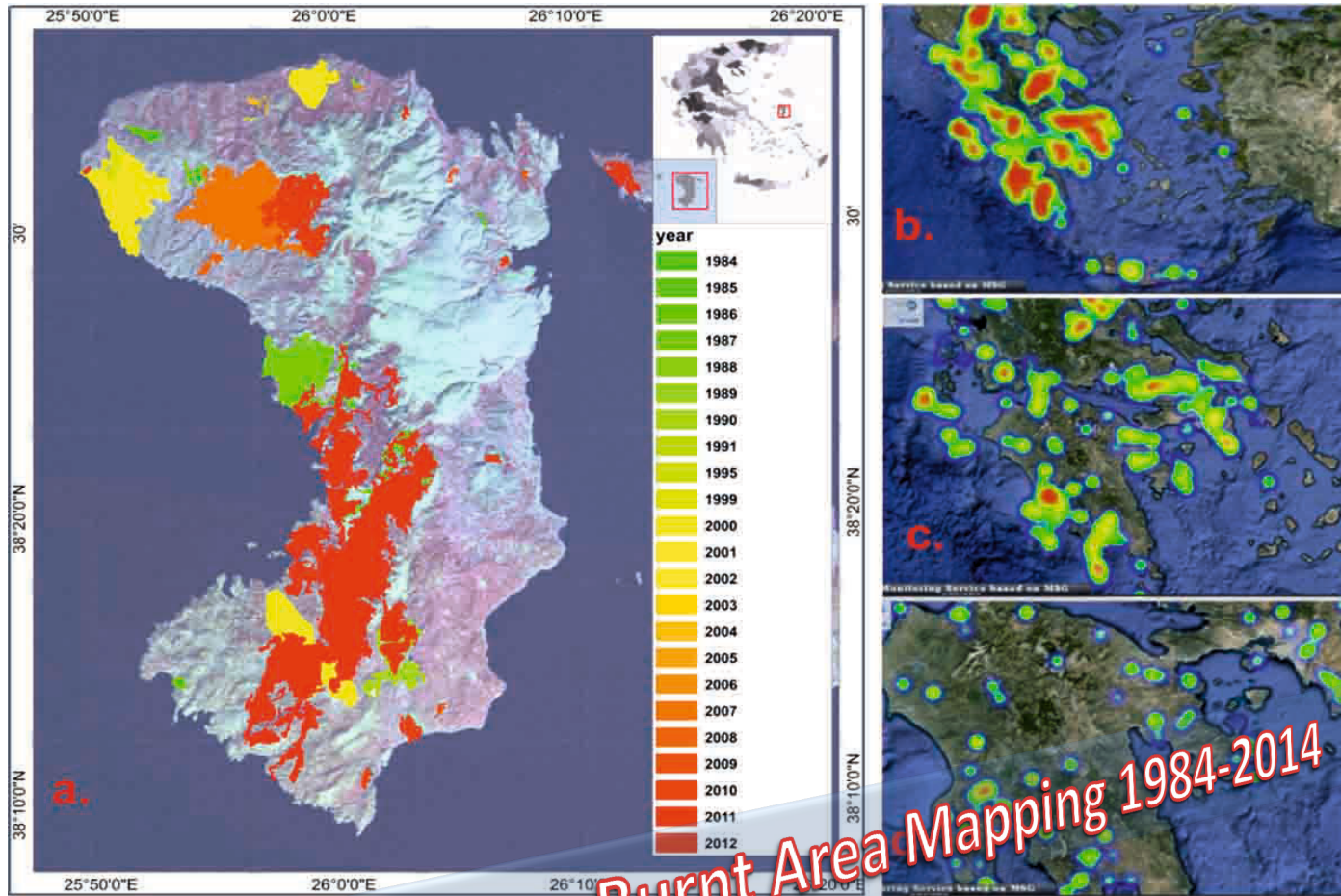
Χαρτογράφηση Καμένων Εκτάσεων 2007  
με χρήση Δορυφορικών Εικόνων  
Επέκταση του προγράμματος RISK-EOS στην Ελλάδα  
Burn Scar Mapping in Greece for Year 2007  
RISK-EOS, Extension to Greece



Εθνικό Αστεροσκοπείο Αθηνών  
Institute for Space Applications and Remote Sensing

Υπουργείο Αγροτικής Ανάπτυξης & Τροφίμων  
Γενική Διεύθυνση Ανάπτυξης και Προστασίας Δασών και Φυσικού Περιβάλλοντος  
Hellenic Ministry of Rural Development and Food  
Directorate General for Development and Protection of Forests and Natural Environment

# BEYOND, European Center of Excellence for EO based Disaster Management



1) More than 650 Landsat TM images acquired over Greece in the period 1984-2013 residing on USGS archives were downloaded and processed fully automatically using the NOA processing chain.

2) Yearly maps of Burned Areas have been produced

3) Yearly statistics per land cover type and administrative data have been generated

4) On-line dissemination of the produced maps and statistics through the NOA's dedicated web interface



# BEYOND, European Center of Excellence for EO based Disaster Management

Firefox SEVIRI Monitor - NOA GIS

papos.space.noa.gr/fend\_static/index.html

Most Visited Getting Started Latest Headlines Γενική Γραμματεία Ερε... TeleiosWiki: Additiona... rts

TELEOS SWoFS gmes strabon EUMETSAT

Status Info:  
 Mode: Archive  
 Beginning Time: 2012-08-21T21:00:00 GMT  
 End Time: 2012-08-27T21:00:00 GMT  
 Total #HotSpots: 2361  
 Latest #HotSpots:

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

	RANK	Municipality	Duration	Ignition	End
0	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	27.25	2012-08-24T23:10:00	2012-08-26T02:20:00
2	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	26.17	2012-08-25T01:45:00	2012-08-26T03:50:00
4	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	17.83	2012-08-25T10:15:00	2012-08-26T04:00:00
5	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	17.75	2012-08-25T10:15:00	2012-08-26T03:55:00
6	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	11.83	2012-08-25T10:10:00	2012-08-25T21:55:00
10	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	11.83	2012-08-25T10:10:00	2012-08-25T21:55:00
12	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	10	2012-08-25T00:55:00	2012-08-25T10:50:00
13	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	16.33	2012-08-25T10:20:00	2012-08-26T02:35:00
14	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	10.67	2012-08-25T12:40:00	2012-08-25T23:15:00

Fire Monitoring Service based on MSG SEVIRI

Realtime Archive

Year & 2012 Month of Reference

1 07 1 08 1 09 1 10 1 11 1 12 May Jun Jul Aug Sep

Submit Ignition Fire End Duration

Fire Simulation

All Detected Hotspots End Time (Days | Hours). From 2012-08-27T21:00:00 to 2012-08-21T21:00:00

Geotype: Populated (Population)

- ★ Athens ≥300000
- ★ Larisa ≥100000
- Chania ≥50000
- Tripoli ≥10000
- Epanomi ≥1000
- Areopoli ≥500
- Kalamos ≥100
- Platania ≥0

Geotype: Mountains (Height[m])

- ▲ M.Olympus ≥2500
- ▲ M.Pilion ≥1500
- ▲ M.Ymittos ≥1000
- ▲ Mavrotoumi ≥0

Geotype: Islands (Area[km2])

- N.Crete ≥3000
- N.Rhodes ≥1000
- N.Andros ≥100
- N.Thira ≥10
- N.Plateia ≥1
- N.Pilonni ≥0

NOA Implementation Team: Haris Kontoes; Themistoklis Herekakis; Dimitris Michail; Ioannis Papoutsis

Contact Email: malto:kontoes@noa.gr

Powered by Leaflet

3:04 μμ 14/9/2012



# BEYOND, European Center of Excellence for EO based Disaster Management

Firefox - SEVIRI Monitor - NOA GIS

papos.space.noa.gr/fend\_static/index.html

Most Visited Getting Started Latest Headlines Γενική Γραμματεία Ερε... TeleiosWiki: Additiona... rts

TELEOS SWoFS gmes strabon EUMETSAT

Status Info:  
 Mode: Archive  
 Beginning Time: 2012-08-21T21:00:00 GMT  
 End Time: 2012-08-27T21:00:00 GMT  
 Total #HotSpots: 2361  
 Latest #HotSpots:

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

	RANK	Municipality	Duration	Ignition	End
0	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	27.25	2012-08-24T23:10:00	2012-08-26T02:20:00
2	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	26.17	2012-08-25T01:45:00	2012-08-26T03:50:00
4	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	17.83	2012-08-25T10:15:00	2012-08-26T04:00:00
5	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	17.75	2012-08-25T10:15:00	2012-08-26T03:55:00
6	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	11.83	2012-08-25T10:10:00	2012-08-25T21:55:00
10	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	11.83	2012-08-25T10:10:00	2012-08-25T21:55:00
12	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	10	2012-08-25T00:55:00	2012-08-25T10:50:00
13	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	16.33	2012-08-25T10:20:00	2012-08-26T02:35:00
14	1910	ΔΗΜΟΣ ΚΥΜΗΣ-ΑΛΙΒΕΡΙΟΥ	10.67	2012-08-25T12:40:00	2012-08-25T23:15:00

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NOA Implementation Team: Haris Kontoes; Themistoklis Herekakis; Dimitris Michail; Ioannis Papoutsis

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Powered by Leaflet

3:04 μμ 14/9/2012





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>



## BEYOND for flood monitoring

**BEYOND** Building a Centre of Excellence for EO-based monitoring of Natural Disasters

HOME PROJECT INFRASTRUCTURE PEOPLE PARTNERS OUTREACH ANNOUNCEMENTS MULTIMEDIA BEYOND SHARE EVENTS

**NATURAL DISASTER SERVICES**

- FIRES
- FLOODS**

► **OVERVIEW**

- CASE STUDIES
- FLOODS

OBSERVATORY

URBAN ENVIRONMENT

GEOPHYSICAL

ATMOSPHERIC

WEATHER

UAV-BASED LOSS

RECORDING

Floods

### FLOODS

#### OVERVIEW

Flood is defined as 'a covering by water of land not normally covered by water' in the European Union Floods Directive 2007/60/EC. Human activities, such as agriculture, urban development, industry and tourism, contribute to an increase in the likelihood and adverse impacts of flood events. It is thus important to establish flood risk management plans focused on prevention, protection and preparedness.

The ultimate goal of the Flood Hazard activities in BEYOND is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. In this direction, we select river basins at high risk of flooding, we study the hydraulic behaviour of the river, and we proceed to the flood modelling validation and enhancement with the integration of satellite optical and radar data.

In the context of the implementation of BEYOND, we have established the [FLOODS OBSERVATORY](#) where we register all the flood events in Greece and we publish the results we produce following process of satellite optical and radar images.

NOA has also established cooperation with the Public Power Corporation S.A. (PPC S.A.), as there is a mutual interest in cooperation in the field of the study of floods to develop a methodology for monitoring and management of flood risks. The contribution of PPC S.A. will cover the provision of relevant expertise and data derived from the processing of the measurements of the hydrometeorological network operated by PPC S.A., and/or data relating to the management of the hydrological basins under study. This cooperation will allow the improved adjustment and calibration of the hydrological models which are to be operated by the IAASARS/NOA, as well as the development of a methodology that will provide reliable observations to the services of PPC S.A in the future. Our first area of interest is Arachthos river basin, a river with several flood events, very close to the city of Artas, where PPC is operating a large hydroelectric plant.

**SEARCH**

**PROJECT MEETINGS**

- [Joint EARLINET-GA/ACTRIS Limassol, Cyprus, 25-29 November 2013](#)
- [KO Athens 2013-07-18](#)

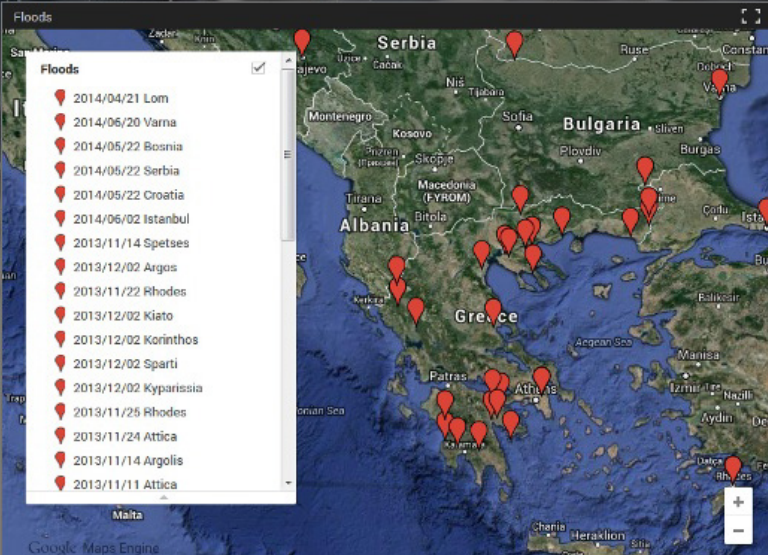

**BEYOND NEWSLETTERS**

- [Newsletter No I](#)
- [Newsletter No II](#)

We have established the **BEYOND Floods Observatory** where we register all the major flood events in Greece and South-Eastern Europe.

## FLOODS OBSERVATORY / ΠΑΡΑΤΗΡΗΤΗΡΙΟ ΠΛΗΜΜΥΡΩΝ

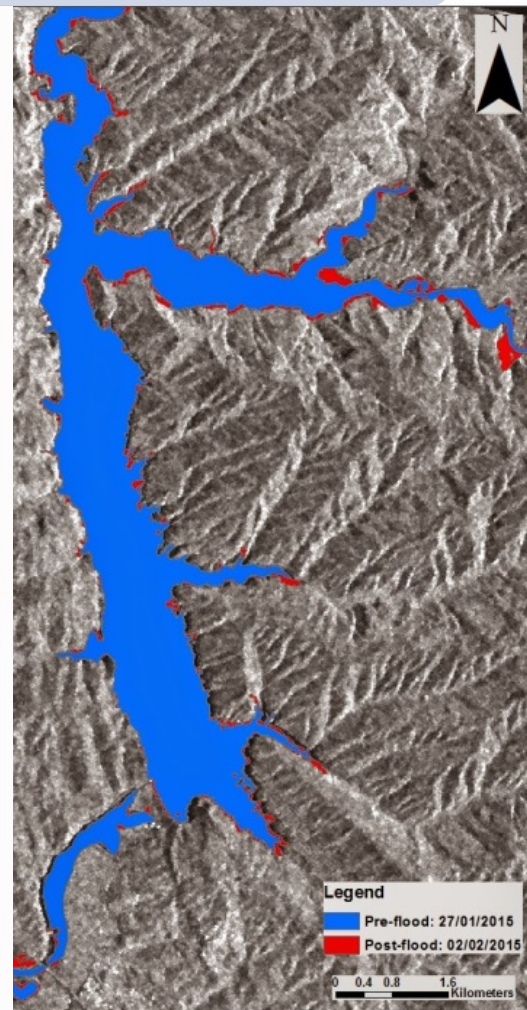
WITHIN THE FRAMEWORK OF THE BEYOND PROJECT SINCE JUNE 2013 / ΣΤΟ ΠΛΑΙΣΙΟ ΤΟΥ ΠΡΟΓΡΑΜΜΑΤΟΣ BEYOND ΑΠΟ ΤΟΝ ΙΟΥΝΙΟ ΤΟΥ 2013



Date	Location
2014/04/21	Lom
2014/06/20	Varna
2014/05/22	Bosnia
2014/05/22	Serbia
2014/05/22	Croatia
2014/06/02	Istanbul
2013/11/14	Spetses
2013/12/02	Argos
2013/11/22	Rhodes
2013/12/02	Kiatio
2013/12/02	Korinthos
2013/12/02	Sparti
2013/12/02	Kyparissia
2013/11/26	Rhodes
2013/11/24	Attica
2013/11/14	Argolis
2013/11/11	Attica

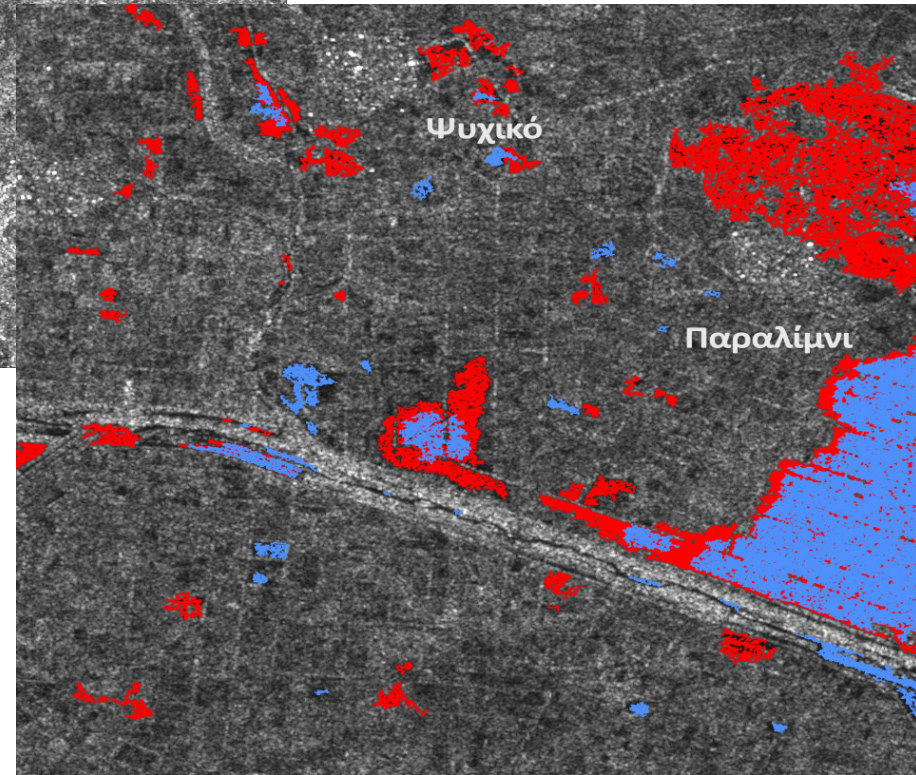
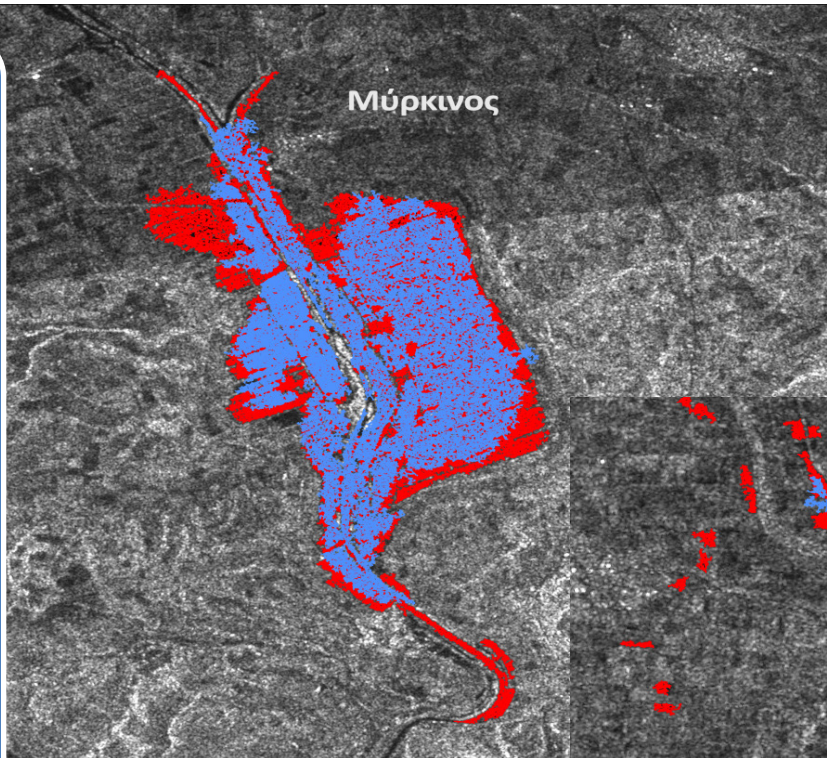


# BEYOND NRT Flood Extend Assessment



Sentinel-1 based  
flood monitoring  
and mapping  
service in  
**BEYOND Floods  
Observatory**

April 2015 flood  
extent maps in  
North Greece  
produced by  
automatic  
ingestion and  
processing of  
satellite radar  
images in RT



## ***BEYOND Floods Early Warning System***

This cooperation allows the improved adjustment and calibration of the hydrological and hydraulic models which are operated by NOA, as well as the development of a methodology that will provide reliable products and services to PPC S.A.

### **CASE STUDY:**

The first case study is the river basin of Arachthos, a river with several flood events, upstream of the city of Arta, where PPC S.A. is operating two hydroelectric plants:

- 1) a large one known as Pournari I (effective capacity of reservoir 303 million m<sup>3</sup>)
- 2) a smaller one known as Pournari II (effective capacity of reservoir 4 million m<sup>3</sup>).



# BEYOND Floods Early Warning EMS Activations- COPERNICUS Program

Bosnia and Herzegovina Flood - May 22, 2014



egend

Light blue: River basin - May 6, 2014  
Blue: Flooded regions - May 22, 2014

0 4.700 9.400 18.800 Meters



# Geophysical hazards

Data & methods tier

NSN

ENIGMA

NOANET

In-situ

Earth Observation - SAR Interferometry

Services tier

Geodesy

Modeling

Hazard assessment

Large scale processing

Applications tier

Volcanoes

Tectonics

Landslides

Subsidence

Users tier

# WEB GIS

GIS



The Web



# Geohazard services - An overview

Service	Status	Input data	Scale
Mapping of large-scale ground velocities & 3D decomposition	Operational	SAR, GPS	National
Estimation of earthquake 3D crustal deformation	Operational	multi-angle SAR, GPS	Local
Seismic risk estimation	pre-operational	SAR, in-situ, GIS	Local
Mapping of tectonic hazard areas in subduction zones	Research	SAR, GPS	Regional
Monitoring of volcanic activity	Operational	SAR, GPS, in-situ	Local
Detection of new landslides	Operational	SAR	Local
Update of landslide inventory maps	pre-operational	SAR, in-situ	Local
Estimation of landslide susceptibility	pre-operational	SAR, in-situ, GIS	Local
Estimation of landslide hazard	Research	SAR, in-situ, GIS	Local
Detection of subsidence in urban & peri-urban areas due to manmade activities & physical processes	Operational	SAR, GPS	Local
Monitoring of construction activities in urban environment	Operational	SAR, GPS	Local

## Earthquakes – Cephalonia case

### Data

NSN

NOANET

ENIGMA

In-situ

### Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

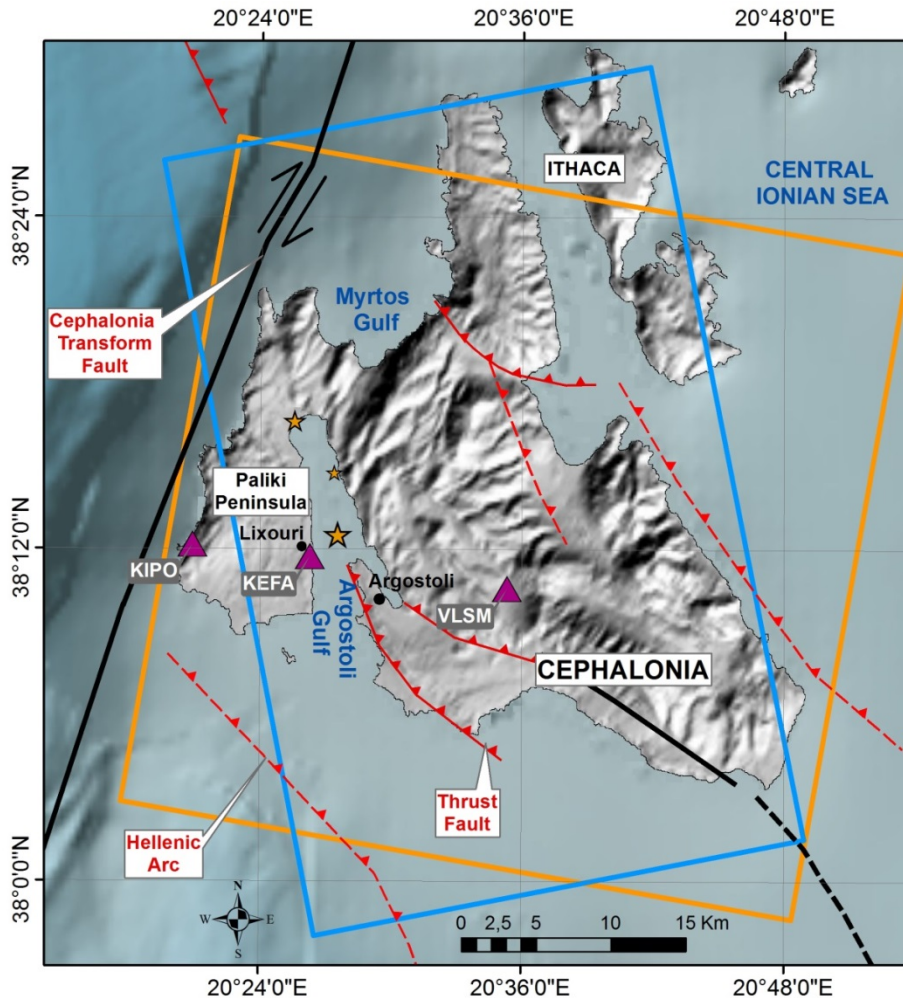
### Applications

Tectonics

Volcanoes

Landslides

Subsidence



#### Mapped faults

- Strike-slip inferred
- Strike-slip
- - - Reverse inferred
- ▲ Reverse

#### GPS stations

- ▲ cGPS

#### Main earthquake events

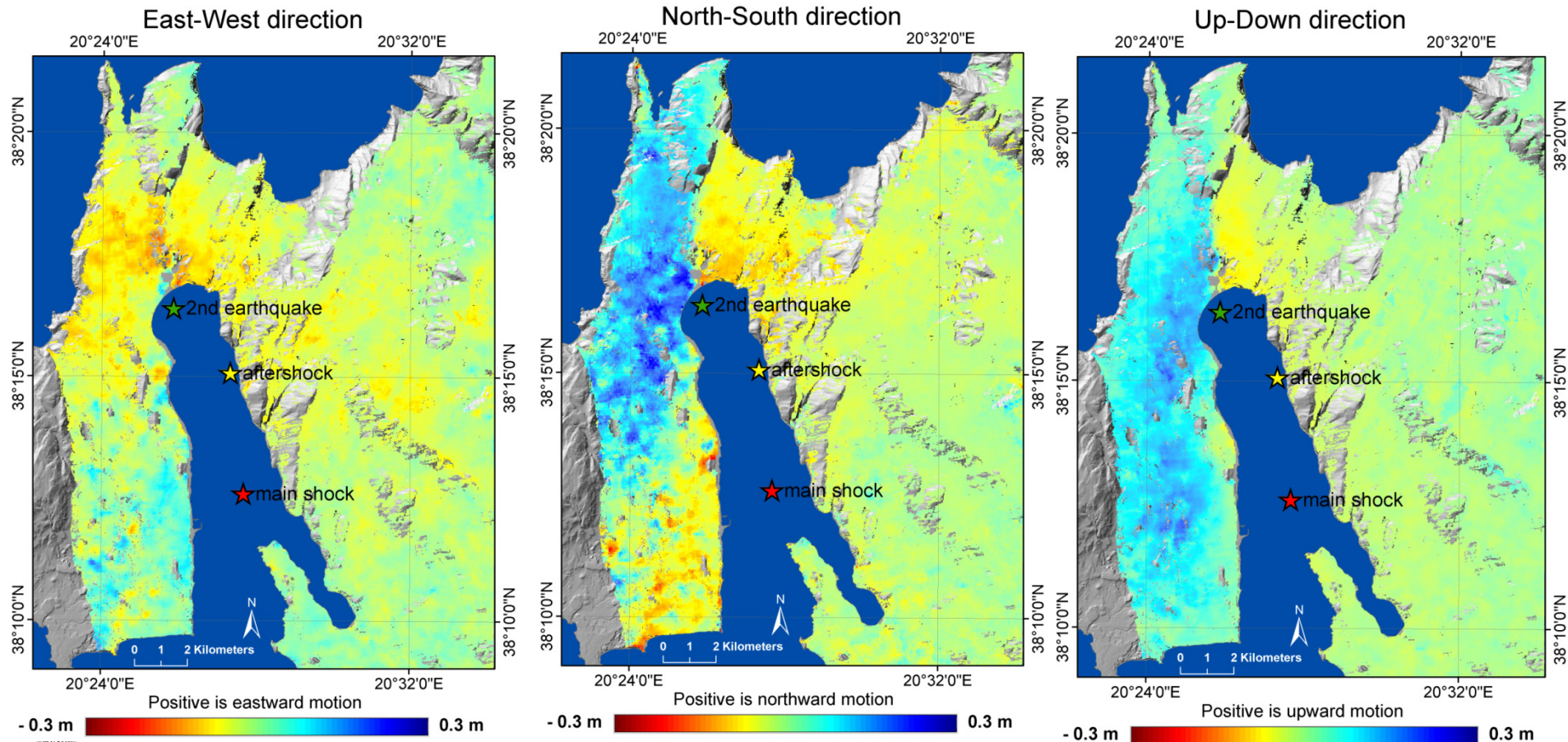
- ★ 26/1/2014 ML 5,1
- ★ 3/2/2014 ML 5,7
- ★ 26/1/2-14 ML 5,9

#### SARframes

- COSMO-SkyMED
- TerraSAR-X

# Earthquakes – Cephalonia case

- 3D crustal deformation from TerraSAR-X & COSMO-SkyMed data
- Inversion to estimate fault parameters



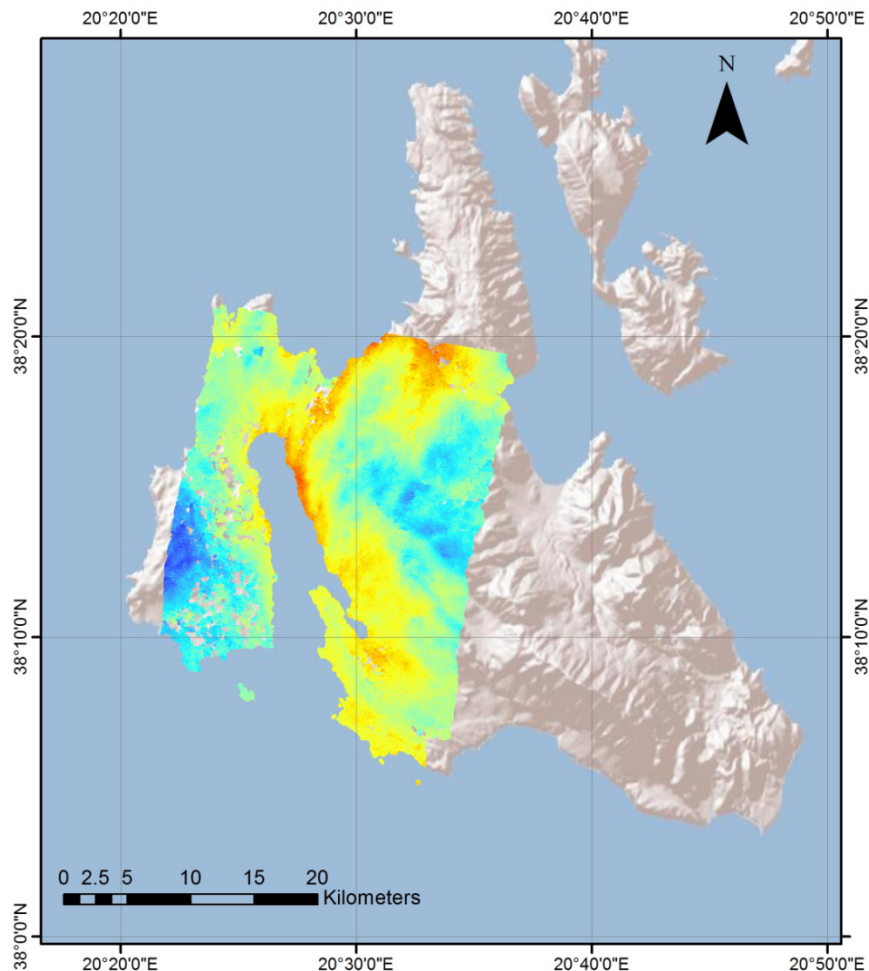
Merryman Boncori et al., SRL 2015





# Earthquakes – Cephalonia case

Post-seismic slip,  
measured with  
COSMO-SkyMed  
data



## Earthquakes – Nepal

### Data

NSN

NOANET

ENIGMA

In-situ

### Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

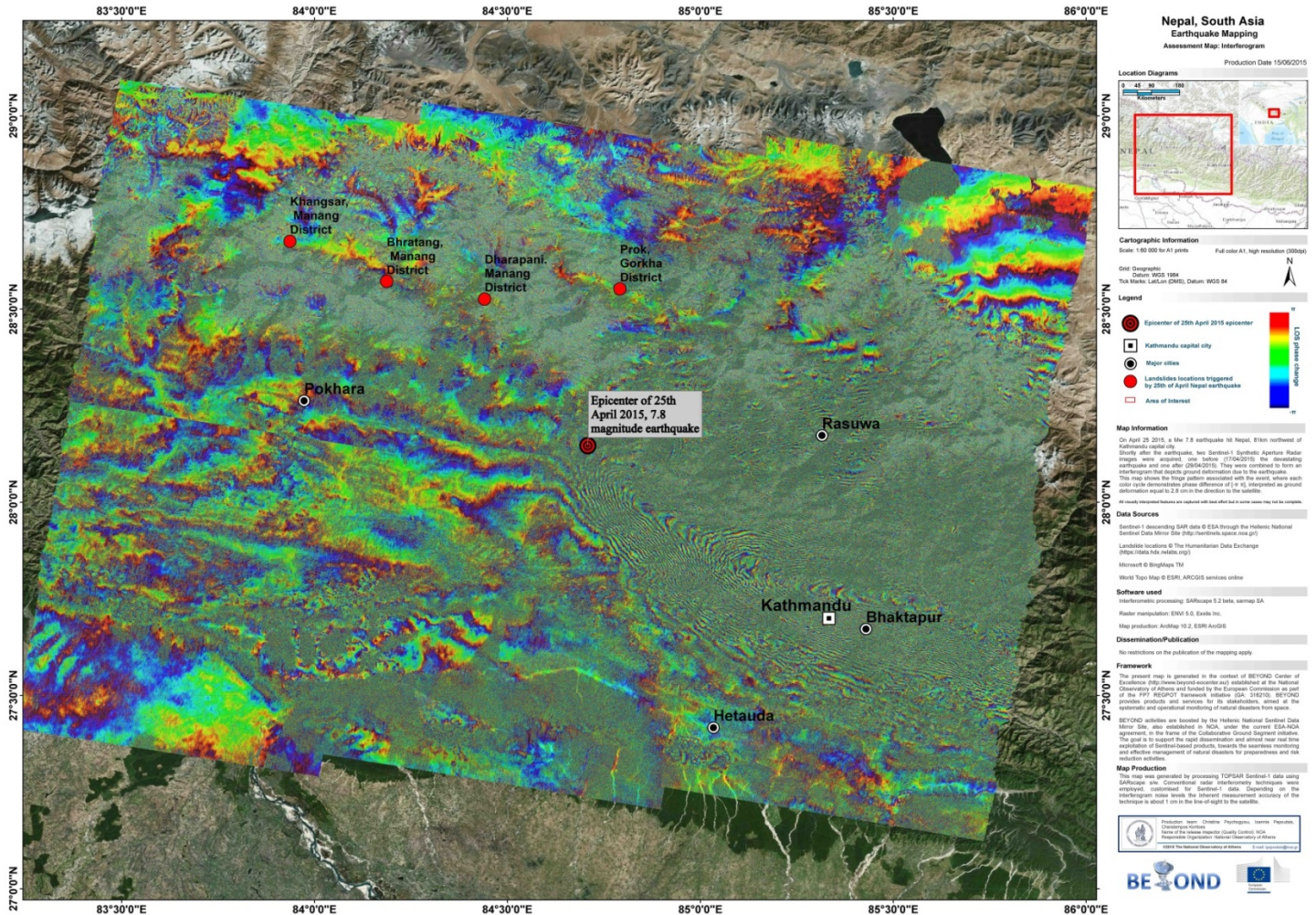
### Applications

Tectonics

Volcanoes

Landslides

Subsidence



# Volcanoes – Santorini case

**Data**

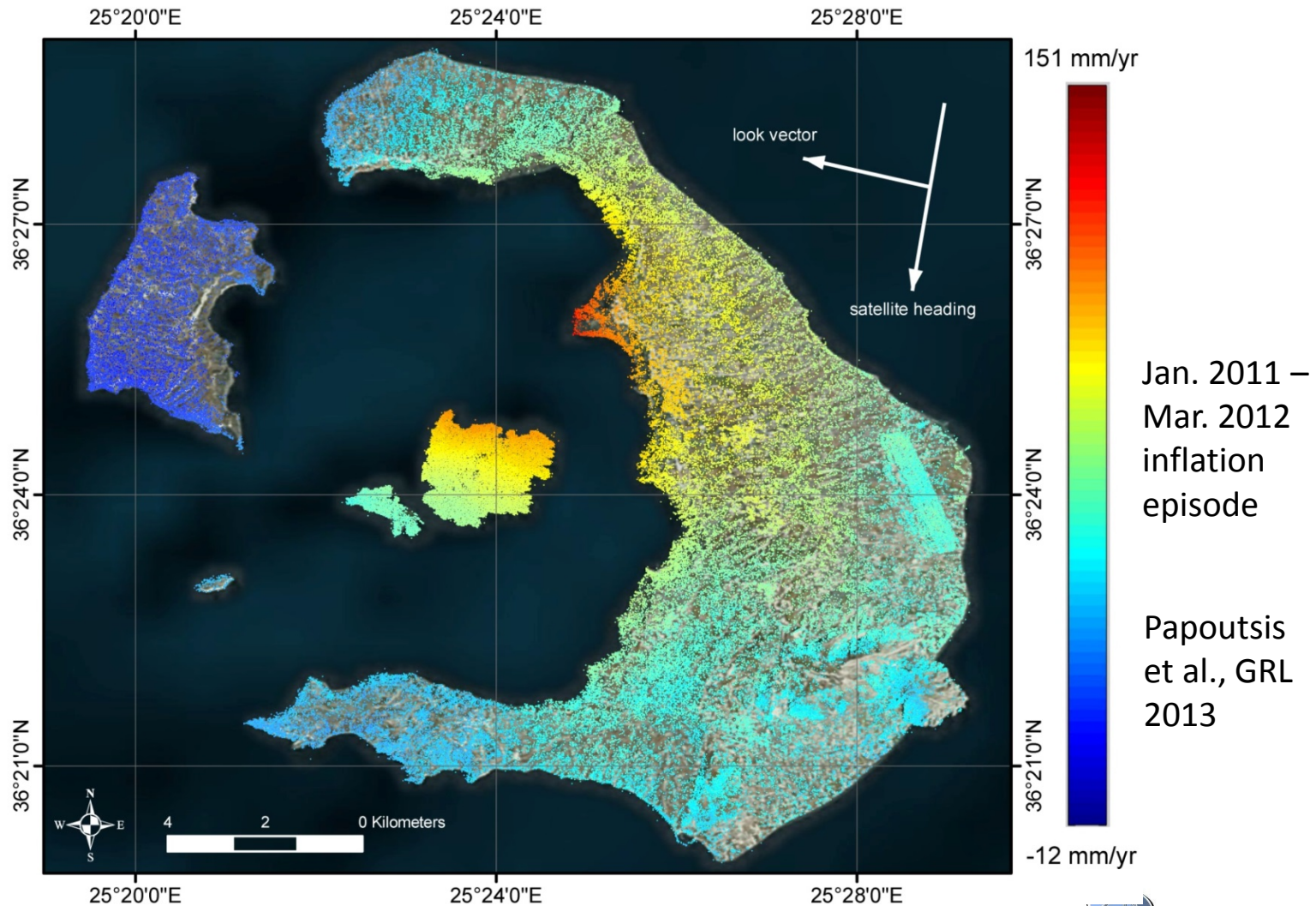
- NSN
- NOANET
- ENIGMA
- In-situ

**Services**

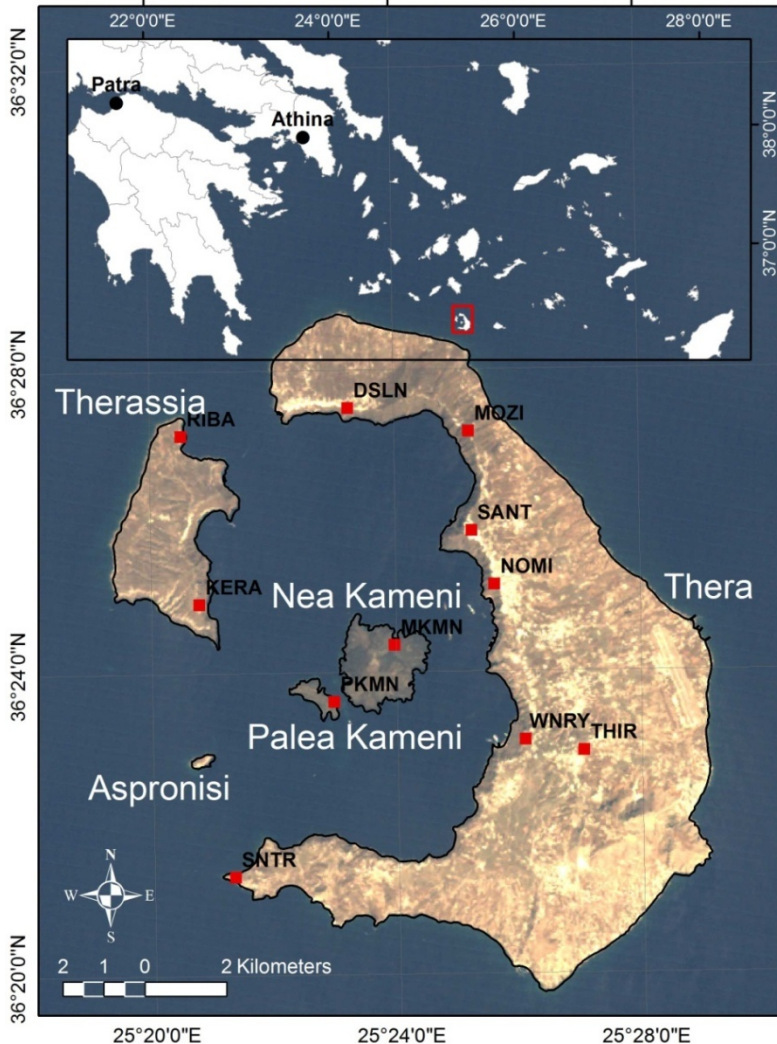
- Geodesy
- Modeling
- Hazard Ass.
- Large Proc.

**Applications**

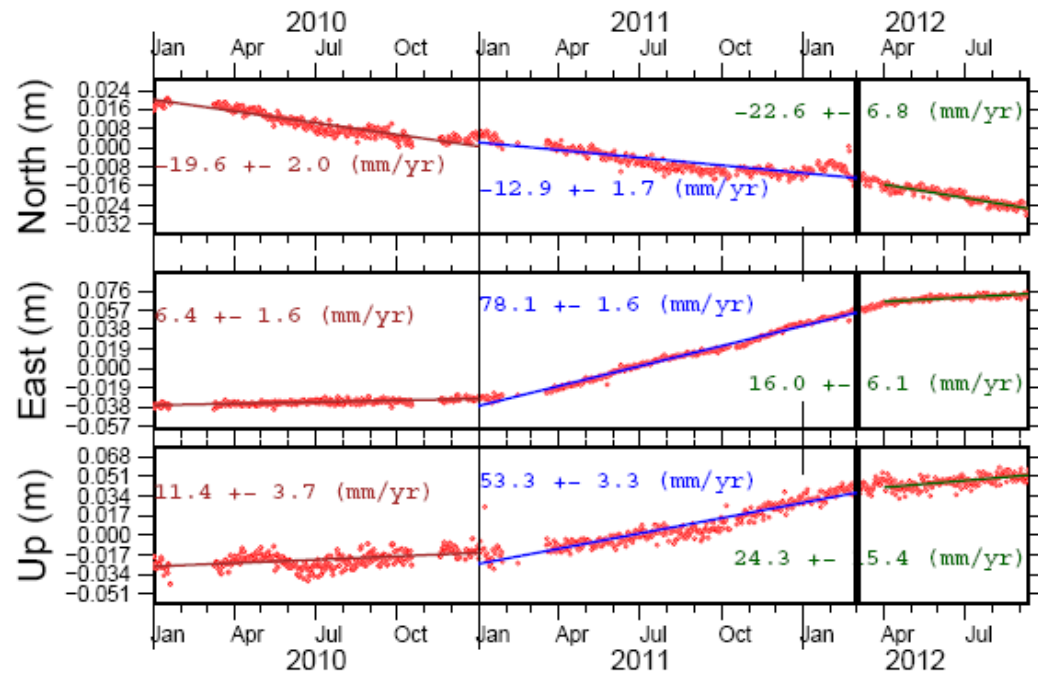
- Tectonics
- Volcanoes**
- Landslides
- Subsidence



# Volcanoes – Santorini case



Time-series monitoring with in-situ GPS stations



GPS data processing by Dionysos Satellite Observatory

# Subsidence

## Data

NSN

NOANET

ENIGMA

In-situ

## Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

## Applications

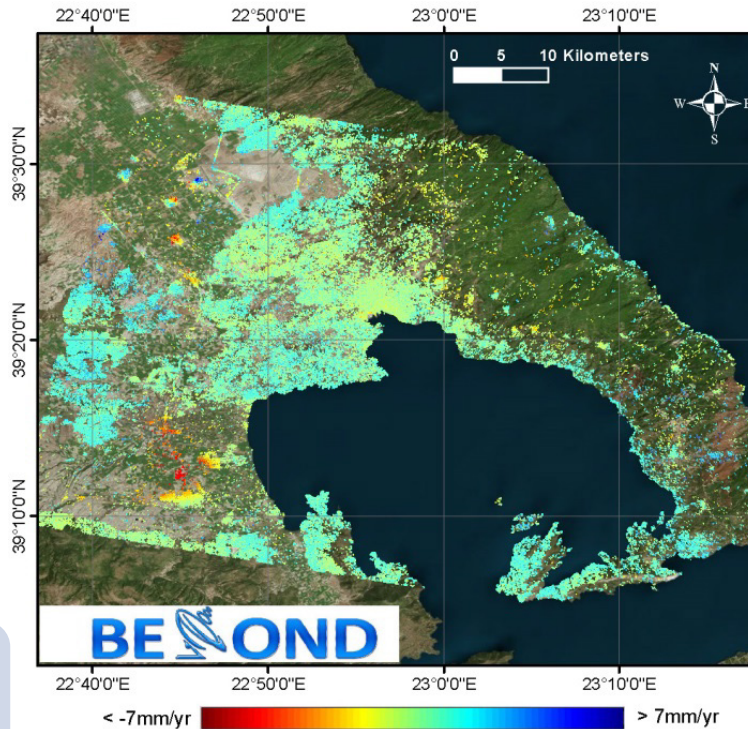
Tectonics

Volcanoes

Landslides

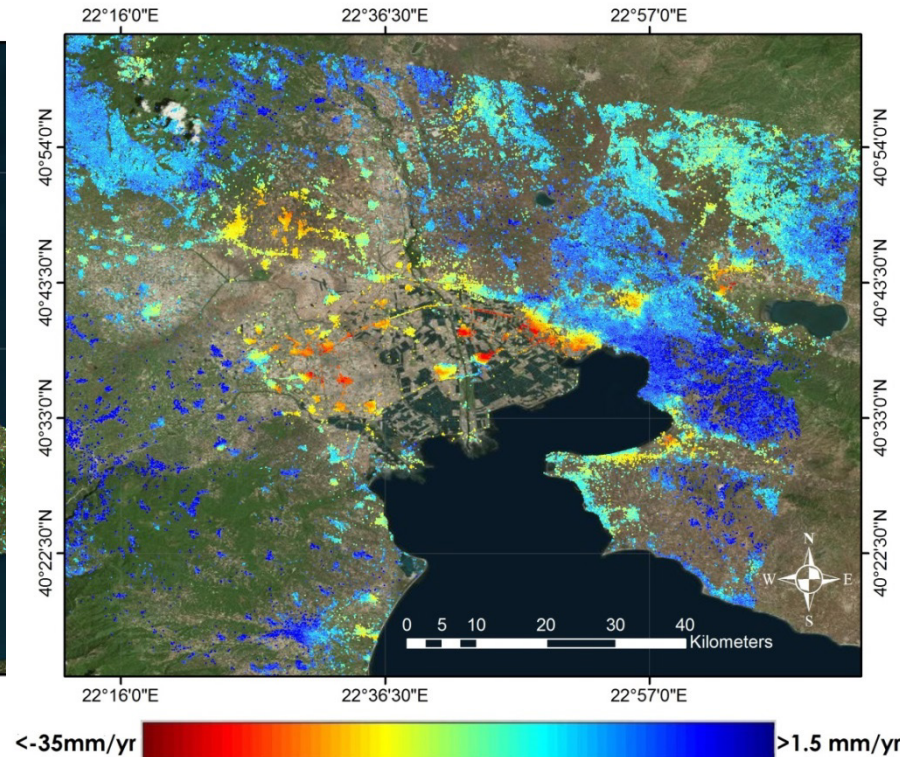
Subsidence

Volos (2002 -2010)



Driver: water over-pumping

Thessaloniki (1992 -2001)



Drivers:

- Over-pumping
- Natural compaction of deposits
- Tectonics

# Subsidence

## Data

NSN

NOANET

ENIGMA

In-situ

## Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

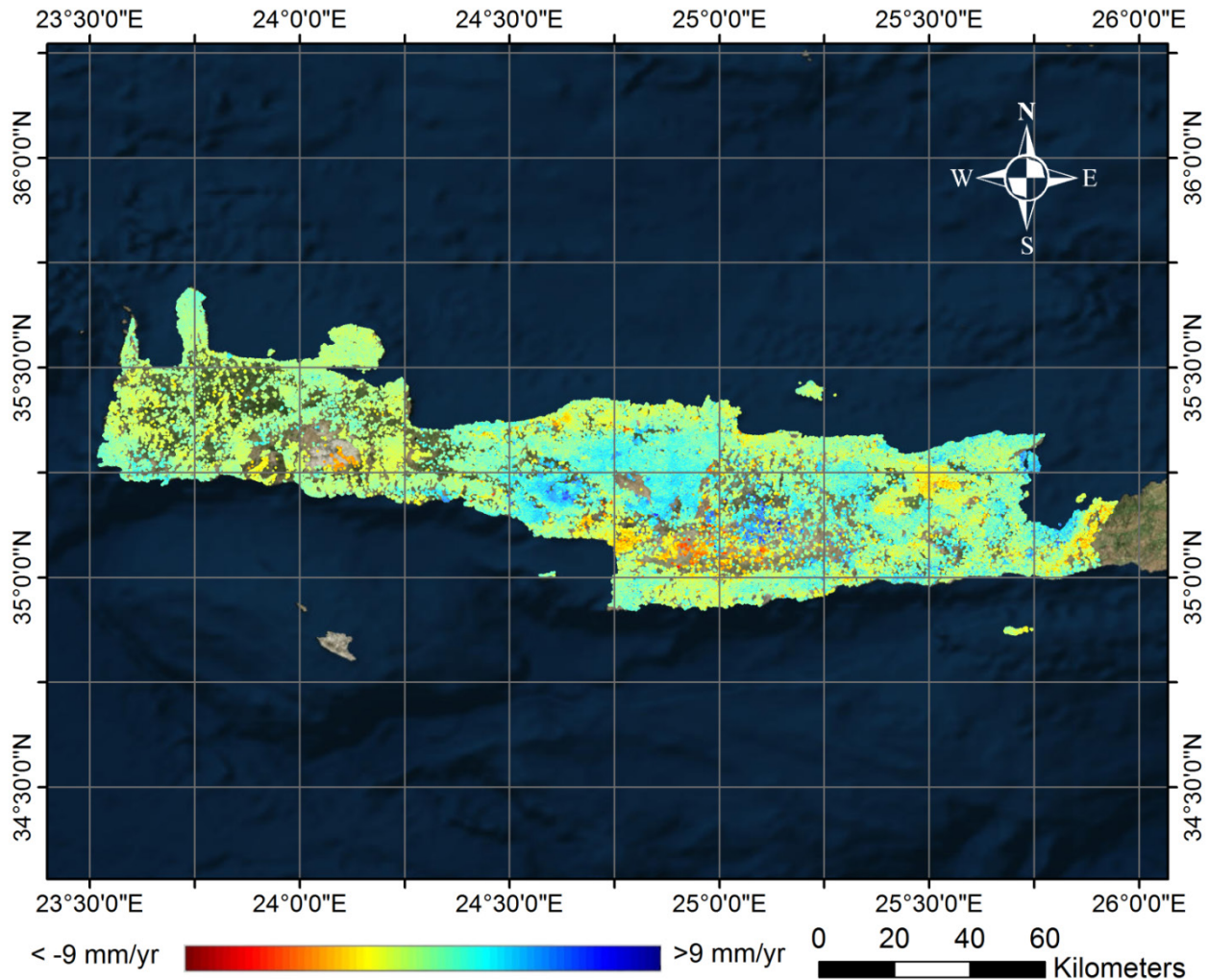
## Applications

Tectonics

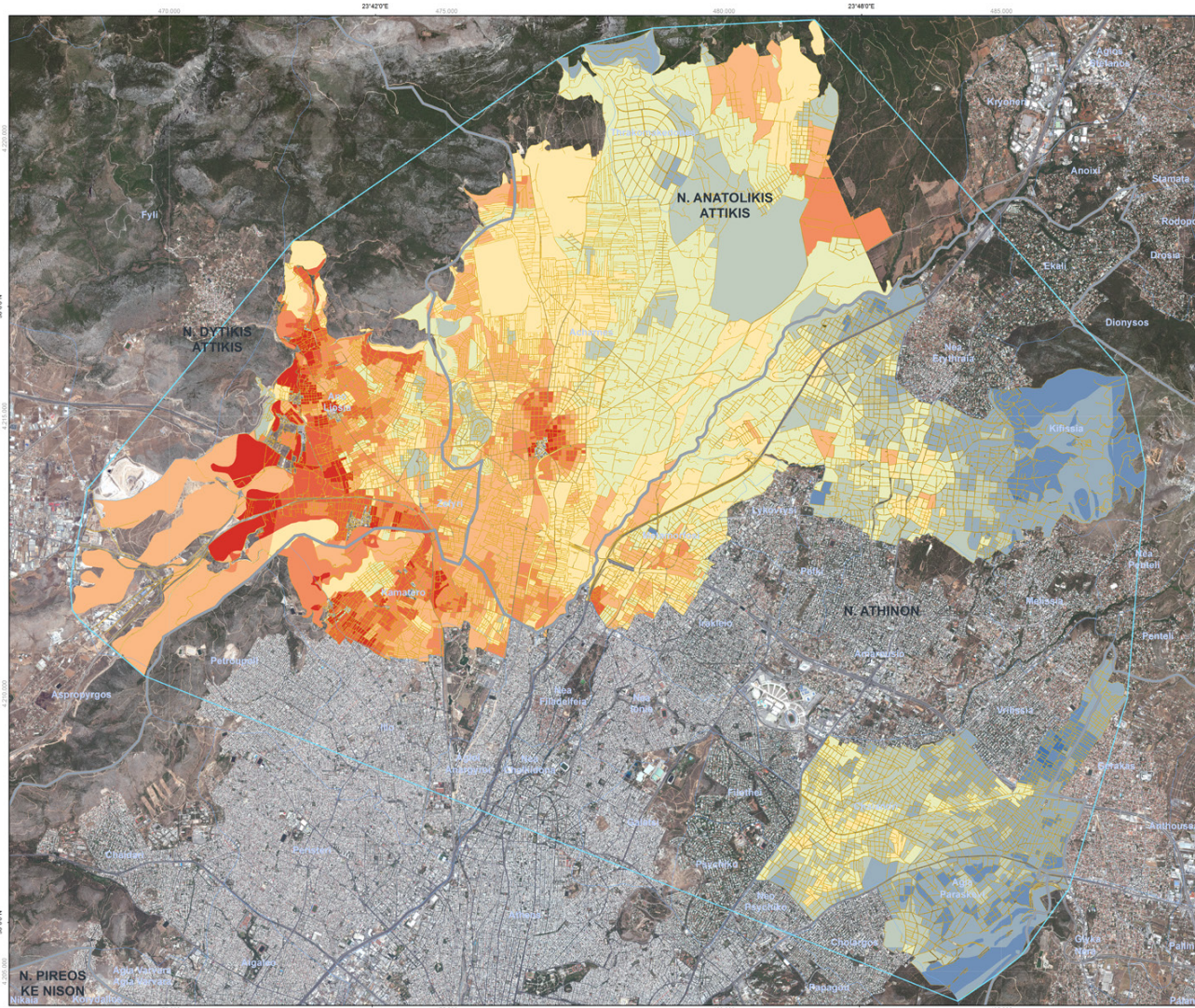
Volcanoes

Landslides

Subsidence



## Seismic Risk – Athens



GLOIDE number: EO-1999-000352-GRC  
 Activation ID: GR.Dr.08.1  
 Product N.: GR.Dr.08.1 (v01)

### Greece - Attiki, Ano Iosia

Seismic Risk Scenario (Athens Earthquake of 07/09/1999)  
 Pre-disaster Situation Map: Seismic Risk Map  
 Production Date 30/11/2010

**Location Diagrams**  
 Scale: 1:3,000 for A1 print  
 Full color A1, high-resolution (300dpi)  
 0 435 870 1.740 Meters

**Cartographic Information**  
 Scale: 1:3,000 for A1 print  
 Full color A1, high-resolution (300dpi)  
 0 435 870 1.740 Meters

GDS: Greek Grid GCS, SGRS, 1987  
 Datum: GDA85, 1987  
 Risk Marks: LatLon (DMS), Datum: WGS 84

**Legend**

Location Diagram		Seismic Risk	
	Earth-Quake Epicenter		1.00 - 1.38
	Final Earth-Quakes		1.39 - 1.77
	Main Map		1.78 - 2.15
	Area Of Interest		2.16 - 2.54
	N.ATHINON Prefecture		2.55 - 2.92
	Penteli Municipality		2.93 - 3.30
	Census Block		3.31 - 3.69
			3.70 - 4.07
			4.08 - 4.45
			4.47 - 4.84

**Map Information**  
 This Seismic Risk Map was used to assess the Athens Earthquake of September 7, 1999 (magnitude M=5.9) that hit the western side of the large metropolitan area of Athens, capital city of Greece (GR), causing 143 human victims.  
 The map was produced in the framework of the MASSISE project which provided the Civil Protection authorities with accurate and up-to-date maps of seismic risk, urban vulnerability, and building damaged risk at census block scale, together with state-of-the-art uncontrolled population evacuation models.  
 All nearby interested features are captured with best effort but in some cases may not be complete.

**Data Sources**  
 © European Commission, 2011, where applicable  
 © UN/FAO Institute of Urban Administration Areas, 2010  
 Modified by Copernicus, 2010

**Dissemination/Publication**  
 Publication or reproduction of the resulting product is not allowed due to the sensitive nature of the data.  
 Delivery formats are GeoPDF, GeoPDF, GeoPDF

**Framework**  
 MASSISE was designed to provide indication as appropriate as possible, neither a geographic information system, nor a risk assessment, neither a hazard, suitable and interpretation of the original source material. MASSISE maps are distributed as an information tool, neither an assessment or report, including but not limited to warranties of suitability for a particular purpose or use. The entire risk is the result of the use of these data is assumed by the user and the supplier accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the map.

**Map Production**  
 Seismic Risk depends on three main parameters (a) the seismic source that produces the hazard (b) the ground motion that is attenuated away from the earthquake epicentre (c) the local soil conditions defined from a geotechnical map.  
 The seismic risk, which is closely related to the expected damage (D) is a function of Hazard (H) and Vulnerability (V):  $D = H \cdot V$   
 Hazard in a particular area is expressed by Peak Ground Acceleration (PGA) while Vulnerability is estimated by parameter  $I$ , related to building age before:  $D = H \cdot I$   
 In a particular area the relationship between PGA and macroseismic intensity (I) is denoted through an empirical relationship:  $\log PGA = f(I)$  where  $f$  is expressed in the 12-grade Mercalli-Sieberg scale.  
 The Area Unit is the Building Block.

Parameters used for Damage Correlation is presented in the following table:  
 $PGA \leq 0.05$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.05 < PGA \leq 0.10$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.10 < PGA \leq 0.15$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.15 < PGA \leq 0.20$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.20 < PGA \leq 0.25$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.25 < PGA \leq 0.30$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.30 < PGA \leq 0.35$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.35 < PGA \leq 0.40$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.40 < PGA \leq 0.45$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.45 < PGA \leq 0.50$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.50 < PGA \leq 0.55$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.55 < PGA \leq 0.60$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.60 < PGA \leq 0.65$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.65 < PGA \leq 0.70$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.70 < PGA \leq 0.75$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.75 < PGA \leq 0.80$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.80 < PGA \leq 0.85$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.85 < PGA \leq 0.90$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.90 < PGA \leq 0.95$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )  
 $0.95 < PGA \leq 1.00$  : 0.000 - 1.27 (20% of  $V \cdot I = 1$ )

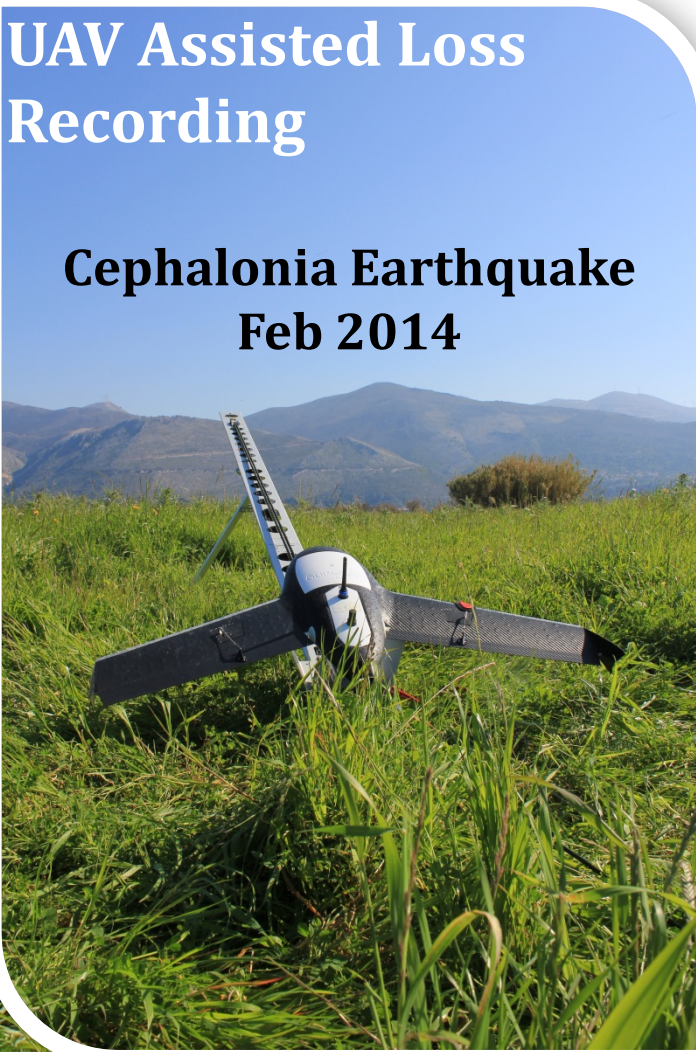
Name of the project: Seismic Risk Scenario (Athens Earthquake of 07/09/1999)  
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 Name of the release: Seismic Risk Scenario (Athens Earthquake of 07/09/1999)  
 Name of the release: Seismic Risk Scenario (Athens Earthquake of 07/09/1999)

- Data
  - NSN
  - NOANET
  - ENIGMA
  - In-situ
- Services
  - Geodesy
  - Modeling
  - Hazard Ass.
  - Large Proc.
- Applications
  - Tectonics
  - Volcanoes
  - Landslides
  - Subsidence



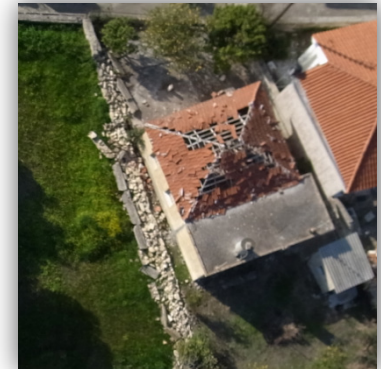
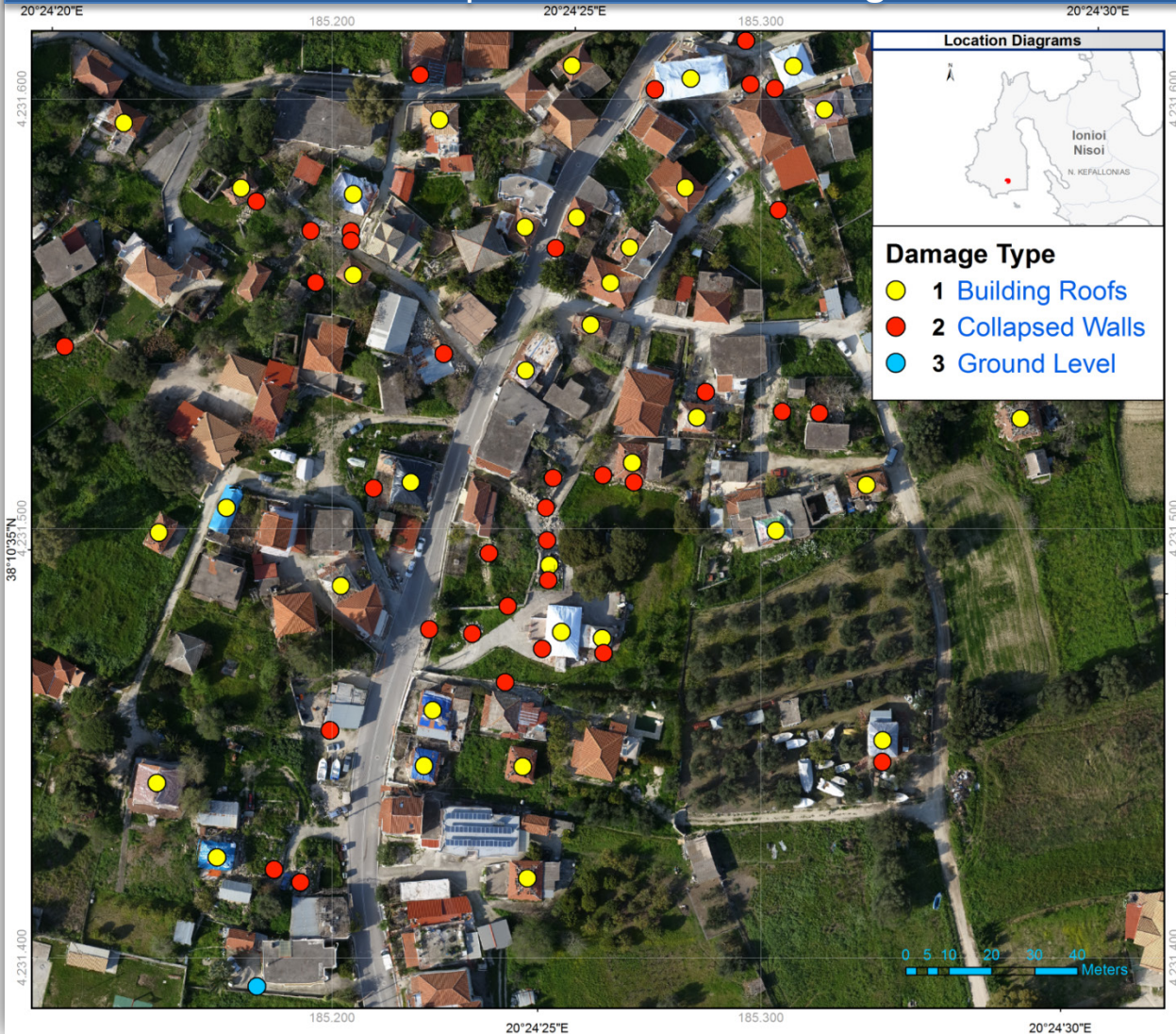
# UAV Assisted Loss Recording

## Cephalonia Earthquake Feb 2014





## Cephalonia Island – Village of Mantzavinata



# Landslides – South Pindus

## Data

NSN

NOANET

ENIGMA

In-situ

## Services

Geodesy

Modeling

Hazard Ass.

Large Proc.

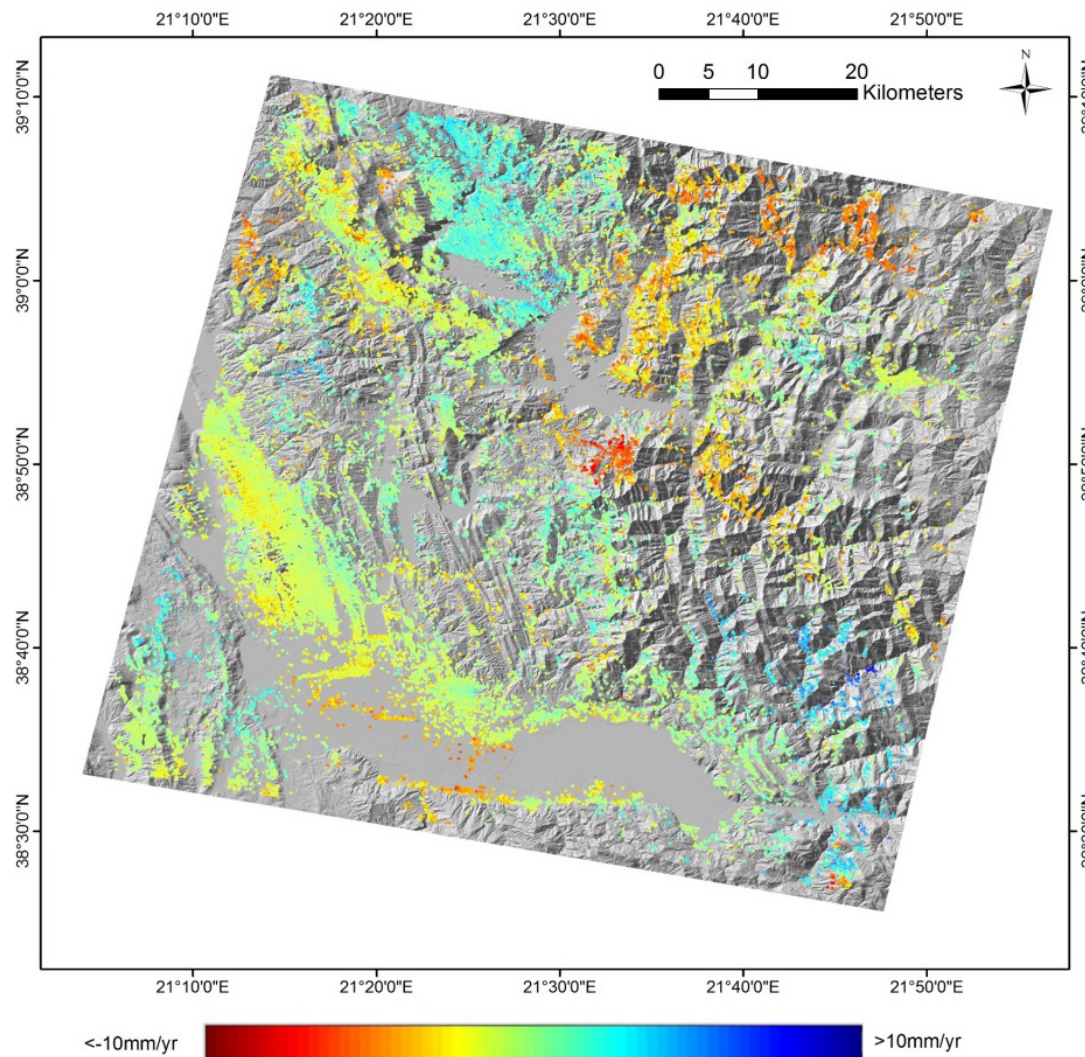
## Applications

Tectonics

Volcanoes

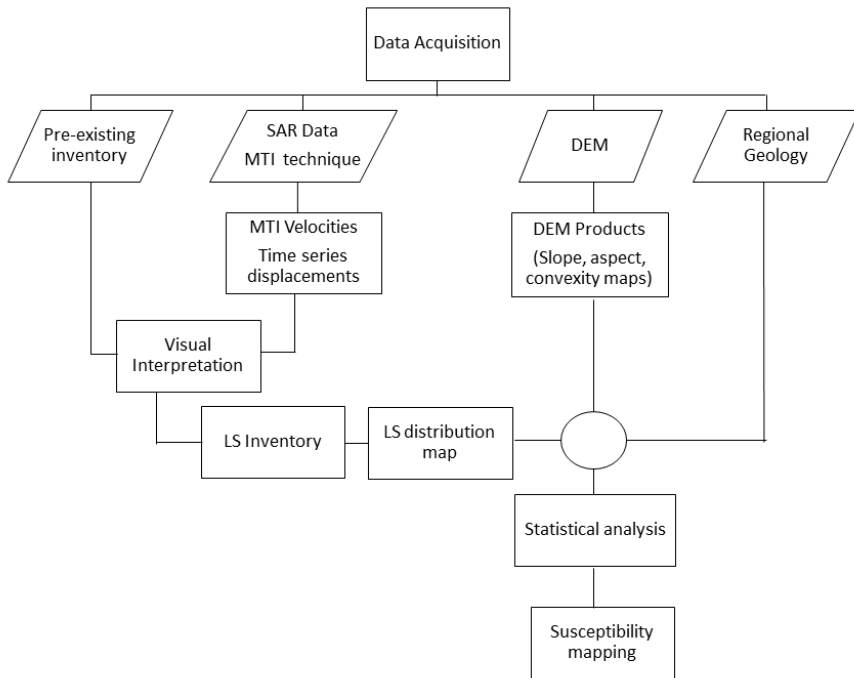
Landslides

Subsidence

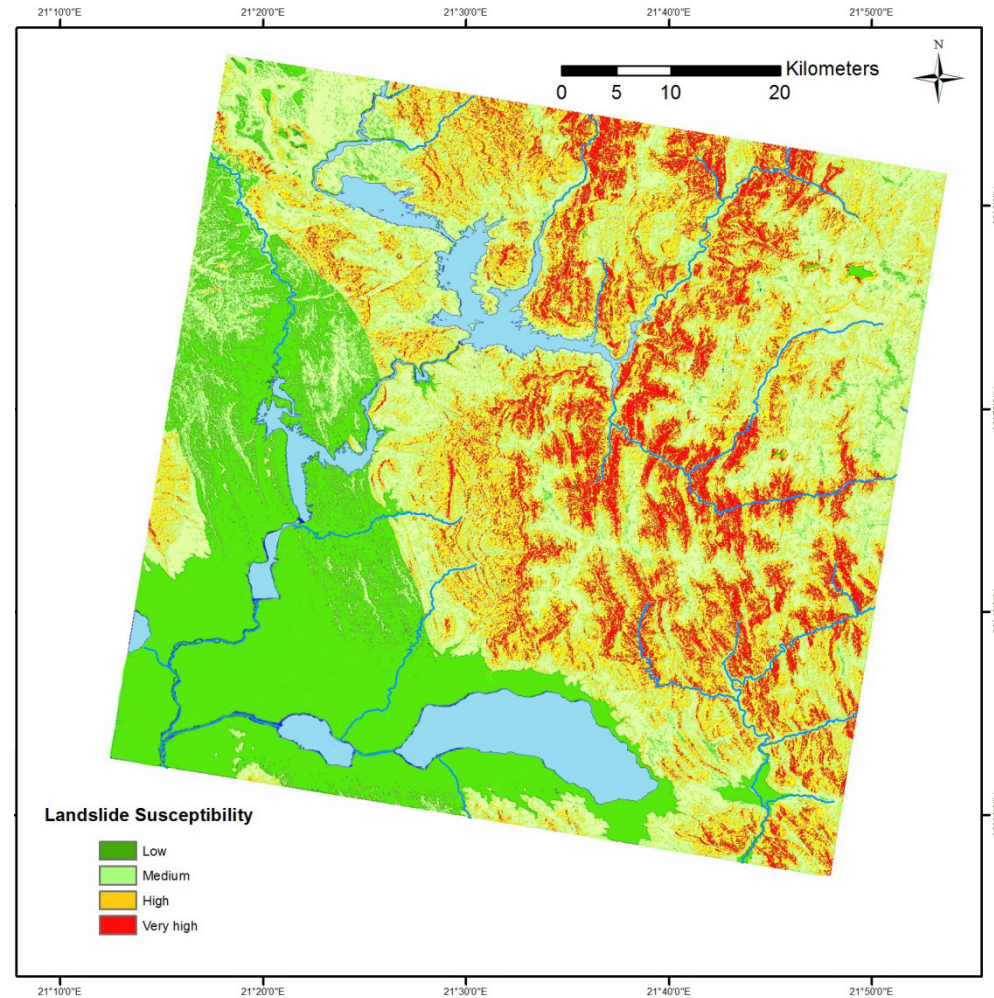


# Landslides – South Pindus

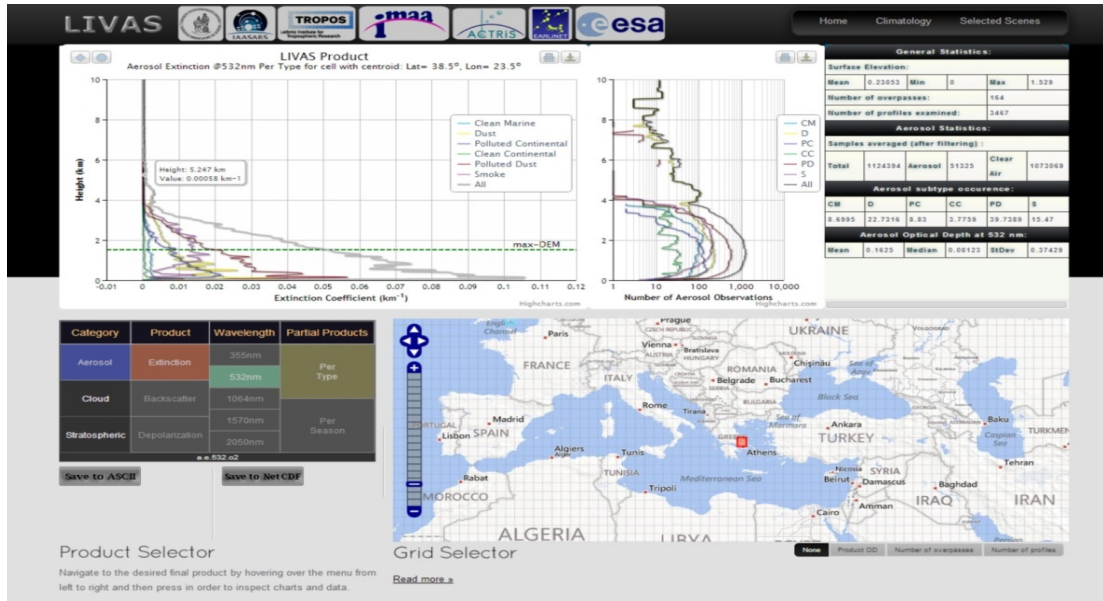
## Landslide susceptibility model



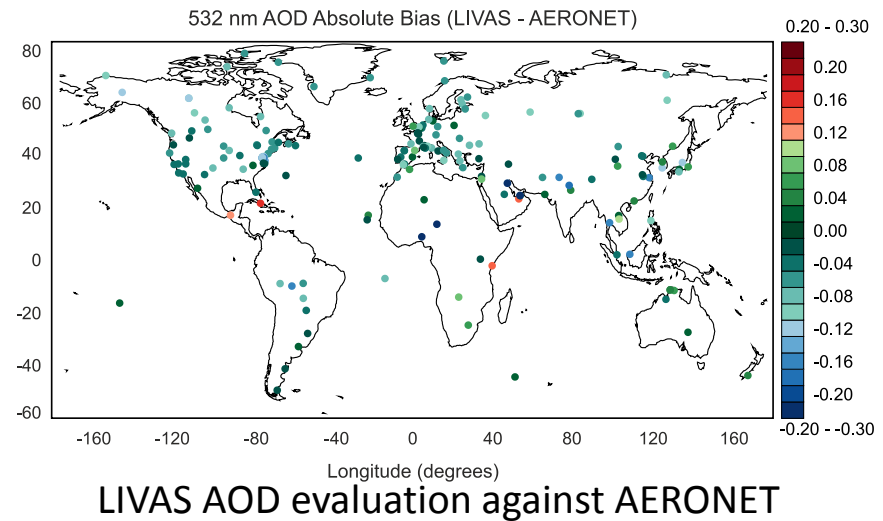
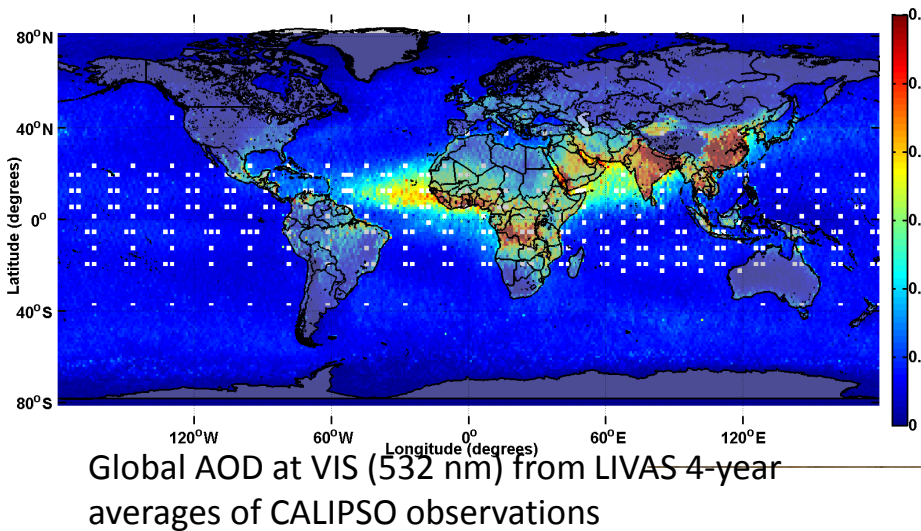
## Landslide susceptibility map



# BEYOND, European Center of Excellence for EO based Disaster Management

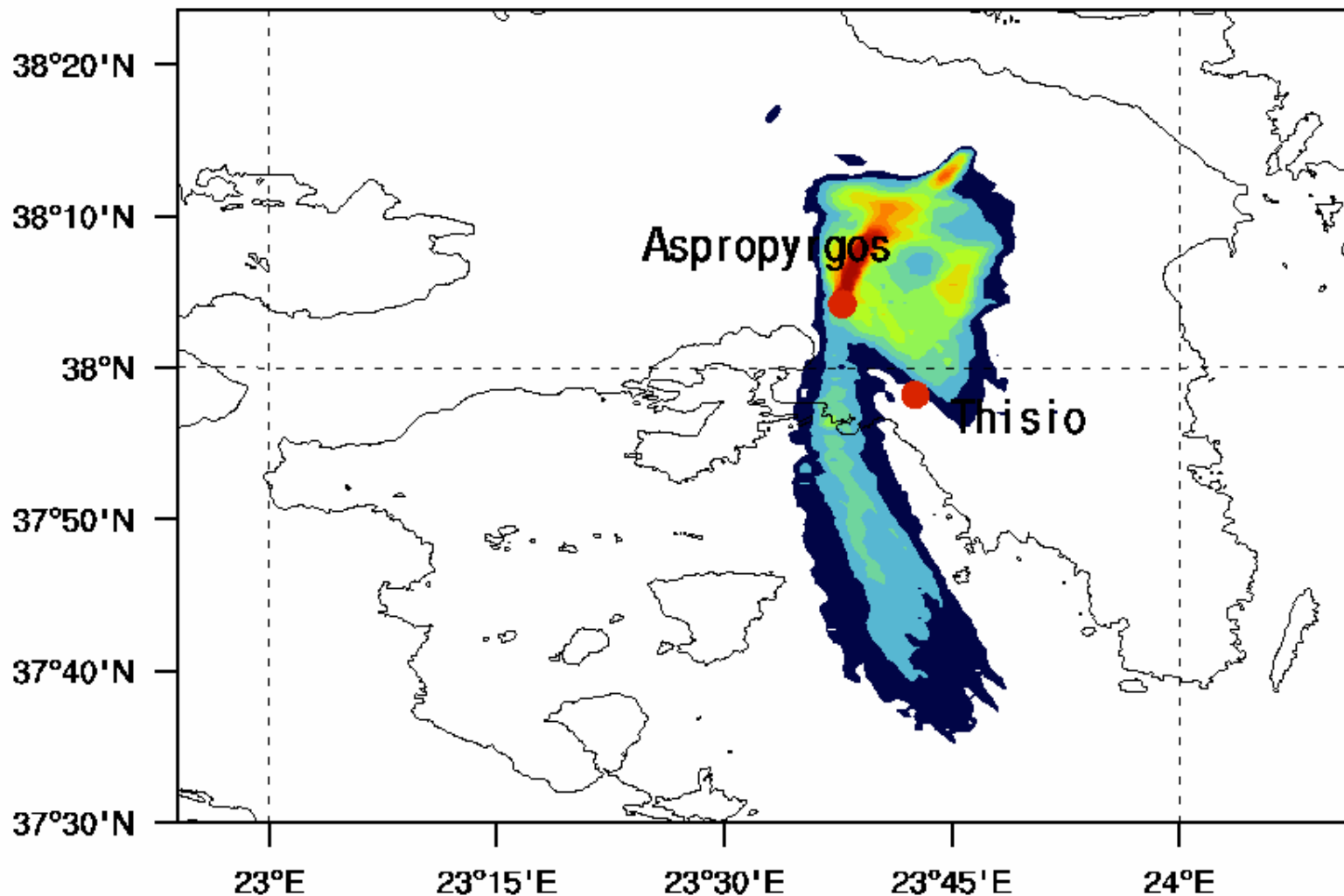


**Global 3D climatology of aerosols and clouds  
LIVAS portal under BEYOND  
(1x1 degree resolution)**



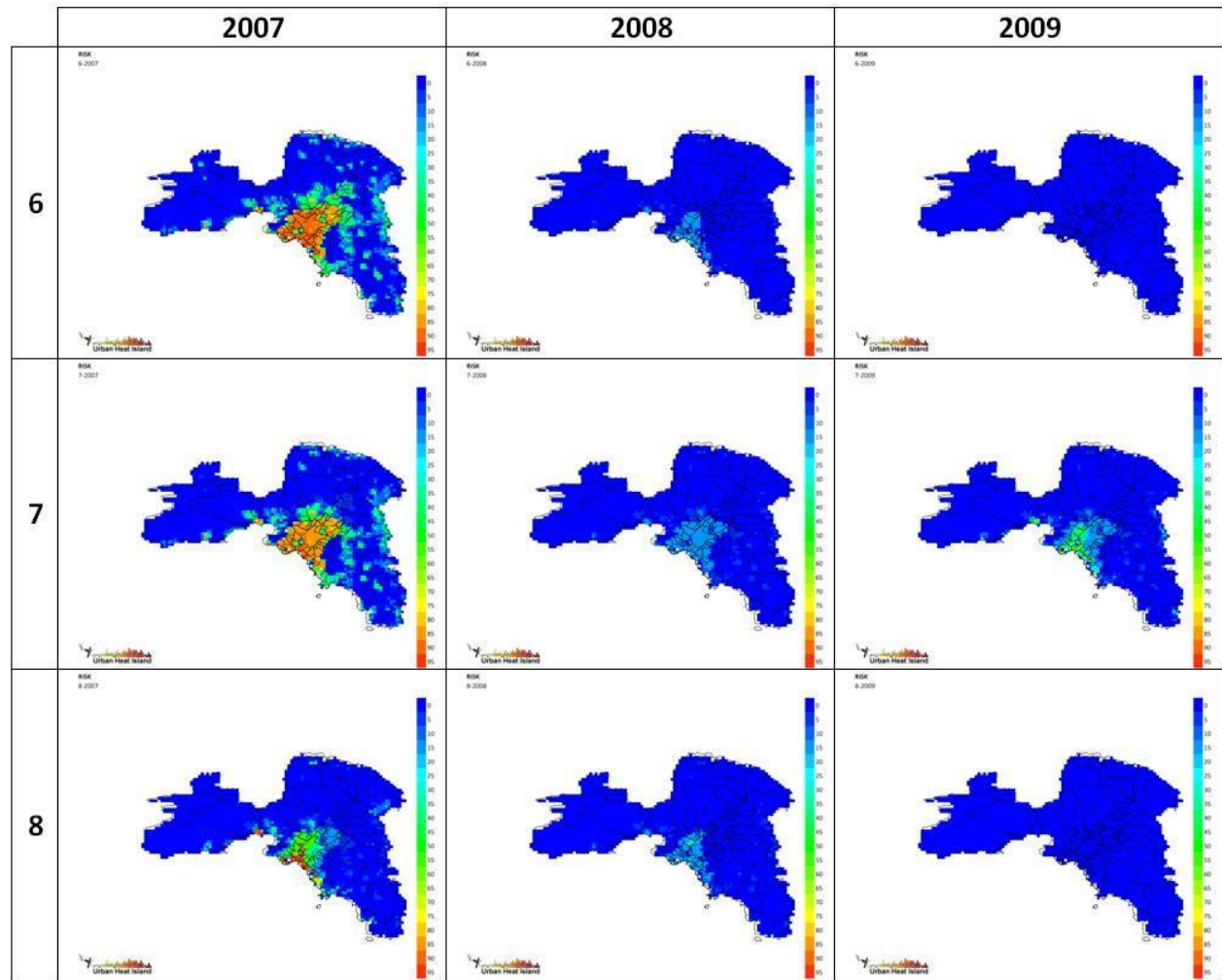
**BEYOND / NOA FLEXPART**  
**Smoke Integrated Column**

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



# Heatwave Risk Assessment

## Urban Heat Island



**Thank you for your attention!**

**For more information**

**<http://www.beyond-eocenter.eu>**