

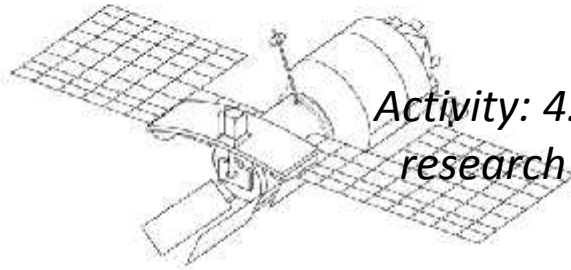


# BEYOND

*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**

Countdown to Horizon 2020 Space  
Tour in Athens, 23/01/2014



FP7-Regpot-2012-23-1

# BEYOND Concept

---



**BEYOND** aims to maintain and expand the existing state-of-the-art and interdisciplinary research potential, by

**Building a Centre of Excellence for Earth Observation based monitoring of Natural Disasters**

in 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 at Europe and US**

# BEYOND Heritage



**LDA Large-scale demonstrators in support of GMES and GNSS based services in Athens, Greece, GMES/DG ENTR, CIP Programme/ European Mobile and Mobility Industries Alliance: Phase II, Extension focusing on the use of information from GMES, the European Earth monitoring programme, and signal from Galileo and EGNOS**

**SWefs- Sensor Web Fire Shield (SWeFS), GSRT**

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

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

**LinkER - Supporting the implementation of an operational Global Monitoring for Environment and Security service in the field of emergency management, Invitation to Tender No: ENTR/08/028**

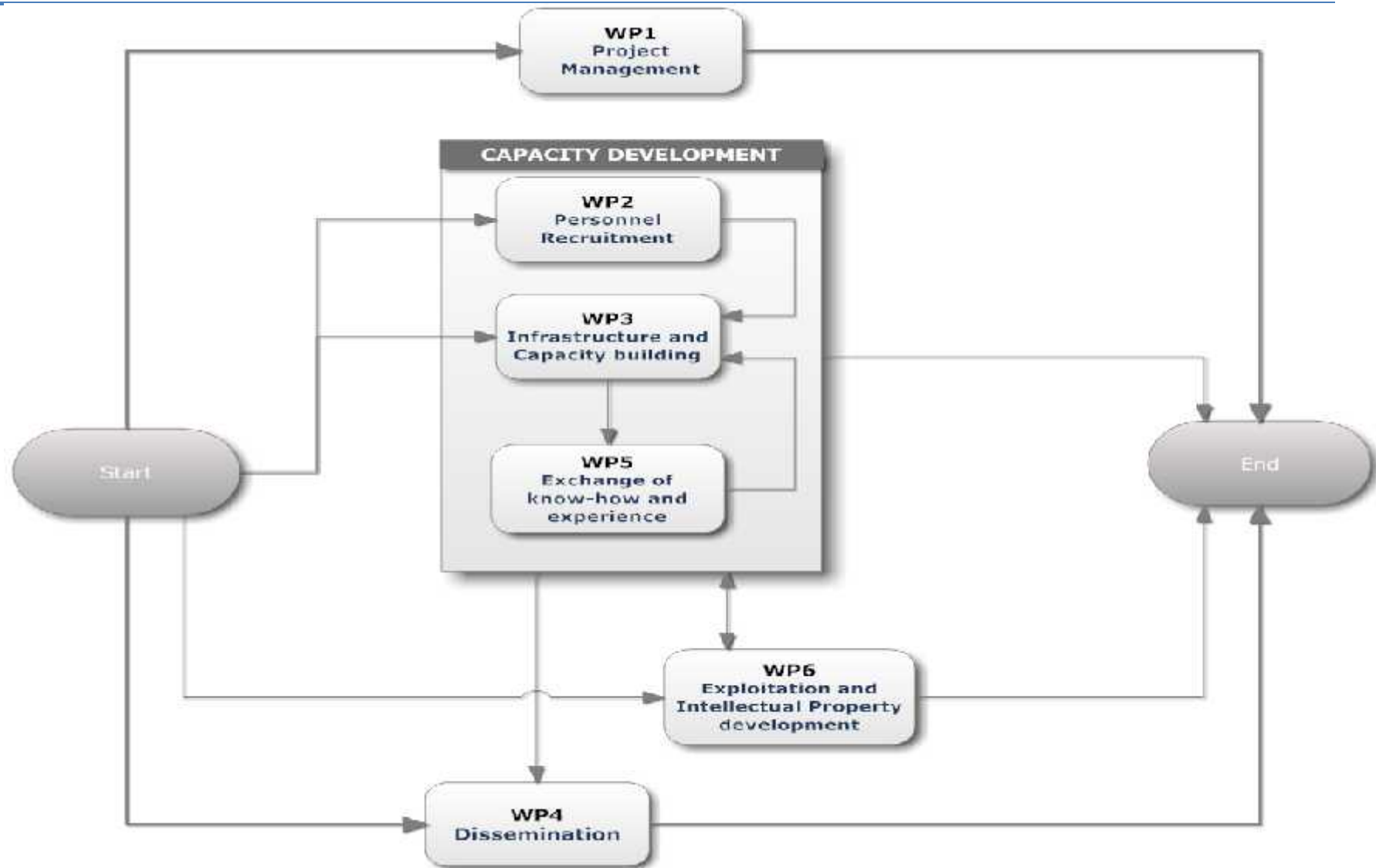
**MASSIVE: Mapping Seismic Vulnerability and Risk of Cities, European Commission - DG ENV A.3 – Civil Protection**

**LIMES (Land and Sea Integrated Monitoring for European Security/Global Monitoring Environment and Security) / Integrated Project, Commission of the European Communities, DG Enterprise**

**RISK-EOS Extension to Greece - Promotion of the GSE RISK-EOS fire services portfolio in Greece. Program for Global Monitoring for Environment and Security. Service Consolidation Actions of EarthWatch GMES Services Elements, ESA/GSE**

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

# BEYOND WP structure



# BEYOND Financial Aspects



## FP7 REGPOT 2012-2013 funding – Period 2013-2016

TOTAL	ALL WPs		P.M.	Person- nel Costs	Travel	Other direct costs	Sub- contract	Indirect	Total
			469	1207980	245864	599100	109000	143706.08	2305650

Total costs WP1	MANAGEMENT		24	73181	12000	0	6000	5962.67	97143.67
Total costs WP2	PERSONNEL RECRUITMENT		356	863438	0	3100	0	60657.66	927195.66
Total costs WP3	INFRASTRUCTURE AND CAPACITY BUILDING		49	149401	0	596000	70000	52178,07	867579,07

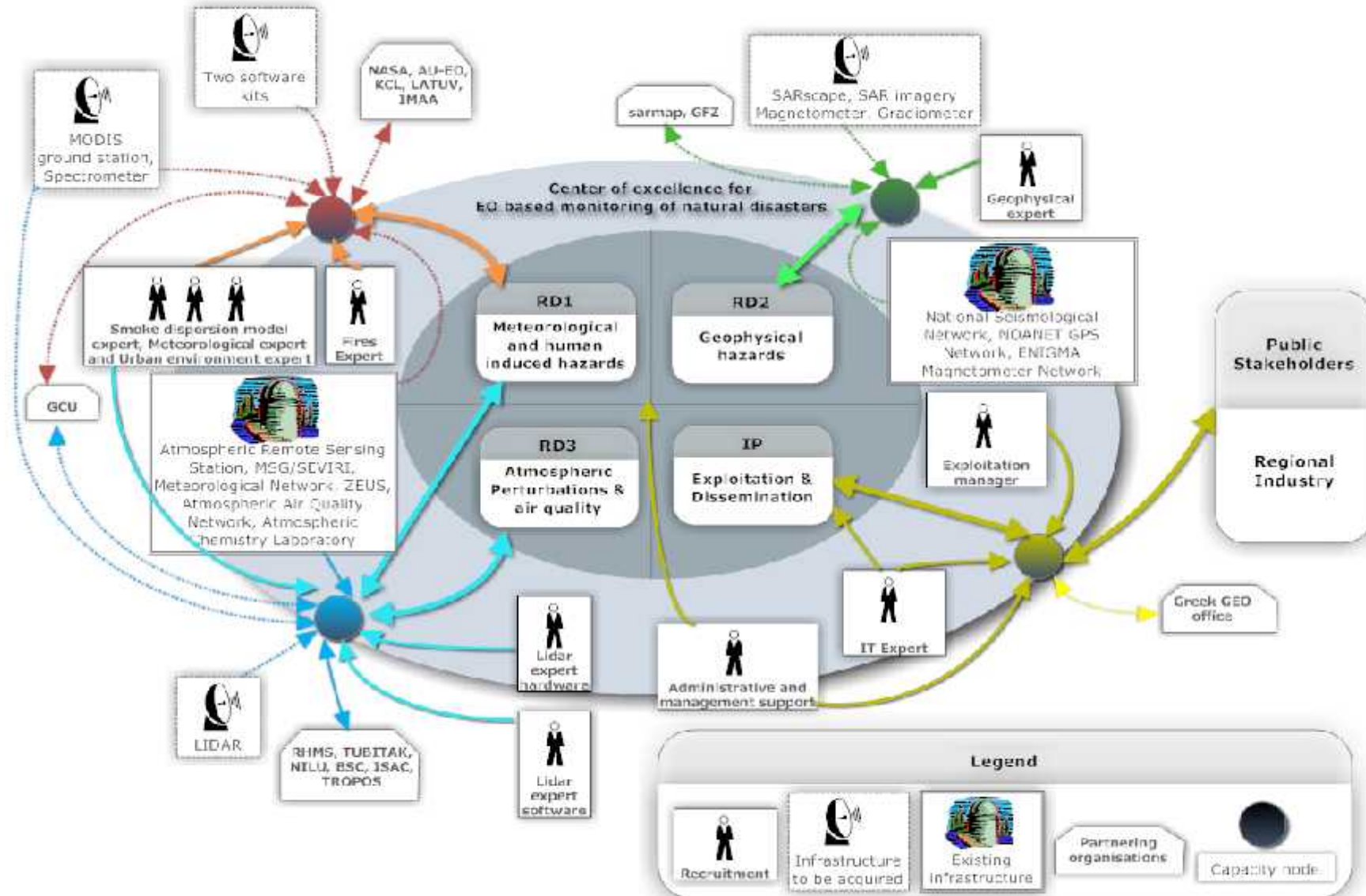
Total costs WP4	DISSEMINATION		21	64029	114196	0	23000	12475,75	213700,75
Total costs WP5	EXCHANGE OF KNOW-HOW AND EXPERIENCE		10	30490	119668	0	0	10511.06	160669.06
Total costs WP6	EXPLOITATION AND INTELLECTUAL PROPERTY DEVELOPMENT		9	27441	0	0	10000	1920,87	39361,8721

## 2.3 MEuros EC Contribution

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

# BEYOND

## How to achieve goals?





# BEYOND Twining Organisations- Know How Exchange



➤ **Enhancing research capacity via training and integration of new technologies and know-how**, by establishing sustainable strategic partnerships with high profile research entities

- **DLR – EO Center of the German Aerospace Center**
- **ESA – European Space Agency (Directorate of Earth Observation Programmes)**
- **GCU-Global Change Unit of the University of Valencia**
- **LATUV-Remote Sensing Laboratory of the Un. Of Valadolid**
- **BSC – Barcelona Supercomputing Center**
- **NILU – Norwegian Institute for Air Research**
- **TUBITAK – Scientific and Technological Research Council of Turkey**
- **IMAA – Inst of Methodologies for Environmental Analysis of INRC**
- **ISAC – Inst of Atmospheric Sciences and Climate of INRC**
- **KCL - King’s College London**
- **SARMAP**
- **HIDMET – Republic Hydrometeorological Service of Servia**
- **GFZ - German Research for Geosciences**
- **TROPOS – Leibniz Inst for Tropospheric Research**
- **AU-EO – EO Laboratory of the Aberystwyth University**
- **NASA – NASA Marshall Space Flight Center, Earth Science Office**
- **Chapman University – USA**

Know-How Capacity  
Building

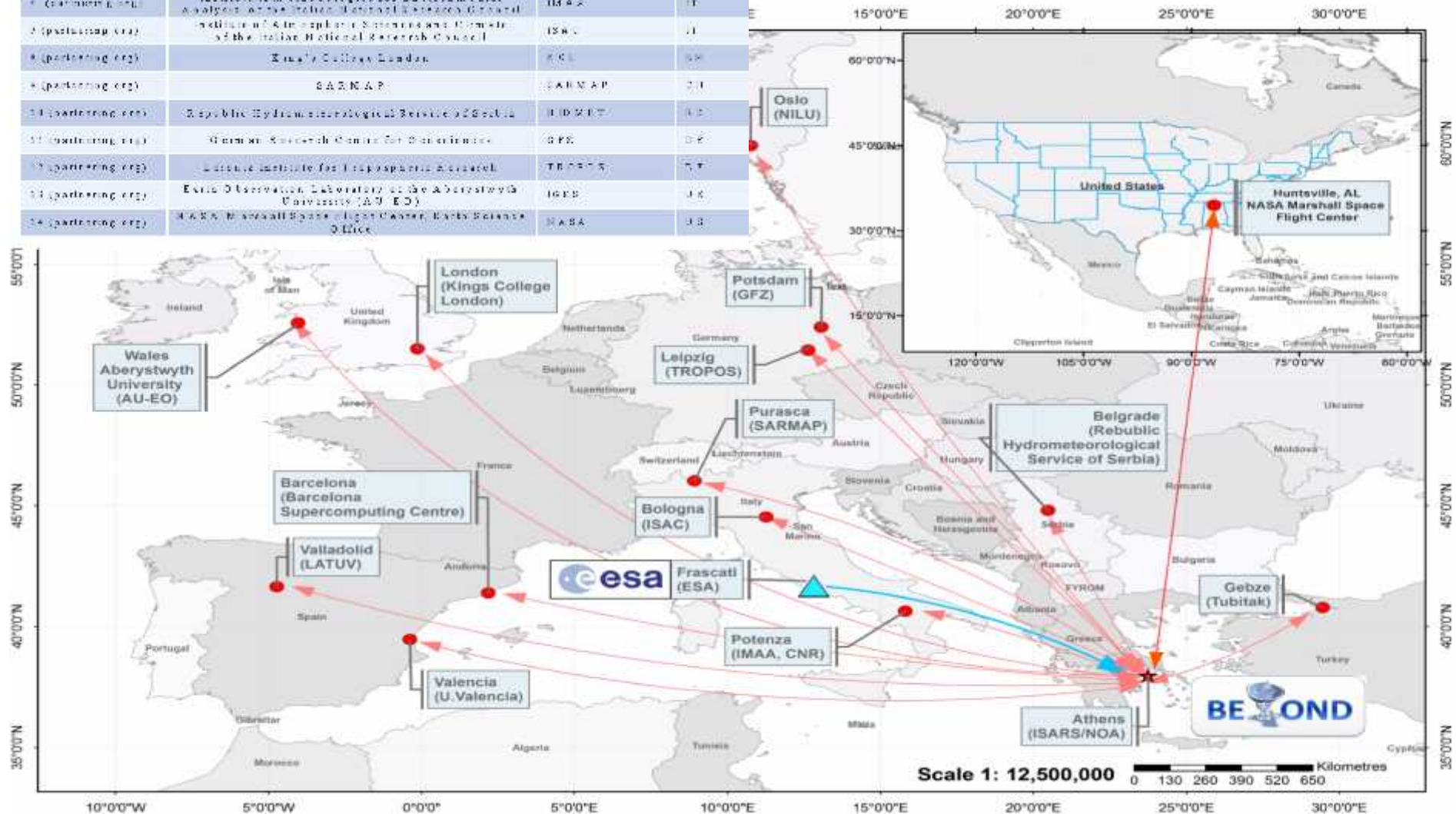
# BEYOND Twining Organisations-

## Know How Exchange



Participant	Participant Organization name	Participant Short Name	Country
1 (Partnering org)	Israeli Aerospace Applications and Research - Scientific and Technological Center	ISARS/NOA	IS
2 (Partnering org)	Israeli Aerospace Applications and Research - Scientific and Technological Center	ISARS	IS
3 (Partnering org)	Science Funding Department, Office of the Vice-Chancellor	LATUV	ES
4 (Partnering org)	German Aerospace Establishment	BEO	DE
5 (Partnering org)	University Institute for Air Research	NIU	NO
6 (Partnering org)	Scientific and Technological Research Council of Turkey - Marmara Research Center	TUBITAK	TR
7 (Partnering org)	Institute of Meteorology and Climatology - Analytical and Applied Meteorological Research Group of the Institute of Atmospheric Sciences and Climate of the Italian National Research Council	IMAA	IT
8 (Partnering org)	Imperial College London	ICL	GB
9 (Partnering org)	SARMAP	SARMAP	CH
10 (Partnering org)	Republic Hydrometeorological Service of Serbia	HMZHRZ	RS
11 (Partnering org)	German Research Centre for Geosciences	GFZ	DE
12 (Partnering org)	Leipzig Institute for Tropospheric Research	TROPOS	DE
13 (Partnering org)	Earth Observation Laboratory of the Aberystwyth University (AU-EO)	LEOS	GB
14 (Partnering org)	NASA Marshall Space Flight Center, Earth Science Office	NASA	US

## Partnering Organisations





# BEYOND Observation & Monitoring Infrastructures



Through BEYOND it will be possible to:

➤ **Set up innovative integrated observational solutions** that will allow to a multitude of monitoring networks (space borne and ground-based) to operate at the premises of the National Observatory of Athens, in a complementary, unified and coordinated manner with similar existing capacities/infrastructures at Europe and US. The monitoring infrastructure includes:

- **X-/L- band acquisition station** (MODIS-EOS Aqua and Terra, NPP, JPSS, NOAA, Met Op, FengYun) (South Easter Europe, Balkans, Middle East, Continental Coverage) **to be part of the DB network**
- **MSG SEVIRI Acquisition station** (Continental Coverage)
- **Mirror Site of ESA's Sentinel missions** (Copernicus) for full and near real time image acquisition of S-1, S-2, and future S3, S5P missions (South Easter Europe, Balkans, Middle East, Continental Coverage)
- Active remote sensing system, namely **PollyXT portable Raman lidar system**, enhancing the existing in-situ Air quality monitoring capabilities used in field studies of aerosols (Regional Coverage)
- **Magnetometer stations** part of the ENIGMA-NOA network (National Coverage)
- Nationwide **Seismological network** (National Coverage)
- Nationwide **GPS/GNSS network** (National Coverage)
- Nationwide **Meteo network** (National Coverage)

Infrastructure Capacity  
Building

# BEYOND/NOA Observation & Monitoring Networks



Atmospheric Remote Sensing Station in Athens since 2008 (member of the NASA – AERONET network)



Operation of the mobile lidar of ESA by IAASARS



Development of a sophisticated advanced lidar system in the frame of BEYOND

Infrastructure Capacity Building

# BEYOND Data Acquisition, Archiving and Delivery

---



- **Create archives and databases** of long series of space based and in-situ observations and derived higher level products
  - Design and operate **the HW/SW infrastructure** (servers) to host the processing of the data from the deployed ground segment (**X-/L-band, MSG/SEVIRI, ESA's Mirror Site Sentinel**), and meet the requirements of the **DB network** to integrate the hosted acquisition stations
  - Design and operate **cloud computing archiving/ processing/ retrieval facilities** to host the satellite image files and data catalogues of the ground segment (GEANT cloud computing services)
- **Make the observations and products available for exploitation** with the involvement of stakeholders, scientists and/or institutional users, applicable for down-streaming to their specific needs
- **Establishing continuous contacts, and sign new MOUs** with End Users, Scientists, and International Organisations e.g., DEH SA, Hellenic Min. of Environment, Fire Brigades, Civil Protection Authorities, InterBalkan Center, ESA, GEO-Natural Disaster Task, GEO-Urban Env Task, DLR, ACTRIS, EARLINET, EFMC

Infrastructure Capacity  
Building

# BEYOND Outreach and Visibility

---



- **Expanding visibility to the national, regional and European communities, and expand the know-how, through:**
  - **Participation and contributions to international conferences related to BEYOND subjects**
  - **Organisation BEYOND related dedicated conferences**
  - **Making media publications in widely circulated national and international journals**
  - **Issuing the BEYOND newsletter**
  - **Setting up and maintaining the BEYOND Web Site**
  
- **Designing a robust Intellectual Property development plan for management and protection of the built capacity and project output**

Expanding Visibility  
Enhancing Know  
Dissemination Actions



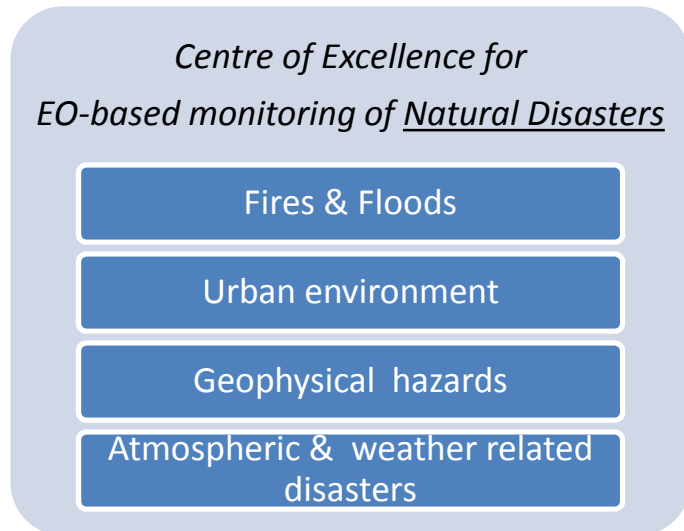
# BEYOND Service/Product Archiving and Delivery



➤ Cover research/product/service generation requirements for a broad portfolio of natural disaster phenomena as

- Earthquakes
- Volcanoes
- Landslides
- Wildfire monitoring and mapping
- Smoke and toxic gasses dispersion
- Dust storms
- Air quality
- Floods
- Urban Heat islands

(three research domains of BEYOND, **RD1: Meteorological and human induced hazards**, **RD2: Geophysical hazards**, and **RD3: Atmospheric pollution and air quality**)



Service Capacity Building



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



Olympia site Fire



Aliveri Euboea Fire



Korinthos Fire



Stira Euboea Fire



Parnon Mt Fire



Taygetos Mt Fire



Megalopolis Fire



Oitilon Fire



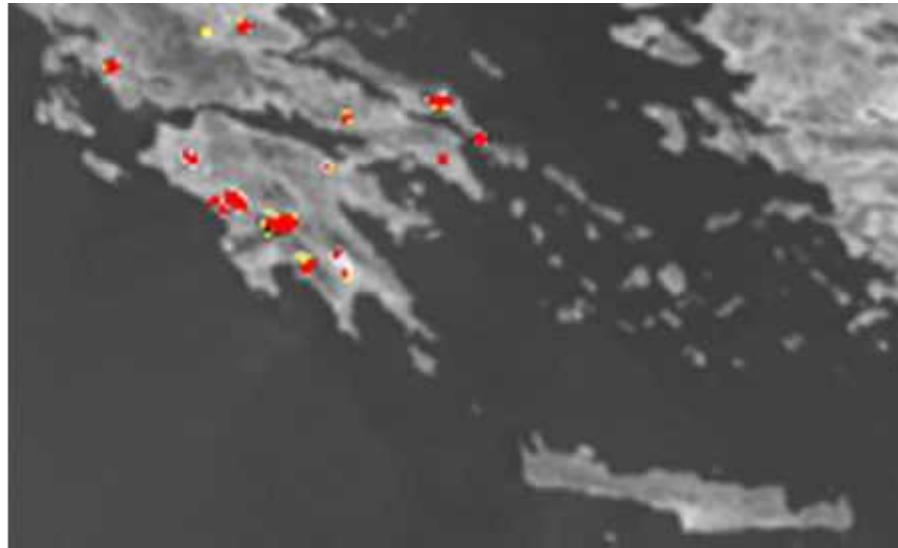
EMERGENCY

SEVIRI MIR 070823\_1030 UTC

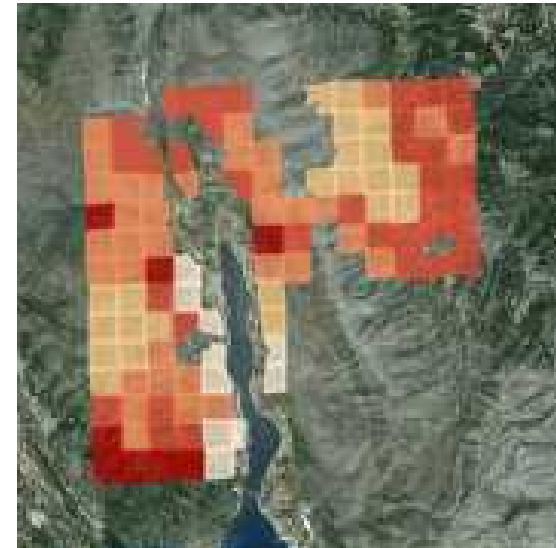


POTENTIAL FIRE  
CONFIRMED FIRE

# On-line Fire Services dissemination Through NOA's dedicated web interface ([http://ocean.space.noa.gr/seviri/fend\\_new/index.php](http://ocean.space.noa.gr/seviri/fend_new/index.php))



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



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



# On-line Fire Services dissemination Through NOA's dedicated web interface ([http://ocean.space.noa.gr/seviri/fend\\_new/index.php](http://ocean.space.noa.gr/seviri/fend_new/index.php))



The major wildfire that burned 148,000 acres of land on the Greek island of Chios between 18 and 22 August 2012, distinguishes 2012 as the year with the largest burned areas that has witnessed the island in the last 30 years. After a natural disaster of that magnitude, in order not to further change the landscape of the island as the forest vegetation of the island deteriorates over time, immediate as well as long-term measures are needed. (source: WWF)

ID	Area	Priority	Area	Start	End
2012020001	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020002	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020003	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020004	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020005	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020006	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020007	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	
2012020008	15,000,000	High	2012-09-15 00:00	2012-09-15 00:00	

Fire Monitoring Service based on MSG SEVIRI

Year: 2012 Month of Reference: August

Legend: 0-100% Burned Area

# On-line Fire Services dissemination Through NOA's dedicated web interface ([http://ocean.space.noa.gr/seviri/fend\\_new/index.php](http://ocean.space.noa.gr/seviri/fend_new/index.php))



The screenshot displays the SEVIRI Monitor web interface. At the top, there is a navigation bar with 'Most Visited', 'Getting Started', 'Latest Headlines', and 'Ελληνικά Προγράμματα Επε...' (Greek Programs...). The main content area features a map of Greece with fire hotspots overlaid. A sidebar on the left contains logos for EUMETSAT, SWeFS, gmes, and strabon. A 'Status Info' box on the right provides details: Mode, Beginning Time (2012-08-23T21:00:00 GMT), End Time (2012-08-23T21:00:00 GMT), Total #HotSpots (2361), and Latest #HotSpots. Below the map is an 'Aggregated Query Data' table with columns for ID, RAIN, Municipality, Duration, Ignition, and End. A 'Fire Monitoring Service based on MSG SEVIRI' banner is visible below the map. At the bottom, there is a 'Realtime' and 'Archive' toggle, a 'Year' selector (2012), and a 'Month of Reference' slider. A 'Fire Simulation' button is also present. The bottom of the interface shows a list of detected hotspots with filters for Population, Elevation, and Area. The Windows taskbar at the bottom indicates the system time as 2:04 pm on 14/9/2012.

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

Countdown to Horizon 2020 Space Tour in Athens, 23/01/2014



# Rapid Fire Mapping Activation in Greece – Peloponnesus 2007



**INTERNATIONAL CHARTER OF MAJOR DISASTERS IS ACTIVATED**

esa

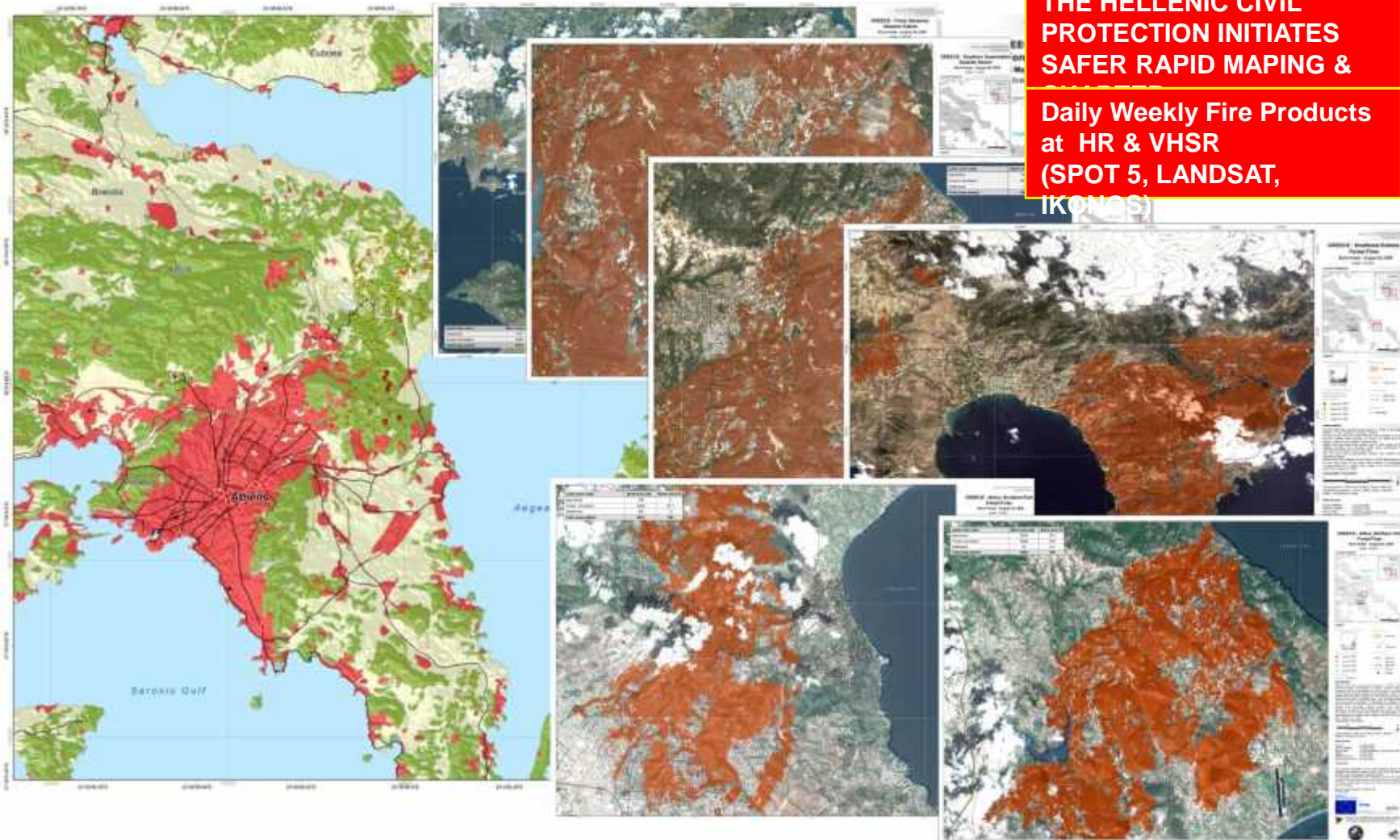
cnes

DLR

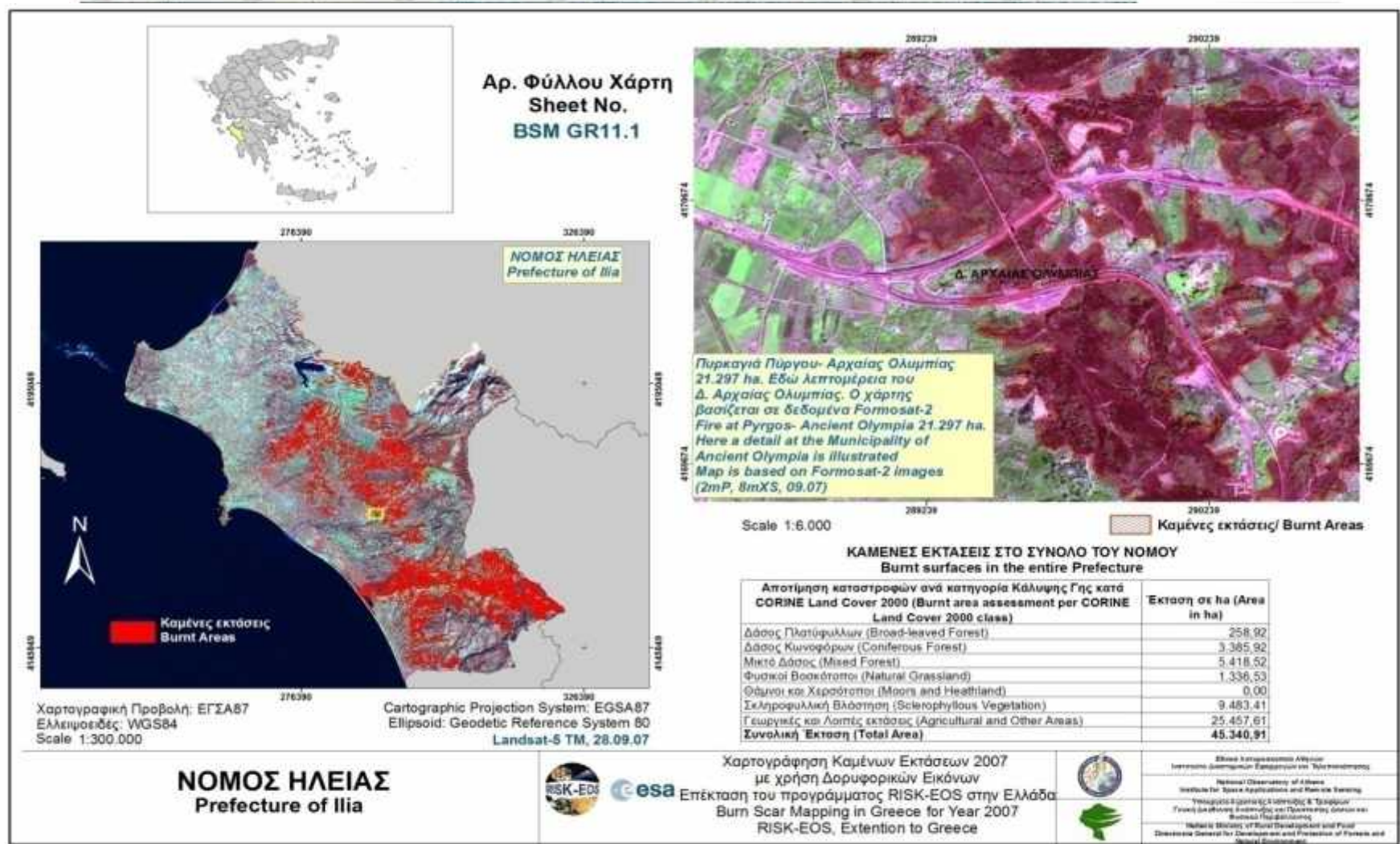
sertit



# Rapid Fire Mapping Activation in Greece – Athens 2009



# Burnt Area Mapping - Emergency Support Immediate Recovery Actions





# Burnt Area Mapping - Emergency Support Immediate Recovery Actions





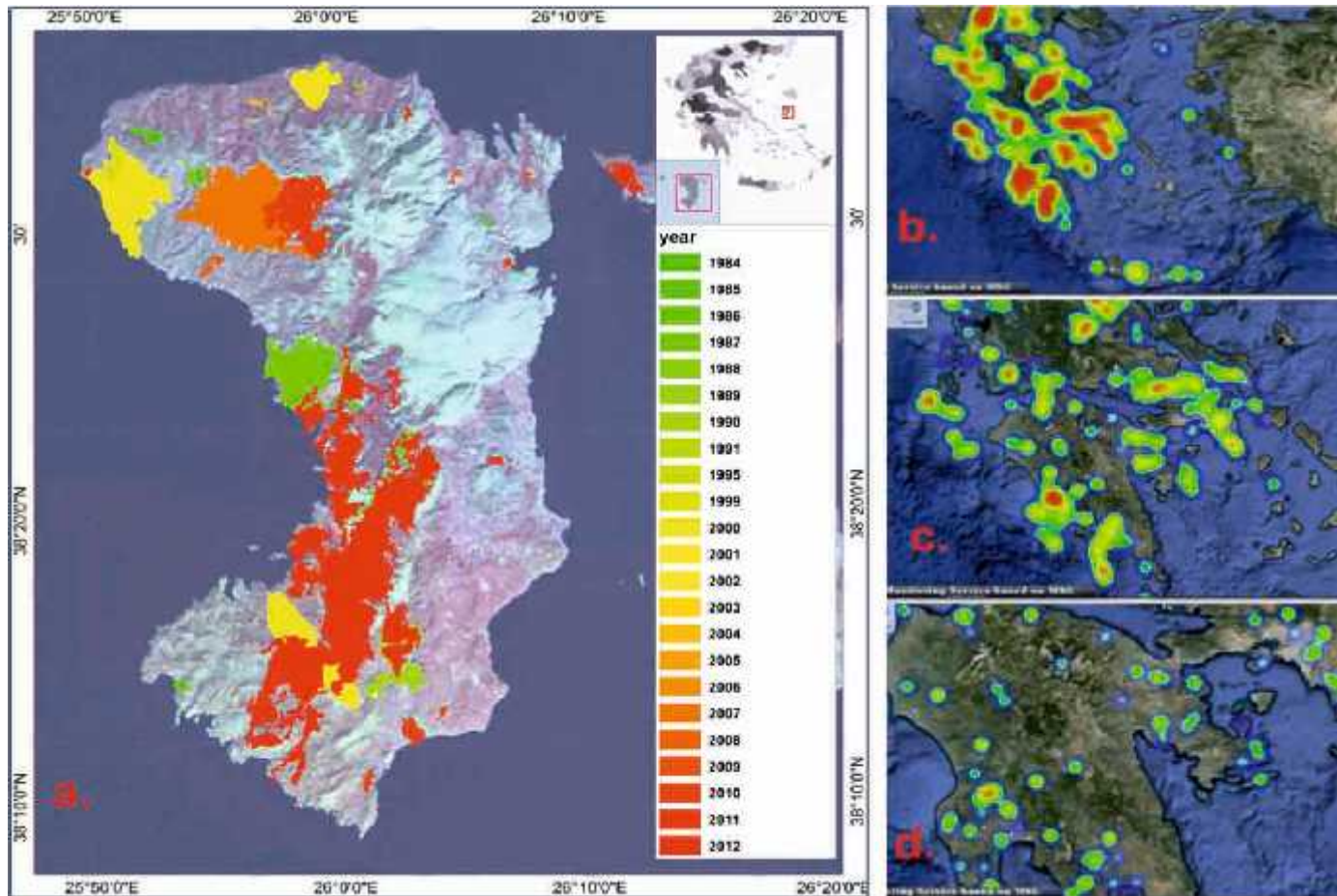
## Seasonal Burn Scar Mapping & Damage Assessments – Recovery Phase





# Diachronic Burn Scar Mapping & Damage Assessments at HR

On-line dissemination through NOA's dedicated web interface  
([http://ocean.space.noa.gr/diachronic\\_bsm/index.php](http://ocean.space.noa.gr/diachronic_bsm/index.php))





# Diachronic Burn Scar Mapping

On-line dissemination through NOA's web interface  
([http://ocean.space.noa.gr/diachronic\\_bsm/index.php](http://ocean.space.noa.gr/diachronic_bsm/index.php))



The screenshot shows the website interface for the Diachronic Burn Scar Mapping project. At the top left is the logo of the National Observatory of Athens. The main header contains the text: "National Observatory of Athens", "Continuous offer to the Scientific Research since 1842", and "Greek General Secretariat for Research and Technology". To the right is an "Event Logo" box. The background features a collage of images: a satellite view of Earth, a close-up of cracked dry earth, and a forest fire. A central text box contains the URL <http://ocean.space.noa.gr/bsm> and the title "DIACHRONIC INVENTORY OF FOREST FIRES OVER GREECE FROM 1984 TO PRESENT, WITH USE OF LANDSAT 4,5,7 SATELLITE DATA". At the bottom, a small box displays the URL: [URL: http://www.noa.gr](http://www.noa.gr)

# Forecasting of wild fire smoke dispersion



Fire monitoring service based on MSG SEVIRI  
(satellite fire detection every 5 minutes)



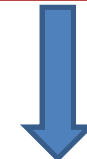
WRF modeling system  
(meteorological forecasting)



FLEXPART  
Lagrangian Dispersion model



Smoke plume  
trajectories



Gas and particle  
concentrations



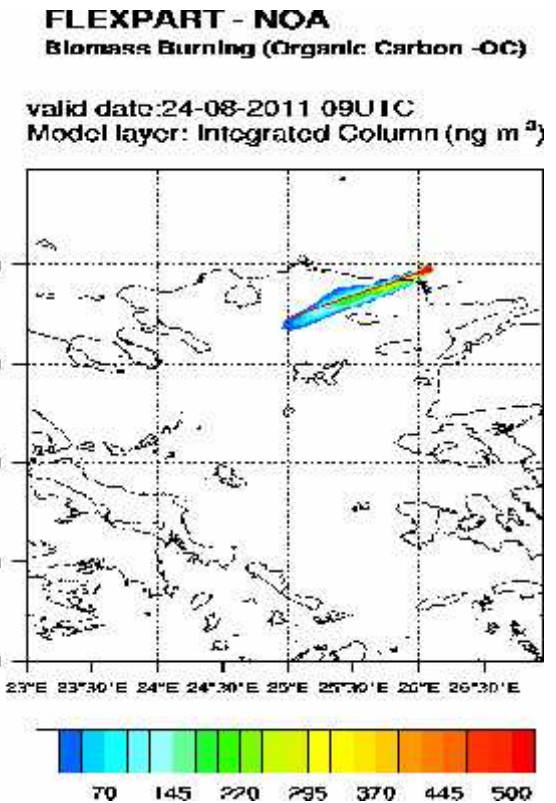
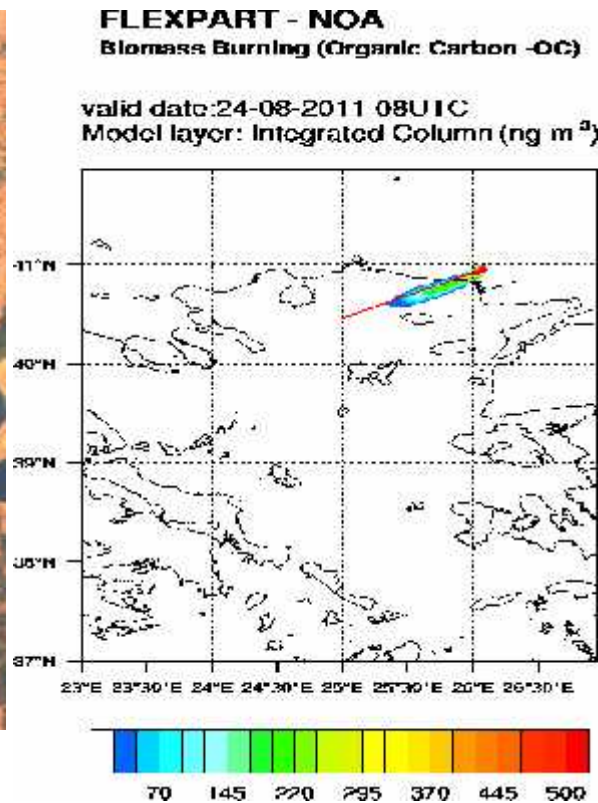
Deposition  
fluxes



# Forecasting of wild fire smoke dispersion

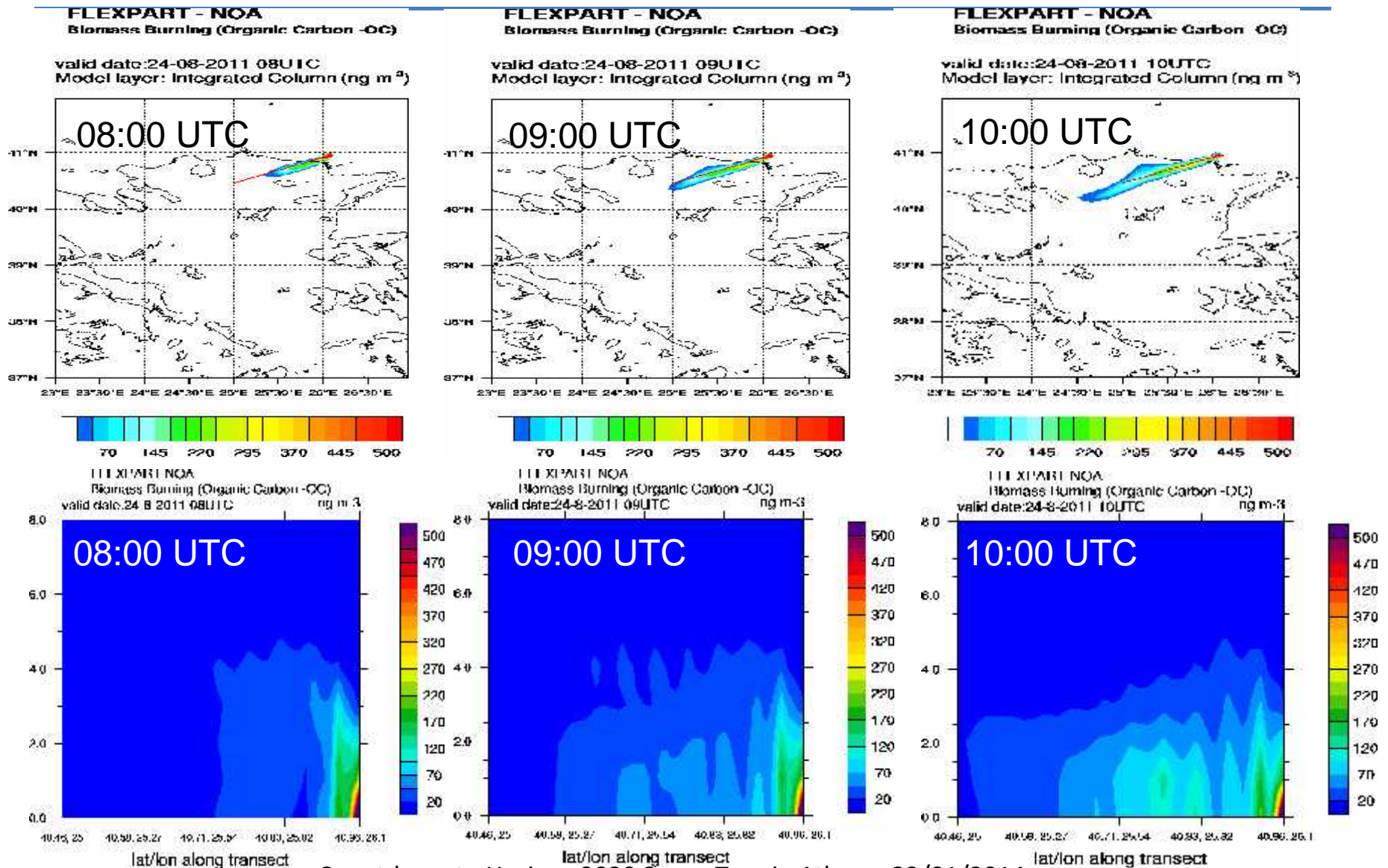


MISR satellite image  
24 August 2011, 08:00 UTC



Simulated concentration of Organic Carbon (ng m<sup>-3</sup>) 24 August 2011, 08:00 (left) and 09:00 (right) UTC

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

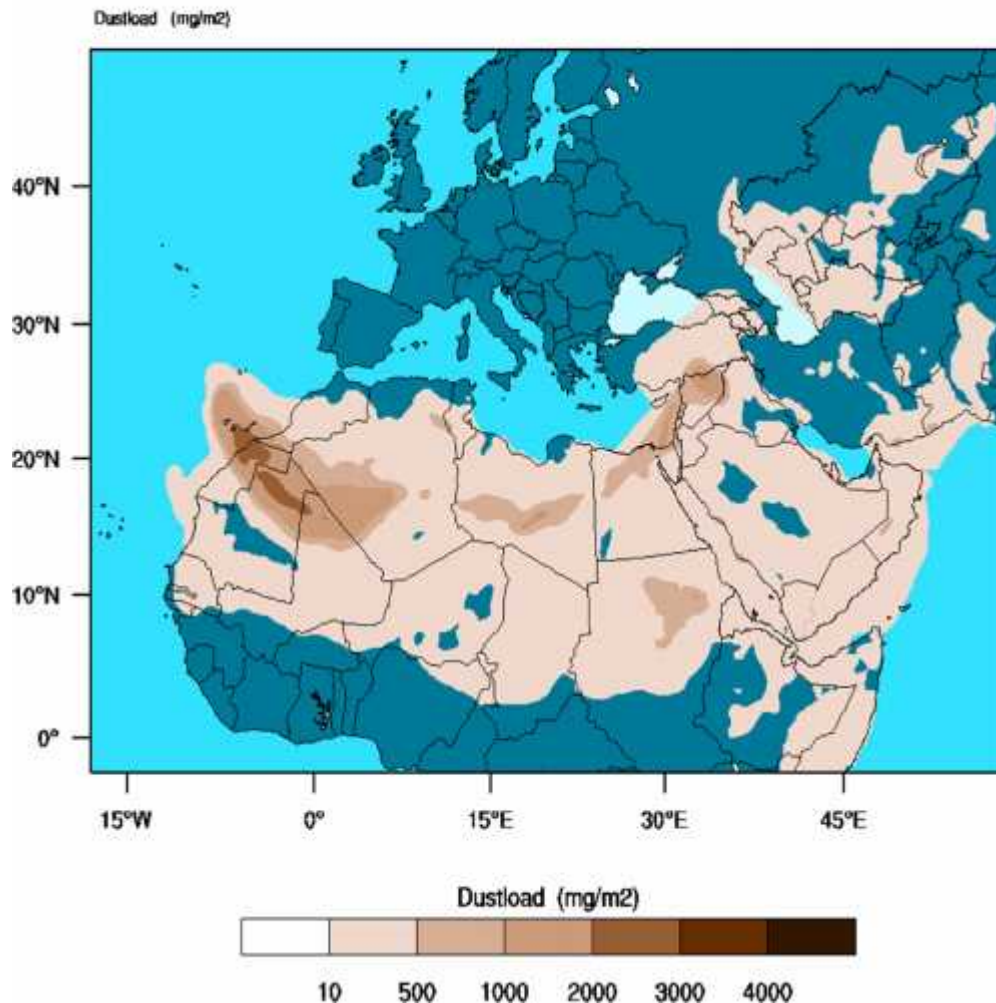




# Forecasting of mineral dust transport in the atmosphere



Valid: 2013-11-27\_06:00:00

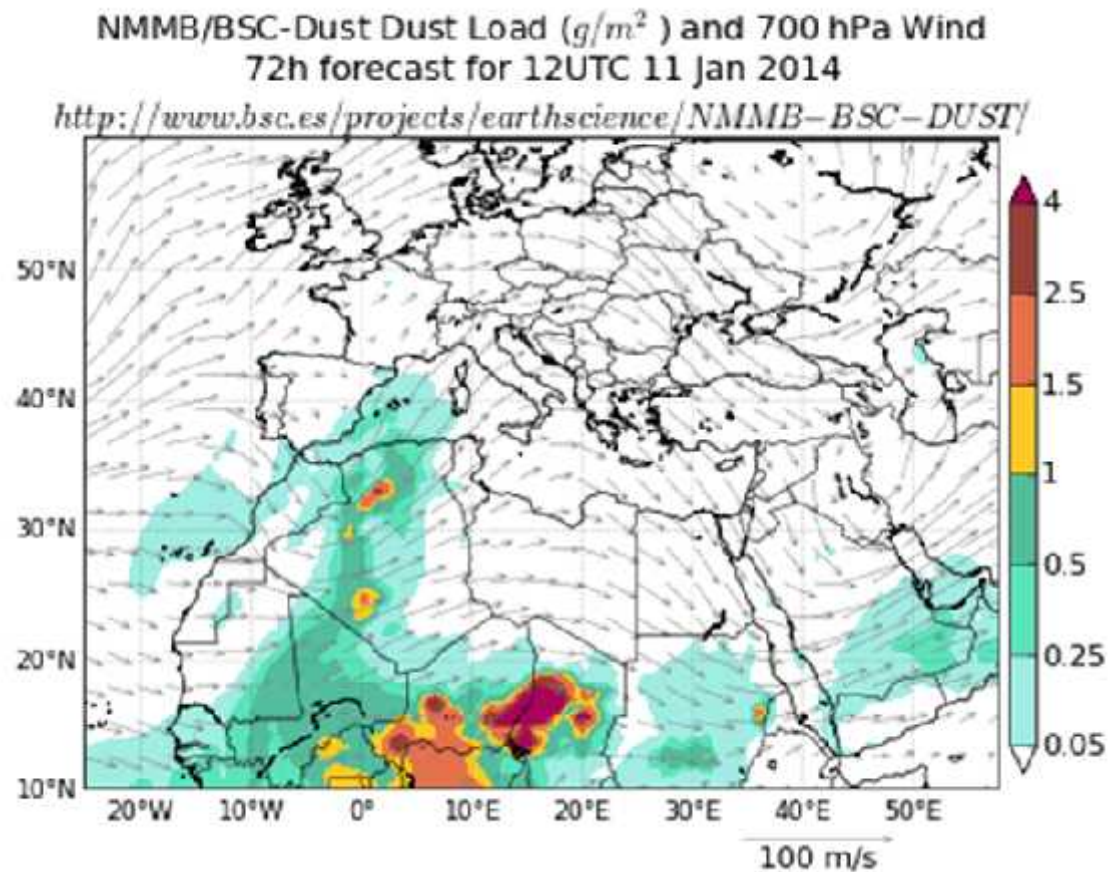


Vertically integrated concentration of airborne dust particles (mg/m<sup>2</sup>)

WRF-CHEM simulation, 27 November 2013, 06:00 UTC



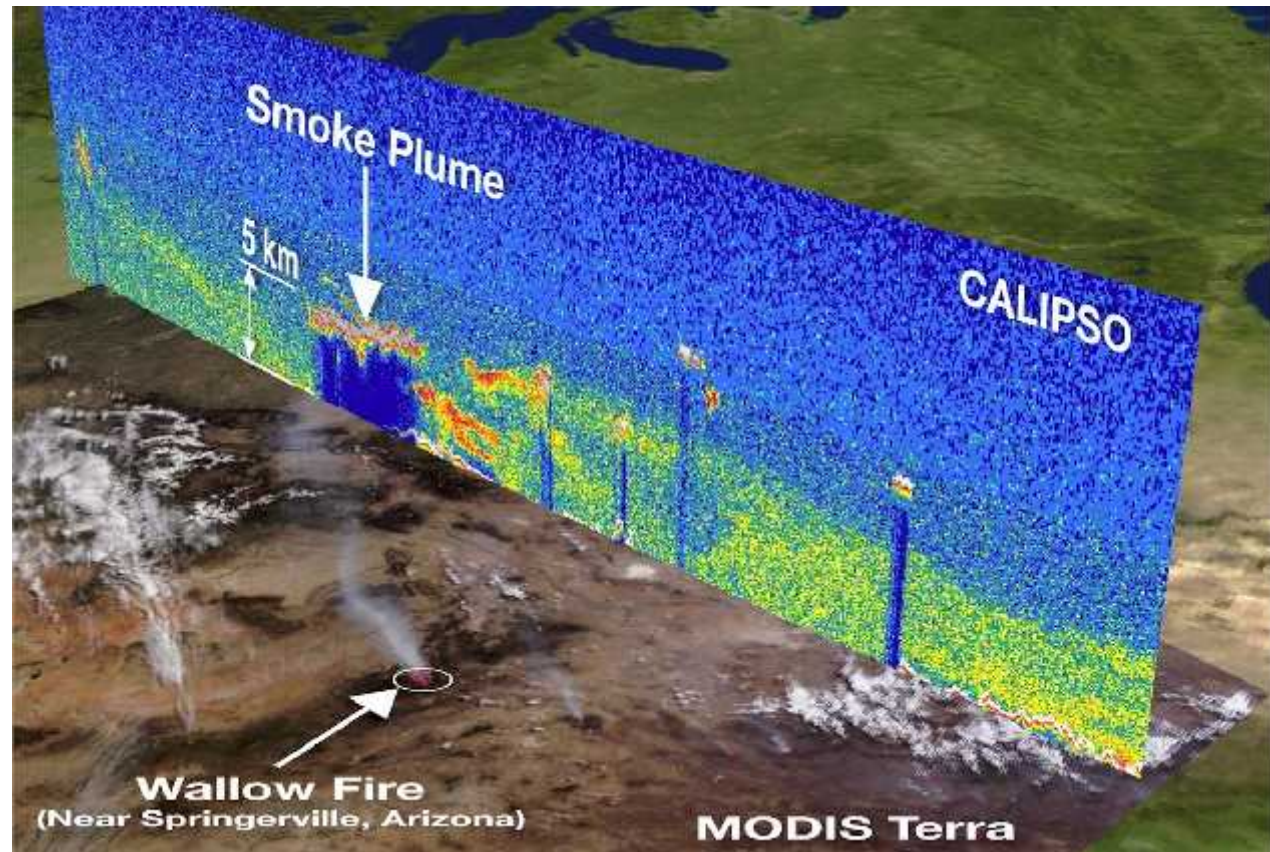
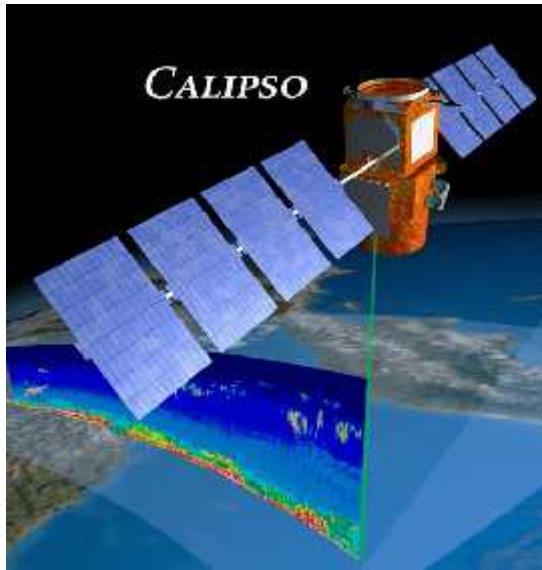
# Forecasting of mineral dust transport in the atmosphere



Vertically integrated concentration of airborne dust particles ( $g/m^2$ ) and wind vectors at 700 hPa

NMMB-BSC-DUST simulation, 14 January 2014, 12:00 UTC

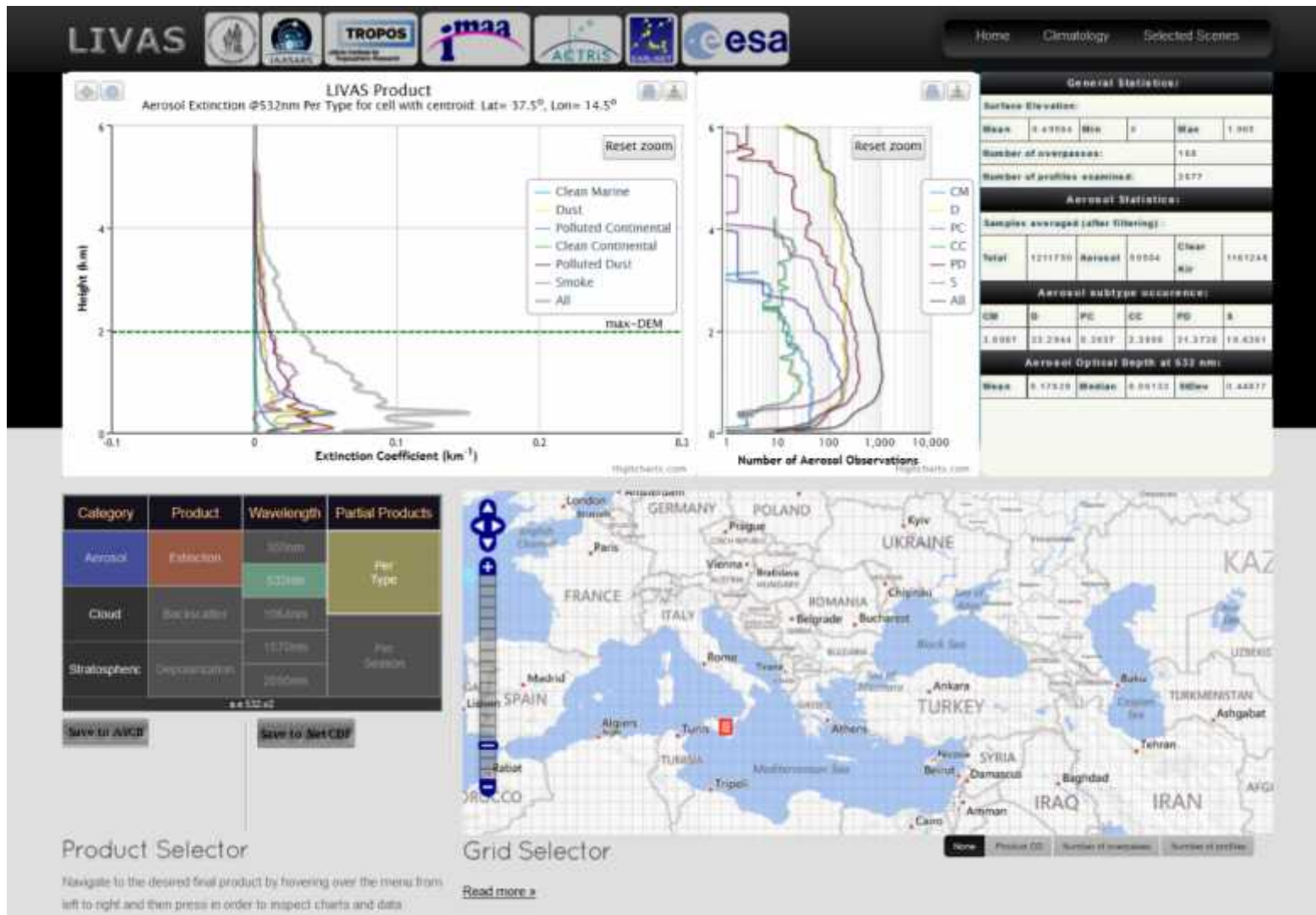
# Vertical structure of smoke plume Space based derived observations





# Global 3D climatology of aerosols and clouds

## LIVAS portal under BEYOND (1x1 degree resolution)



**LIVAS Product**  
Aerosol Extinction @532nm Per Type for cell with centroid: Lat= 37.5°, Lon= 14.5°

**General Statistics:**

Surface Elevation:			
Max:	1 41004	Min:	0
Max:		Max:	1 907
Number of overpasses:			
103			
Number of profiles examined:			
3 677			

**Aerosol Statistics:**

Samples averaged (after filtering):

Total	1211730	Aerosol	50004	Clean	1161244
				NR	

**Aerosol subtype occurrence:**

CM	D	PC	CC	PD	S
1.6997	22.2944	0.2637	2.3999	31.3739	19.4391

**Aerosol Optical Depth at 532 nm:**

Mean	0.17529	Median	0.00102	SDDev	0.44217
------	---------	--------	---------	-------	---------

**Product Selector**

Category	Product	Wavelength	Partial Products
Aerosol	Extinction	532nm	Per Type
Cloud	Backscatter	1064nm	Per Session
Stratospheric	Deposition	2000nm	

**Grid Selector**

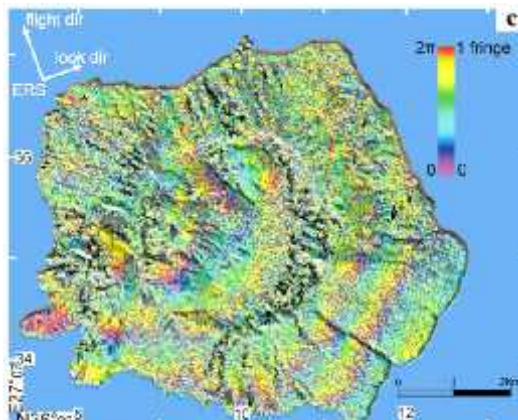
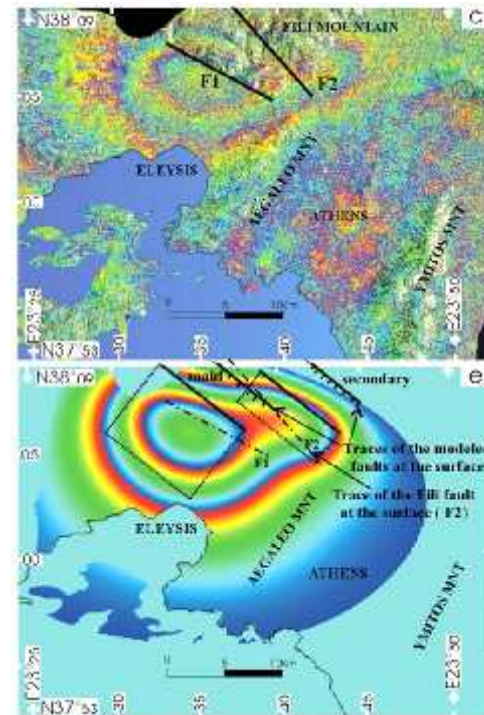
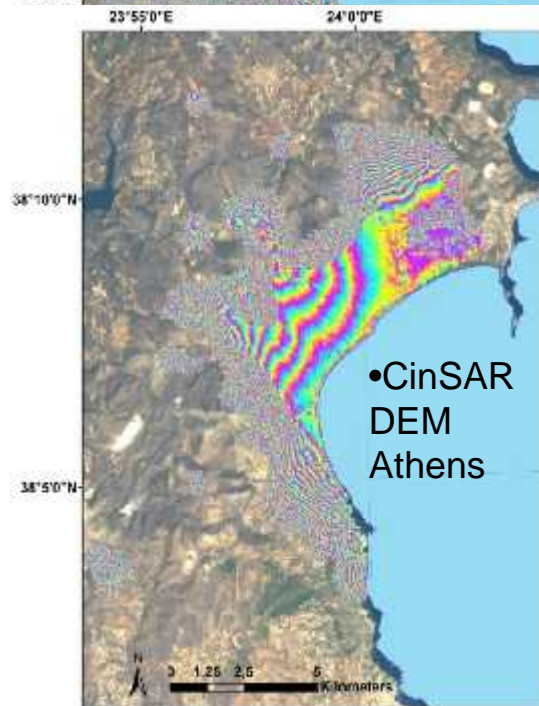
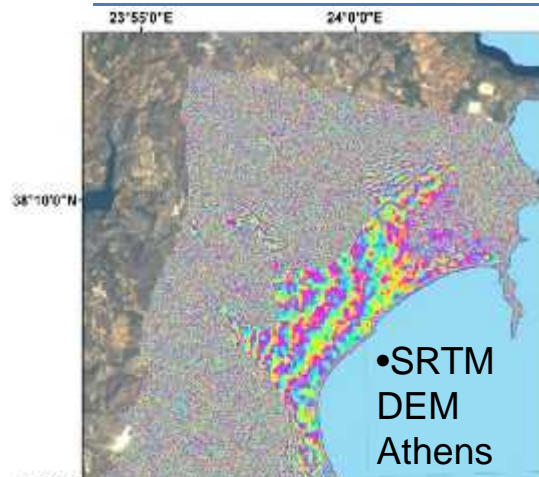
Navigation: Home Climatology Selected Scenes

Product: CC | Number of overpasses: | Number of profiles:

# InSAR and CinSAR services

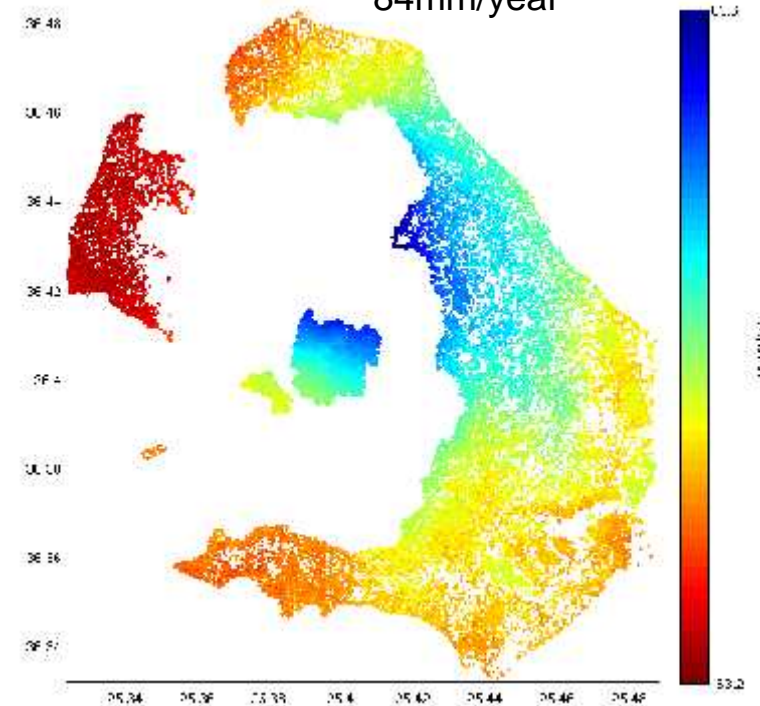
## Operational Deformation Rate monitoring

### ESA AO ERS & ENVISAT awarded projects



•1999 Athens earthquake  
Crustal Post Seismic  
Deformation 80-90mm

- Santorini volcano unrest 2011-12
- ~60000 points
- Deformation rate - 63mm/year - 84mm/year



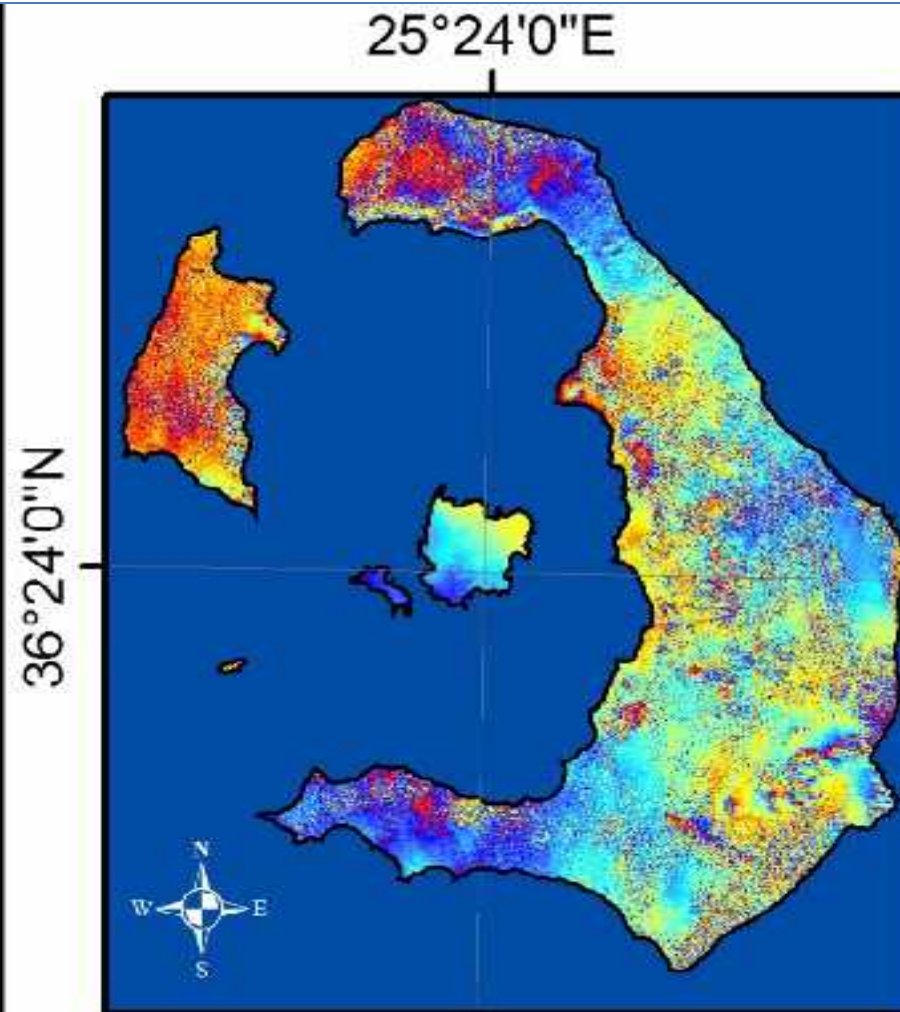
•Nisiros volcano unrest  
Deformation rate 1997-  
2000 87mm/year



InSAR and CinSAR services  
Operational Deformation Rate monitoring  
**ESA AO ERS & ENVISAT awarded projects**

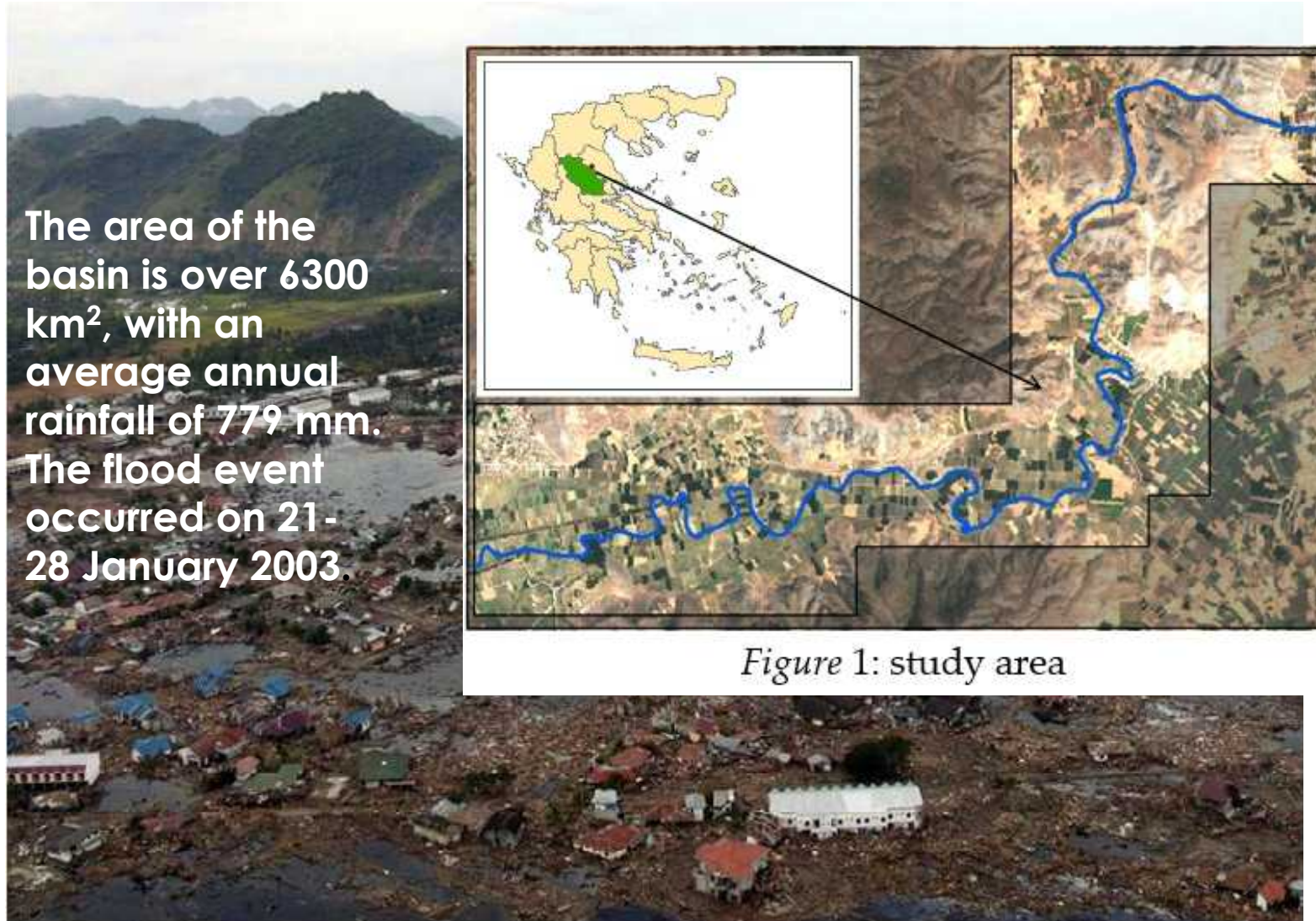


November  
2011



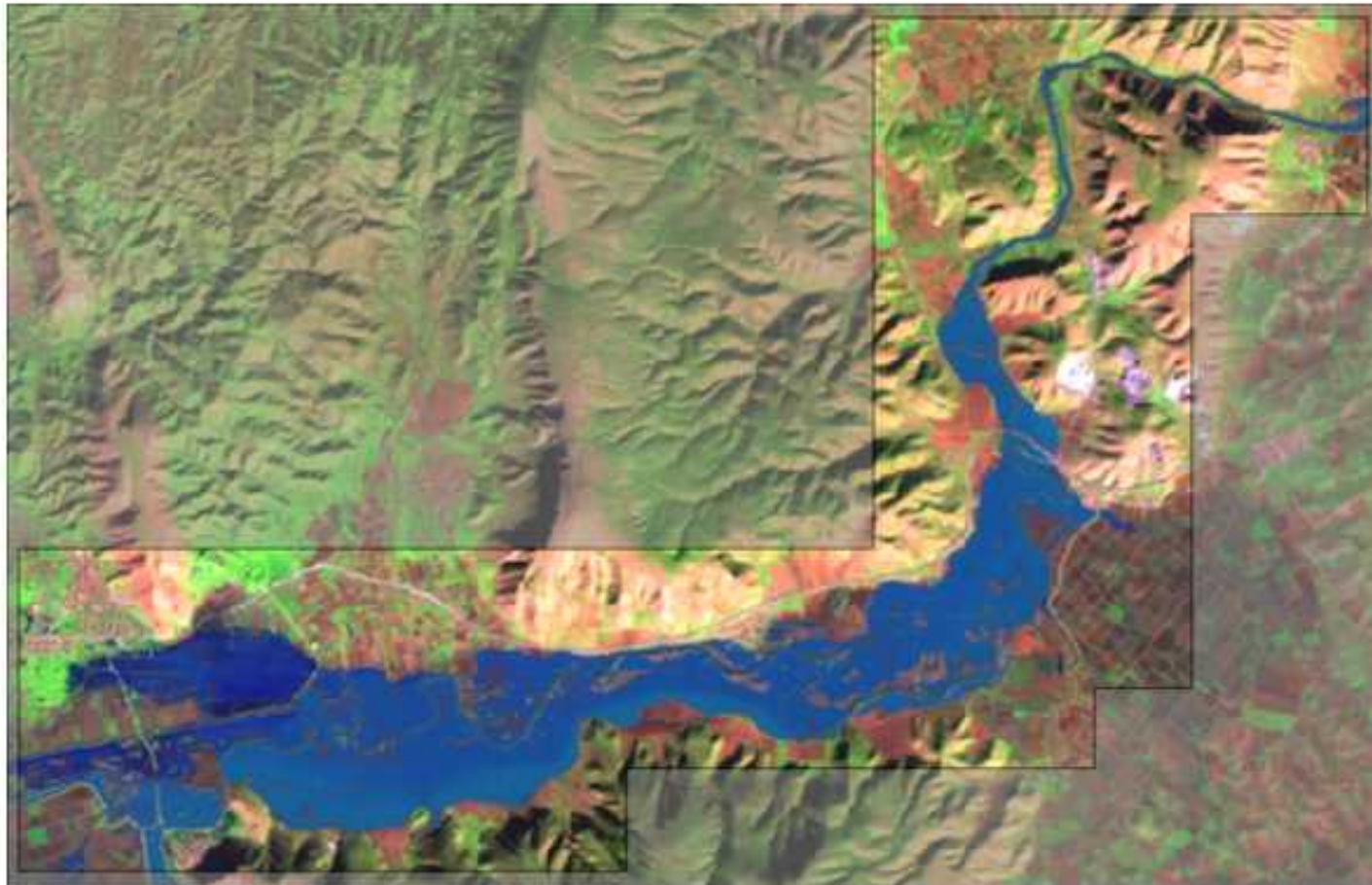


## Flood Risk Modelling and Flood extend



## Flood Risk Modelling and Flood extend

---



*Figure 3: Landsat-7 satellite image (flooded area)*







**Thank you for your attention!**

**For more information**

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