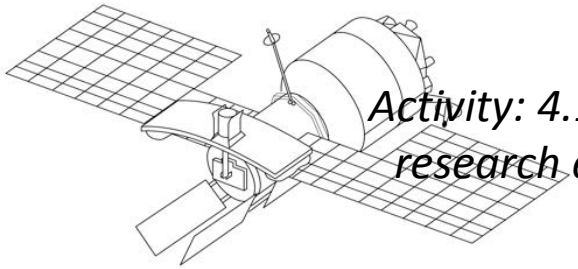
BEYOND

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

SWF/GEO Workshop on Natural Disasters Mitigation and Earth Observations
13/01/2014, Geneva, Switzerland

FP7-Regpot-2012-23-1

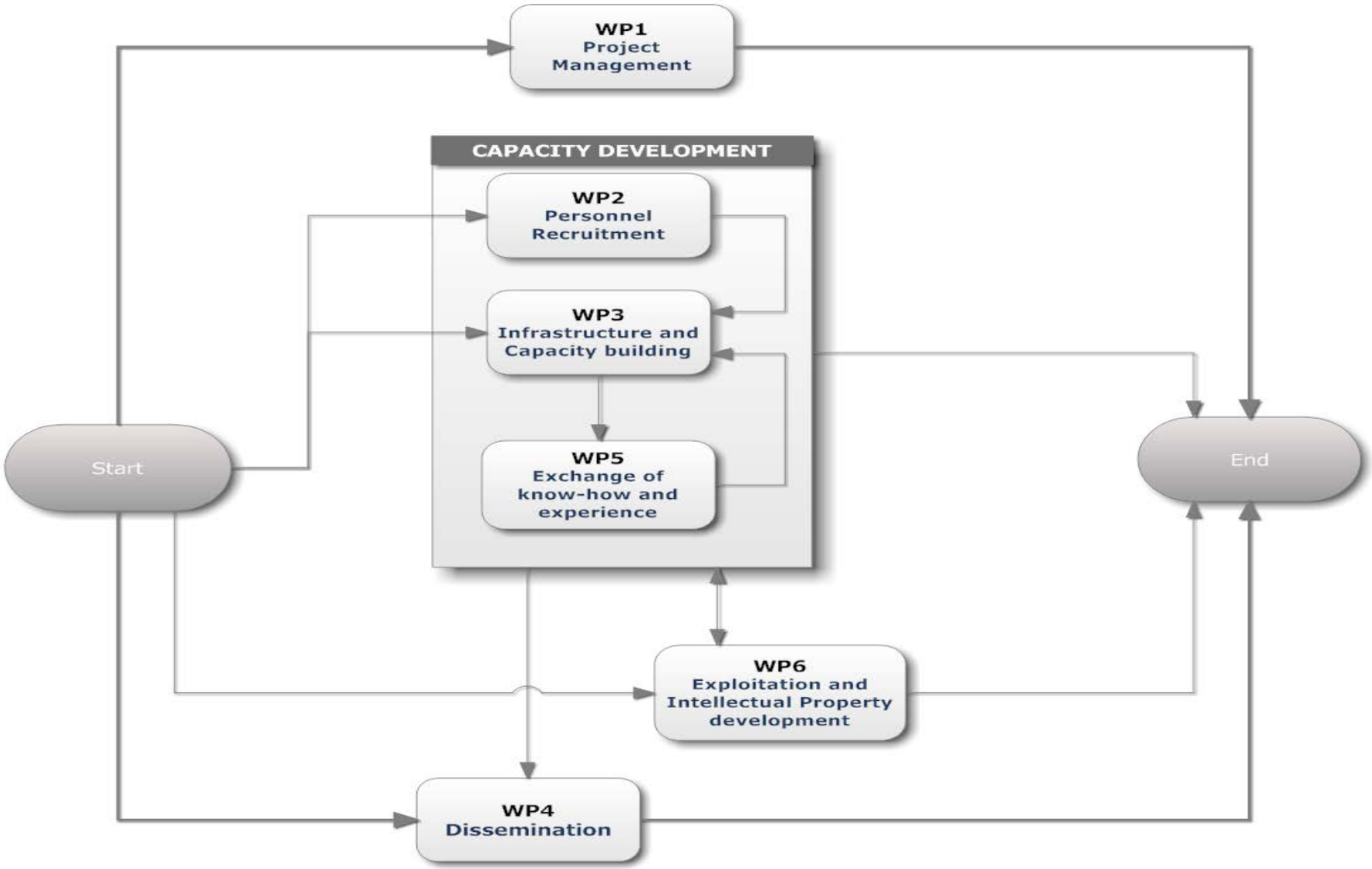
BEYOND Concept

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 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

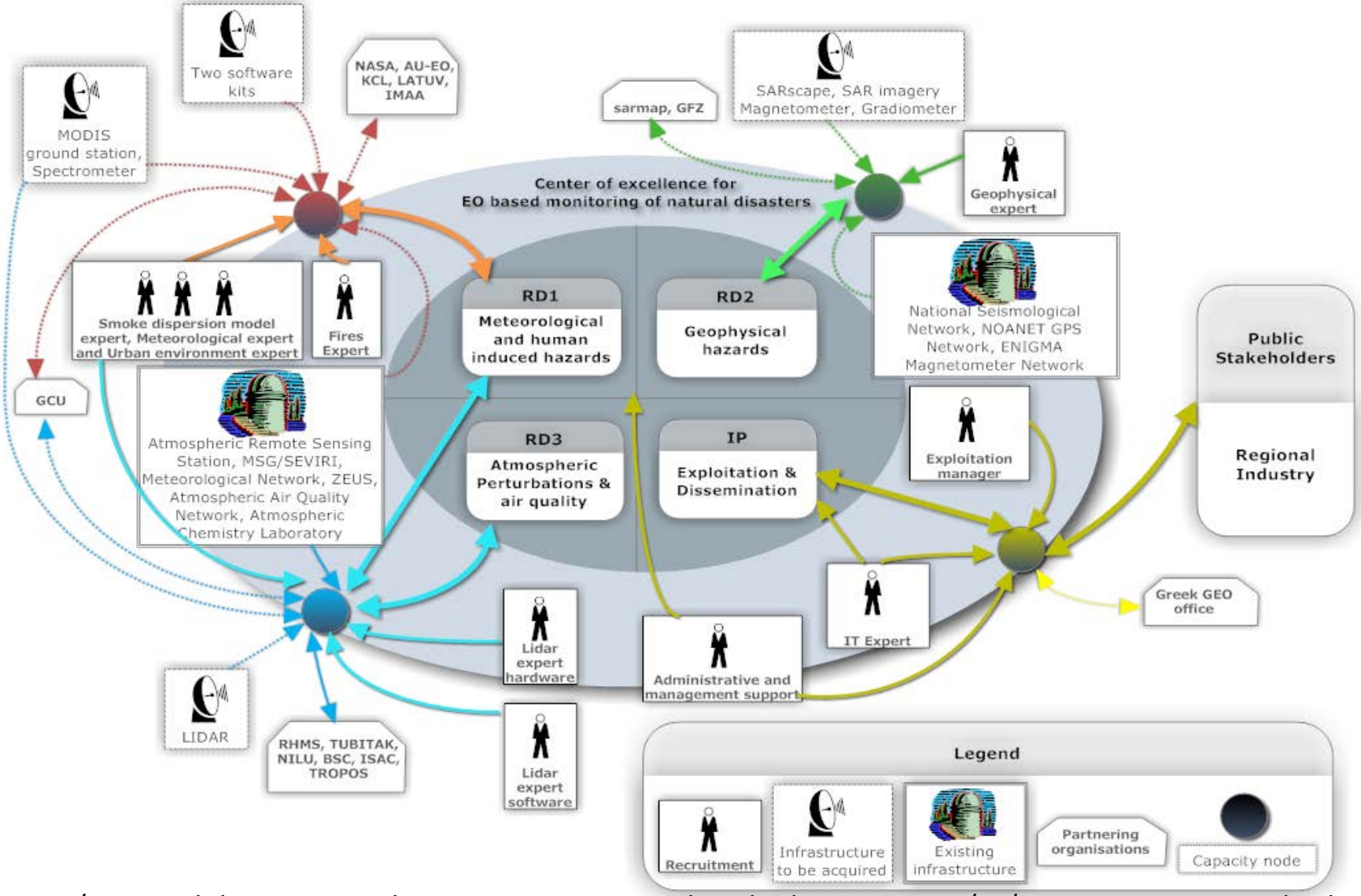
Total costs WP1	MANAGEMENT		24	73181	12000	0	6000	5962.67	97143.67
Total costs WP2	PERSONNEL RECRUITMENT		356	863438	0	3100	0	60657.66	927195.66
Total costs WP3	INFRASTRUCTURE AND CAPACITY BUILDING		49	149401	0	596000	70000	52178,07	867579,07

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

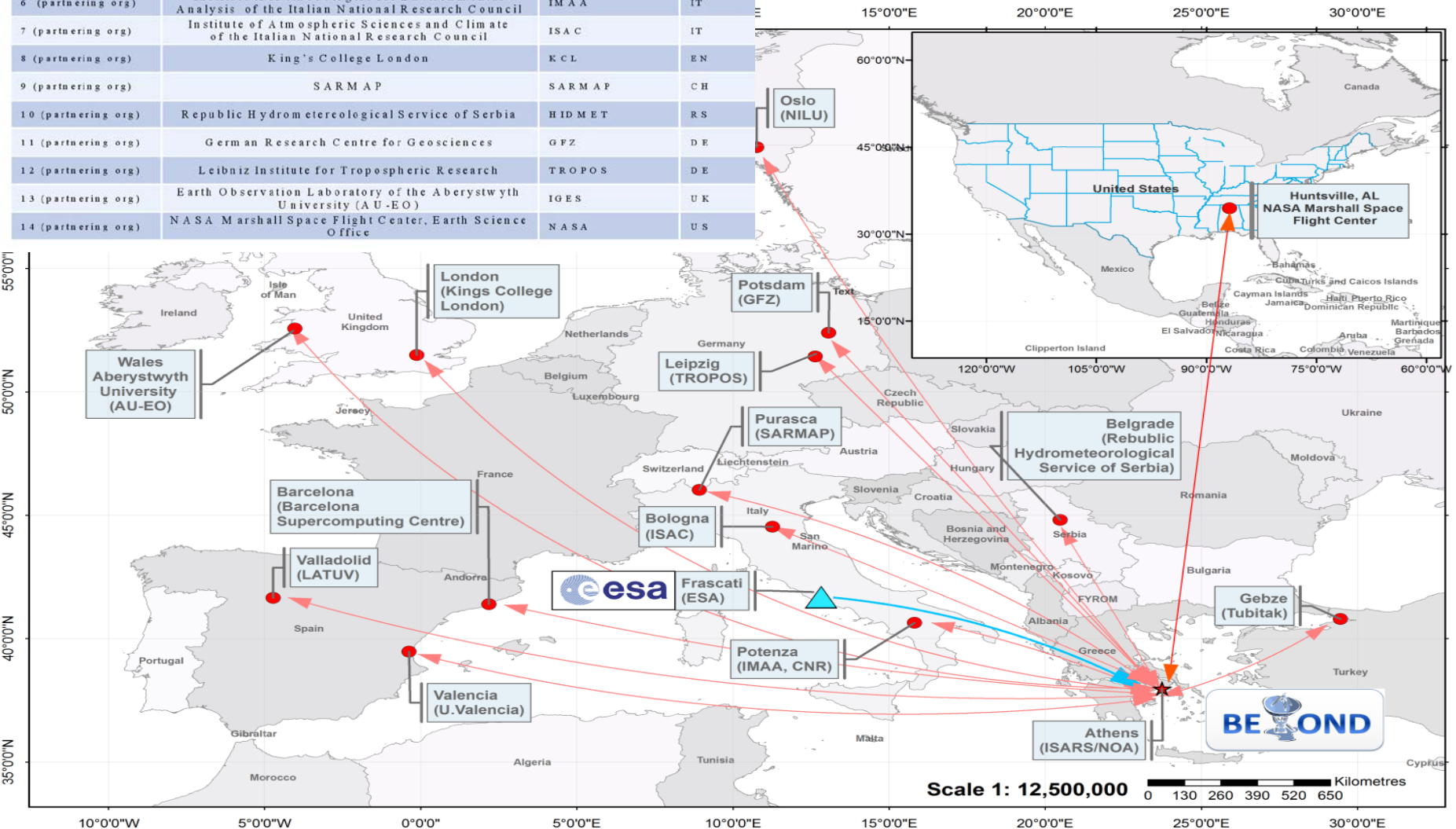
- ➢**DLR – EO Center of the German Aerospace Center**
- ➢**ESA – European Space Agency (Directorate of Earth Observation Programmes)**
- ➢**GCU-Global Change Unit of the University of Valencia**
- ➢**LATUV-Remote Sensing Laboratory of the Un. Of Valadolid**
- ➢**BSC – Barcelona Supercomputing Center**
- ➢**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 Organisation name	Participant Short Name	Country
1 (Applicant)	Institute for Space Applications and Remote Sensing (National Observatory of Athens)	ISARS/NOA	GR
1 (partnering org)	Global Change Unit (Image Processing Laboratory) University of Valencia		ES
2 (partnering org)	Remote Sensing Laboratory of the University of Valladolid	LATUV	ES
3 (partnering org)	Barcelona Supercomputing Center	BSC	ES
4 (partnering org)	Norwegian Institute for Air Research	NILU	NO
5 (partnering org)	Scientific and Technological Research Council of Turkey– Marmara Research Center	TUBITAK	TR
6 (partnering org)	Institute if Methodologies for Environmental Analysis of the Italian National Research Council	IMAA	IT
7 (partnering org)	Institute of Atmospheric Sciences and Climate of the Italian National Research Council	ISAC	IT
8 (partnering org)	King's College London	KCL	EN
9 (partnering org)	SARMAP	SARMAP	CH
10 (partnering org)	Republic Hydrometereological Service of Serbia	HIDMET	RS
11 (partnering org)	German Research Centre for Geosciences	GFZ	DE
12 (partnering org)	Leibniz Institute for Tropospheric Research	TROPOS	DE
13 (partnering org)	Earth Observation Laboratory of the Aberystwyth University (AU-EO)	IGES	UK
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

Centre of Excellence for

EO-based monitoring of Natural Disasters

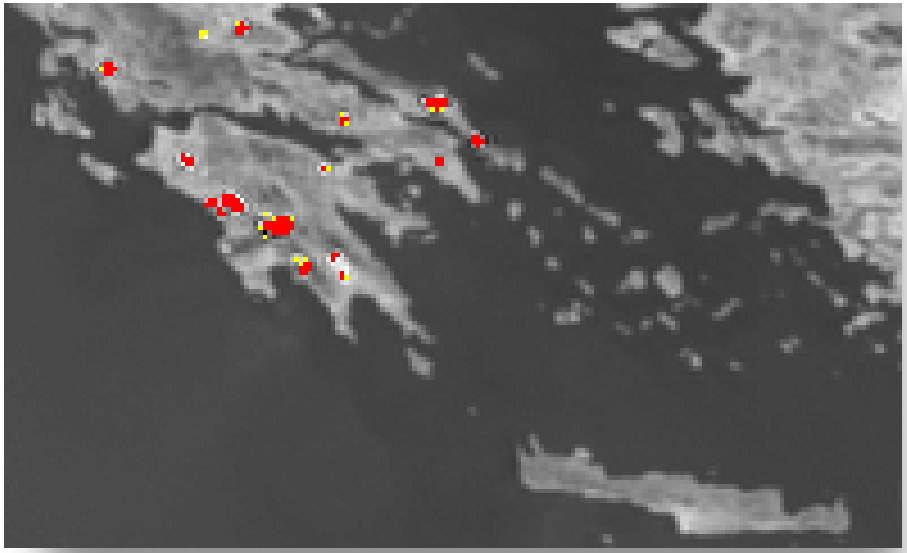
- Fires & Floods
- Urban environment
- Geophysical hazards
- Atmospheric & weather related disasters

Service Capacity Building

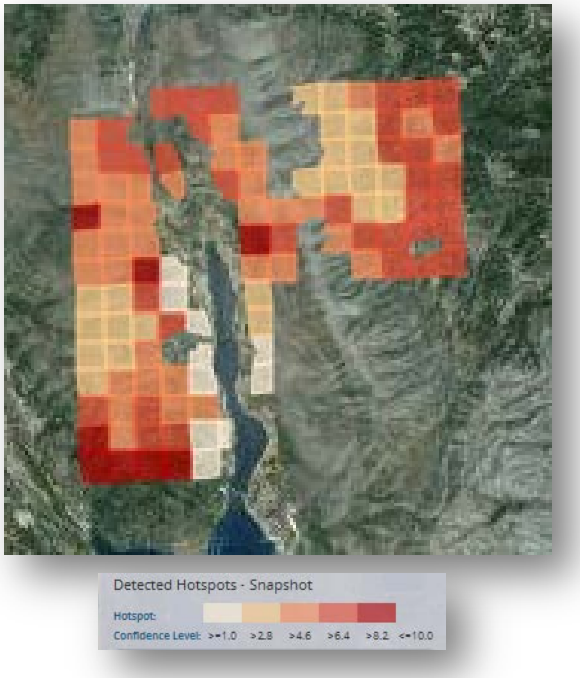
(three research domains of BEYOND, **RD1: Meteorological and human induced hazards**, **RD2: Geophysical hazards**, and **RD3: Atmospheric pollution and air quality)**

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

On-line Fire Services dissemination Through NOA‘s dedicated web interface (http://ocean.space.noa.gr/seviri/fend_new/index.php)

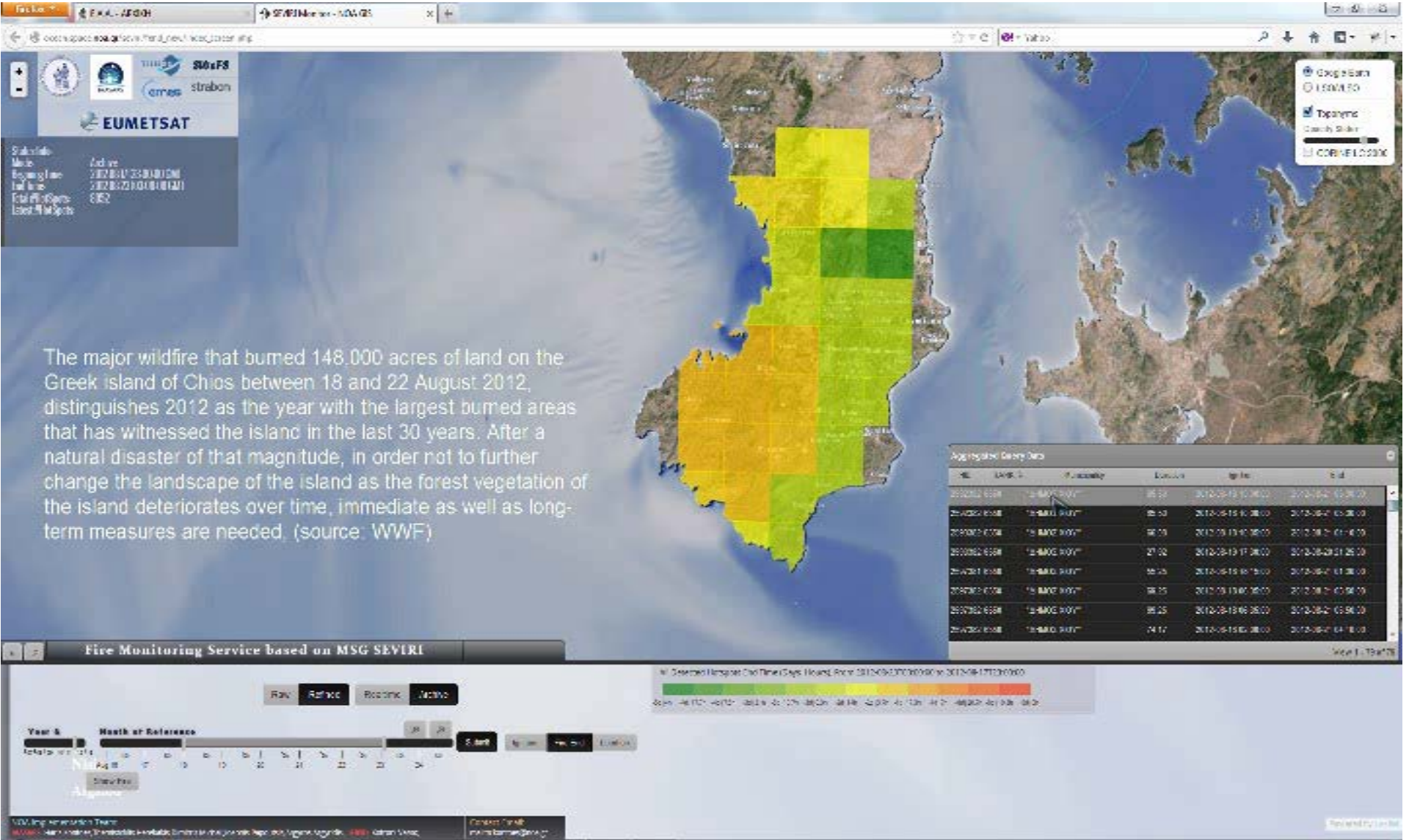


Raw resolution: 3.5x3.5 km wide pixel over entire

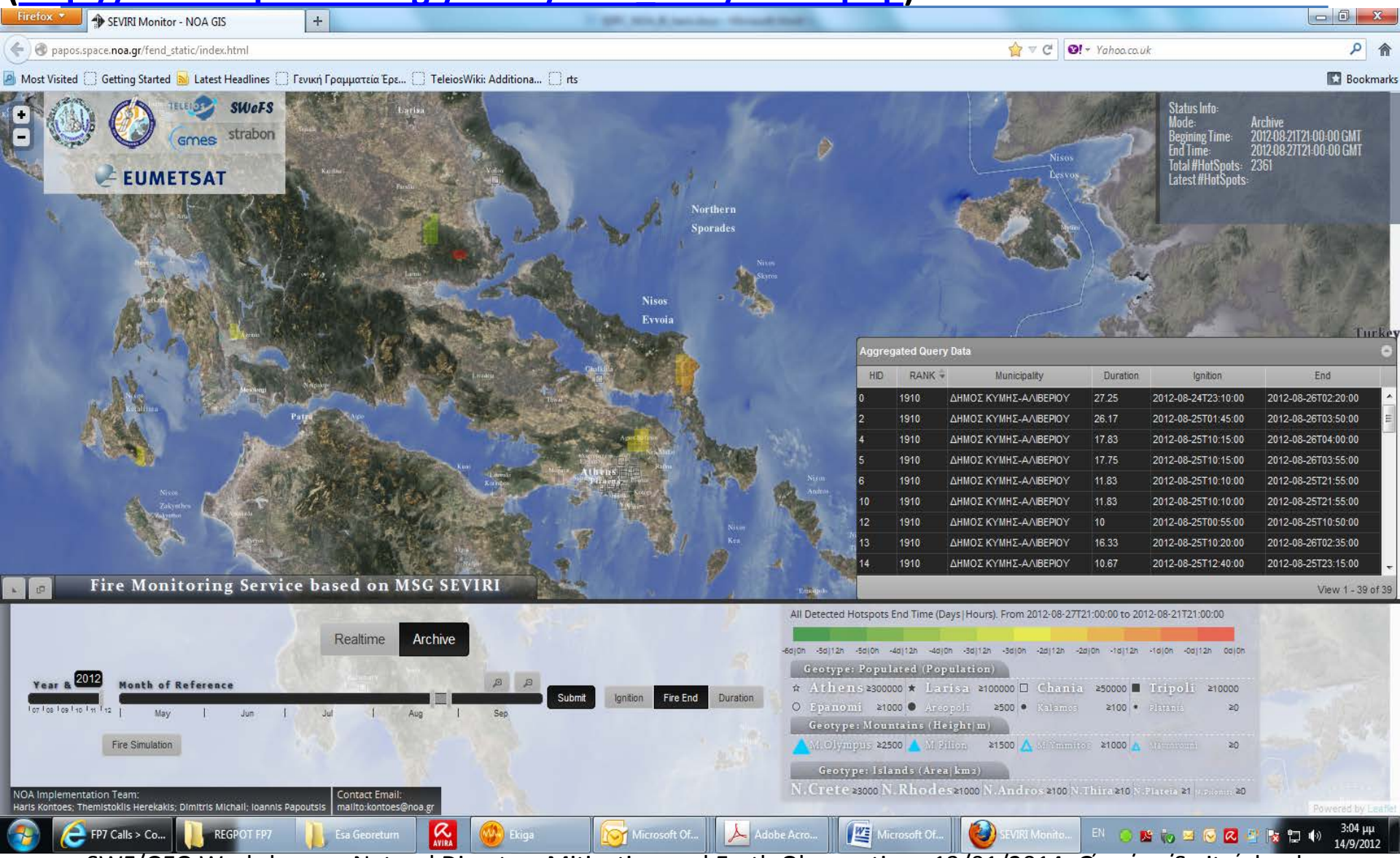


Refined resolution: 0.5x0.5 km wide pixel over entire Greece

On-line Fire Services dissemination Through NOA‘s dedicated web interface (http://ocean.space.noa.gr/seviri/fend_new/index.php)



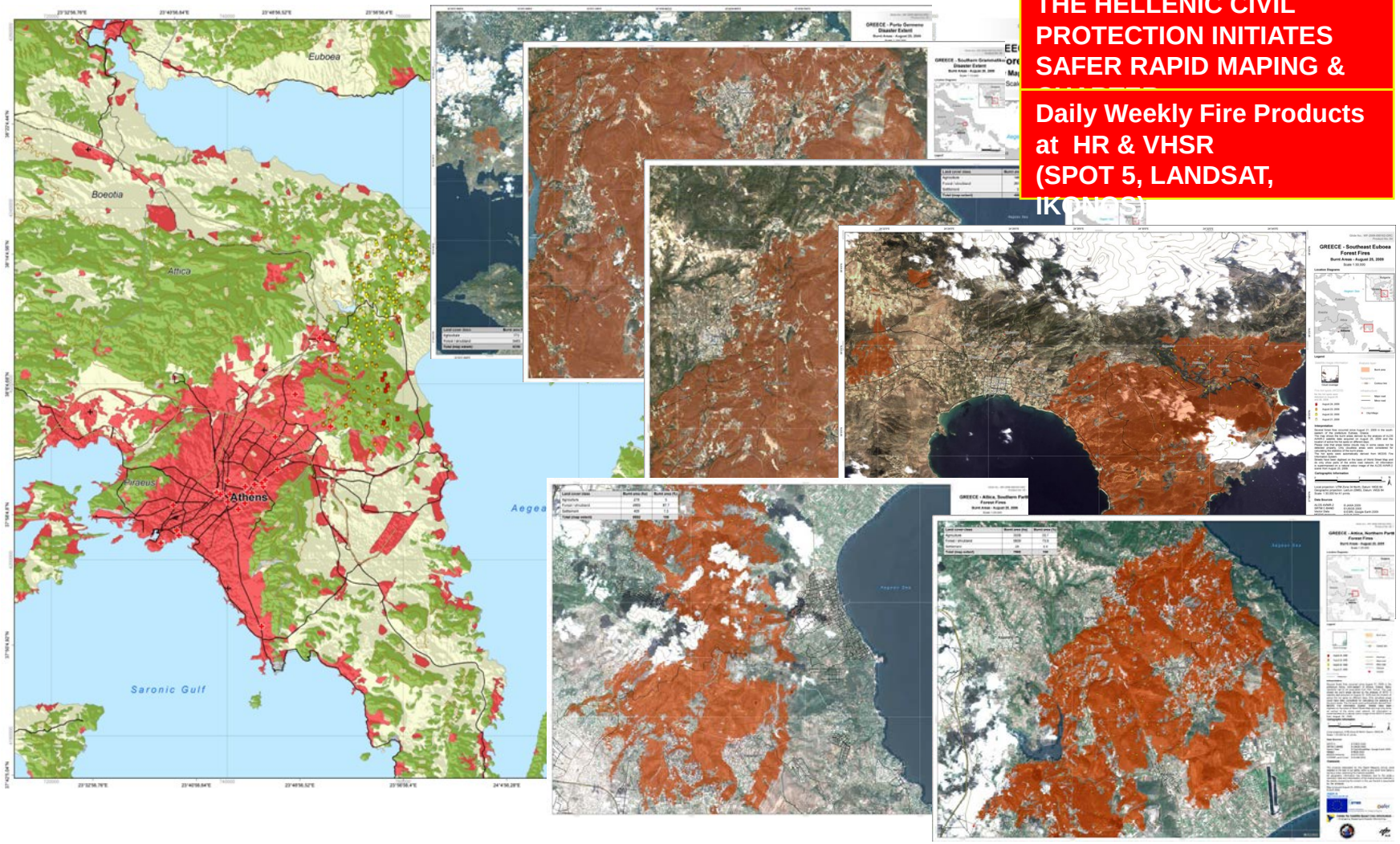
On-line Fire Services dissemination Through NOA's dedicated web interface (http://ocean.space.noa.gr/seviri/fend_new/index.php)



Rapid Fire Mapping Activation in Greece – Peloponnesus 2007

INTERNATIONAL CHARTER OF MAJOR DISASTERS IS ACTIVATED

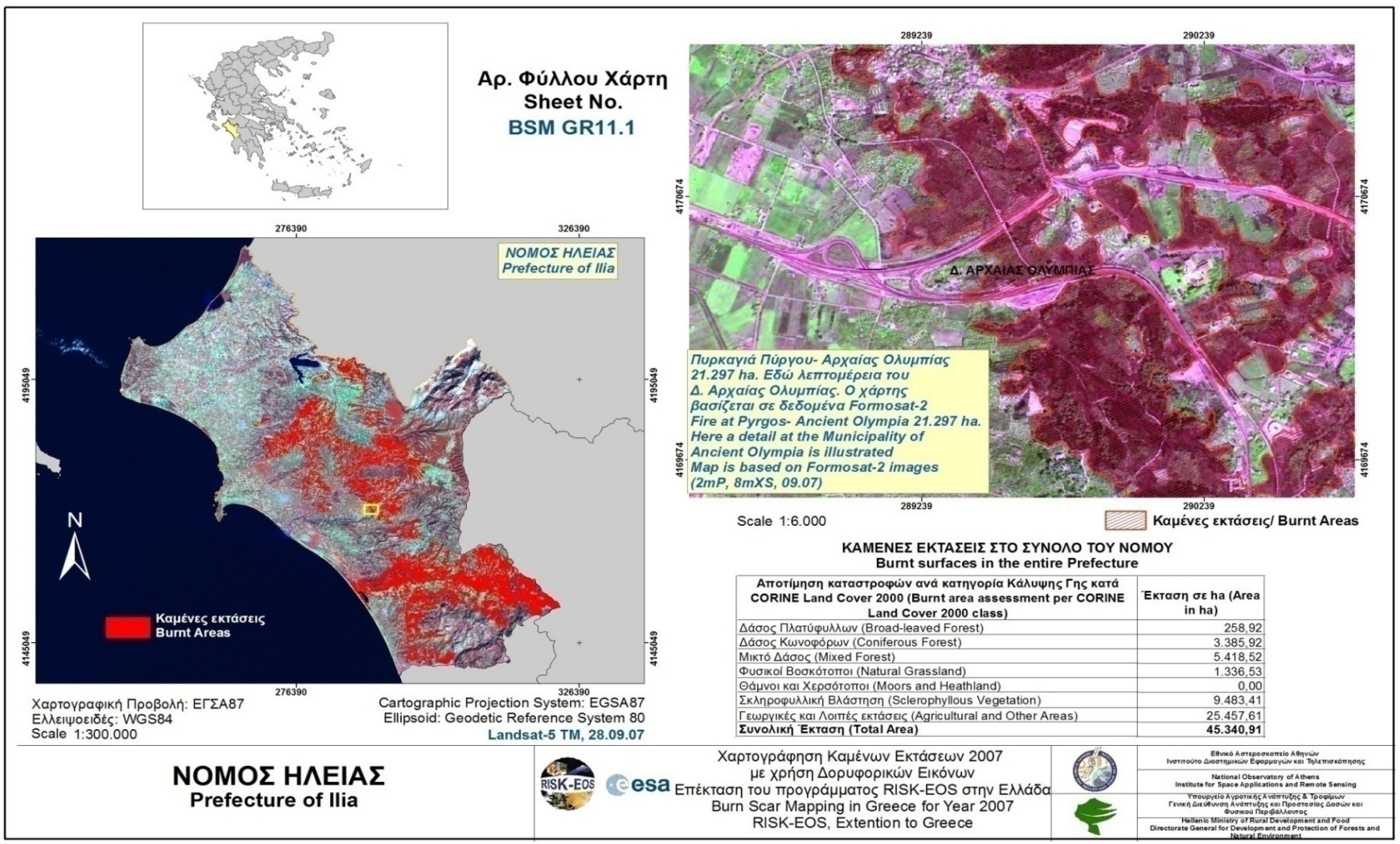
Rapid Fire Mapping Activation in Greece – Athens 2009



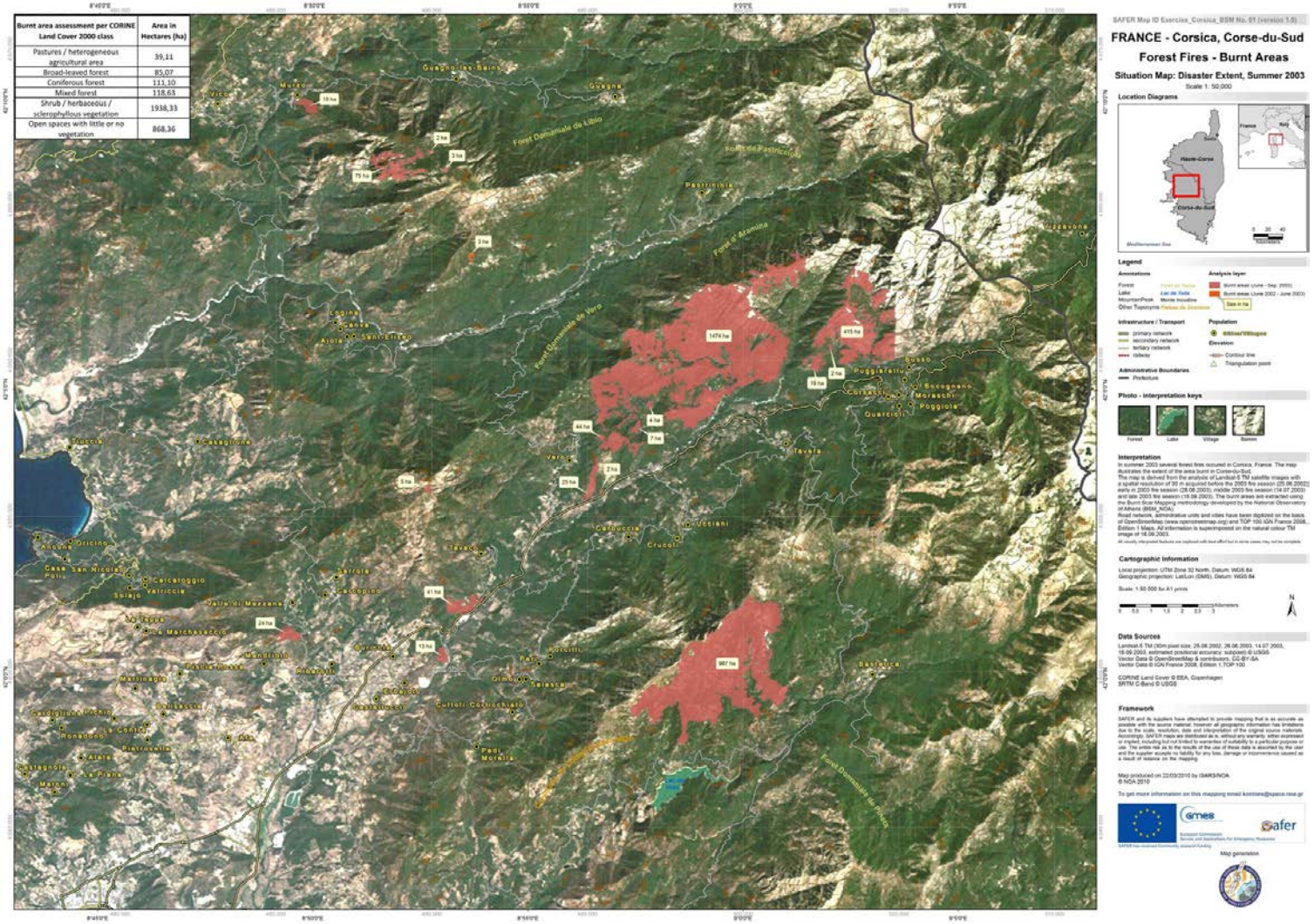
THE HELLENIC CIVIL PROTECTION INITIATES SAFER RAPID MAPING &

Daily Weekly Fire Products at HR & VHSR (SPOT 5, LANDSAT, IKONOS)

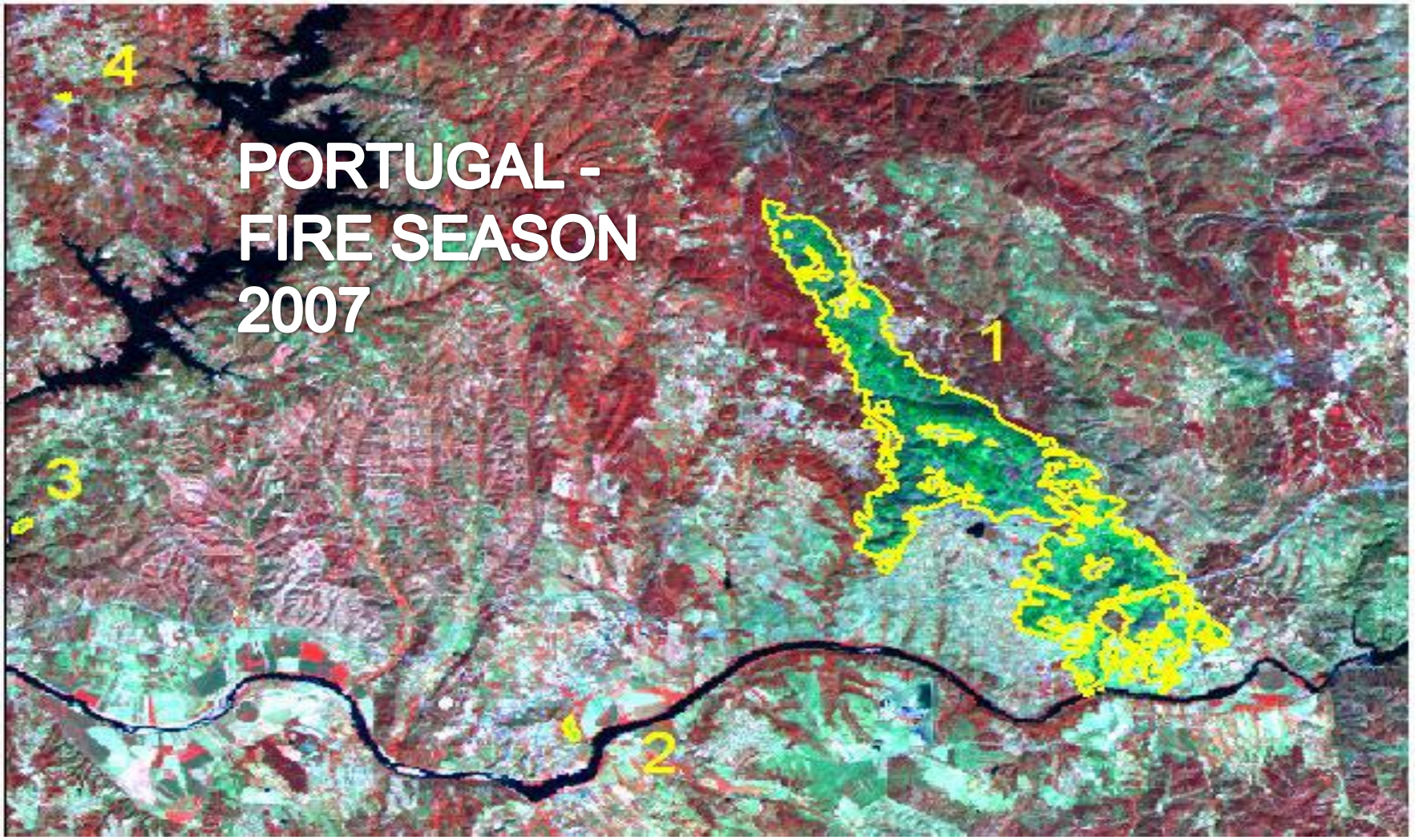
Burnt Area Mapping - Emergency Support Immediate Recovery Actions



Burnt Area Mapping - Emergency Support Immediate Recovery Actions

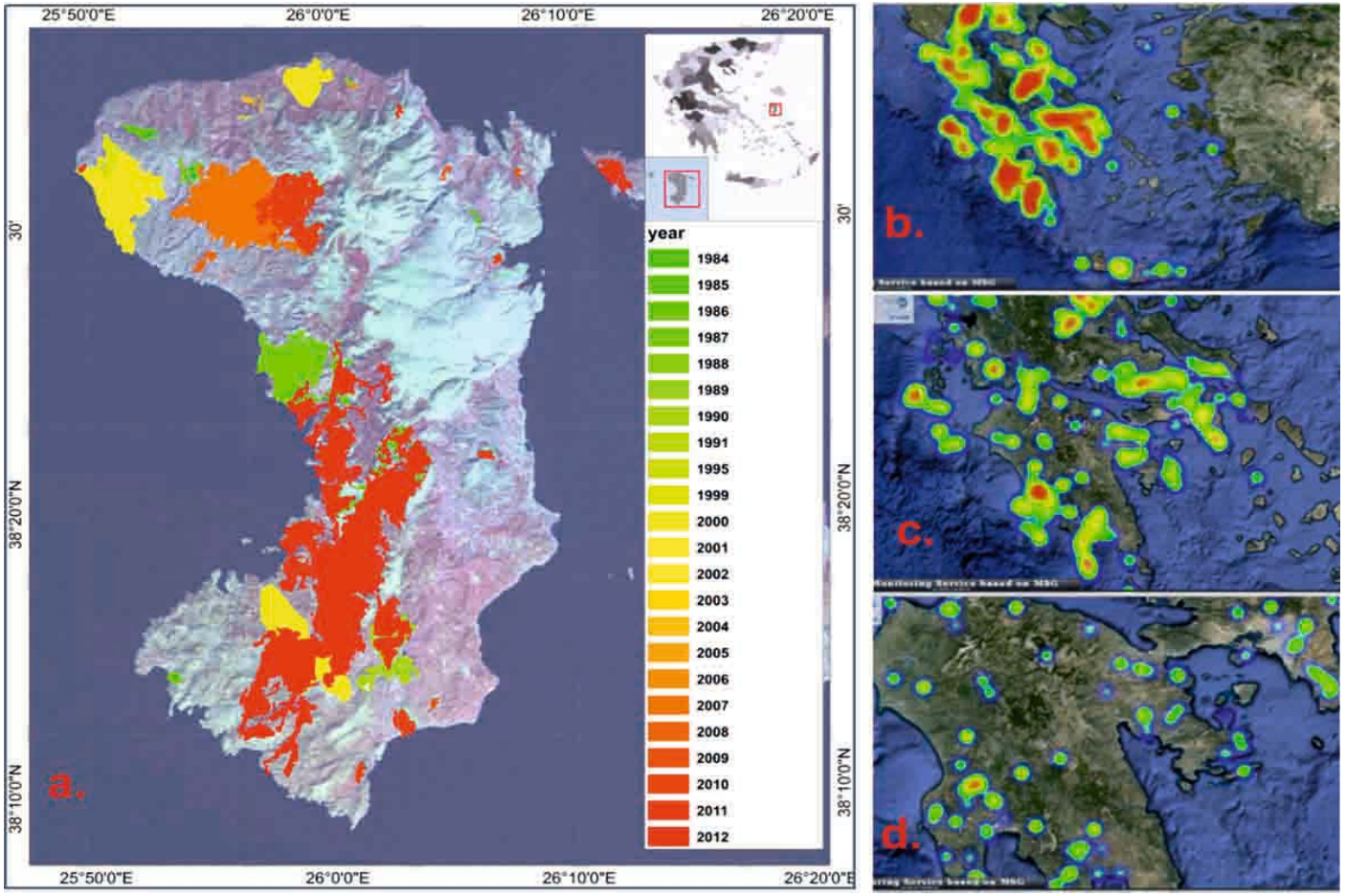


Seasonal Burn Scar Mapping & Damage Assessments – Recovery Phase



Diachronic Burn Scar Mapping & Damage Assessments at HR

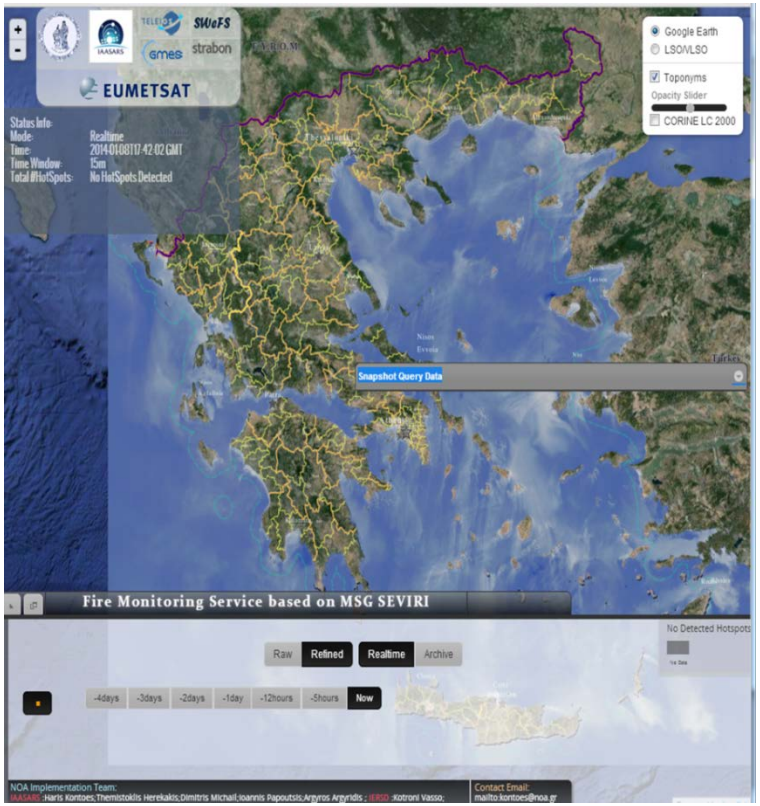
On-line dissemination through NOA‘s dedicated web interface (http://ocean.space.noa.gr/diachronic_bsm/index.php)



Diachronic Burn Scar Mapping

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

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

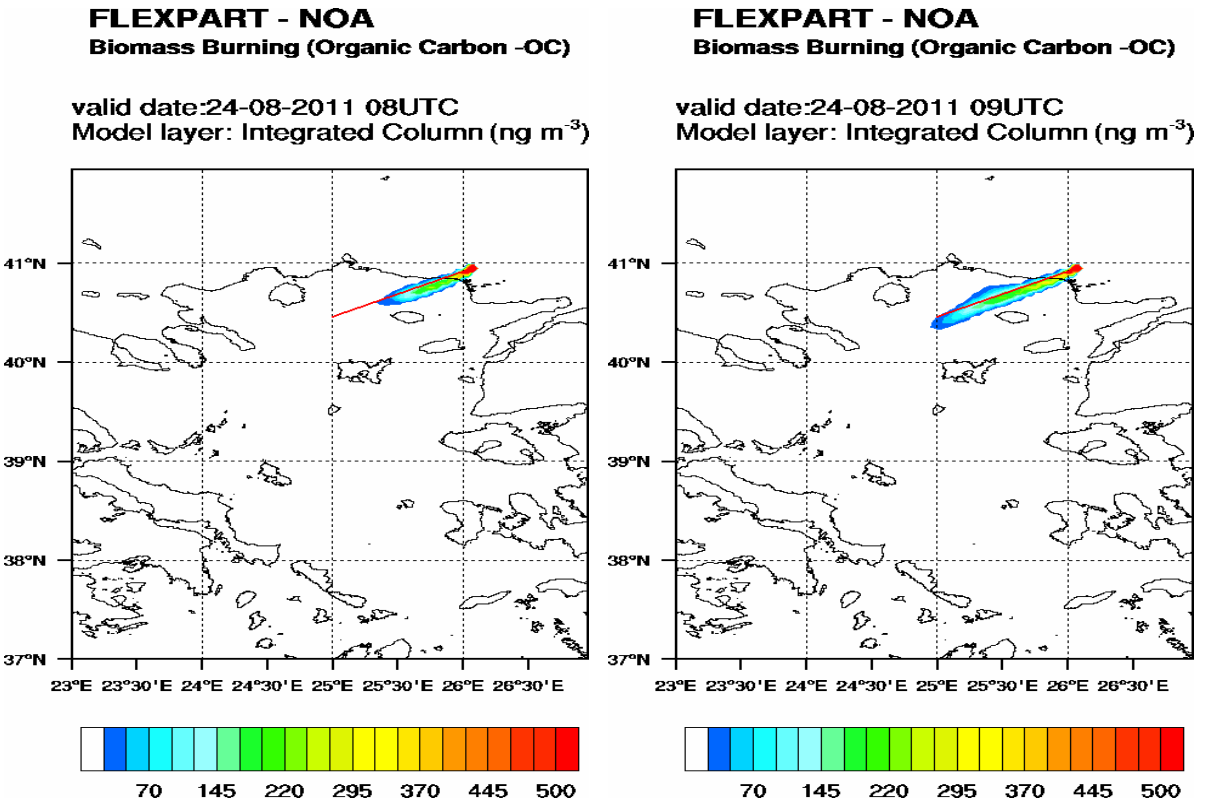
Smoke plume trajectories

Gas and particle concentrations

Deposition fluxes

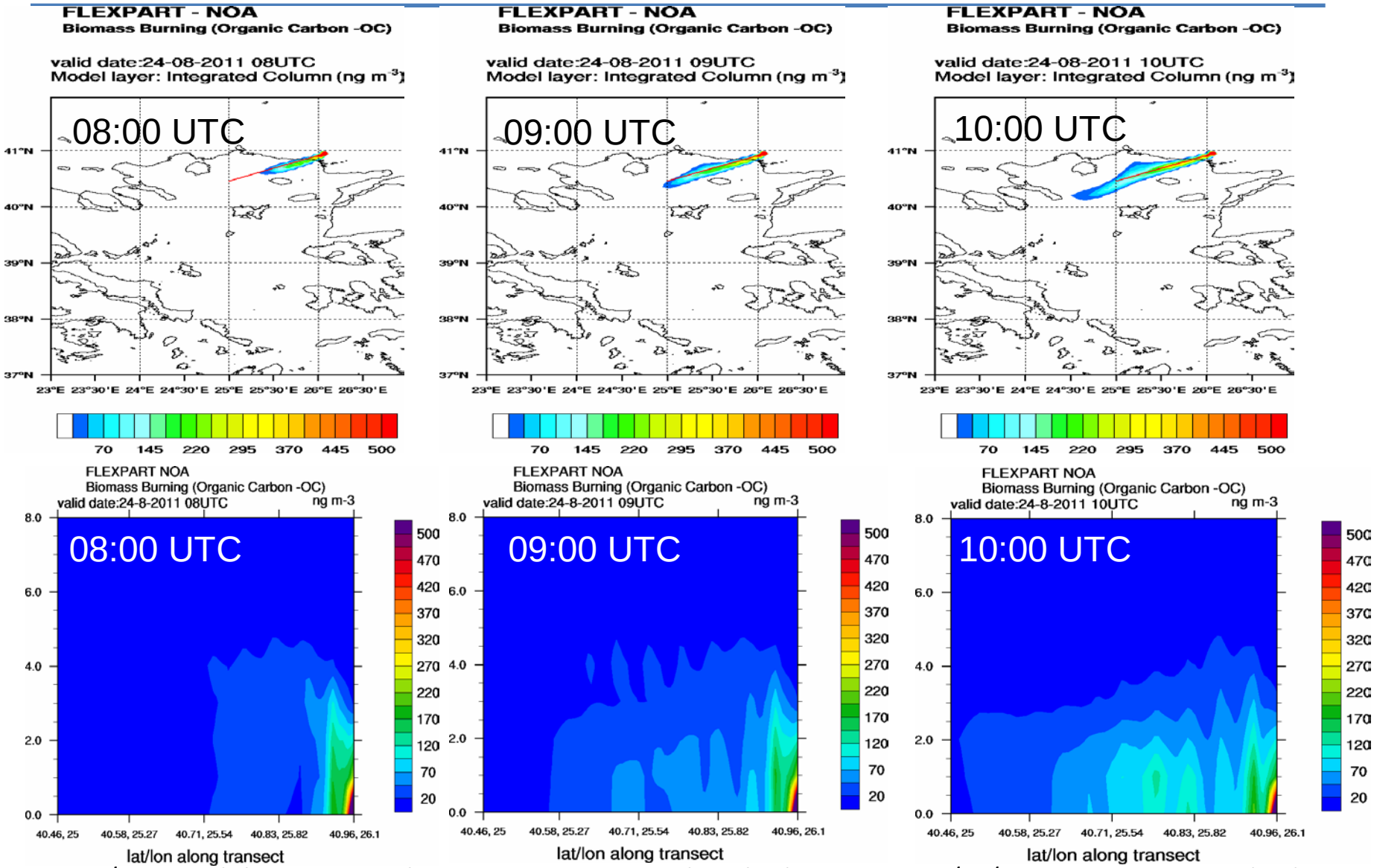
Forecasting of wild fire smoke dispersion

MISR satellite image
24 August 2011, 08:00 UTC

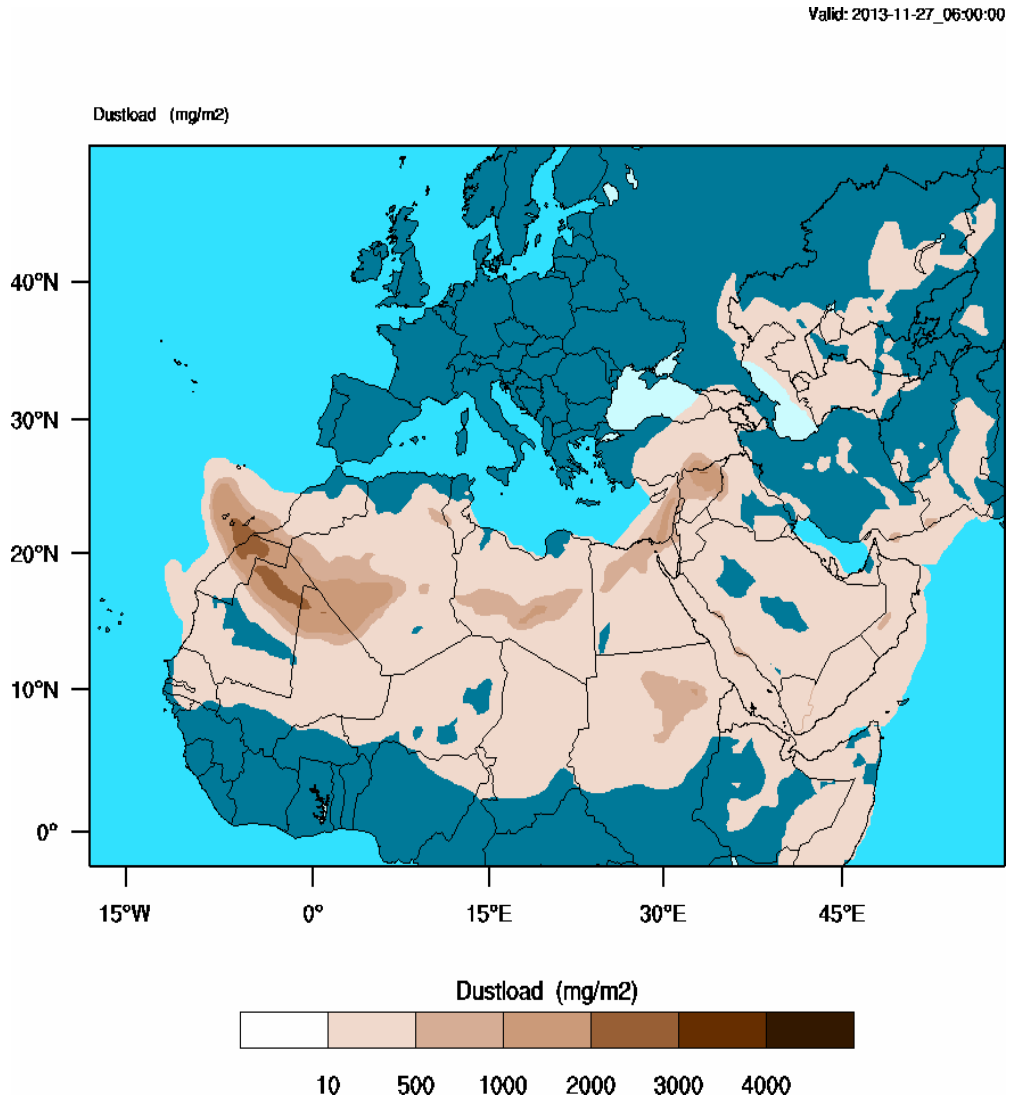


Simulated concentration of Organic Carbon (ng m^{-3}) 24 August 2011, 08:00 (left) and 09:00 (right) UTC

Forecasting Vertical structure of smoke plume Cross section of Organic Carbon concentration (ng m-3)



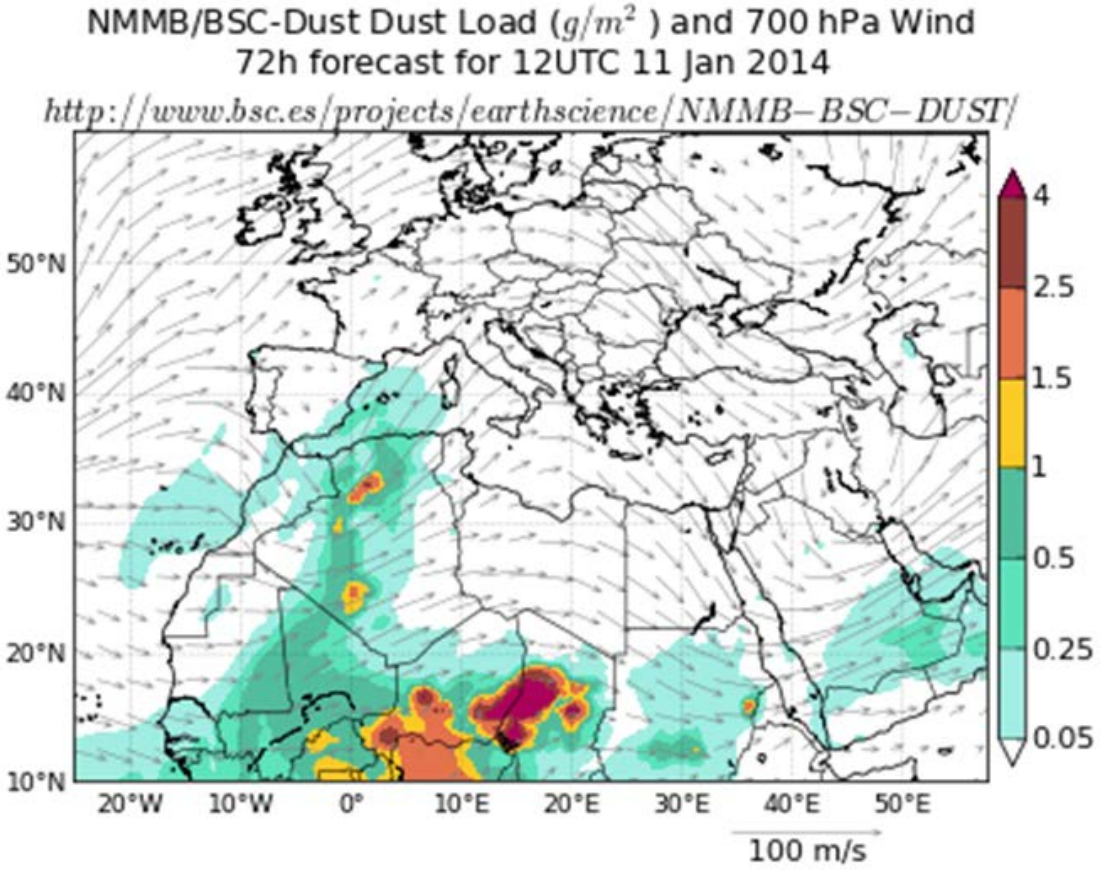
Forecasting of mineral dust transport in the atmosphere



Vertically integrated concentration of airborne dust particles (mg/m^2)

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

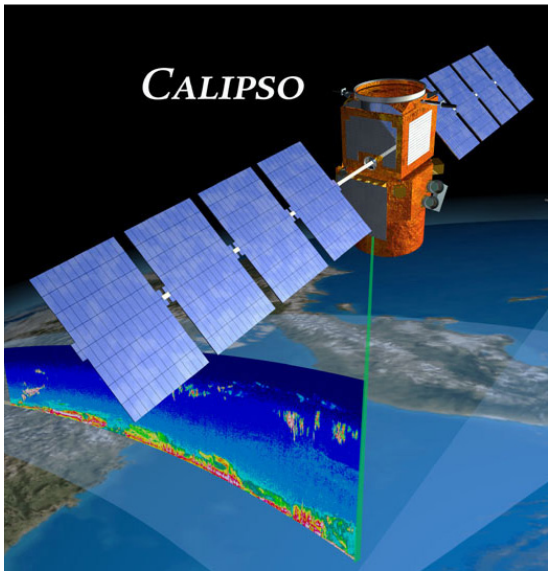
Forecasting of mineral dust transport in the atmosphere

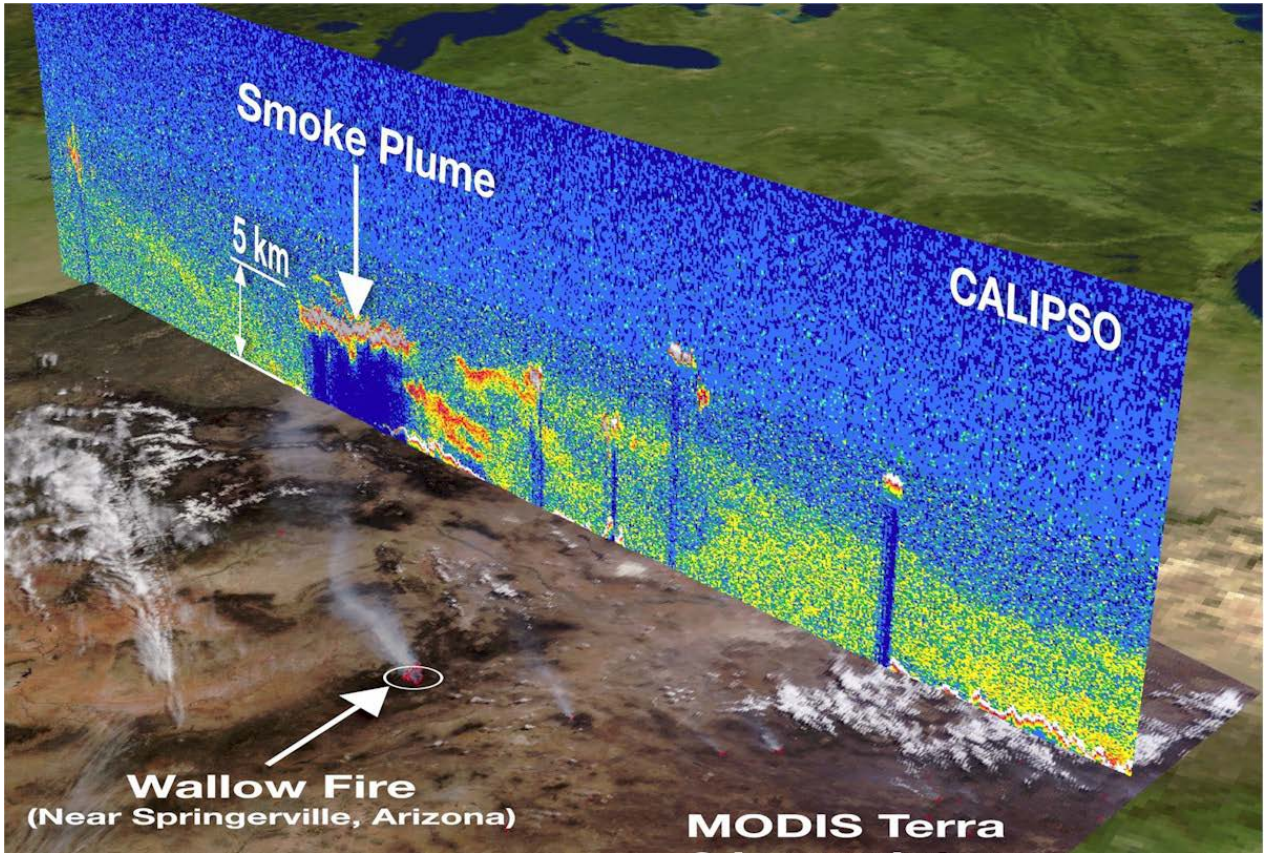


Vertically integrated concentration of airborne dust particles (g/m^2) and wind vectors at 700 hPa

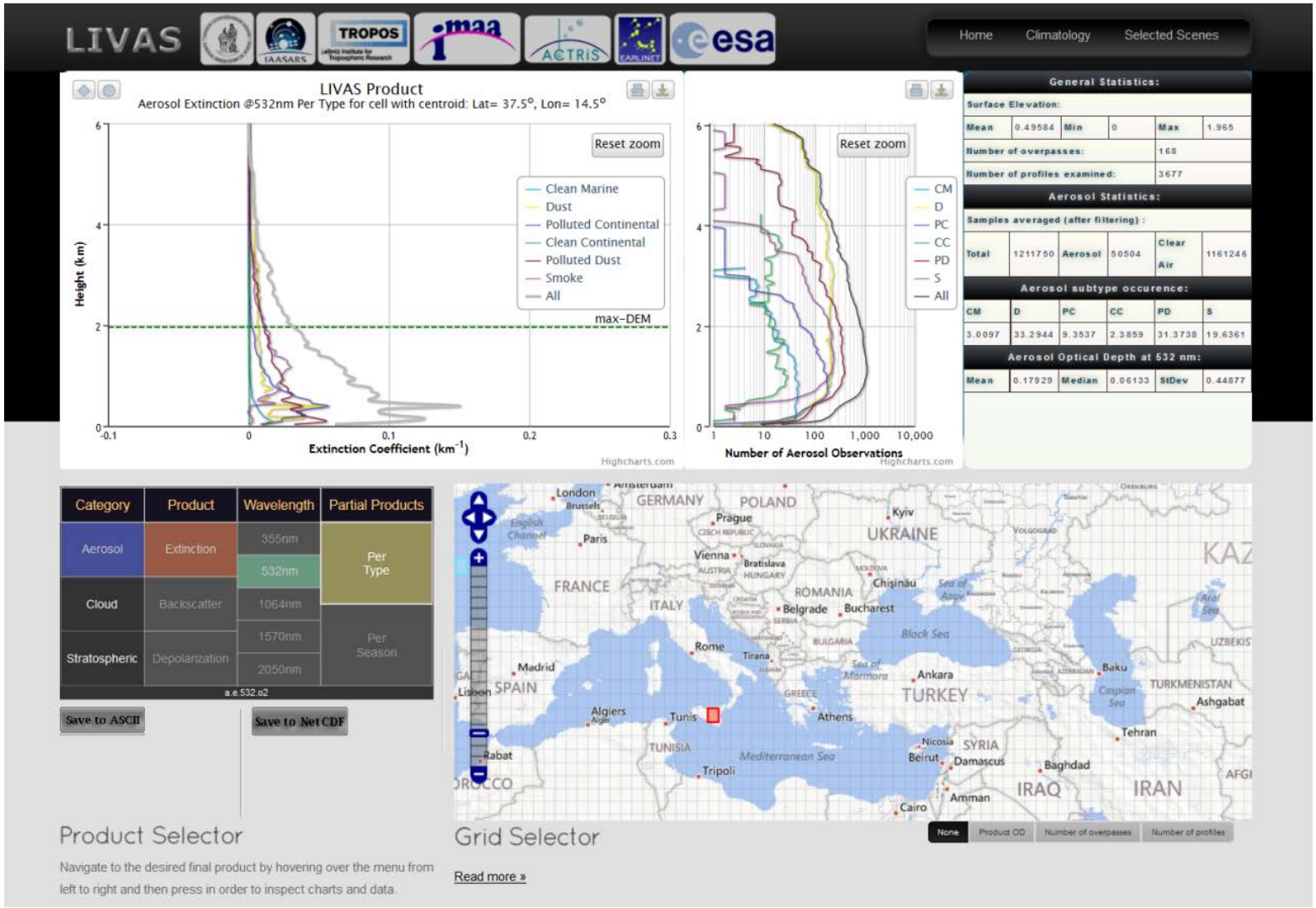
NMMB-BSC-DUST simulation, 14 January 2014, 12:00 UTC

Vertical structure of smoke plume
Space based derived observations

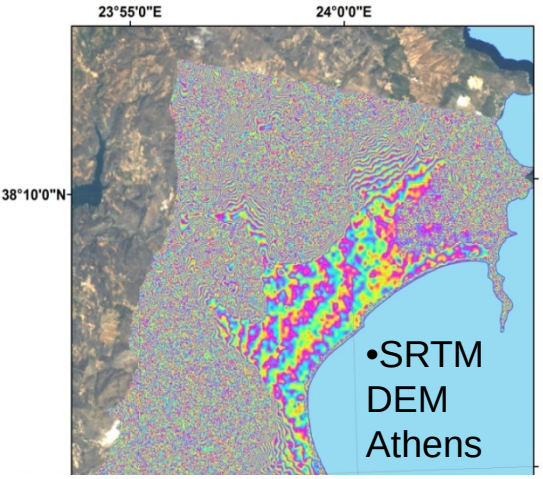


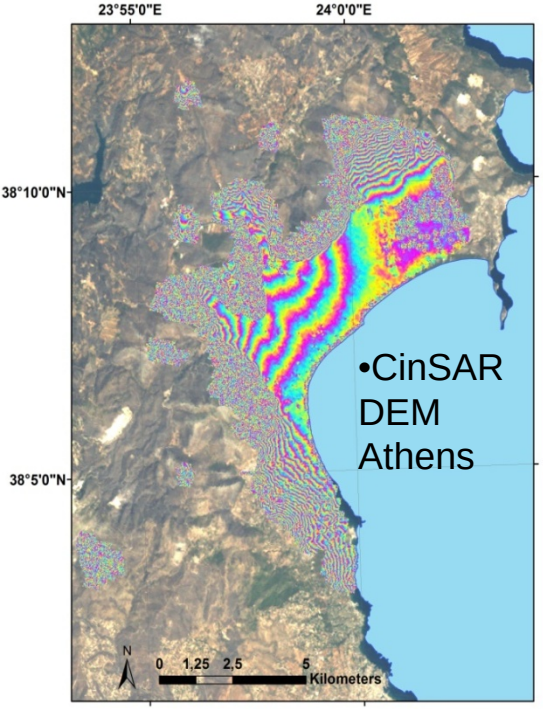


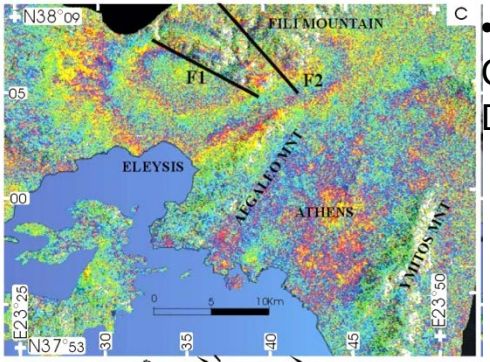
Global 3D climatology of aerosols and clouds
LIVAS portal under BEYOND (1x1 degree resolution)

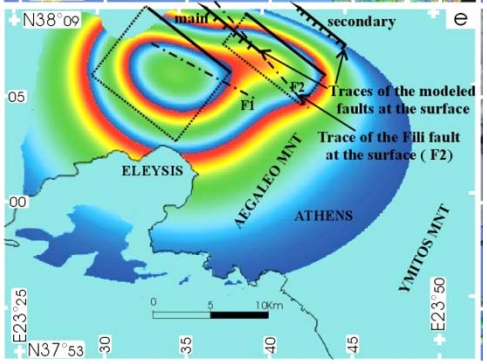


InSAR and CinSAR services
Operational Deformation Rate monitoring
ESA AO ERS & ENVISAT awarded projects

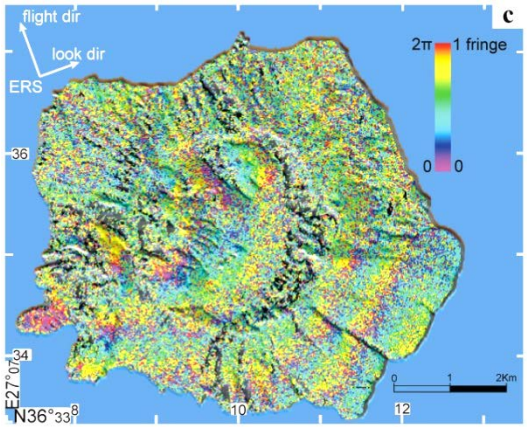




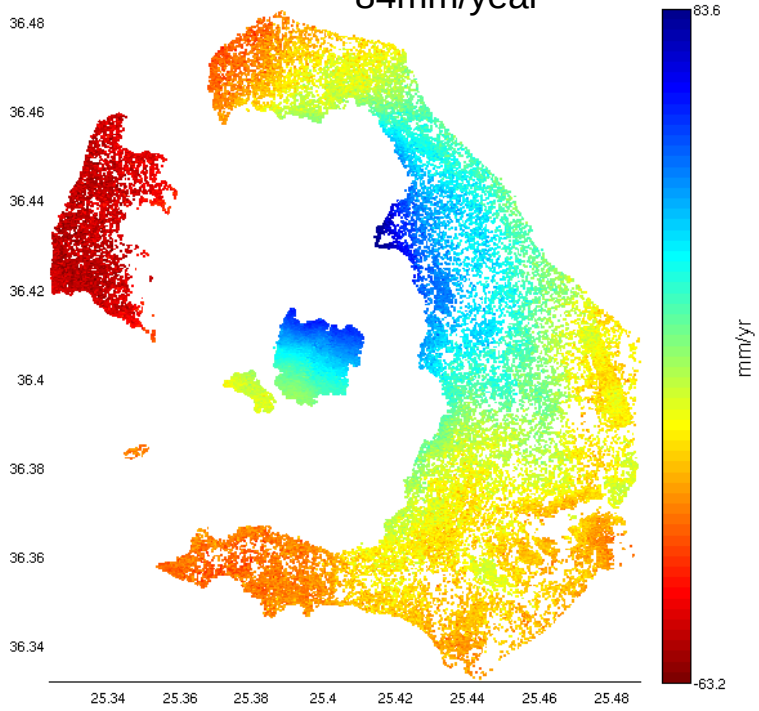




•1999 Athens earthquake Crustal Post Seismic Deformation 80-90mm

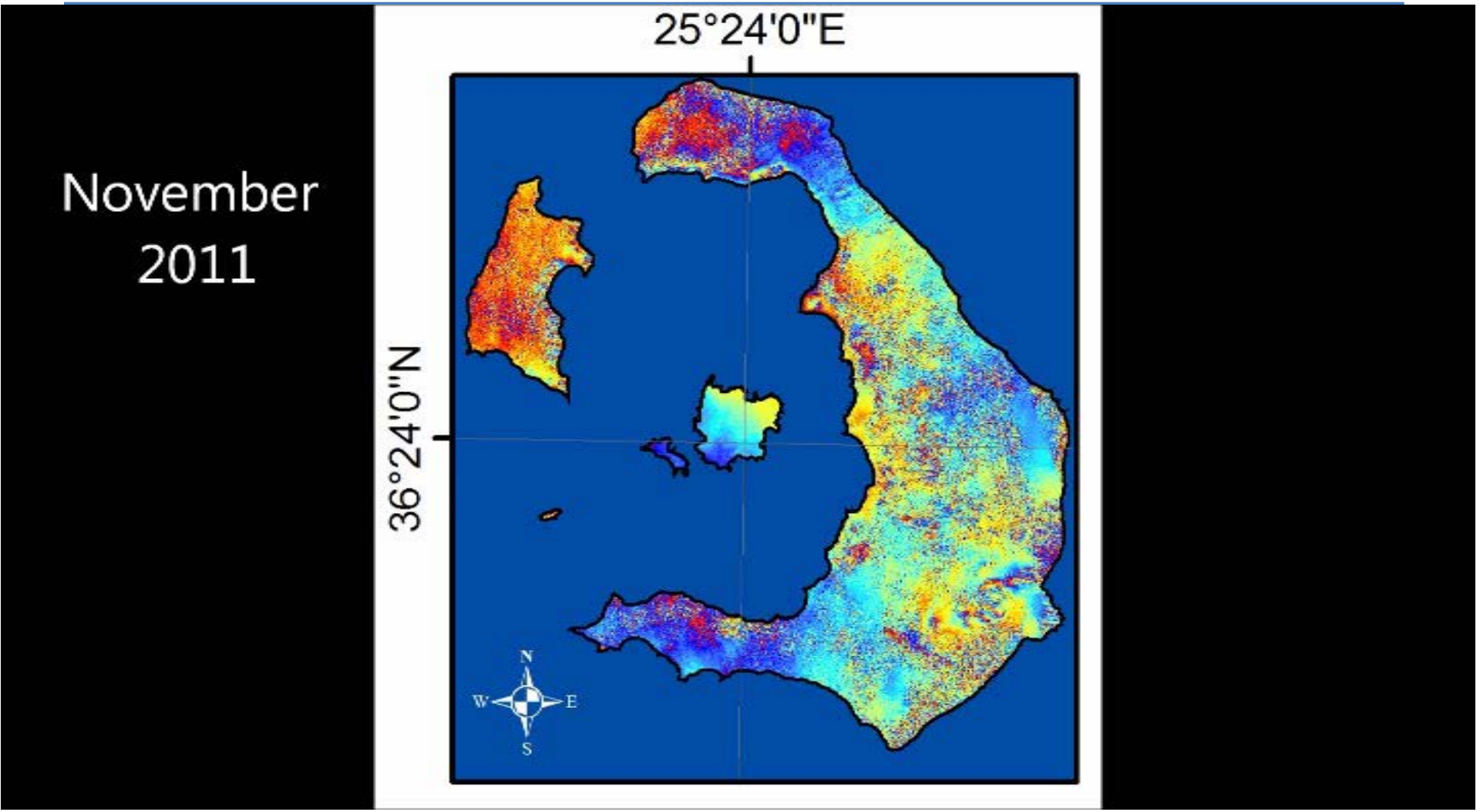


•Santorini volcano unrest 2011-12
•~60000 points
•Deformation rate - 63mm/year - 84mm/year



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

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



Flood Risk Modelling and Flood extend

The area of the basin is over 6300 km^2, with an average annual rainfall of 779 mm. The flood event occurred on 21-28 January 2003.

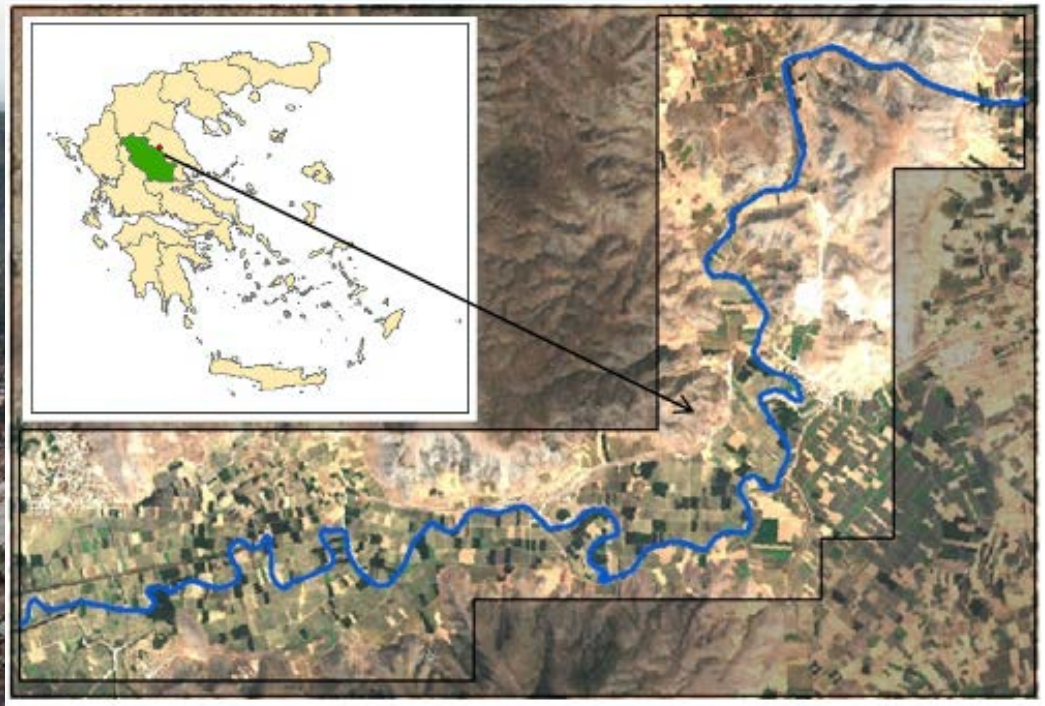


Figure 1: study area

Flood Risk Modelling and Flood extend

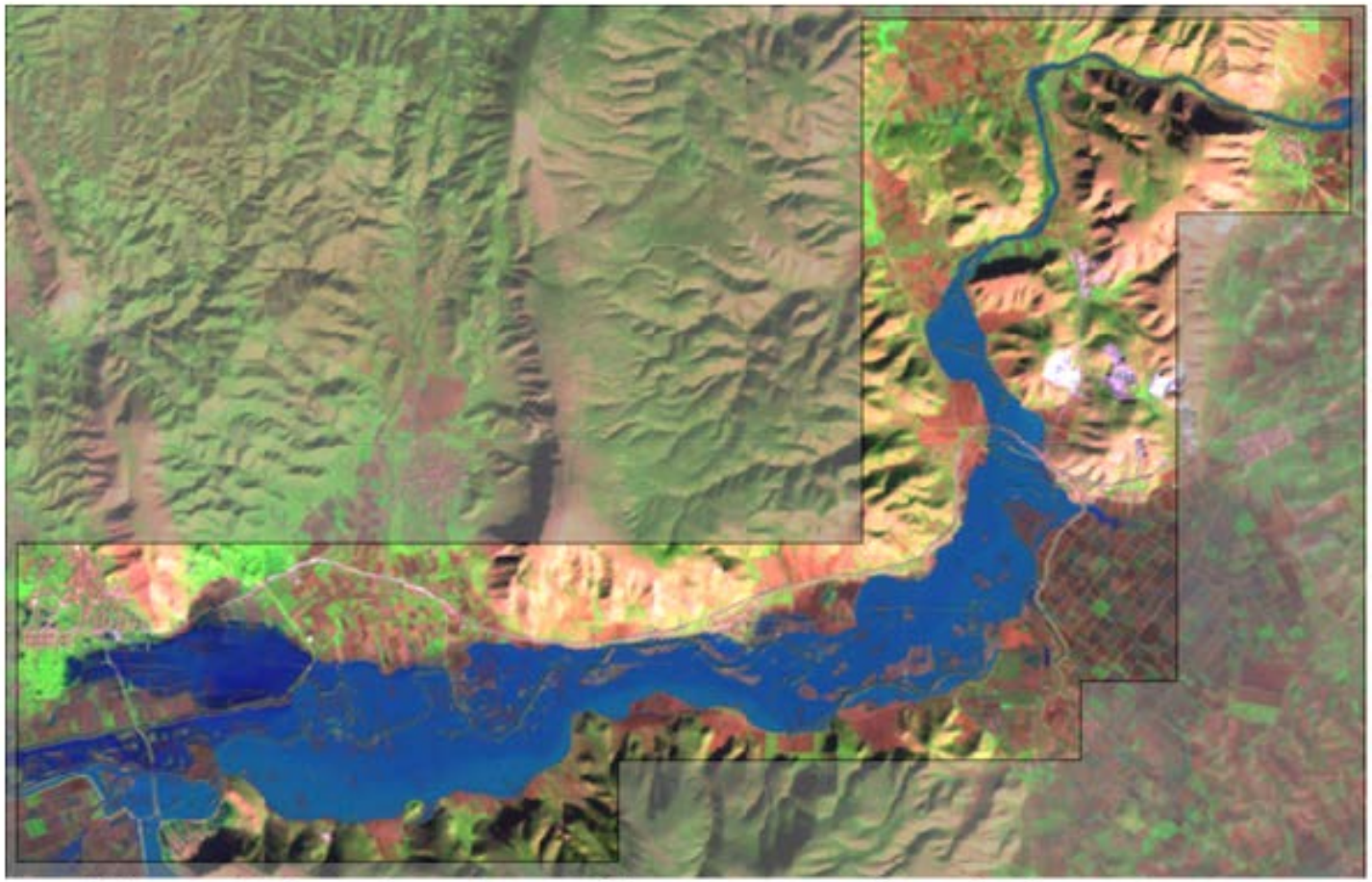


Figure 3: Landsat-7 satellite image (flooded area)

Flood Risk Modelling and Flood extend

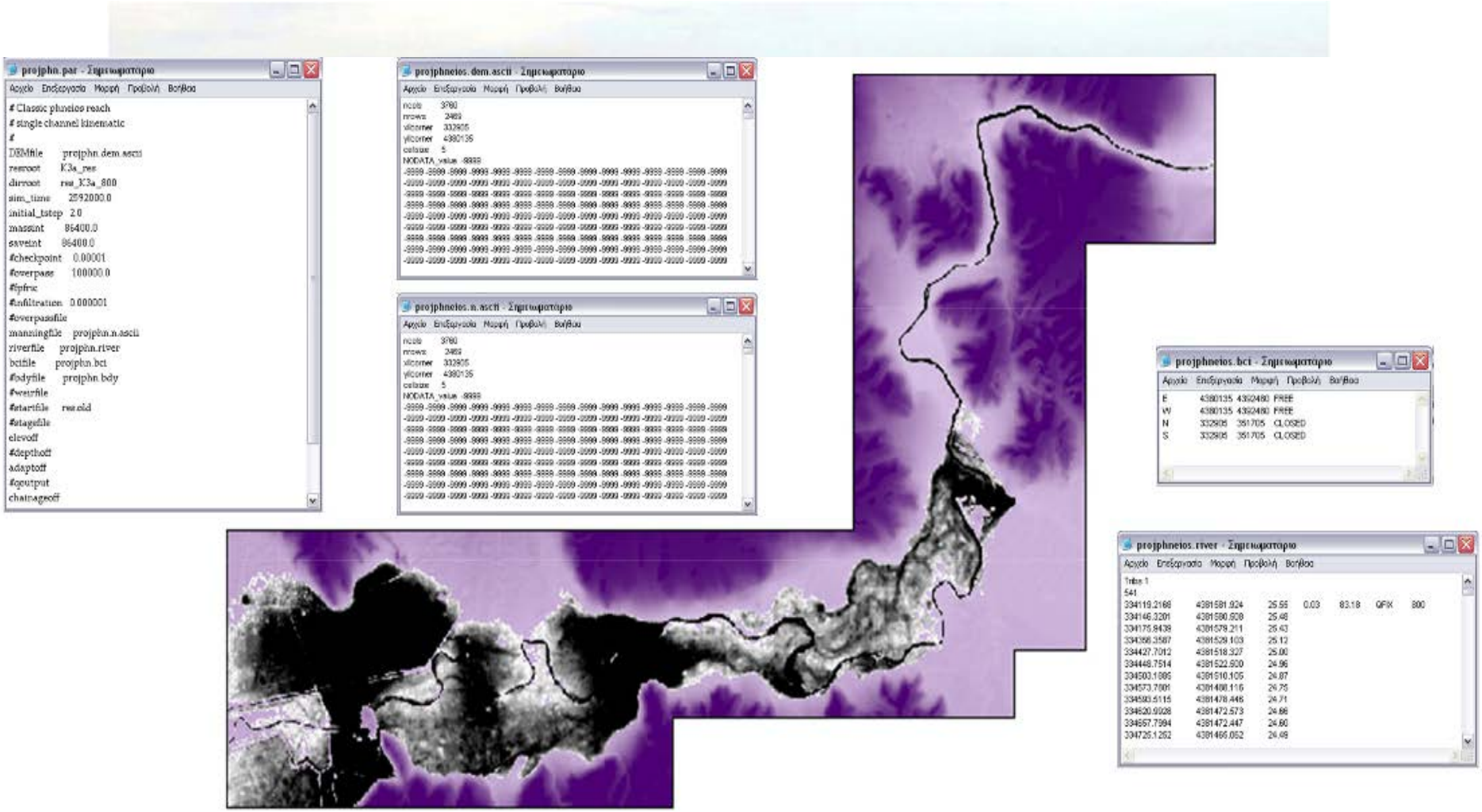


Figure 5: LISFLOOD-FP hydraulic model

Thank you for your attention!

For more information

http://www.beyond-eocenter.eu