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

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Project Coordinator

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

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## BEYOND Financial Aspects

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

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>ALL WPs</th>
<th>P.M.</th>
<th>Personnel Costs</th>
<th>Travel</th>
<th>Other direct costs</th>
<th>Sub-contract</th>
<th>Indirect</th>
<th>Total</th>
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<td>469</td>
<td>1207980</td>
<td>245864</td>
<td>599100</td>
<td>109000</td>
<td>143706.08</td>
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| 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

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BEYOND
How to achieve goals?

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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
  - Chapman University – USA

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### Partnering Organisations

<table>
<thead>
<tr>
<th>Participant</th>
<th>Participant Organisation name</th>
<th>Participant Site Name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (partner org)</td>
<td>Institute for Space Applications and Remote Sensing, National Observatory of Athens</td>
<td>SARONIA</td>
<td>GR</td>
</tr>
<tr>
<td>1 (partner org)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2 (partner org)</td>
<td>Remote Sensing Laboratory of the University of Valladolid</td>
<td>LATUV</td>
<td>ES</td>
</tr>
<tr>
<td>3 (partner org)</td>
<td>Barcelona Supercomputing Center</td>
<td>BSC</td>
<td>ES</td>
</tr>
<tr>
<td>4 (partner org)</td>
<td>Norwegian Institute for Air Research</td>
<td>NILU</td>
<td>NO</td>
</tr>
<tr>
<td>5 (partner org)</td>
<td>Scientific and Technological Research Council of Turkey - Meteor Research Center</td>
<td>TUBITAK</td>
<td>TR</td>
</tr>
<tr>
<td>6 (partner org)</td>
<td>Institute of M et hodologies for Environmental Analysis of the Italian National Research Council</td>
<td>IMAA</td>
<td>IT</td>
</tr>
<tr>
<td>7 (partner org)</td>
<td>Institute of Atmospheric Sciences and Climate of the Italian National Research Council</td>
<td>ISAC</td>
<td>IT</td>
</tr>
<tr>
<td>8 (partner org)</td>
<td>King's College London</td>
<td>KCL</td>
<td>UK</td>
</tr>
<tr>
<td>9 (partner org)</td>
<td>SARMAP</td>
<td>SARMAP</td>
<td>CH</td>
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<tr>
<td>10 (partner org)</td>
<td>Republic Hydrometeorological Service of Serbia</td>
<td>HDMET</td>
<td>RS</td>
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<td>11 (partner org)</td>
<td>German Research Center for Geosciences</td>
<td>GFZ</td>
<td>DE</td>
</tr>
<tr>
<td>12 (partner org)</td>
<td>Lithuanian Institute for Troopspheric Research</td>
<td>TROPOS</td>
<td>DE</td>
</tr>
<tr>
<td>13 (partner org)</td>
<td>Earth Observation Laboratory of the Aberystwyth University (AU-EO)</td>
<td>ISRES</td>
<td>UK</td>
</tr>
<tr>
<td>14 (partner org)</td>
<td>NASA Marshall Space Flight Center, Earth Science Office</td>
<td>NASA</td>
<td>US</td>
</tr>
</tbody>
</table>
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 Eastern 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 Eastern 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)

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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

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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

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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
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)

Centre of Excellence for EO-based monitoring of Natural Disasters

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

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

- Parnon Mt Fire
- Olympia site Fire
- Taygetos Mt Fire
- Meilopolis Fire
- Oitilon Fire
- Zanaro Fire
- Olympia site Fire
- Korinthos Fire
- Stira Euboea Fire
- Aliveri Euboea Fire

SEVIRI MIR 070823_1030 UTC
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)

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

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Rapid Fire Mapping Activation in Greece – Peloponnesus 2007
Rapid Fire Mapping Activation in Greece – Athens 2009

THE HELLENIC CIVIL PROTECTION INITIATES SAFER RAPID MAPPING &
Daily Weekly Fire Products at HR & VHSR (SPOT 5, LANDSAT, IKONOS)

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Burnt Area Mapping - Emergency Support
Immediate Recovery Actions

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Burnt Area Mapping - Emergency Support
Immediate Recovery Actions
Seasonal Burn Scar Mapping & Damage Assessments – Recovery Phase

PORTUGAL - FIRE SEASON 2007

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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

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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/m²)

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/m²) 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

- SRTM DEM Athens
- CinSAR DEM Athens
- 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
The area of the basin is over 6300 km², with an average annual rainfall of 779 mm. The flood event occurred on 21-28 January 2003.
Flood Risk Modelling and Flood extend

Figure 3: Landsat-7 satellite image (flooded area)
Figure 5: LISFLOOD-FP hydraulic model

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Thank you for your attention!

For more information

http://www.beyond-eocenter.eu