SMURBS

SMart URBan Solutions for air quality, disasters and city growth

component:

Disasters

Dr. Haris Kontoes,
National Observatory of Athens (NOA), Greece
(presented by Dr. Evangelos Gerasopoulos)

Horizon 2020
Call: H2020-SC5-2015-one-stage
Topic: SC5-15-2015
Type of action: ERA-NET-Cofund
Grant agreement no: 689443
Proposal acronym: ERA-PLANET

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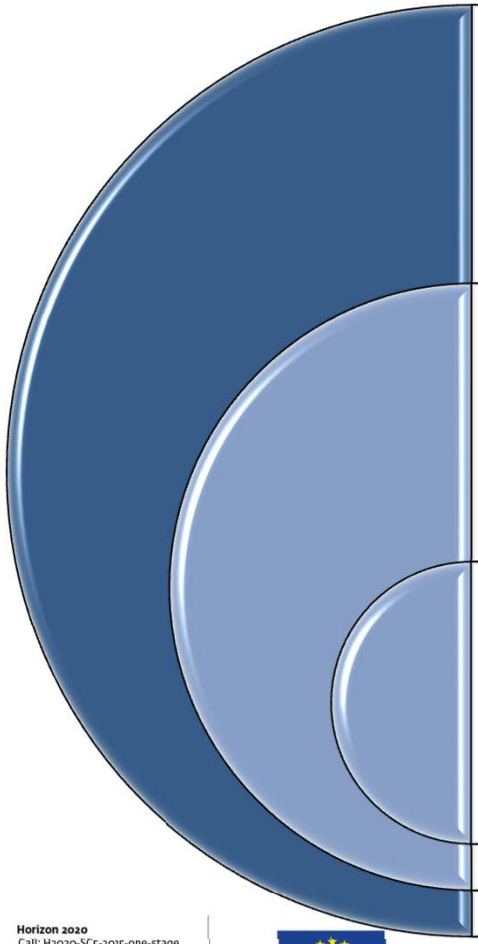
DISASTERS

Context and motivation

Relevant Political framework for Disaster Risk Reduction



The Shendai Framework for DRR 2015-2030 adopted by the UN Member States	• Reduce disaster mortality, and the number of people affected by disasters; • Reduce economic loss from disasters, and damage to health and educational facilities caused by disasters • Uptake the national and local strategies
Regulation (EU) No 377/2014 establishing the Copernicus EO Program	• Ensure an autonomous EU capacity for space borne observations • Build operational environmental, civil protection, and civil security services • Make use of Copernicus space & in-situ data and third party mission data
Copernicus Work Programme and the **GEO Work Programme**	• Copernicus is the European contribution to building the GEOSS developed within the framework of GEO • Provide disaster service evolution enabling the enhanced Rapid Mapping, Risk & Recovery and Early Warning throughout the Emergency Management cycle

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Context and motivation

Needs and Challenges

Challenge 1

- **Engage** the stakeholders from the Copernicus EMS, EO scientists, EO data owners, crowdsourcing and end user communities

Challenge 2

- **Develop tools and methodologies** in support of the effective integration of EO and crowdsourced data in the context of **Disaster Risk Reduction and Disaster Management**

Challenge 3

- **Demonstrate validated services** for enhanced preparedness, from early warning to early action tailored to the well specified End User needs

Challenge 4

- **Customize, test and validate interoperable and scalable technologies** for smart cities data collection towards operational systems for handling **local scale problems** (urban & peri-urban scale)

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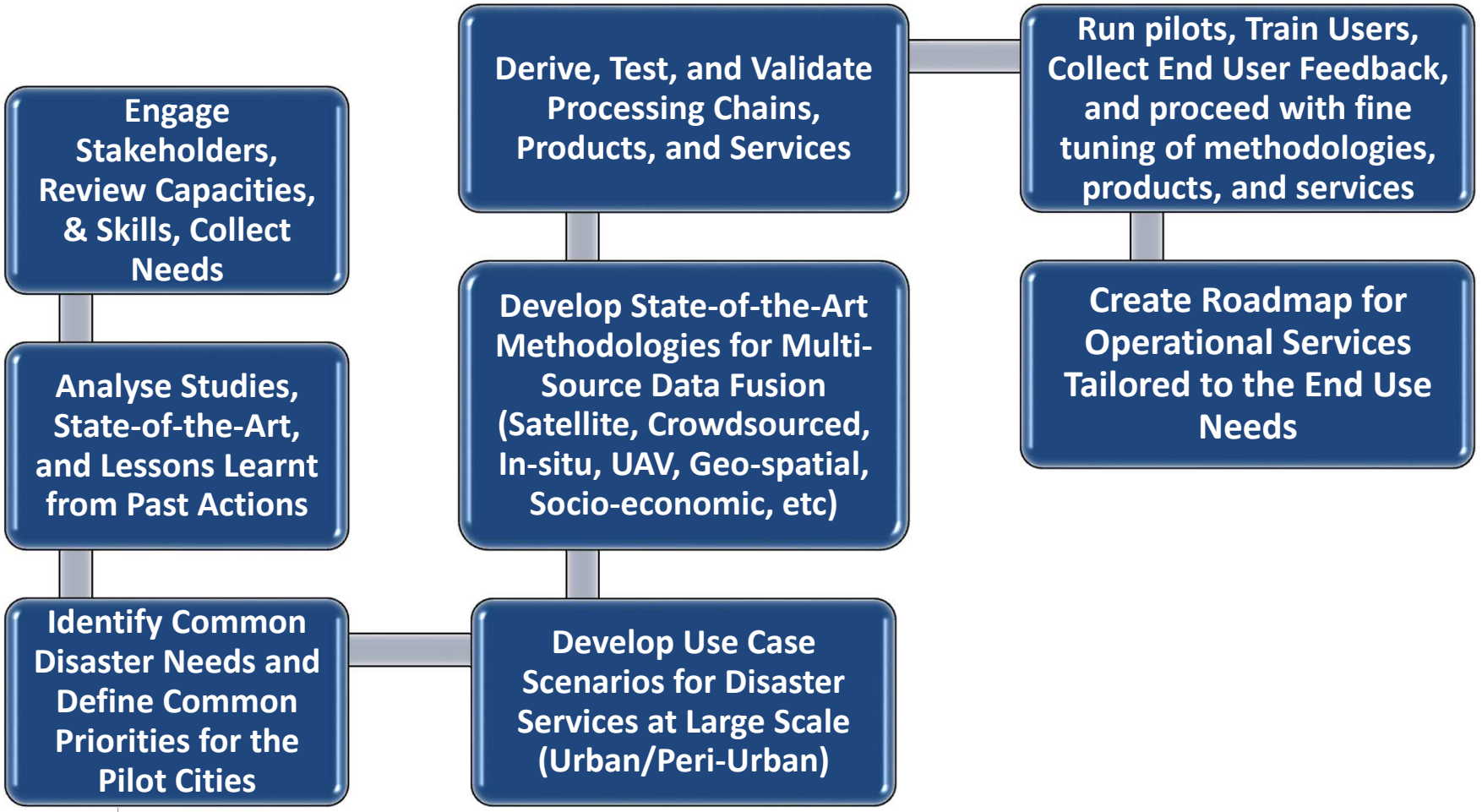
Approach and expected outcome

Concept – Methodology – Expected Outcome



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Task – Theme main participants

JSI

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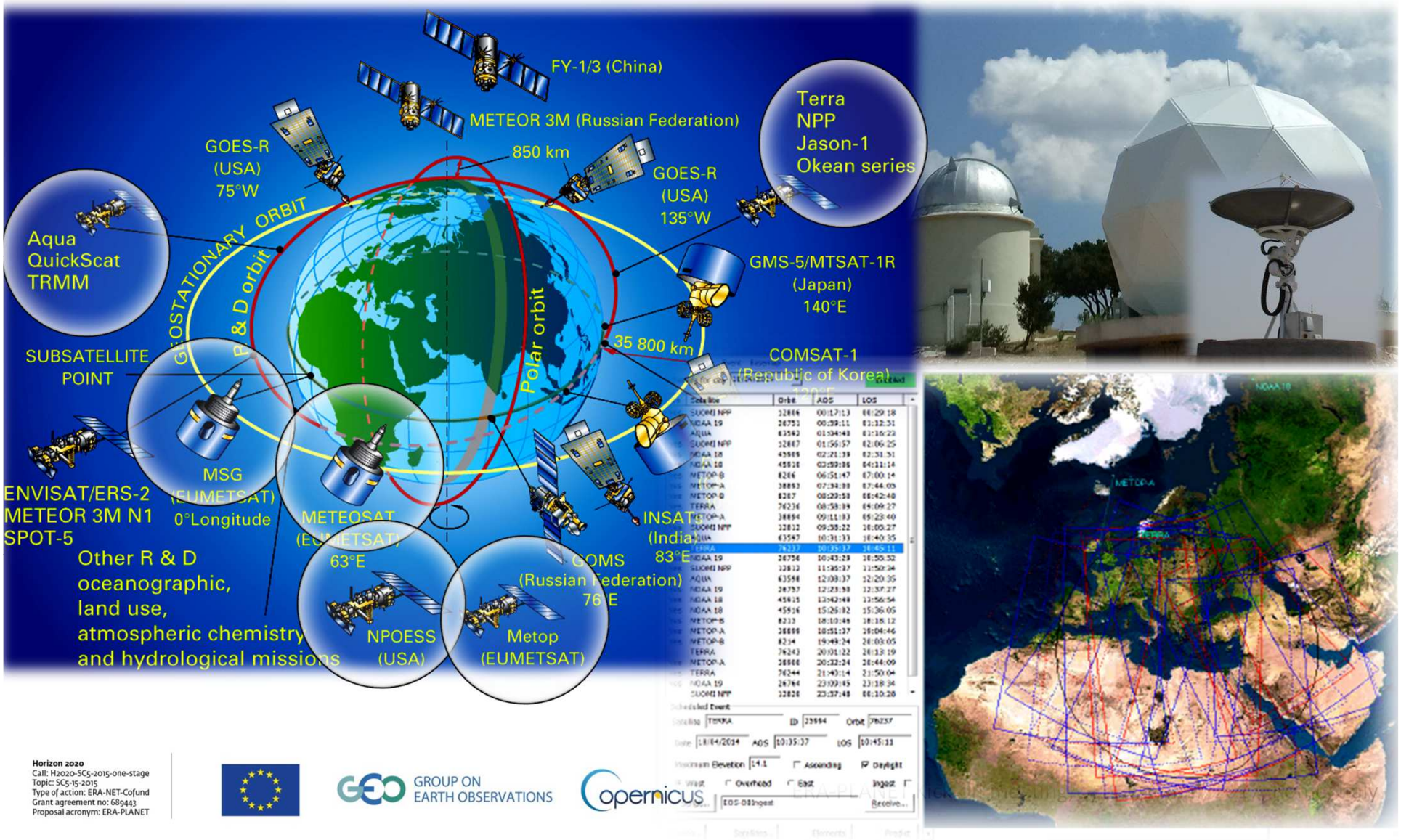
NOA's Tools and Acquisition Facilities



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NOA's Tools and Acquisition Facilities

Operate two MSG acquisition stations of DVB-S & DVB-S2 systems

Exploit high throughput provided with the new EUMETCast Europe service, based on using the EUTELSAT 10A

part of EUMETSAT's network

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NOA's Tools and Acquisition Facilities

SENTINEL IMAGE PROCESSING TOOLBOX

Sentinel Image Processing Toolbox Overview and Description Text.

View the Sentinel Processing Toolbox User Manual.

NOA Hellenic National Sentinel Data Mirror Site Team
NOA Official: Prof. Kanaris C. Tsinganos, President of NOA
Scientific Coordinator: Dr. Haris Kontoes, Research Director
WebMaster: MSc. Themistocles Herekakis, Research Associate
Development: MSc. Vassilis Tsironis, Research Associate
Curator: Mr. Vaggelis Papakirikou, Research Associate
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National Observatory of Athens

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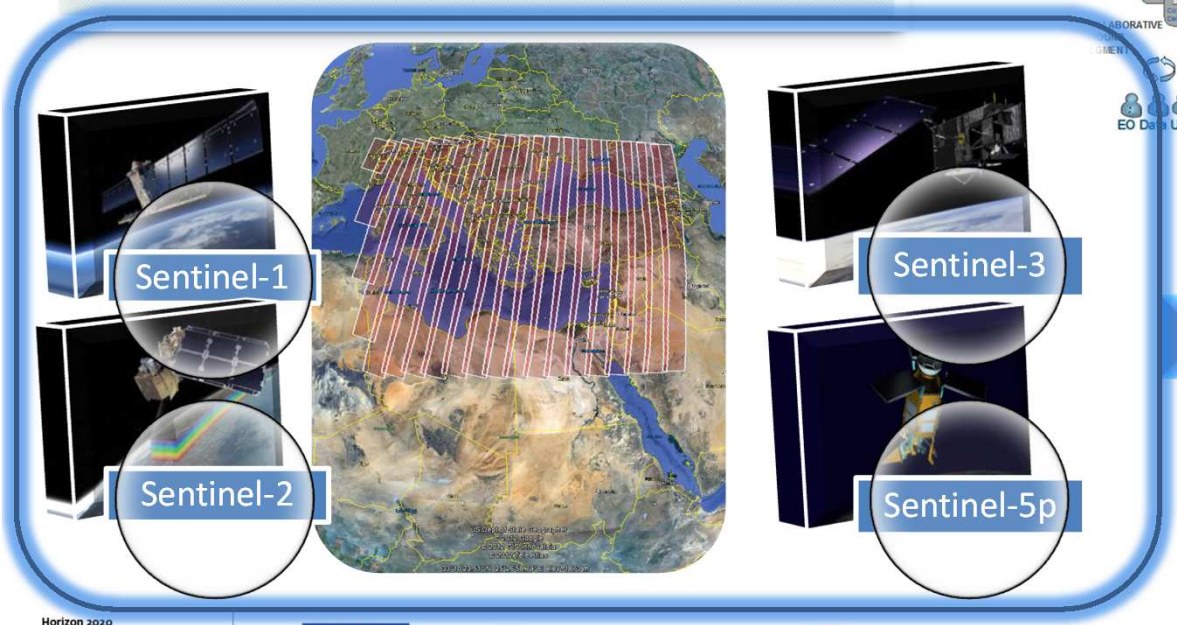
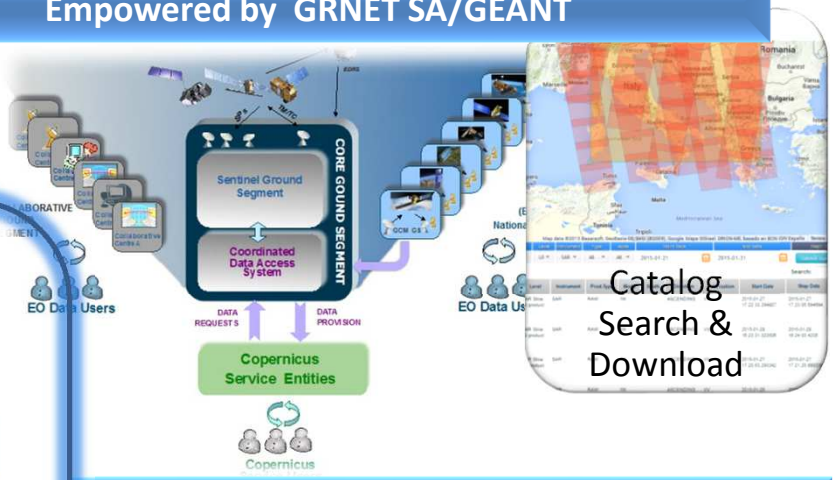
NOA Web Site: www.noa.gr
IAASARS Web Site: www.astro.noa.gr
Contact Us



Operate the 1st Collaborative Ground Segment (Hellenic Sentinel Data Hub- Mirror Site), allowing near real time acquisition of S-1, S-2, S3, and future S5P satellite missions

Empowered by GRNET SA/GEANT



http://sentinels.space.noa.gr

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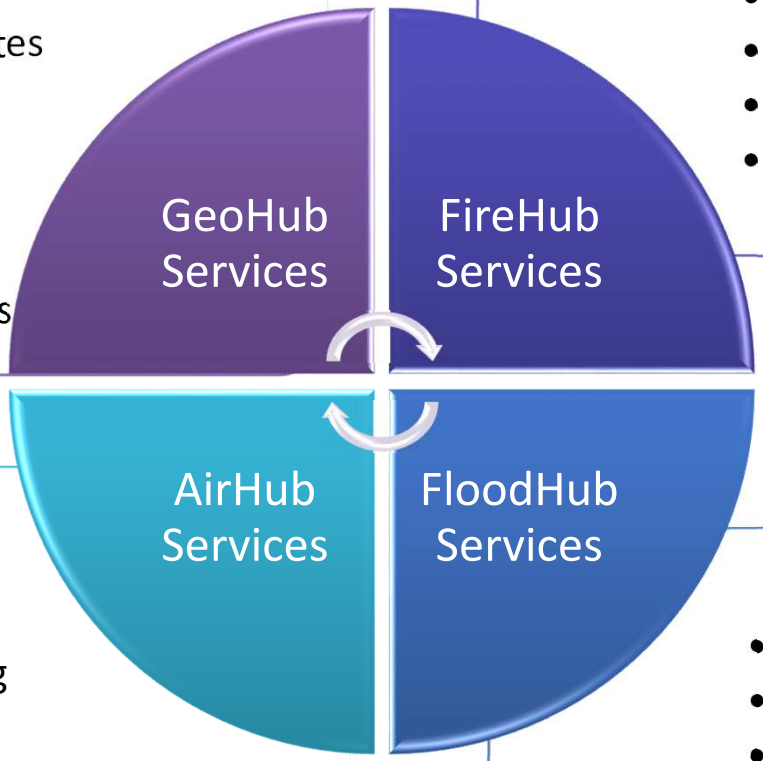
NOA's mature tools and services (TRL > 7)

- InSar based Crust deformation mapping
- Small scale deformation rates - PS SAR Processing
- Landslide modeling
- Earthquake modeling
- Volcanic/Lava modeling
- Soil/Coastal Erosion models



- Fire spread modeling
- Fire risk analysis
- EO Active Fire Mapping
- EO Burn Scar Mapping (Rapid/Seasonal)

- Dust circulation modeling
- Smoke dispersion modeling
- Toxic gases dispersion modeling (industrial accidents)

- EO based Flood Mapping
- Flood Modeling
- Hydraulic Modeling

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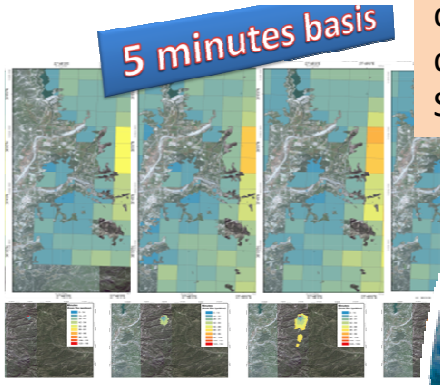
NOA's tool example – FireHub

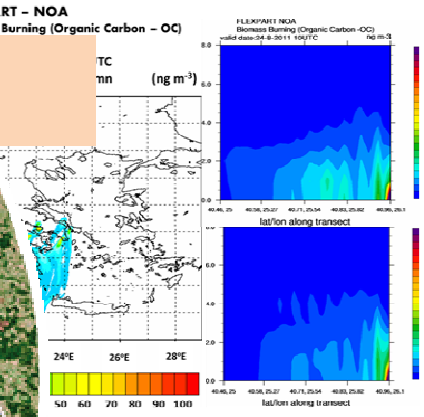
Active Fire Mapping: 5 ' - 5



Real-time Fire Monitoring module (continuous downscaled information - at 500 m - on active fires detected from the Meteosat Second Generation SEVIRI instrument, 5-m

Hourly Fire Smoke dispersion

Smoke Dispersion Forecast (Lagrangian model)



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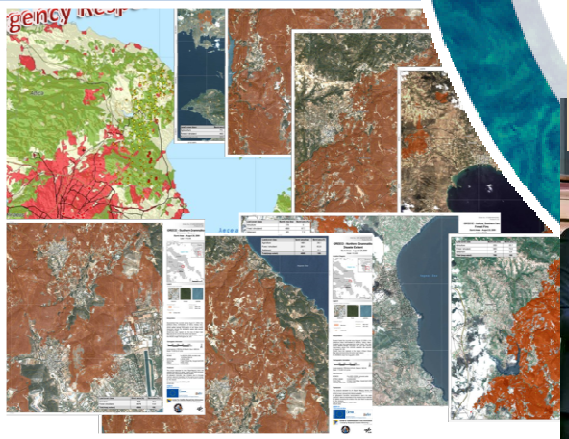
WINNER

BEST SERVICE CHALLENGE

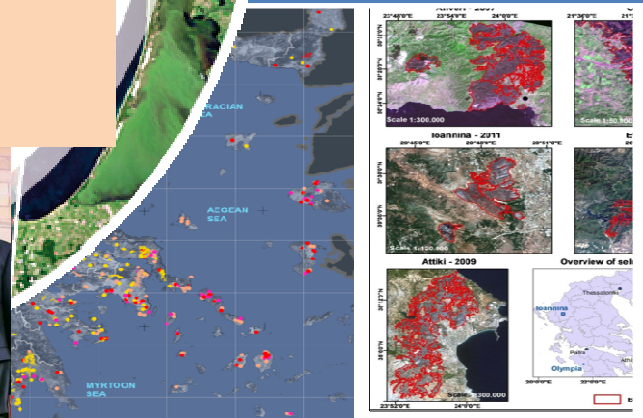
Burnt Area Mapping: H

daily/weekly/season



Burn Scar Mapping and Damage Assessment module (Sentinel-2 and Landsat data).

nt Area Mapping



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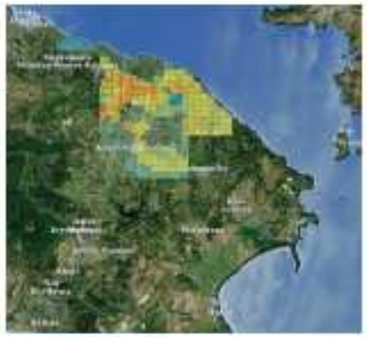
NOA's tool example – FireHub



Στις 13 Αυγούστου 2017 και ώρα 16:50 τοπική, το σύστημα FireHub του Εθνικού Αστεροσκοπείου Αθηνών ανίχνευσε για πρώτη φορά την πυρκαγιά στον Κάλαμο Αττικής. Η πυρκαγιά έλαβε γρήγορα διαστάσεις λόγω της μεταβλητότητας του ανέμου, του είδους της βλάστησης και της ποσότητας της καύσιμης ύλης, και του ανάγλυφου της περιοχής. Η πυρκαγιά τέθηκε υπό έλεγχο στις 15 Αυγούστου αργά το απόγευμα. Καθ' όλη τη διάρκεια της πυρκαγιάς, το FireHub δίνει σε πραγματικό χρόνο και σε 500 μέτρα χωρική ανάλυση, τη διασπορά των εστιών, και την εξέλιξη του φαινομένου και του μετώπου της φωτιάς, με χρήση όλων των διαθέσιμων δορυφορικών μέσων.

Παράλληλα, το σύστημα FireHub παρέχει την υπηρεσία της ημερήσιας χαρτογράφησης των καμμένων εκτάσεων, με χρήση των πρώτων διαθέσιμων δορυφορικών δεδομένων μέσης και χαμηλής χωρικής ανάλυσης. Ο στόχος είναι να δοθεί στις Αρχές έγκαιρα μια πρώτη εκτίμηση του αποτυπώματος της καταστροφής. Στην περίπτωση της πυρκαγιάς του Καλάμου, στις 16 Αυγούστου, μία ημέρα αφού τέθηκε η πυρκαγιά υπό έλεγχο, χρησιμοποιήθηκαν δεδομένα MODIS και VIIRS με ανάλυση τα 400 μέτρα περίπου για την ταχεία χαρτογράφηση των καμμένων εκτάσεων. Η πρώτη αυτή εκτίμηση έδωσε 26,900 στρέμματα καμμένης γης, με το 44% να είναι μεταβατικές δασώδεις και θαμνώδεις εκτάσεις.

Το σύστημα FireHub χαρτογράφησε την καμμένη έκταση, με δεδομένα Sentinel υψηλής ανάλυσης στα 10 μέτρα. Στη περίπτωση του Καλάμου, η πρώτη καλλιτλη εικόνα ήρθε από τον Sentinel-2B με ημερομηνία λήψης 19/8/2017. Τα δεδομένα έγιναν διαθέσιμα στις 20/07, στις 02:00, μέσα από το Ελληνικό Sentinel Mirror Site που λειτουργεί στο BEYOND/ EAA. Λίγες ώρες μετά, η ομάδα FireHub επεξεργάστηκε τα δεδομένα και δημοσιεύσε το παραπάνω θεματικό προϊόν με την λεπτομερή καταγραφή των καμμένων εκτάσεων. Συνολικά, κάηκαν 29.530 στρέμματα δασικής και αγροτικής γης, πολύ κοντά στην αρχική εκτίμηση που έγινε με βάση την υπηρεσία της ταχείας ημερήσιας χαρτογράφησης.

Η εκτίμηση της καταστροφής των φυσικών οικοσυστημάτων σε ημερήσια βάση για κάθε κατηγορία χρήσης γης, γίνεται σε μέση χωρική ανάλυση και περισσότερο από μια φορά την ημέρα, ενώ περίπου κάθε δέκα ημέρες προκύπτει μια πανελλήνια χαρτογράφηση σε υψηλή ανάλυση στα 10 m. Τα αποτελέσματα στέλνονται σε πραγματικό χρόνο στην Πυροσβεστική Υπηρεσία και στις κατά τόπους Αρχές που αναλαμβάνουν το δύσκολο έργο της αντιμετώπισης της καταστροφής την ώρα της κρίσης, αλλά και της αποκατάστασης του τοπίου και της απόδοσης αποζημιώσεων αμέσως μετά την πυρκαγιά.

FIREHUB
FireHub Service Application: http://ocean.space.noa.gr/FireHub
Fire Monitoring Application: http://ocean.space.noa.gr/fires
BSM application: http://ocean.space.noa.gr/bsm

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BEYOND

THE FIREHUB SATELLITE BASED SERVICE

THE 13/8/2017 FIRE DISASTER IN EASTERN ATTICA

RELEVANT INFO DELIVERED IN REAL TIME TO FIRE BRIGADES OPERATION CENTER

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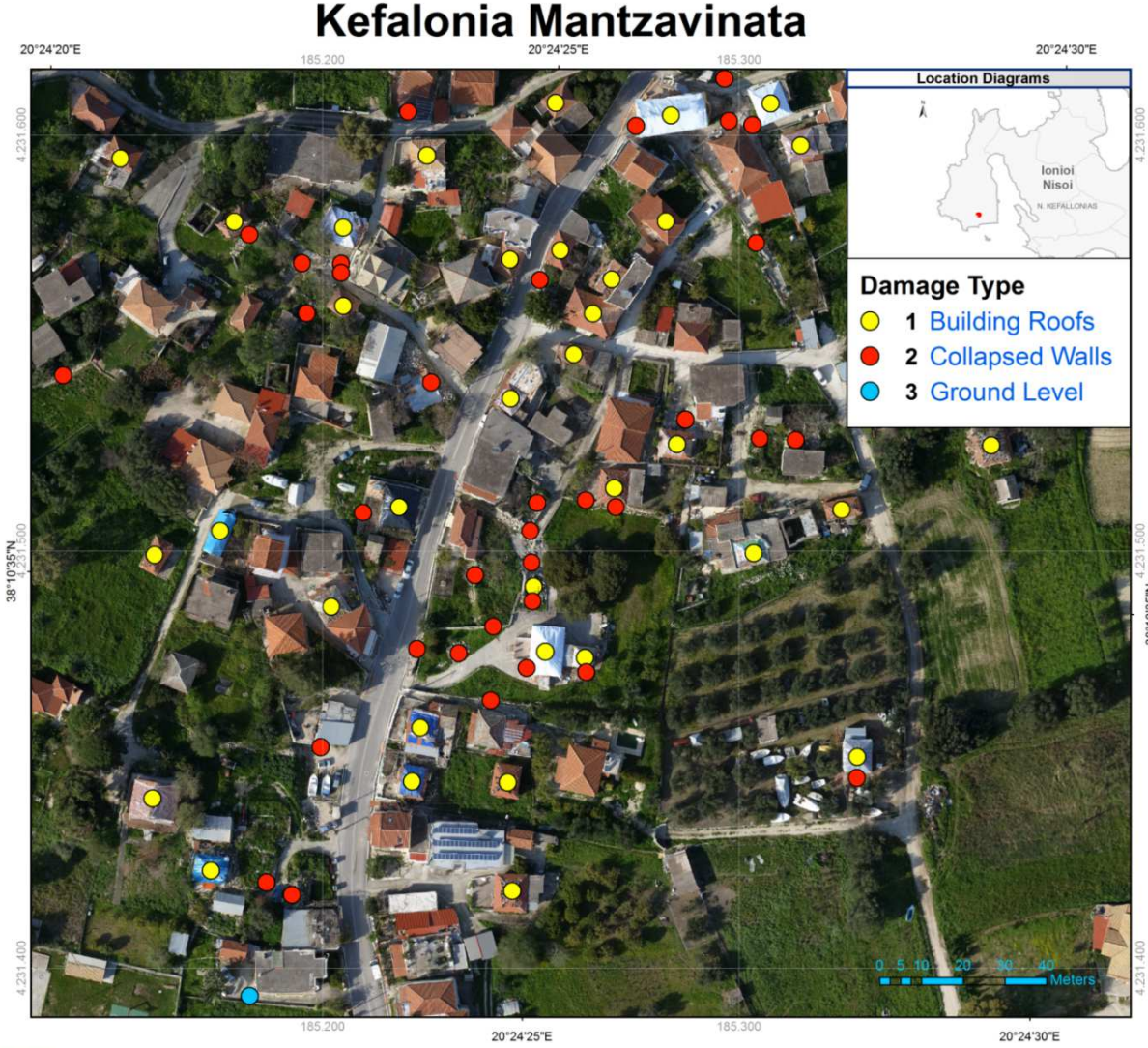
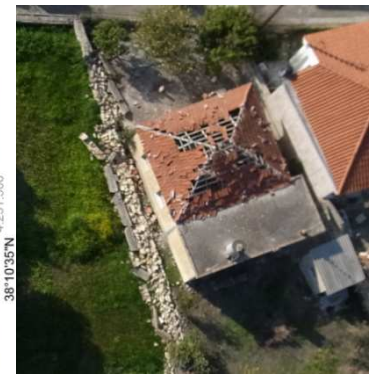
DISASTERS

NOA's tool example – GeoHub

UAV & VHR satellite based Earthquake Damage Mapping – The City of Mantzavinata case in Kefalonia island





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Infra & Acquisition Facilities

- ROSA Headquarters in the centre of Bucharest
  - Offices, information retrieval and processing facilities, GRID
  - http://www.rosa.ro
- ROSA Research Centre
  - Geospatial Intelligence Centre (in development)
  - Shared facilities with INCAS and the Institute of Space Science
  - Laboratories, Library, Data processing and GRID
  - Ground station for EO satellites
- Space Applications Centre (CRUTA)
  - Established 1993, fully equipped for satellite data processing
  - Data bases of EO and ground data, Land use / Land Cover for Romania
- ISO Integral certification (t.b. finalized Q2/2007), certified NATO supplier

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Core projects

- ROSA Research Centre own projects
  - GOLIAT – Nanosatellite mission and developments in formation flying, including networked environment
  - GEOINT – Centre for Geospatial intelligence
  - LUCIUS: Building a National Network for **GMES** Applications Support by Setting Up a Land Use Land Cover Information Unified System
  - INSPAM: Spatial Data Infrastructures with Applications in Environmental Protection (INSPIRE)
  - SPIM: Centre for disaster monitoring by space technology
  - BANG – **GNSS / Galileo** applications, Location based Services
  - LPIS – RO – Quality control and information management for the IACS – Land parcel Information System

- Copernicus (former GMES) projects: *Land monitoring, Emergency Situations Management*
  - **Geoland** (Operational Monitoring Services for our Changing Environment)
  - **SAFER** (Services and Aplications for Emergency Response)
  - **IncREO** (Increasing Resilience through Earth Observation)

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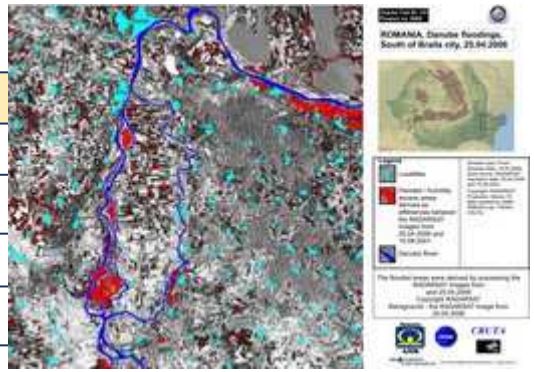
DISASTERS

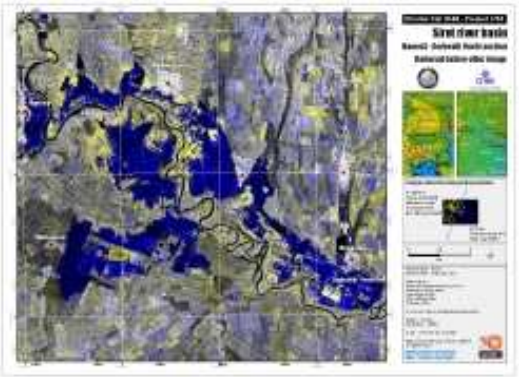
Floods Risk Management

- **International Charter Space and Major Disasters**

Type of Event:	Floods
Location of Event:	Romania
Date of Charter Activation:	19/04/2006
Charter Requestor:	**Romanian Space Agency**
Project Management:	DLR



Type of Event:	Floods
Location of Event:	Romania
Date of Charter Activation:	15/07/2005
Charter Requestor:	European Commission Civil Protection Environment Unit
Project Management:	CNES



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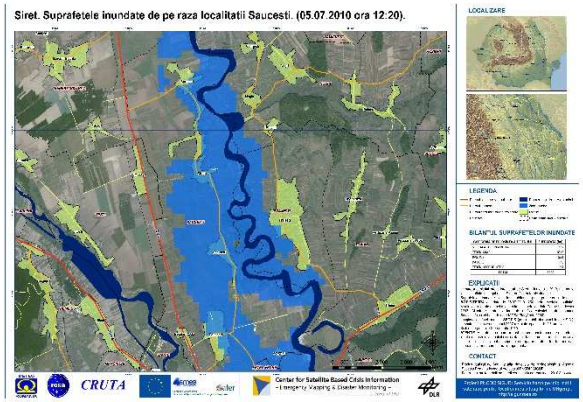
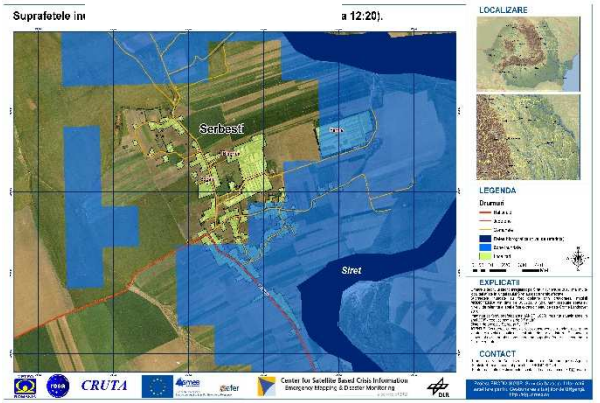
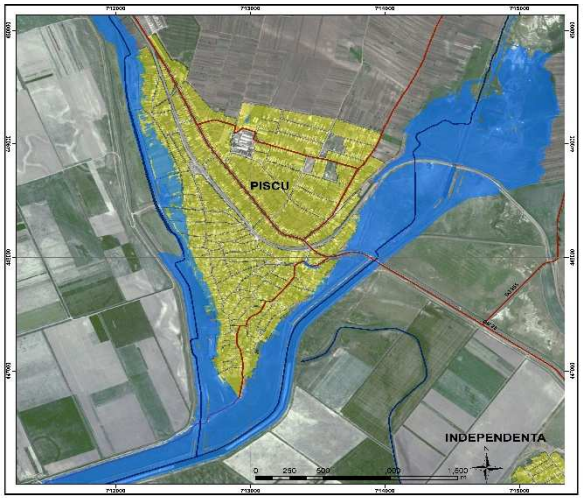
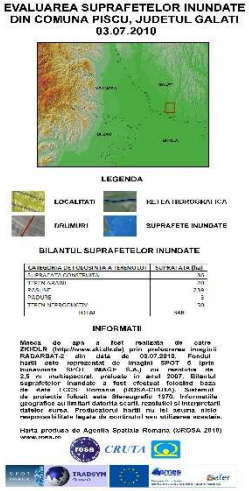
Floods Risk Management

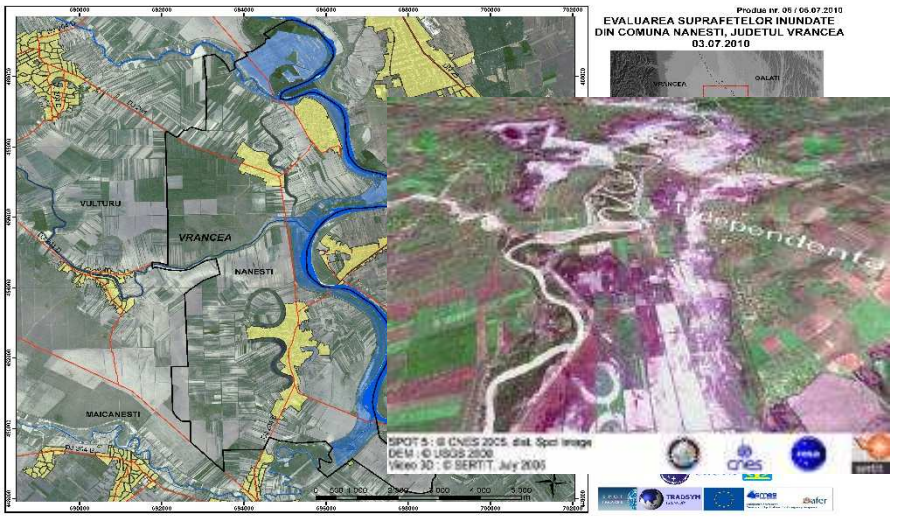
Type of Event:	Floods
Location of Event:	Romania
Date of Charter Activation:	04/07/2010
Charter Requestor:	**Romanian Space Agency**
Project Management:	Emergency Response Service GMES











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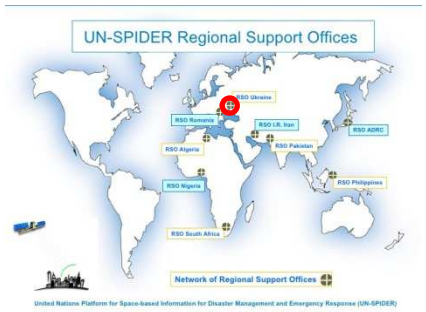
DISASTERS

SRI Ukraine expertise in disaster monitoring

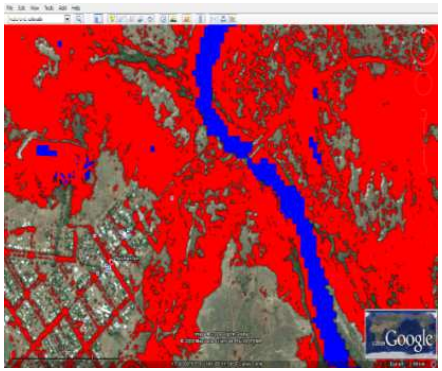
UNITED NATIONS Office for Outer Space Affairs
UN-SPIDER
www.un-spider.org

***U**nited **N**ation**s** **P**latform for **D**isaster Management and **E**mergency **R**esponse*
SRI hosts UN-SPIDER Regional Support Office in Ukraine



Experience in disaster monitoring:

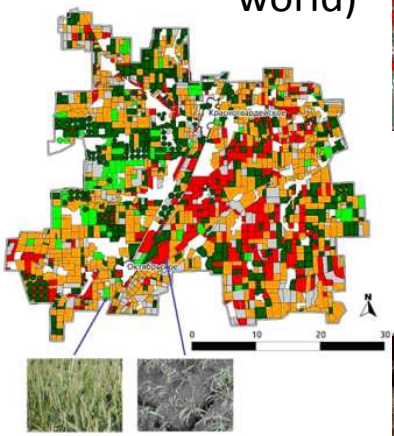
✓ ***Flood monitoring*** (within *International Charter* all over the world)



Flood monitoring, Australia

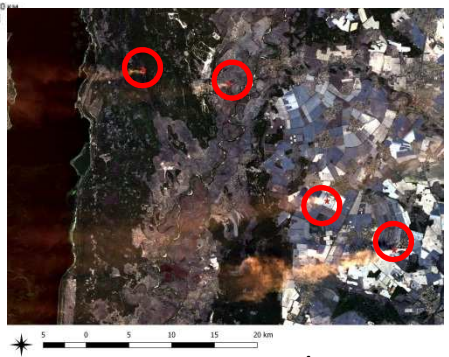
✓ ***Drought risk assessment***
EvIDENz Project (Earth observation-based information products for drought risk on a national basis)

- SRI - University of Bonn
- 2016-2018



Agriculture draught, Ukraine

✓ ***Peat fire monitoring***



Kiev region, Ukraine

Horizon 2020
Call: H2020-SC5-2015-one-stage
Topic: SC5-15-2015
Type of action: ERA-NET-Cofund
Grant agreement no: 689443
Proposal acronym: ERA-PLANET

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DISASTERS

AUTH's Tools and Facilities

In situ components also involve **2D/3D mapping** as well as the use of **GIS/Geospatial Decision making systems for pre- and post- assessment of disasters**. Such approaches combine the use of either RS data acquisition mechanisms (i.e. satellite and aerial/UAV imagery) with in-situ data collection (i.e. GNSS control point measurement, Mobile Mapping Systems, laser scanners, etc).

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AUTH's Tools and Facilities

Synergistic use of UAVs in SMURBS, include optimi-zation of advanced sensors and **imaging capabilities for LU/LC and post-disaster monitoring.**

•During the preparedness/prevention phase, such data are collected without time restrictions, achieving high accuracy

•During the post-disaster assessment phase, the involved barriers (i.e. time frame, costs, civil protection priorities, etc) are stricter and consequently different methodologies are used

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Mature services in SMURBS' arsenal

Table 2: Indicative list of services, tools and products already developed from SMURBS partners. The concept for their further development within SMURBS is also indicated.

Services/ Tools/ Products	Description	Further development
Firehub 1st prize, Copernicus 2014 Masters	Operational EO-based fire management service. Real-time fire detection, monitoring, large scale mapping during/after wildfires, fire smoke dispersion forecasting.	Fusion of multi-modal satellite data to increase detection and monitoring accuracy in hybrid underlying land cover.
DisasterHub	Mobile application that integrates EO data (space, in-situ, airborne, crowd) with additional spatio-temporal evidence (from Core Copernicus, GEO, GEOSS) to higher value DRR/EMS decision support products.	Use of crowd-sourced information collected through DisasterHub to reinitialize the modeling engine of FireHub (above) and provide a dynamic information feed.
GEOHub	System based on satellite interferometry (InSAR) for high precision monitoring of natural disasters (crustal deformation).	Enhancement to deployable status for monitoring critical infrastructures and construction works in the urban fabric.
FORCIP+	Tool for identification of best route and estimation of optimum/shortest time for emergency response in forest roads.	DSS optimization with additional parameters (road sinuosity, altitude, slope, barriers, vehicle type, etc).
SAVEMEDCOASTS	Multi-hazard assessment for the Mediterranean basin and areas up to 1m above sea level of high economic and environmental value.	Fusion of multi-sensor data for developing smart tools for risk assessment of shallow-waters-tsunamis

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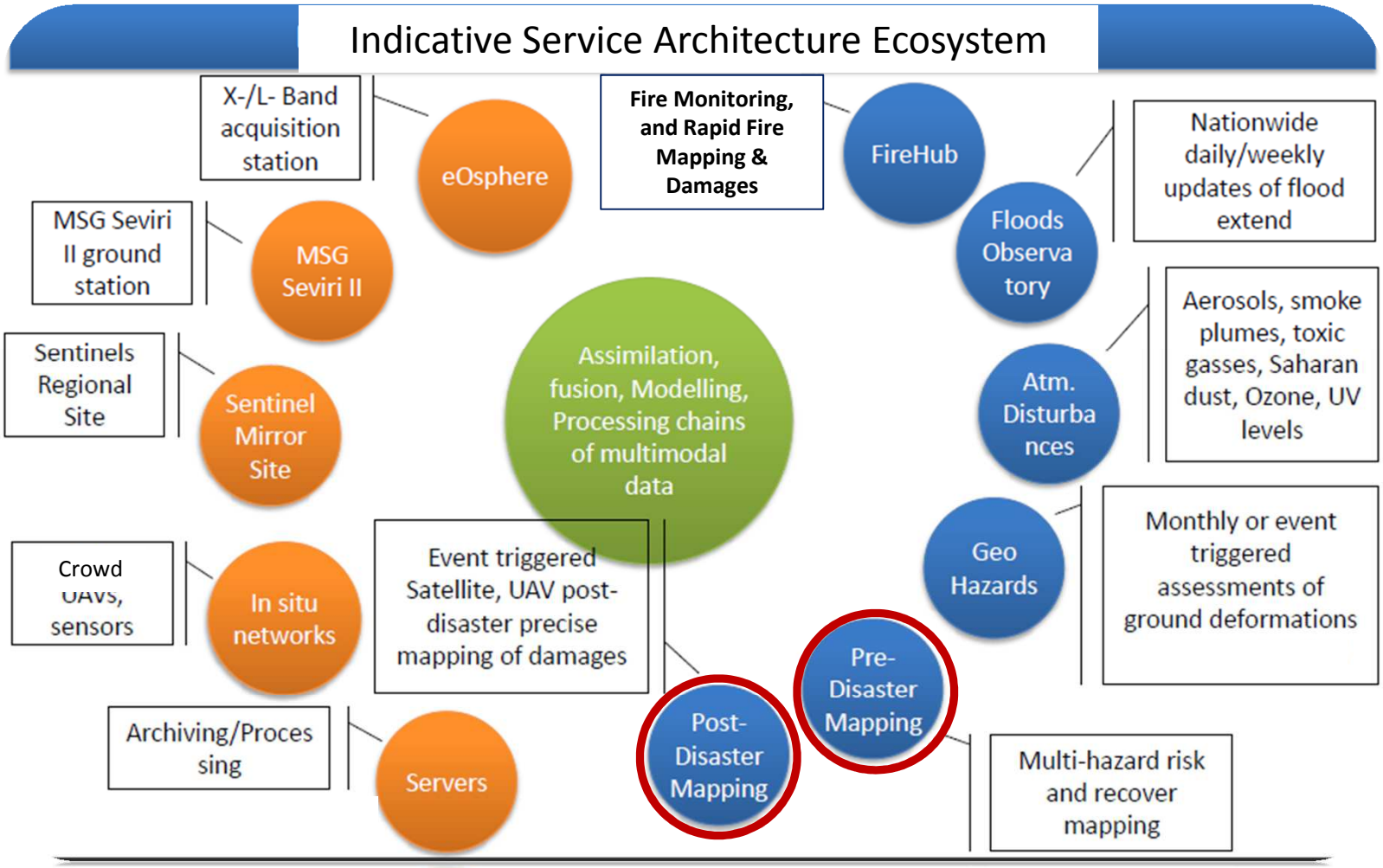
Vision



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Progress beyond the state-of-the-art

- Develop **data mining and data fusion tools**, and methods for integrating **crowdsource data** together with EO and other data sources in the processing chain for dynamic early warning and damage mapping
- **Engagement of voluntary communities** in collecting crowdsourced data and employment of a **geofence-driven approach** to maximise the potential of involvement of citizens
- Enhance/fine tune existing state-of-the-art services to **adapt site specificities** and ensure **service transferability** that meets the end user requirements at city level
- To establish new models for **effective operation of the existing platforms** in an integrated and coordinated manner e.g. the Hellenic Collaborative Ground Segment (Mirror Site), the Copernicus Data Hub (through the DIAS back offices/front offices), the Regional Data Hubs, the GCI, and any available in the project crowd (mobile) platform(s)

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DISASTERS

Tangible outcomes - Deliverables

- **Provide the stakeholders with robust and comprehensive Smart Urban solutions for disaster management**
- **Expand the portfolio of EO based services, and information products for disaster management through know-how transfer and technology exchange**
- **Building capacity in countries and the engaged End Users communities through the provision of services and training actions**
- **Pave the ground for the development and implementation of validated and standardized EO based services in the domain of disaster management, and the evolution of relevant Copernicus services to meet the specificities of sites and requirements of urban authorities**
- **Integrate monitoring capacities for filling in the existing monitoring gaps in the urban and peri-urban environment using smart sensor EO technology**
- **Foster EO-based SDG implementation and monitoring in the urban environment**

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"Take-home" message

- DRR is one of the priority pillars for GEO
- Services to cover all phases of the disaster management cycle, namely, preparedness and planning, early warning, emergency response and recovery
- SMURBS' partners are mature in handling disasters at operational level
- Challenge to adapt services under the "smart cities" context, integrate the solutions and make them easily replicable

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source: World Bank

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