



Francoise VILLETTE

European Commission

DG GROW, Copernicus Unit

- ★ Copernicus Space programme – what is it ?
- ★ The 6 services from Copernicus
- ★ The Emergency service

- ★ **Earth Observation programme** providing relevant information to EU policies in the fields of **environment, disaster management and security** (former GMES)
- ★ Copernicus is a **flagship of the European Space Policy**
 - ★ *Copernicus Space Programme of the European Space Agency (ESA)*
 - ★ *Copernicus Regulation + MFF*


Objectives




"The Union Earth observation and monitoring programme"

Monitor the environment


Foster downstream applications in a number of fields




Protect people and assets




Increase general knowledge on the state of the Planet



Improve environmental policy effectiveness



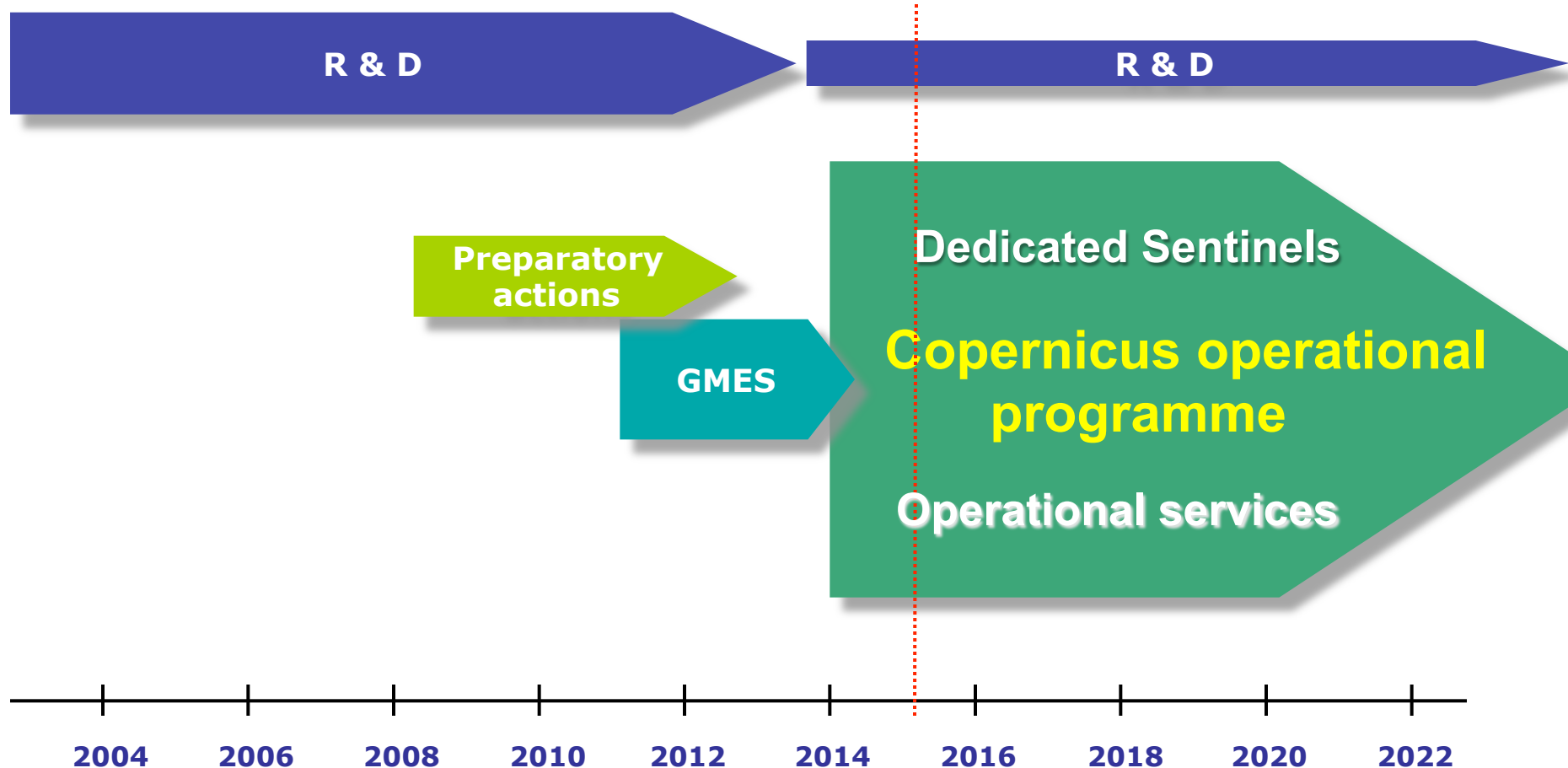
Facilitate adaptation to climate change



Help managing emergency and security related situations



Activities now transfer from research to operations



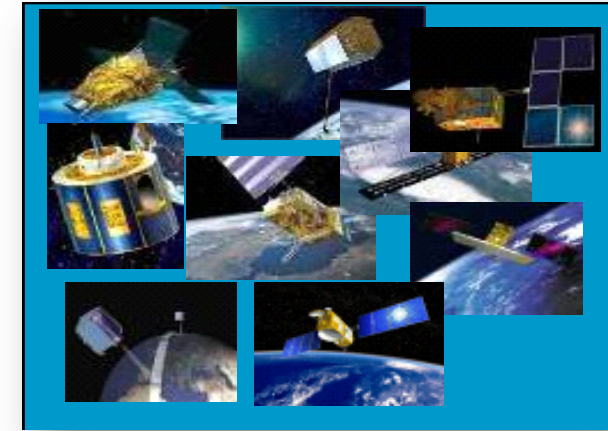
Seven Milestones reached:

- **Programme Regulation adopted**
- **Budget of € 4.3 Bn for 2014-2020**
- **Full, free and open access to data**
- **Successful launch of Sentinels 1A+2A**
- **First images used**
- **Funds delegated to ESA/EUMETSAT and service providers**
- **Four services are operational delivering 24h/7d**

Copernicus architecture



**6 services use
Earth Observation
data to deliver ...**

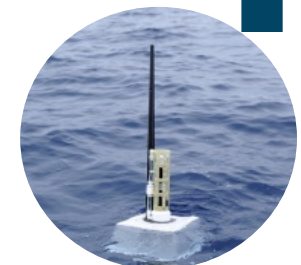
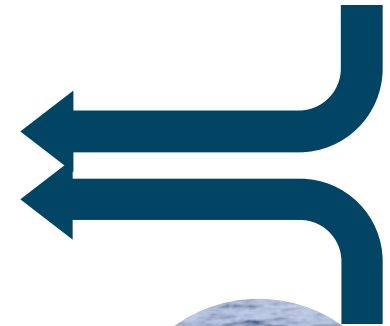


Sentinels

Contributing missions



...added-value products



in-situ

Each Sentinel is technically different to meet the needs of the 6 services



Sentinel 1 – radar imaging
All weather, day/night applications



Sentinel 2 – Optical imaging
Land applications: urban, forest, agriculture,..



Sentinel 3+6 – Ocean and global land monitoring, high precision ocean altimetry



Sentinel 4+5 – Atmosphere composition monitoring, from a geostationary (-4) and a polar orbit (-5)

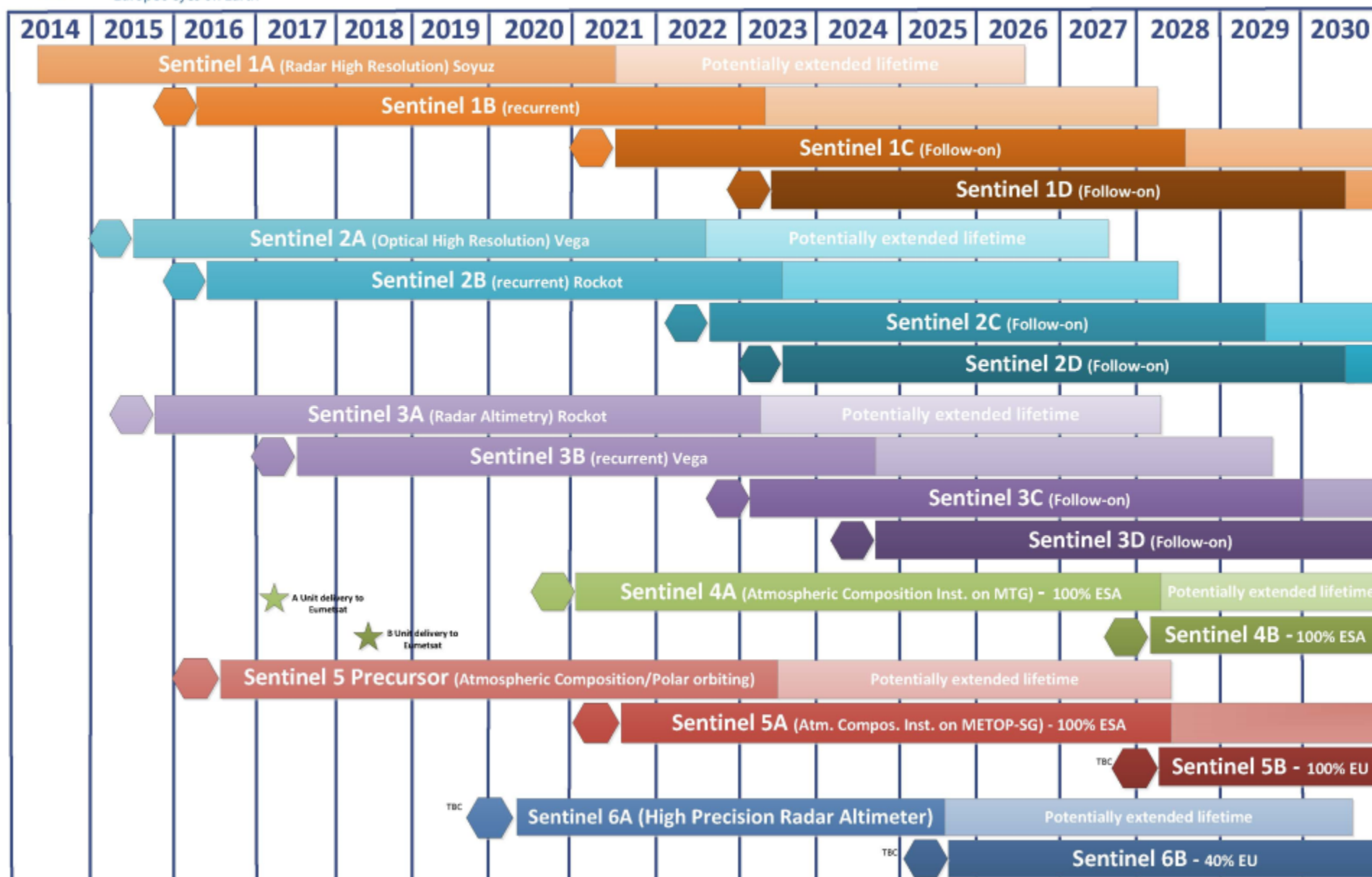


- **First Sentinel launched April 2014, operational since Oct 2014. Sentinel 2 launched June 2015**
- **By end 2020: 8 Sentinel satellites in orbit, over 24 Sentinels by 2040, providing most of the data needed by Copernicus services**
- **Where Sentinels not yet operational, Programme buys Earth Observation data from other satellite data providers**



**Launch from Europe's Spaceport
in Kourou, French Guiana, on 3 April 2014**

Copernicus Constellations Deployment Schedule



Sentinel Data Access



**Full, free
and open
Access for
everybody**



Copernicus Space Component
Data Access Portal

sentinels.copernicus.eu

Copernicus
Services
Access

Scientific / Other
Access Hub

Collaborative
Access Hub

International
Agreements
Access Hub

Two complementary approaches:

★ *Bringing the data to the user:*

web portal, mirroring of the data – high bandwidth connection needed (e.g. Géant)

★ *Bringing the user to the data:*

cloud computing ('hosted computing') – upgrade of the Copernicus core ground segment needed

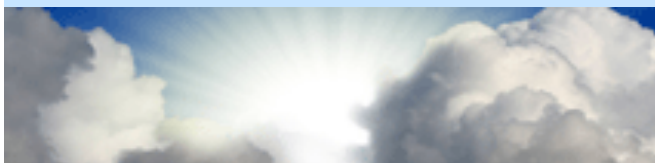
Monitoring of earth systems



Land



Marine



Atmosphere



Security



Emergency



Climate Change

The Emergency



Service

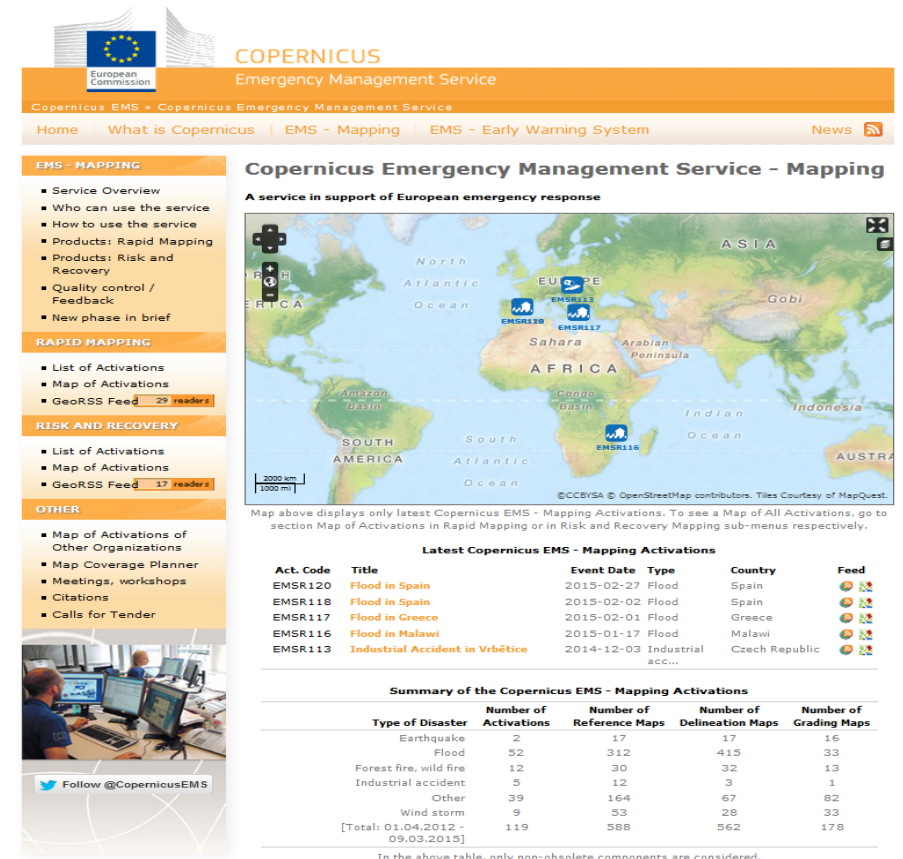


Space

The Copernicus logo, featuring the word "Copernicus" in a stylized font with a blue and orange graphic element, and the tagline "Europe's eyes on Earth" below it.

Emergency Management Service (EMS)

- ★ Operational since April 2012
- ★ 24/7 addressing natural and man-made disasters globally
- ★ Provides disaster management information based on space data combined with other information
- ★ Focal point for users is the Emergency Response Coordination Centre at DG ECHO (ERCC)
- ★ Coordination by DG ECHO, DG GROW, DG JRC
- ★ **Two components: Mapping and Early Warning System (EWS)**
- ★ For some events EMS Mapping is supported by EWS
- ★ Standard delivery: raster and vector maps



COPERNICUS
Emergency Management Service

Copernicus EMS » Copernicus Emergency Management Service

Home | What is Copernicus | EMS - Mapping | EMS - Early Warning System | News

EMS - MAPPING

- Service Overview
- Who can use the service
- How to use the service
- Products: Rapid Mapping
- Products: Risk and Recovery
- Quality control / Feedback
- New phase in brief

RAPID MAPPING

- List of Activations
- Map of Activations
- GeoRSS Feed **29 readers**

RISK AND RECOVERY

- List of Activations
- Map of Activations
- GeoRSS Feed **17 readers**


OTHER

- Map of Activations of Other Organizations
- Map Coverage Planner
- Meetings, workshops
- Citations
- Calls for Tender

Follow @CopernicusEMS

Copernicus Emergency Management Service - Mapping

A service in support of European emergency response



Map above displays only latest Copernicus EMS - Mapping Activations. To see a Map of All Activations, go to section Map of Activations in Rapid Mapping or in Risk and Recovery Mapping sub-menus respectively.

Latest Copernicus EMS - Mapping Activations

| Act. Code | Title | Event Date | Type | Country | Feed |
|-----------|---------------------------------|------------|-------------------|----------------|------|
| EMSR120 | Flood in Spain | 2015-02-27 | Flood | Spain | |
| EMSR118 | Flood in Spain | 2015-02-02 | Flood | Spain | |
| EMSR117 | Flood in Greece | 2015-02-01 | Flood | Greece | |
| EMSR116 | Flood in Malawi | 2015-01-17 | Flood | Malawi | |
| EMSR113 | Industrial Accident in Vrbětice | 2014-12-03 | Industrial acc... | Czech Republic | |

Summary of the Copernicus EMS - Mapping Activations

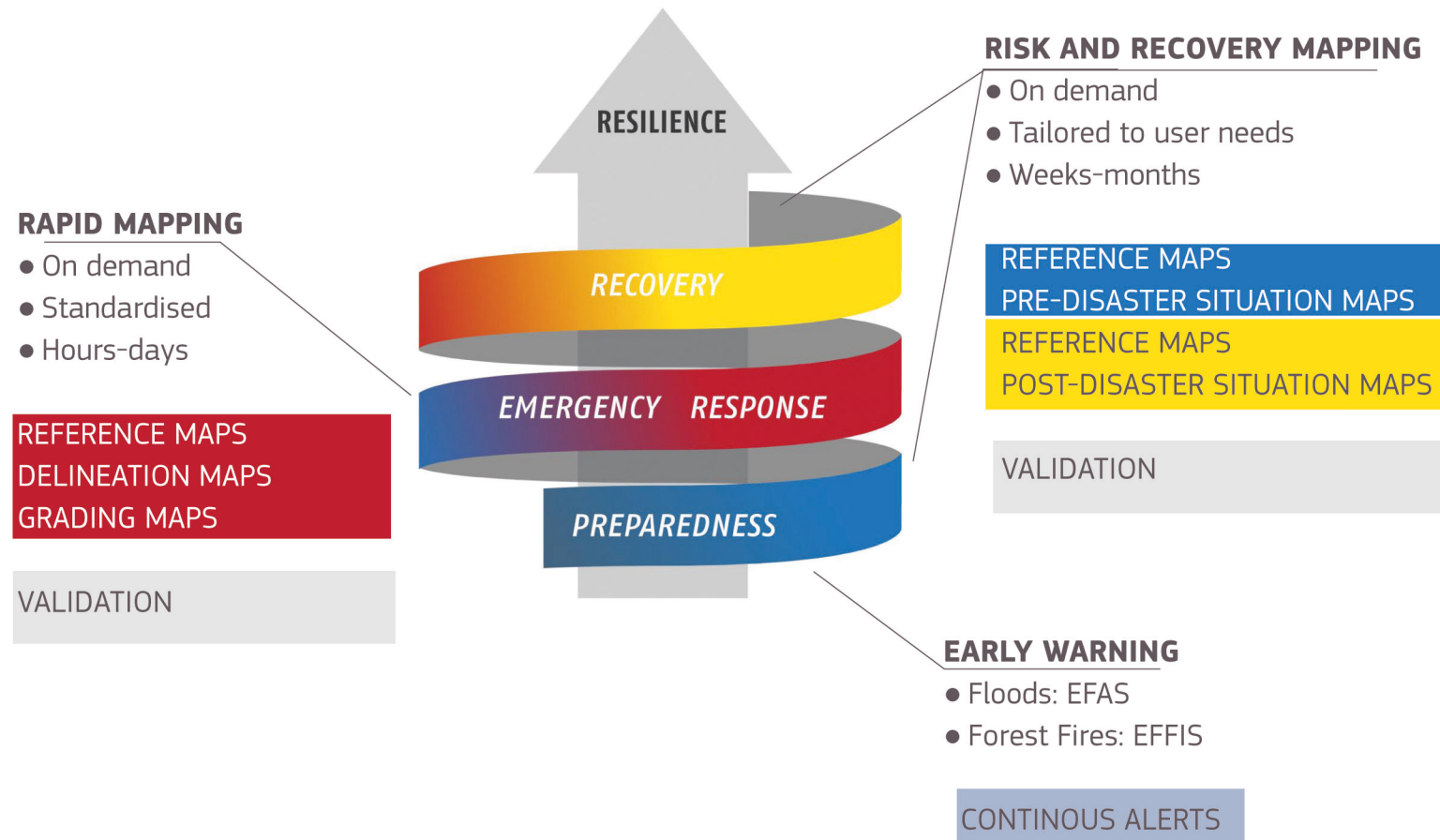
| Type of Disaster | Number of Activations | Number of Reference Maps | Number of Delineation Maps | Number of Grading Maps |
|----------------------------------|-----------------------|--------------------------|----------------------------|------------------------|
| Earthquake | 2 | 17 | 17 | 16 |
| Flood | 52 | 312 | 415 | 33 |
| Forest fire, wild fire | 12 | 30 | 32 | 13 |
| Industrial accident | 5 | 12 | 3 | 1 |
| Other | 39 | 164 | 67 | 82 |
| Wind storm | 9 | 53 | 28 | 33 |
| [Total: 01.04.2012 - 09.03.2015] | 119 | 588 | 562 | 178 |

In the above table, only non-obsolete components are considered.

Copernicus Emergency Management Service (EMS) provides information for emergency response in relation to different types of disasters, including meteorological hazards, geophysical hazards, deliberate and accidental man-made disasters and other humanitarian disasters, as well as prevention, preparedness, response and recovery activities.

Copernicus EMS consists of the Mapping Service and of the Early Warning System (floods).

The Emergency Management Service - Mapping, which has been an operational activity since April 1st, 2012, is a fully operational service as defined in Article 5 to the Copernicus Regulation.



Emergency Management Service (EMS) has two components:

► *Mapping*

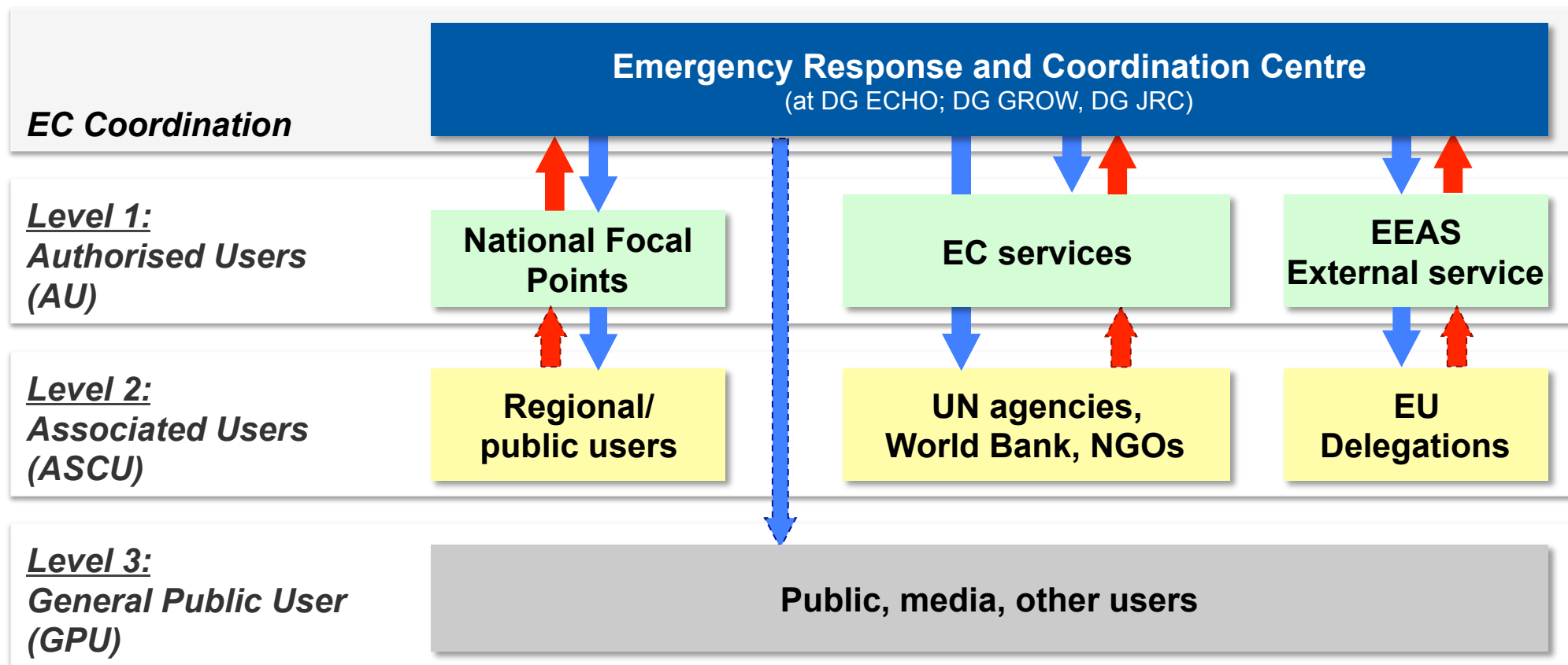
- *Rapid Mapping*
- *Risk & Recovery*

► *Early Warning*

- *EFAS (floods)*
- *EFFIS (forest fires)*



Copernicus EMS Mapping - Users



❑ How many activations?

135 in total since April 2012:

→ 69 in Europe, 66 outside

❑ Which kind of disaster?

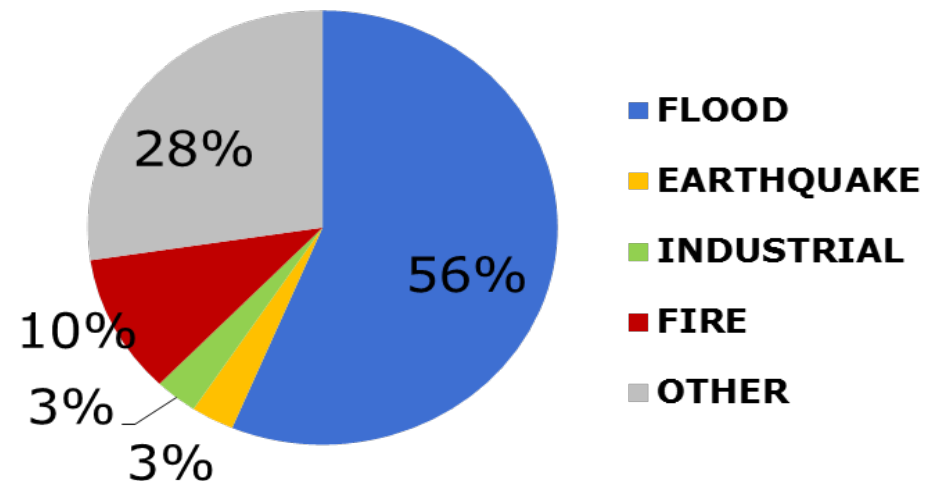
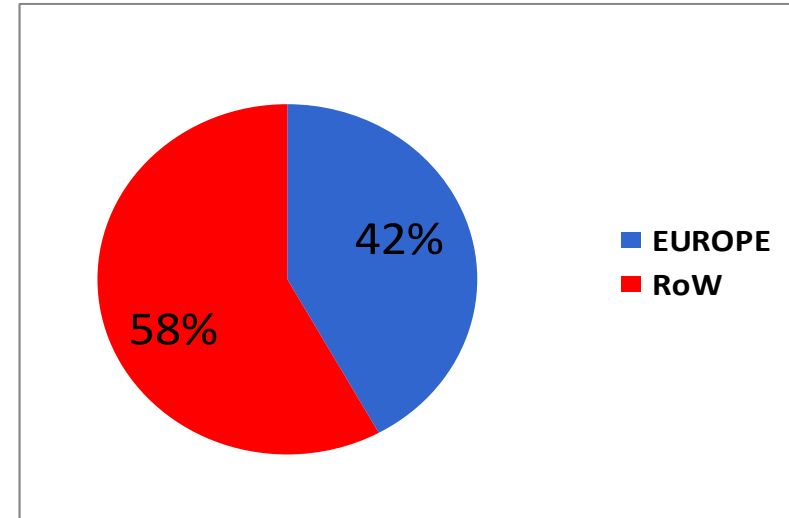
**14 Fires, 76 Floods, 4 Earthquakes,
4 Industrial accidents, 37 Other**

- In Europe: mostly floods
- Outside Europe: many humanitarian

❑ Who is activating?

Activations are received by:

- MS Civil Protection,
- European Services or
- UN agencies via DG ECHO



Emergency Management service



Enterprise and Industries

Providing support to emergency response services

Situation maps, reference information

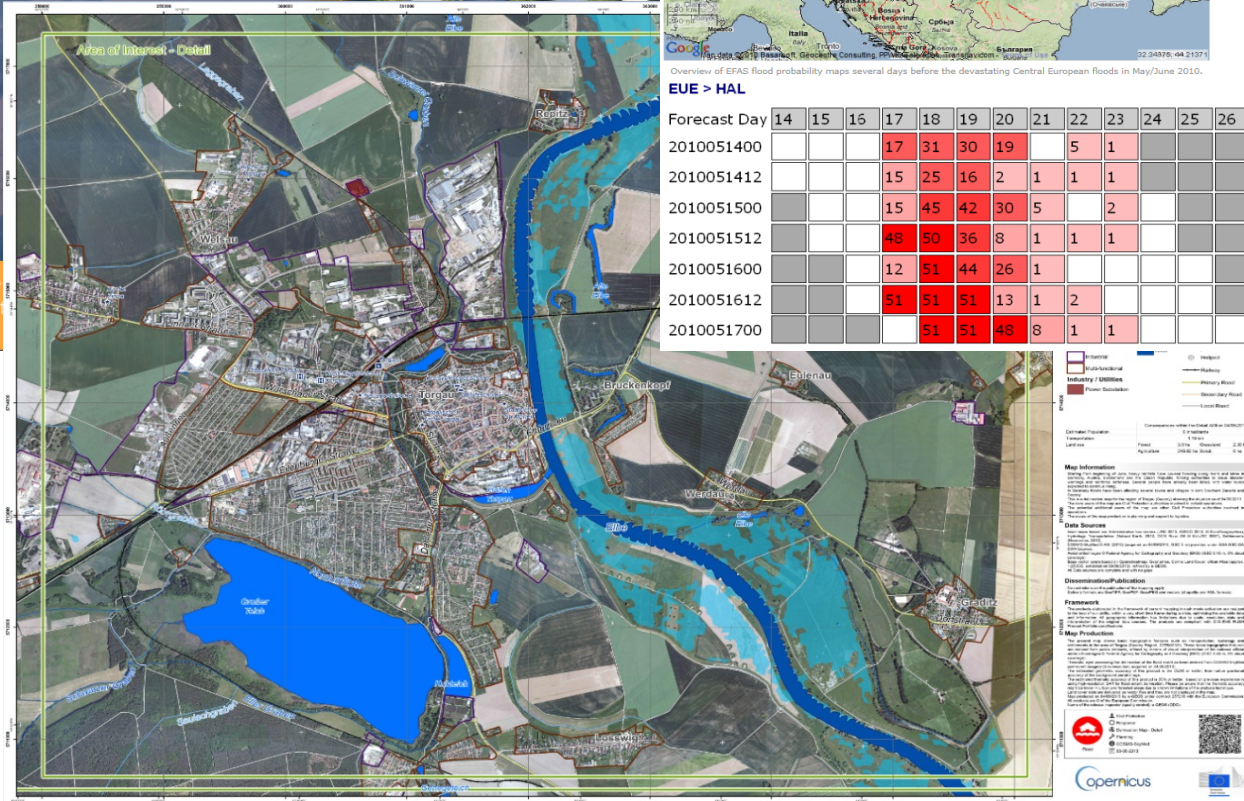
Flood and forest fire risk forecasts



Overview of EFAS flood probability maps several days before the devastating Central European floods in May/June 2010.

EUE > HAL

| Forecast Day | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 2010051400 | | | | 17 | 31 | 30 | 19 | | 5 | 1 | | | |
| 2010051412 | | | | 15 | 25 | 16 | 2 | 1 | 1 | 1 | | | |
| 2010051500 | | | | 15 | 45 | 42 | 30 | 5 | | 2 | | | |
| 2010051512 | | | | 48 | 50 | 36 | 8 | 1 | 1 | 1 | | | |
| 2010051600 | | | | 12 | 51 | 44 | 26 | 1 | | | | | |
| 2010051612 | | | | 51 | 51 | 51 | 13 | 1 | 2 | | | | |
| 2010051700 | | | | | 51 | 51 | 48 | 8 | 1 | 1 | | | |



Copernicus

What is possible with Rapid Mapping?

- ★ On-demand, fast provision (hours-days) of geo-spatial information in support to emergency management activities
- ★ Provide an overview of the reference situation on the ground
 - ★ Location of assets (settlements, transportation, land use, land cover, etc.)
 - ★ Terrain, hydrology
- ★ Delineate the disaster's extent (e.g. flooded or burnt area, lava flow extent)
- ★ Locate damages to buildings, transportation infrastructure, etc. (to be used for quantitative estimates)

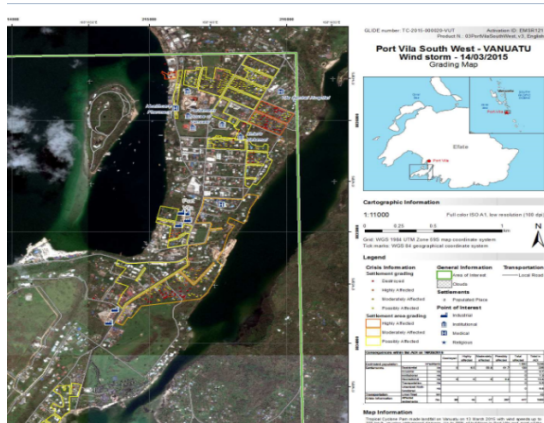
Copernicus EMS Rapid Mapping

- ★ 24/7 service
- ★ Standardised products (map types)
- ★ Two production modes (service levels SL)

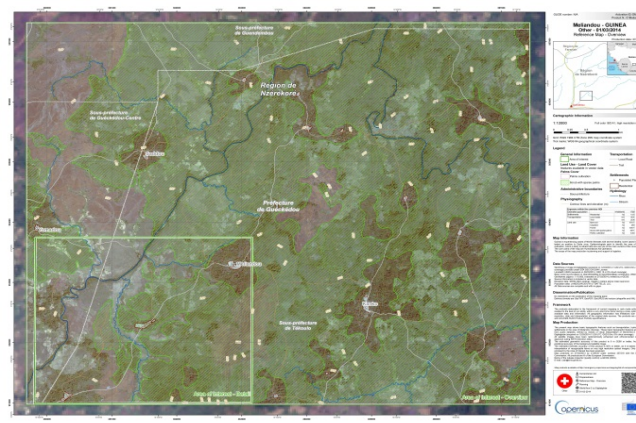
| MAP TYPE | CONTENT | DELIVERY TIME* | |
|-------------|--|----------------|--------|
| | | SL1 | SL5 |
| Reference | Detailed status of the territory & assets prior to the crisis e.g. Topographic features & specific information | 9h | 5 days |
| Delineation | Assessment of the event's extent e.g. delineation of burnt area, delineation of flooded area, earthquake impact area; estimations on the exposed or affected population and assets | 12h | 5 days |
| Grading | Assessment of the damage grade & its spatial distribution e.g. for any disaster event, location of destroyed/damaged buildings and assets, and damage grading (possibly-moderately-highly affected-destroyed) | 12h | 5 days |

* after satellite image delivery

EMS Mapping



**Tropical Cyclone,
Vanuatu**



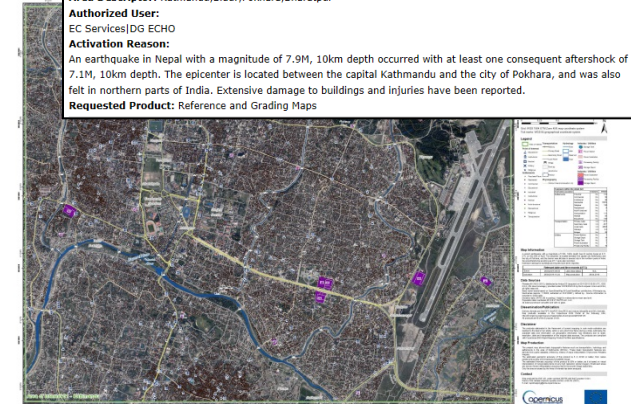
**Ebola epidemic,
Guinea**

EMSR125: Earthquake in Nepal

Event Time (UTC): 2015-04-25 11:45
Event Time (LOC): 2015-04-25 16:45
Event Type: Earthquake
Activation Time (UTC): 2015-04-25 12:20
Reference maps: 4
Delineation maps: 0
Grading maps: 4
Activation Status: Open
Affected Countries:



Area Descriptor: Katmandu, Bidur, Pokhara, Bharatpur
Authorized User:
EC Services/DG ECHO
Activation Reason:
An earthquake in Nepal with a magnitude of 7.9M, 10km depth occurred with at least one consequent aftershock of 7.1M, 10km depth. The epicenter is located between the capital Kathmandu and the city of Pokhara, and was also felt in northern parts of India. Extensive damage to buildings and injuries have been reported.
Requested Product: Reference and Grading Maps



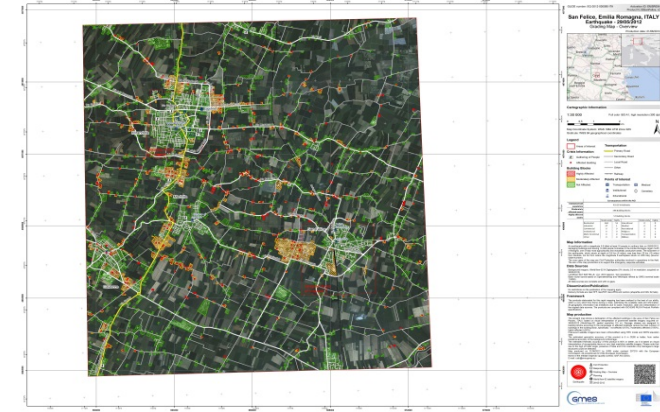
**Earthquake,
Nepal**



**Refugee Camp,
Al Mafrqa Jordan**



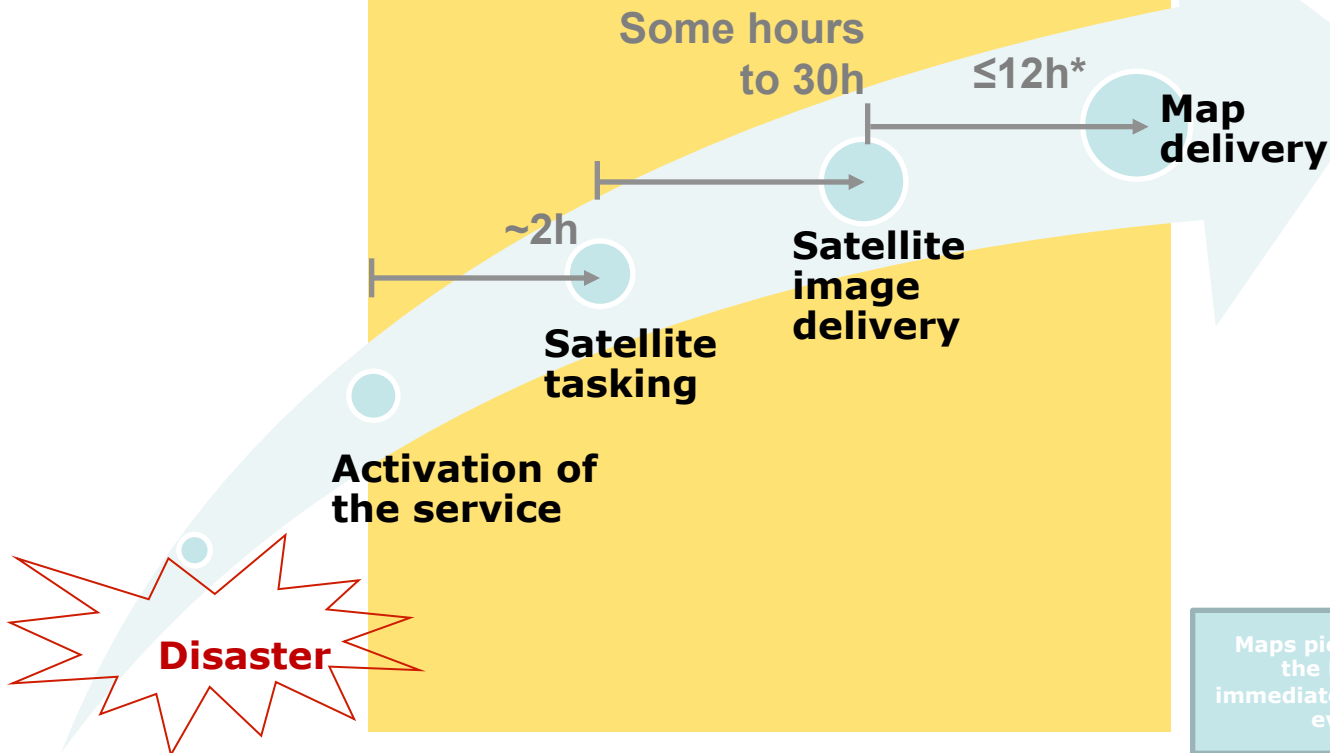
**Floods,
Ostlandet Norway**



**Earthquake, San Felice
sul Panaro, Italy**

Timeline

EMS Rapid Mapping



Maps picked up by the MEDIA immediately after the event

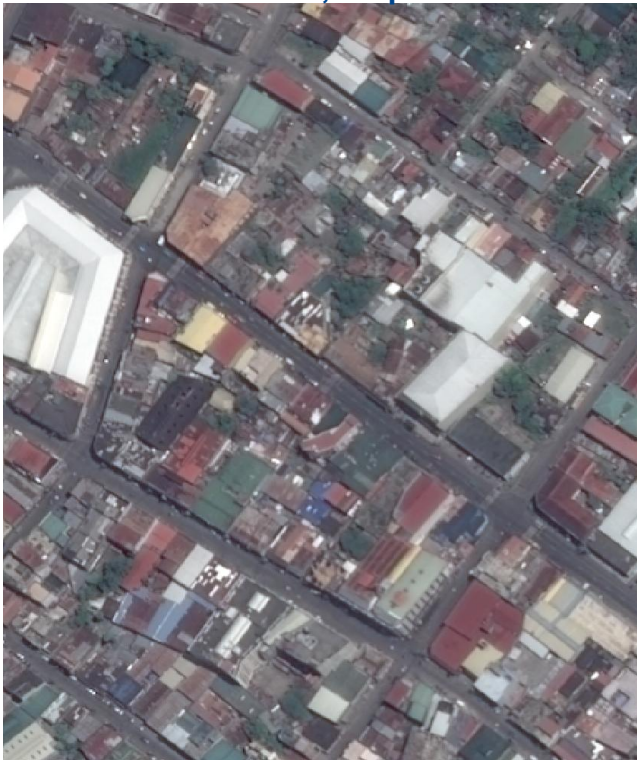
* Production time in service level 1

Storm

Damage assessment after Typhoon, Philippines, November 2013

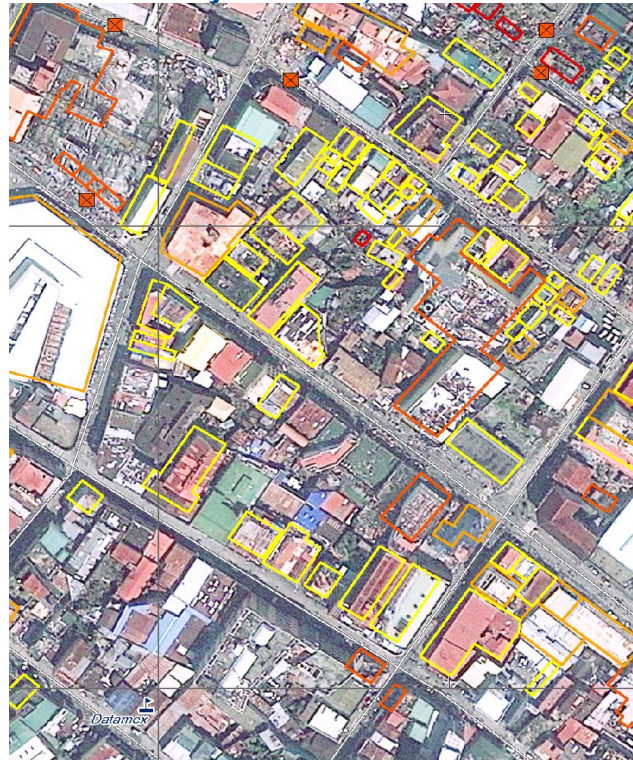
Pre-disaster image

Pleiades 0.7m, 7 April 2013



Post-disaster image

GeoEye-1 0.5m, 10 November 2013



Crisis Information


 Road Block

Settlement Grading

 Destroyed

 Highly Affected

 Moderately Affected

 Possibly Affected

*Source: Copernicus EMS
Rapid Mapping activation
EMSR058*

Typhoon in the Philippines

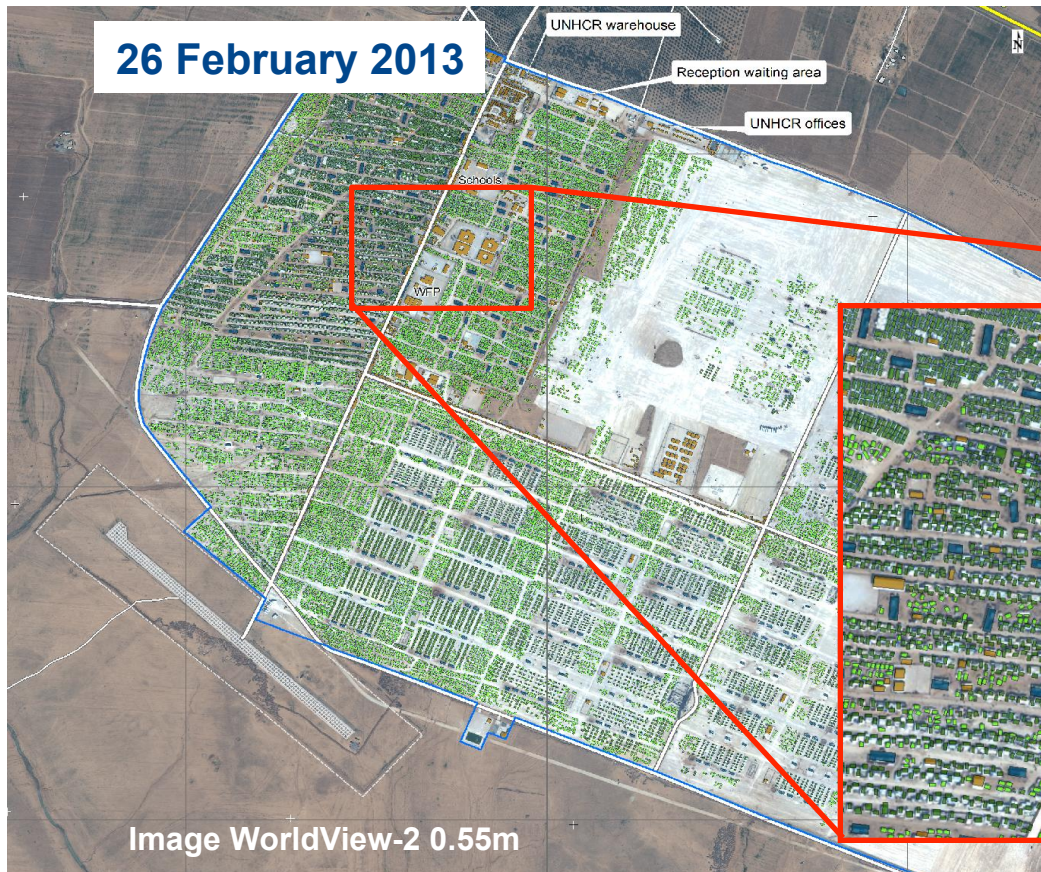
- ★ **Activation Time (UTC): 08-11-2013, 12:16**
 - ★ Pre-alerting based on GDACS predicted typhoon path
 - ★ Good response time (the first post-disaster map delivered 09-11-2013 17:02 (UTC))
 - ★ The first grading map of Tacloban delivered on 10-11-2013 15:45 (UTC)

Total number of maps:

20 reference, 6 delineation, 13 grading maps

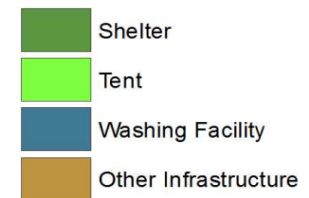
Humanitarian Aid

IDP camp near Al Mafrq (Jordan)



- Reference map => camp delineation, identification of building footprints, infrastructure

| Facilities within the camp on date 26/02/2013 | |
|---|--------------|
| Shelter | 8091 |
| Tent | 15403 |
| Washing Facility | 364 |
| Other Infrastructure | 903 |
| Total | 24761 |



IDP camp near Al Mafraq (Jordan)



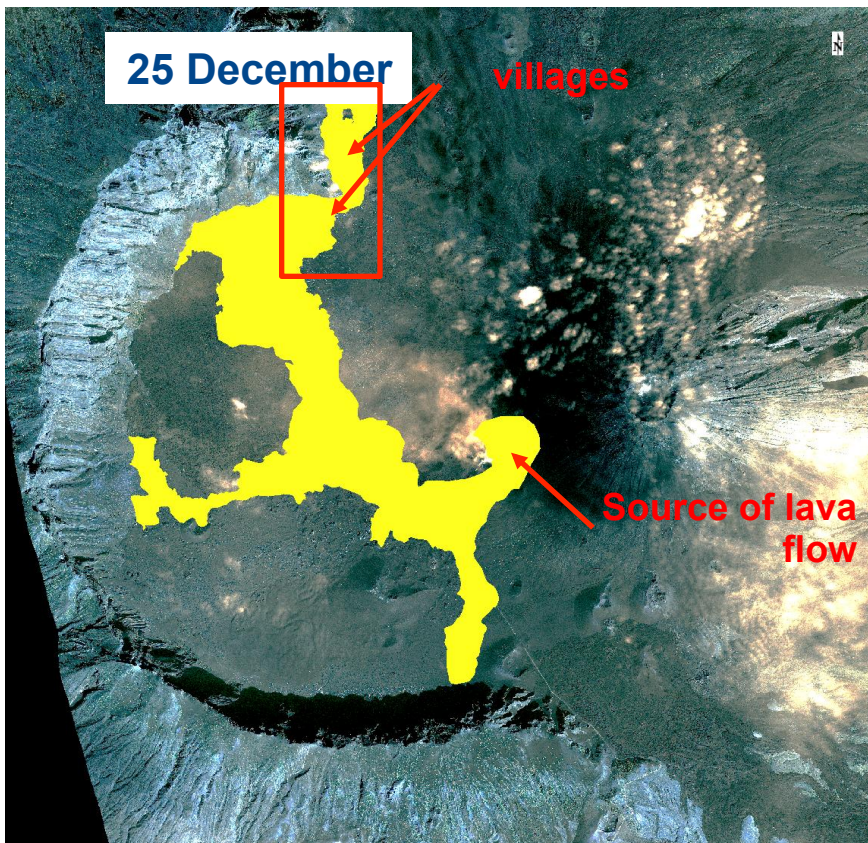
- ### Crisis Information

 Potentially Flooded Area

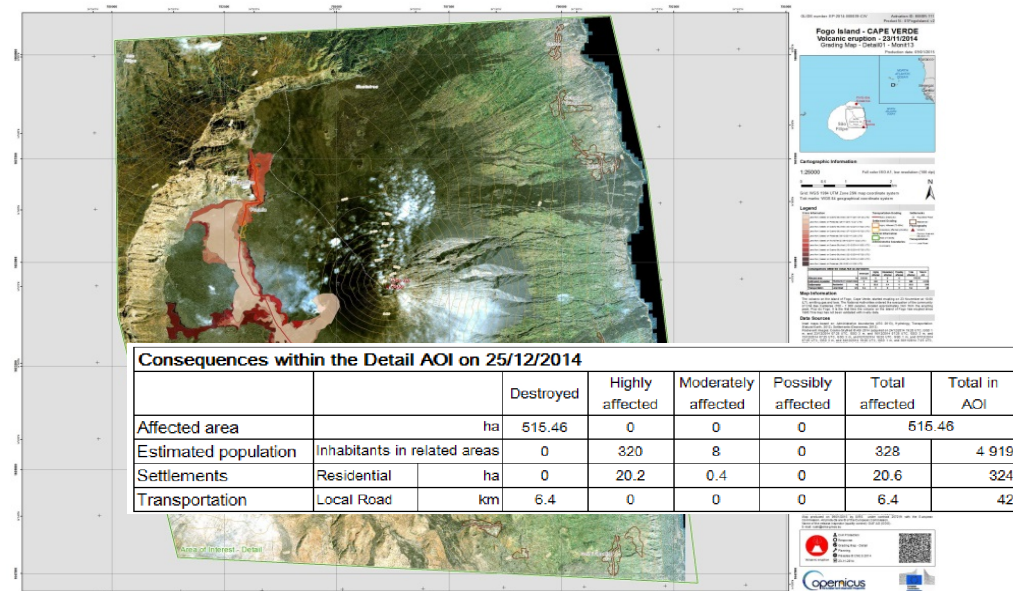
Space

Volcanic eruption

Fogo Island (Cape Verde), November-December 2014



- Monitoring of the lava flow extent for one month mainly from Radar data
- Evacuation of two villages in the caldera



Workflow



Emergency Management Service (EMS) has two components:

► *Mapping*

- *Rapid Mapping*
- *Risk & Recovery*

► *Early Warning*

- *EFAS (floods)*
- *EFFIS (forest fires)*



Copernicus Emergency Management Service

Which contribution can Risk & Recovery mapping make?

Provides on-demand geospatial information supporting emergency management activities not related to the immediate response. It addresses prevention, preparedness, disaster risk reduction and supports the recovery phase.

Product delivery phase: 35 days (15 + 20)

| MAP TYPE | CONTENT | DELIV. TIME |
|-----------------|--|-------------|
| REFERENCE | Detailed status of the territory and assets. <ul style="list-style-type: none"> E.g. Topographic features and specific information, e.g. land use zoning plans, mitigation measures | 20d (#) |
| PRE - DISASTER | Relevant info to help planning for contingencies on vulnerable areas <ul style="list-style-type: none"> E.g. Hazard exposure to hazardous events; Vulnerability / resilience of settlements and buildings; Risk status for population and assets; Evacuation plans; Forecasts; Alerts | 20d (#) |
| POST - DISASTER | Relevant thematic information, beyond the immediate response phase <ul style="list-style-type: none"> E.g. Hazard exposure to hazardous events; Vulnerability / resilience of settlements and buildings; Risk status for population and assets; Post disaster needs assessment; Recovery plans; Reconstruction / rehabilitation monitoring; IDP monitoring (IDP camps, IDP movements). | 20d (#) |

(#) working days after signature of a specific contract, which may require normally 15 days after the service request

Reference Maps

Aim: Providing comprehensive knowledge of the territory and assets in the context of prevention, preparedness, disaster risk reduction and recovery.

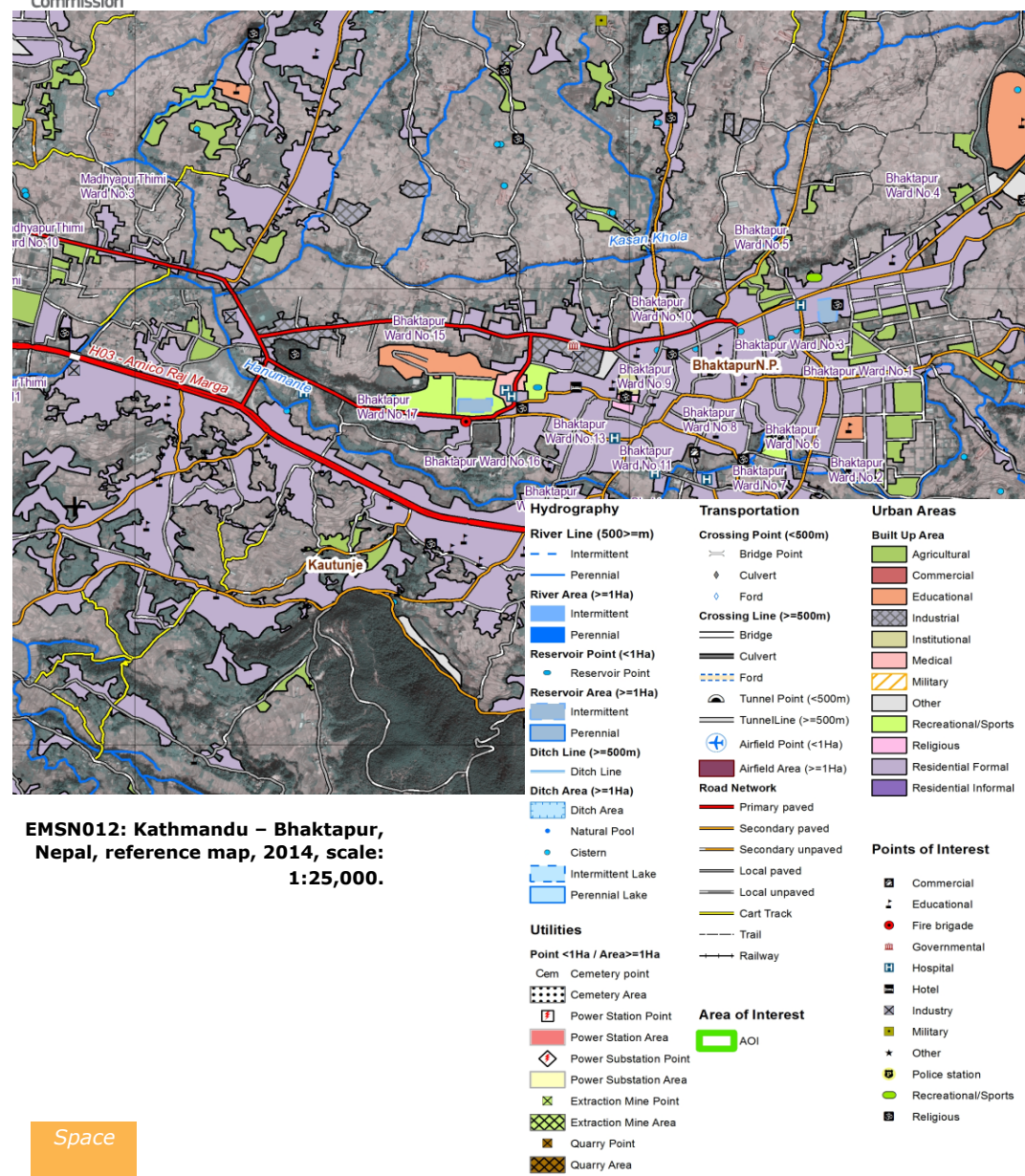
Topographic features

Disaster risk information

Other available information for crisis management

Typical key features of reference maps (not exclusive)

| Hydrology | Transport | Population-related (incl. Industry & Utilities) | Land cover & Physiography |
|---|---|--|--|
| Rivers Canals Lakes Reservoirs Open Water Shorelines Dams Wells Ponds | Railways Roads Cart tracks Bridges River crossing points Airfields Runways Ports | Toponyms Administrative boundaries Built-up areas Settlements Processing / industrial plants Pipelines Power lines Power stations | Woodland Natural vegetation Cropland Grassland Scrub Bare soil Snow/Ice Floodplains Void Areas Contours, spot heights Cliffs |



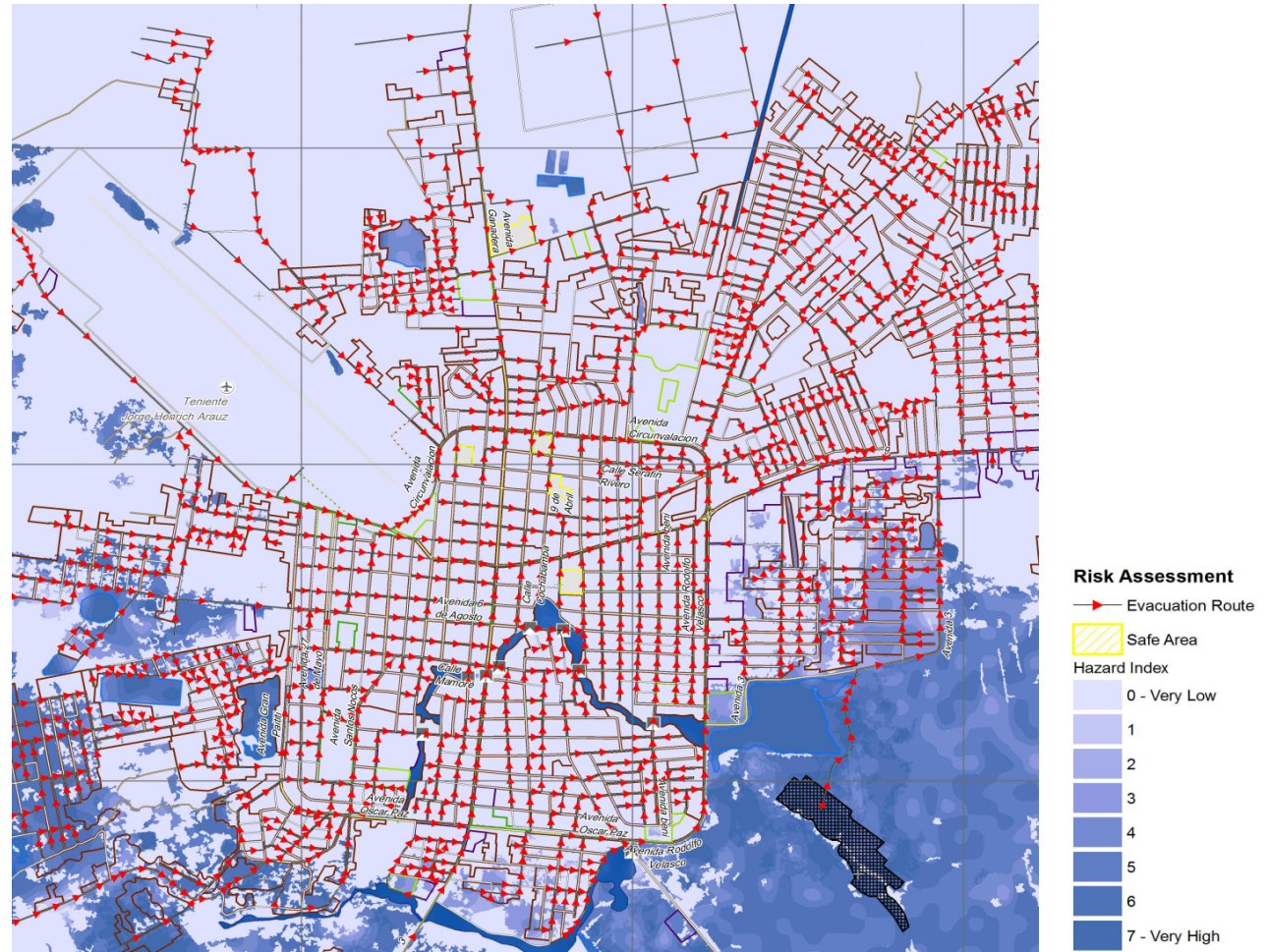
EMS012: Kathmandu – Bhaktapur, Nepal, reference map, 2014, scale: 1:25,000.

Pre-disaster maps



- ★ Aim : Provide relevant and up-to-date thematic information that can help civil protection and humanitarian aid agencies plan for contingencies and areas vulnerable to hazards.

★ Examples: Hazard exposure, Vulnerability or resilience, Risk status for population and assets, Evacuation plans



**EMSN014: Rio Mamore, Trinidad, Bolivia, Flood risk asesment,
1/11/2014, scale: 1:20,000.**

Post-disaster maps



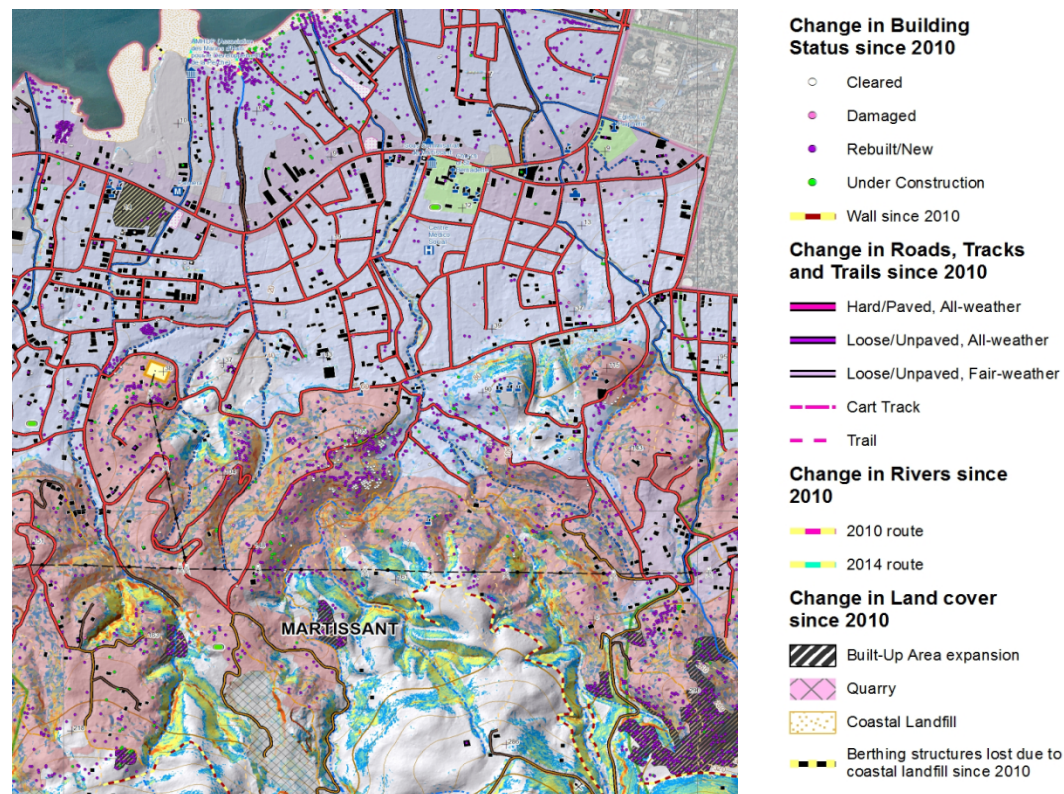
Provide relevant and up-to-date thematic information beyond the immediate response phase.

- Topographic features
- Disaster risk information
- Specific information regarding recovery needs, reconstruction planning and progress monitoring, long-term impact

Examples:

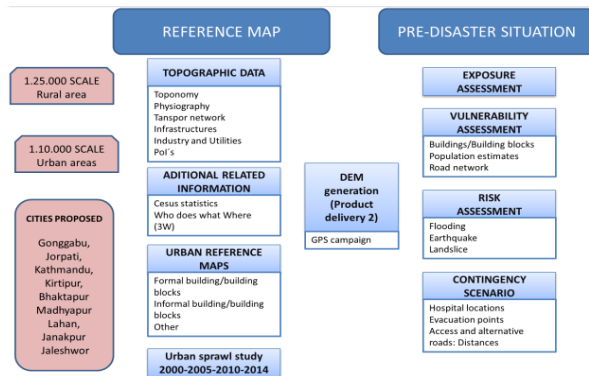
Hazard exposure and vulnerability and risk status of (in particular) new assets.

Post-disaster needs assessment, recovery plans, reconstruction/rehabilitation monitoring

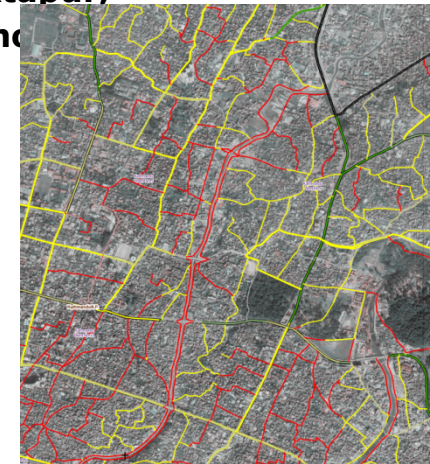


EMSN013: Martissant/Carrefour Feuilles/Baillergeau, Haiti, Reference Map Thematic Change 2010 - 2014, scale: 1:10,000.

Example - EMSN012: Preparedness, disaster risk assessment and disaster risk reduction covering districts of: Kathmandu/Bhaktapur, Dhanusa, Siraha and Maho



EMSN012: Kathmandu – Bhaktapur, Nepal.
Overview of generated products. Next to a map set of reference maps, several pre-disaster map sets have been created, covering exposure, vulnerability and risk assessment including a contingency scenario. In addition a DEM has been derived.



Road Network Vulnerability

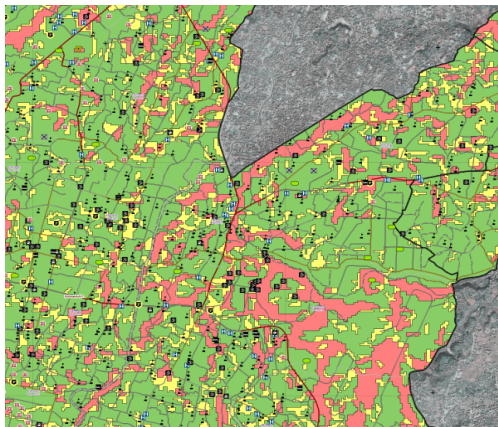
Road Hierarchy

- Primary
- Secondary
- Local
- Cart Track
- Trail

Road Vulnerability

- Low
- Medium
- High

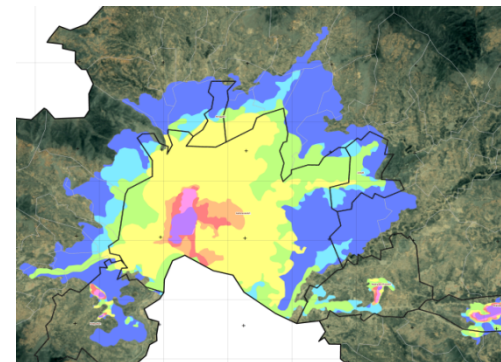
EMSN012: Kathmandu – Bhaktapur, Nepal. Road network vulnerability.
The methodology for generating this map is based on geology type, road hierarchy and surface, and the frequency of bridges.



Landslide Hazard Assessment

- High
- Low
- Medium
- No Data
- Null

EMSN012: Kathmandu – Bhaktapur, Nepal. Landslide hazard exposure.
The methodology for generating this map is based on landslide hazard index computation using slope factor, lithological factor, soil moisture conditions factor and precipitation factor.



EMSN012: Kathmandu – Bhaktapur, Nepal. Urban Sprawl
This map shows the urban sprawl of Kathmandu, Bhaktapur, Kirtipur, Madhyapur Thimi, Jorpati and Gonggabu cities between 1972 and 2014, understanding as urban area a continuous aggregation of buildings with high-medium density of houses that can be observed in the Landsat imagery. These cities belong to Kathmandu and Bhaktapur

Emergency Management Service (EMS) has two components:

- ▶ **Mapping**
 - *Rapid Mapping*
 - *Risk & Recovery*
- ▶ **Early Warning**
 - *EFAS (floods)*
 - *EFFIS (forest fires)*

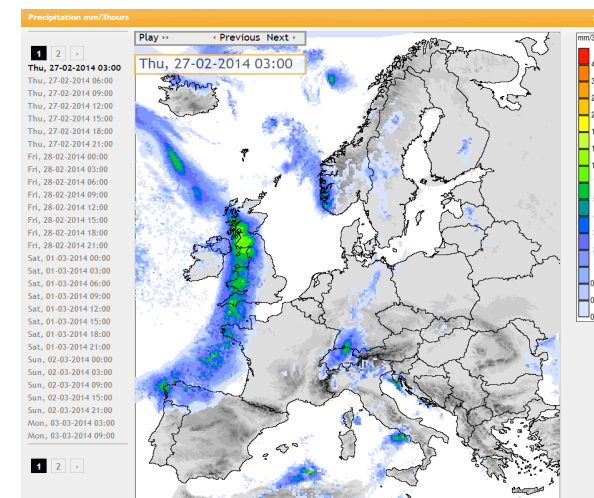
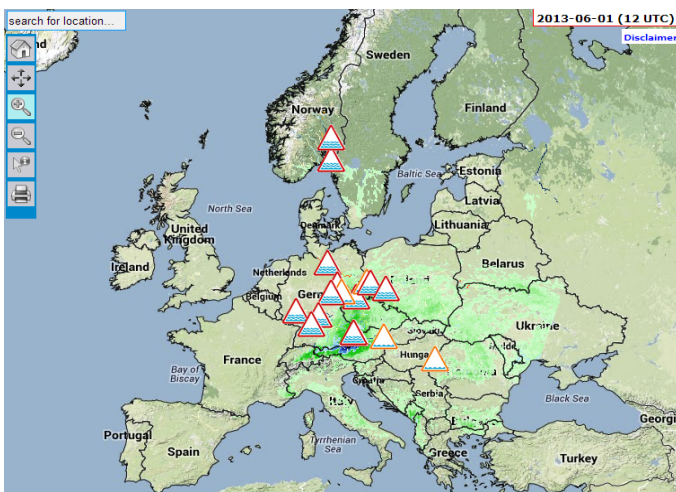


European Flood Awareness System (EFAS), the early warning system for floods

★ EFAS fully operational: under development at JRC since 2002 and fully operational since September 2012 under the Copernicus Emergency Management Service.

★ Objectives of EFAS:

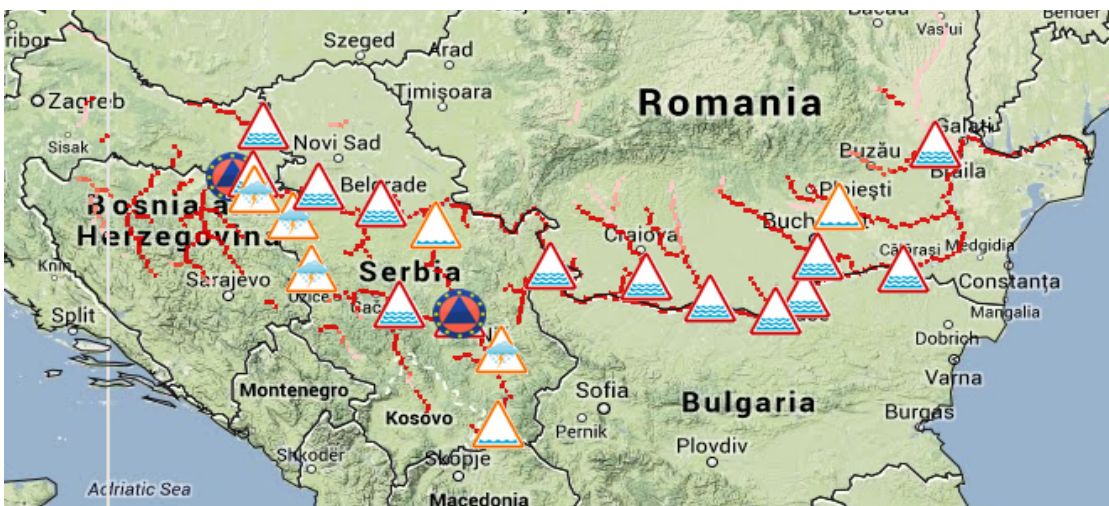
- ✓ Provide complementary flood forecasting information to national services
- ✓ Provide European scale overview to the ERCC/ECHO
- ✓ Pre-alerting Copernicus EMS Mapping



- EFAS partners: national/regional hydrometeorological authorities; currently more than 35 partners (EU & non-EU)

Balkan Floods May 2014: EFAS performance

Overview active EFAS warnings 2014-05-15 12UTC forecast:



EFAS General rule:

EFAS alerts are sent to all EFAS partners sharing the same river basin

EFAS alerts are only a call of attention.

More info on www.efas.eu

- Heavy rain started 13 May and flooding 14/15/16 May
- First flood signals visible from 8/9 May
- First EFAS alert to RS, BG, RO issued 11th May (Note: BA is currently not an EFAS partner)
- Subsequently 18 EFAS Flood warnings were issued for the Balkan region & lower Danube river basin between the 11th and 16th May



EFAS Flood/Watch/Flash Flood Watch issued



ERCC Activation

- Daily detailed reports based on EFAS and national information were provided to the Emergency Response and Coordination Centre of DG ECHO from 12th May onwards
- EFAS info was provided for pre-tasking of satellites for Copernicus EMS Rapid Mapping

European Forest Fire Information System

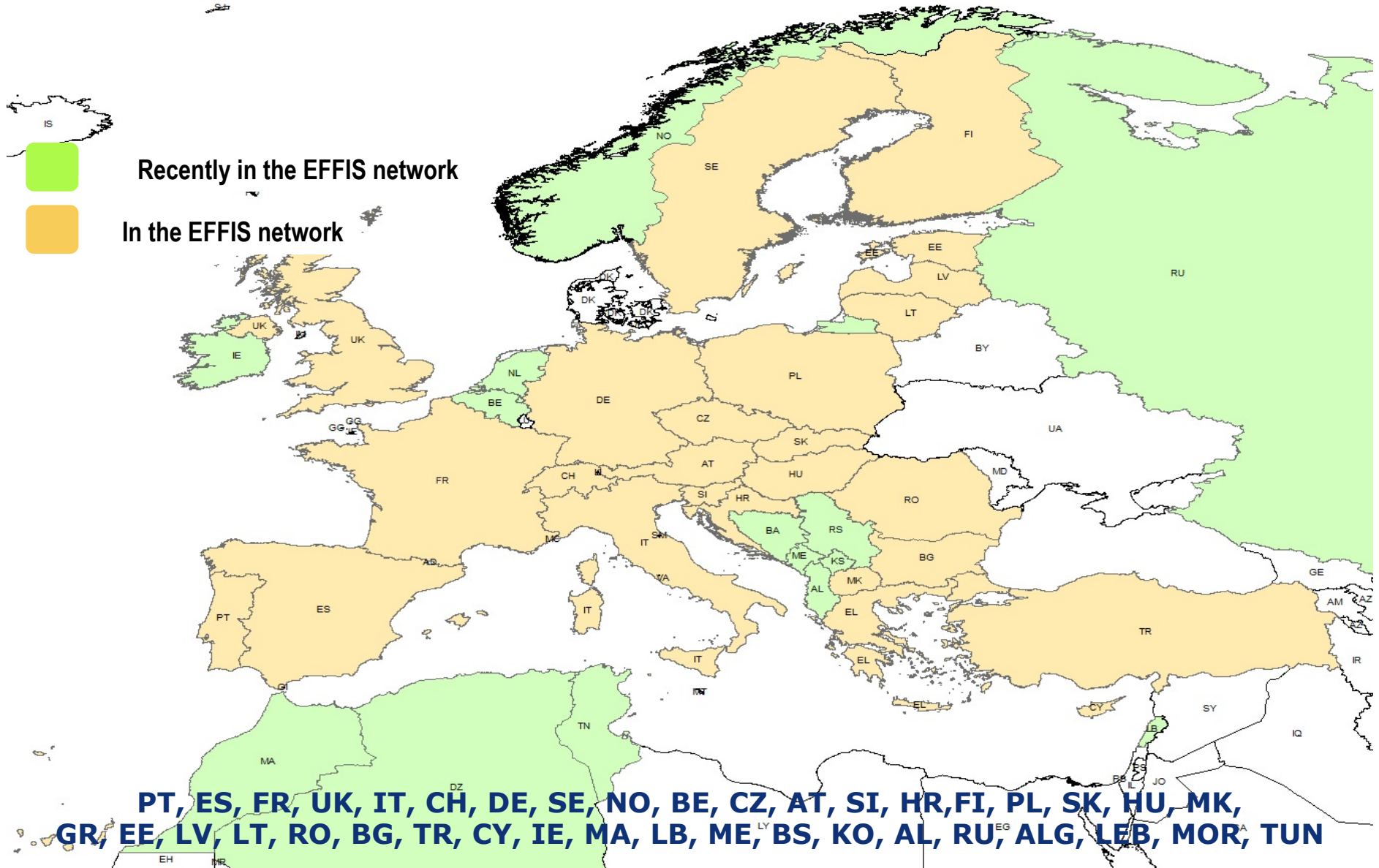
- ***The scope of EFFIS is to:***

- Provide EU level assessments during both pre-fire and post-fire phases
- Complement national fire information systems
- Support forest fire fighting operations

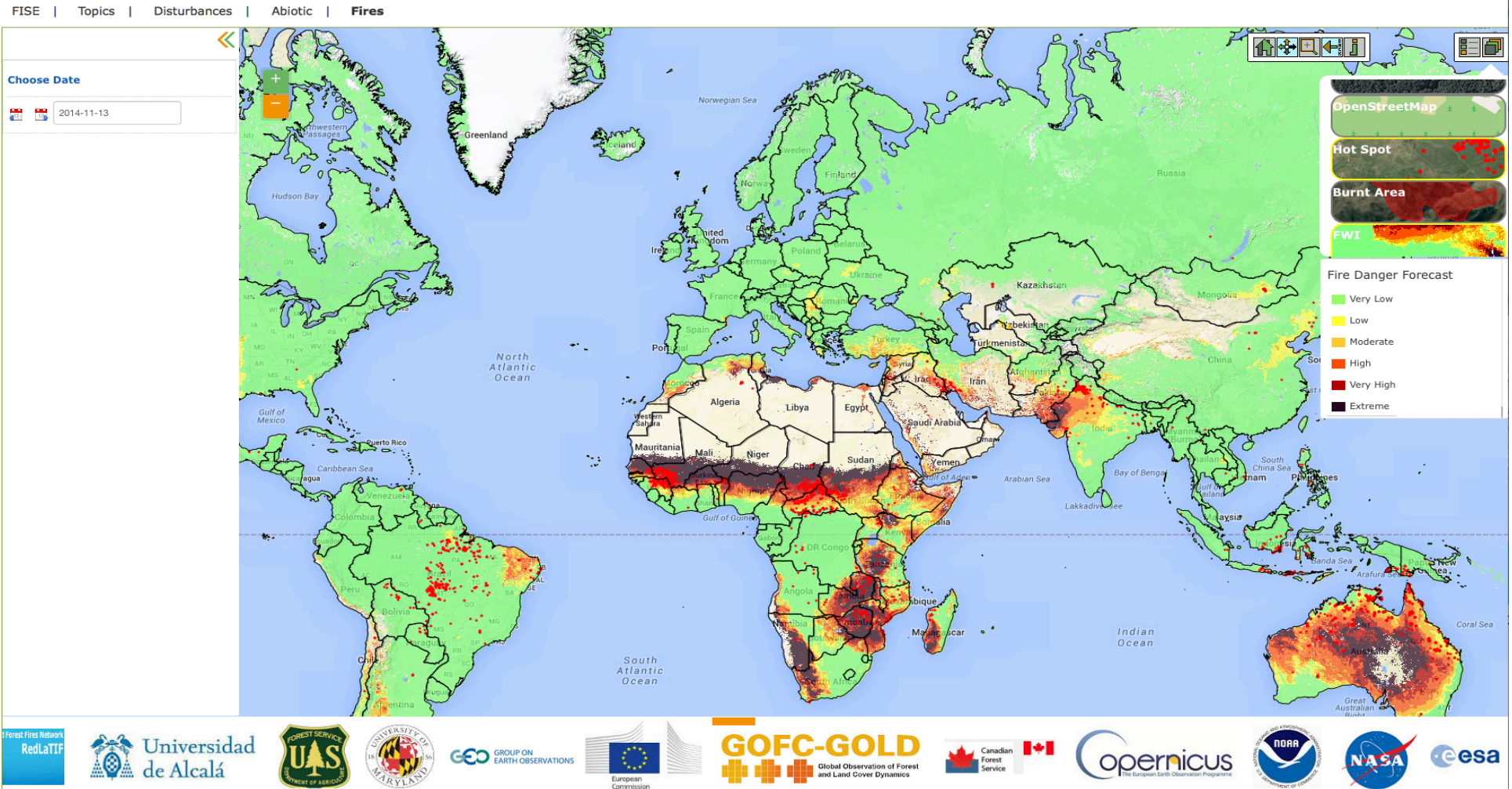
- ***Users***

- EC Services, European Parliament, national/regional forest fires and civil protection services of EU and non-EU countries, and EU citizens
- FAO, United Nations Economic Commission for Europe, FAO *Silva Mediterranea*

EFFIS network



Global Wildfire Information System



New development

A pilot activity is launched to assess the potential role of (un)manned aerial platforms as an alternative source of post-event imagery during emergency situations in a rapid response context:

- ★ To test their integration in the Copernicus EMS operations
- ★ To test assessment of deployment techniques and legislative aspects
- ★ To be used when VHR cannot provide the required output (e.g. Damage assessments over high value assets)

Integration of UAS in Copernicus Emergency Management Service (EMS)

- Pilot activities on role of (un) manned aerial platforms will be launched in 2015 in complement or alternative to satellite sensors during specific disasters
- Assessment of UAS deployment mechanisms and legislation and regulation will be addressed
- Integration of UAS in Copernicus EMS will be tested for potential scale-up after 2015

Contract specifics

- ★ Deliverables within 48 Hr after activation request (EU countries)
 - Raw data (picture + geotag) + camera details
 - UAV GPS track
 - Digital Surface Model
 - Fully Ortho rectified imagery
 - Post processing report
 - Ground Control Point information

- ★ Study report :
 - On the procedure to follow related to permit requests and regulations in EU Countries

The Copernicus Emergency Service

- ★ <http://www.copernicus.eu/>
- ★ <http://www.emergency.copernicus.eu>



Thank you for your attention

Francoise.Villette@ec.europa.eu

emergency.copernicus.eu

FB: CopernicusEU

Twitter: @Copernicus EU

