Copernicus Emergency Service

Bonn, 28 May 2015

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DG GROW, Copernicus Unit

Outline

★ Copernicus Space programme – what is it ?

★ The 6 services from Copernicus

★ The Emergency service

Copernicus in a nutshell

European Commission

- **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*

Copernicus current status

Five Milestones reached:

- Budget of **€ 4.3 Bn** for 2014-2020
- **Full, free and open access** to data
- Successful launch of **Sentinel 1A**
- Legal basis for the programme adopted
- First satellite images used for services

Space Segment

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

Sentinel-1A launched

European Commission

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

European Commission

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)

The 6 Copernicus Services

European Commission

Monitoring of earth systems

Land

Marine

Atmosphere

Security

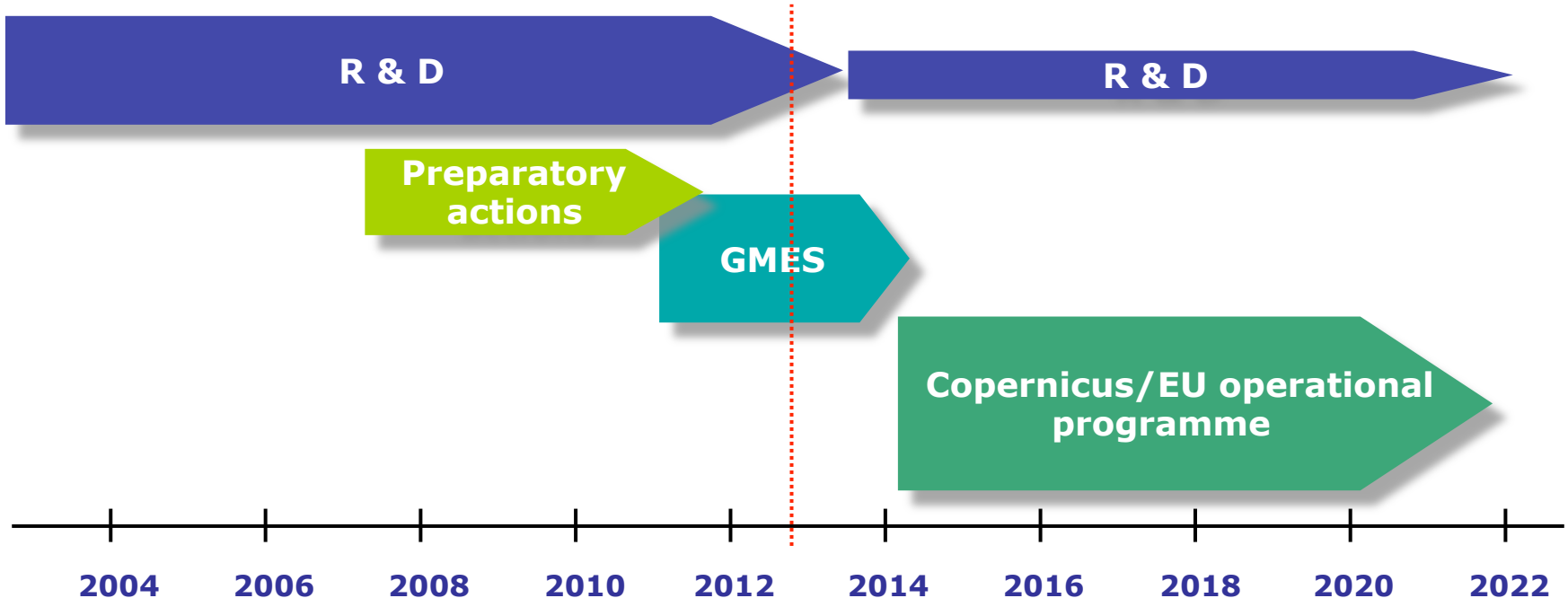
Emergency

Climate Change

Space

European Commission

Activities now transfer to operations



The Emergency Service

European Commission

Helping victims when disaster strikes

Space

Copernicus Europe's eyes on Earth

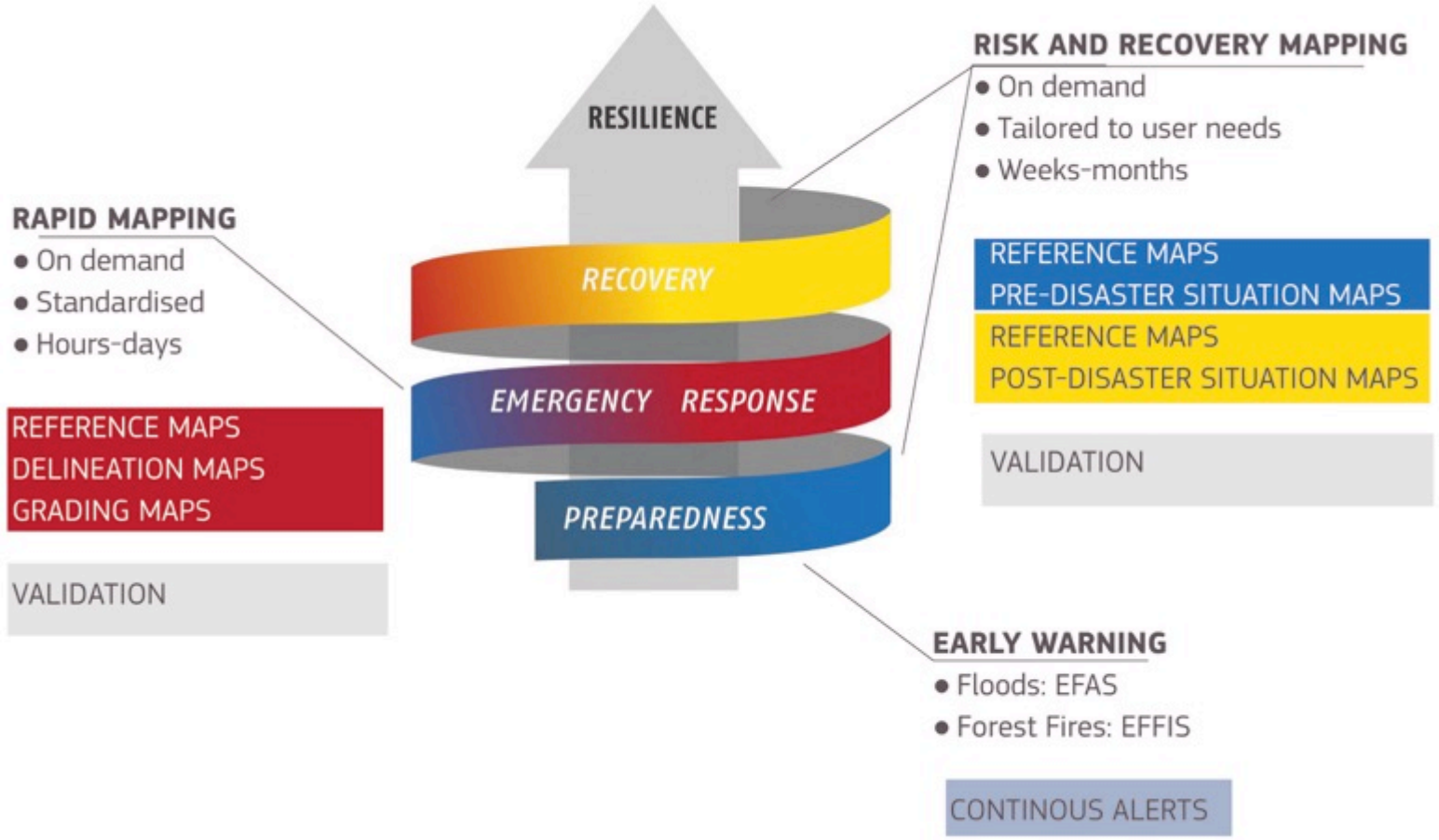
The Emergency Service

Space

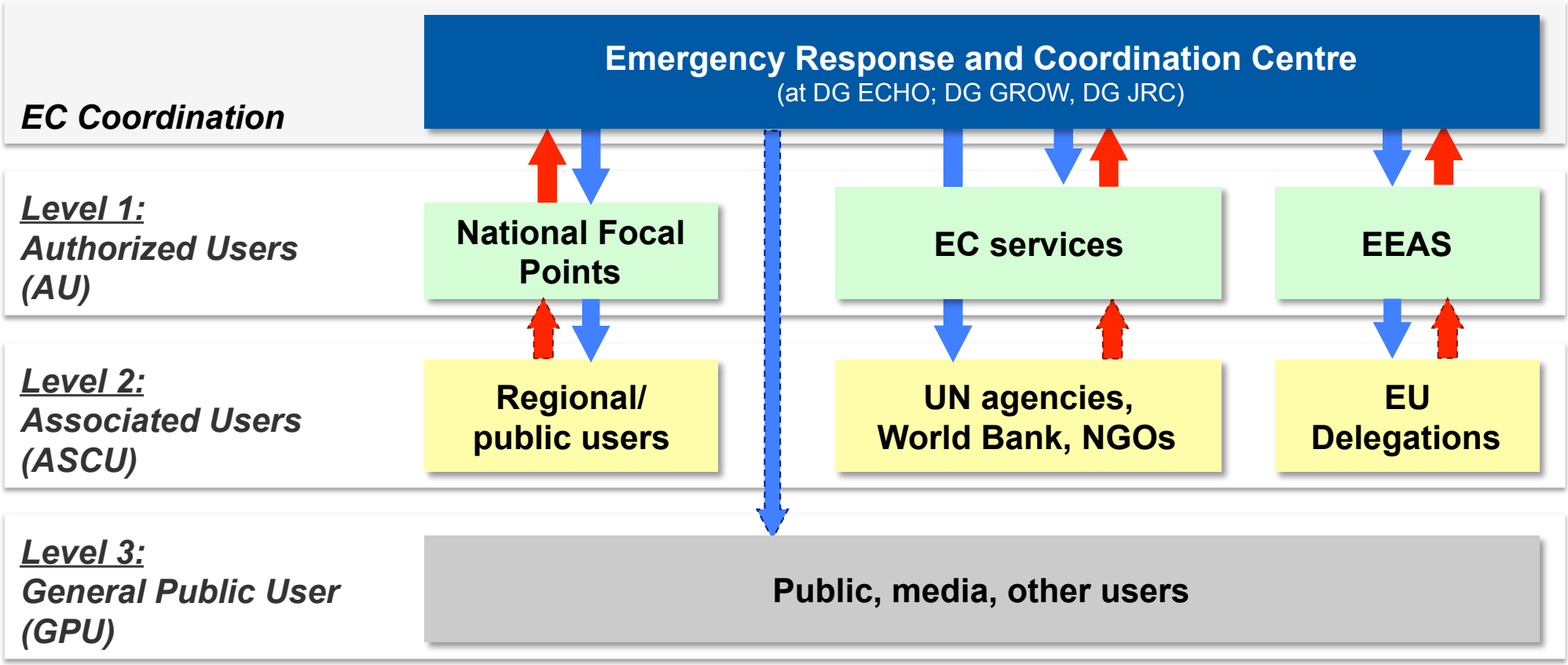
European Commission

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


RESILIENCE
RECOVERY
EMERGENCY RESPONSE
PREPAREDNESS
RAPID MAPPING
• On demand
• Standardised
• Hours-days
REFERENCE MAPS
DELINEATION MAPS
GRADING MAPS
VALIDATION
RISK AND RECOVERY MAPPING
• On demand
• Tailored to user needs
• Weeks-months
REFERENCE MAPS
PRE-DISASTER SITUATION MAPS
REFERENCE MAPS
POST-DISASTER SITUATION MAPS
VALIDATION
EARLY WARNING
• Floods: EFAS
• Forest Fires: EFFIS
CONTINOUS ALERTS

Copernicus EMS Mapping - Users



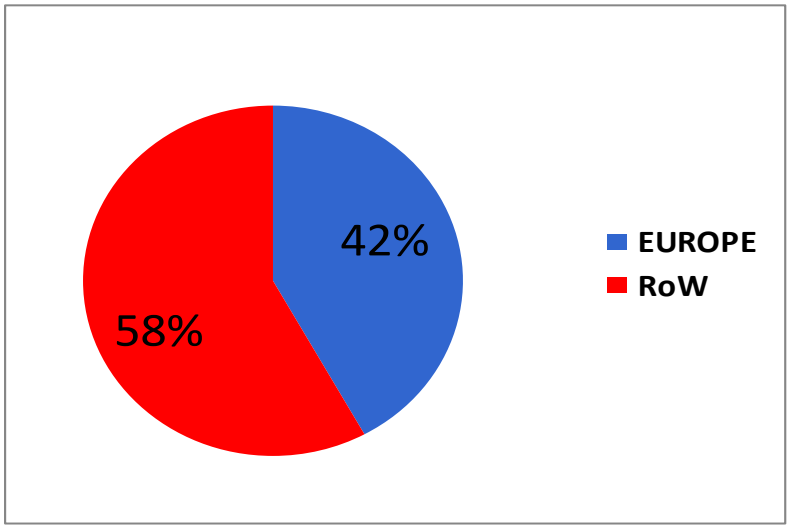
Emergency Management Service

European Commission

❑ How many activations?

135 in total since April 2012:

➔ 69 in Europe, 66 outside



❑ Which kind of disaster?

14 Fires, 76 Floods, 4 Earthquakes,

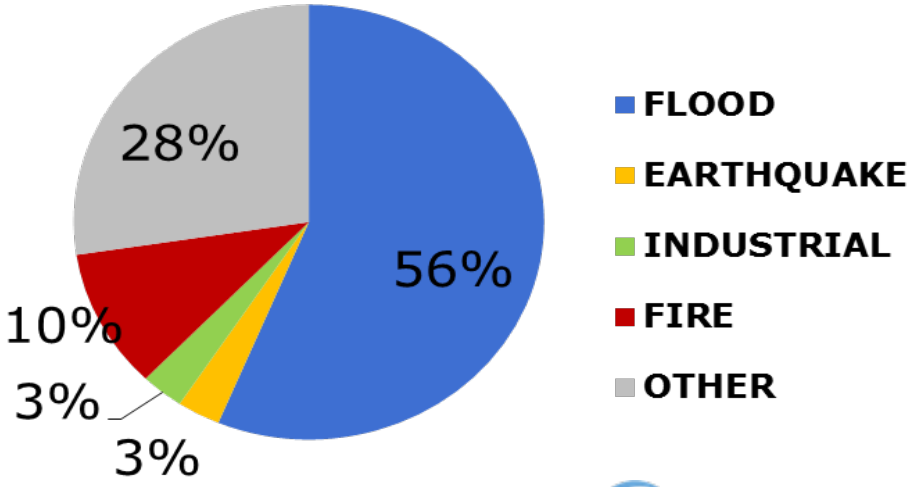
4 Industrial accidents, 37 Other

- **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**



Copernicus Europe's eyes on Earth

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

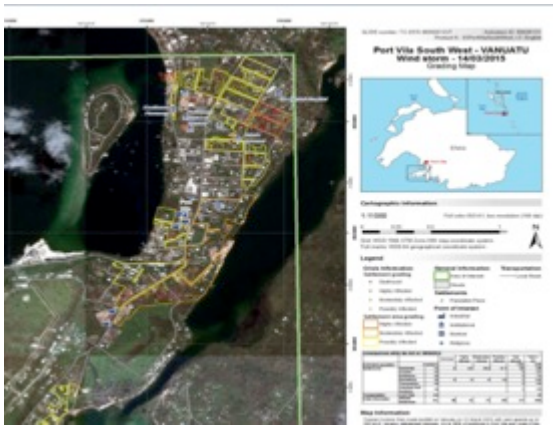
- ★ 24/7 service
- ★ Standardised products (map types)
- ★ Two production modes (service levels SL)

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**

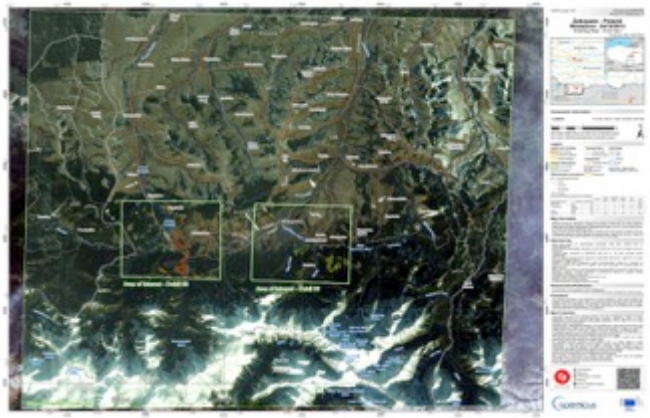
European Commission

Copernicus



Tropical Cyclone, Vanuatu

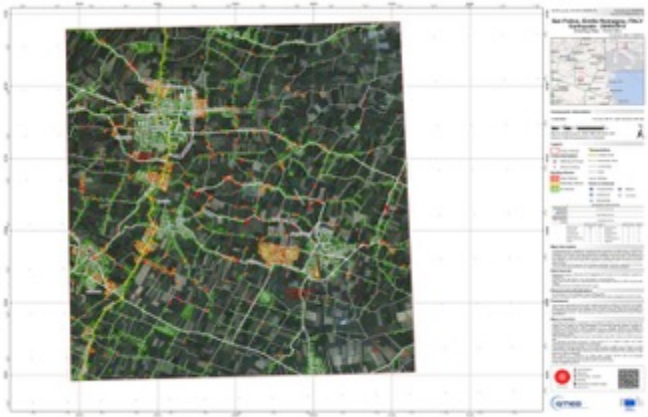
Ebola epidemic, Guinea



Wind storm, Zakopane, Republic of Poland

Refugee Camp, Al Mafraq Jordan

Floods, Ostlandet Norway



Earthquake, San Felice sul Panaro, Italy

European Commission

Timeline

EMS Rapid Mapping

Disaster

Activation of the service

~2h

Satellite tasking

Some hours to 30h

Satellite image delivery

≤12h*

Map delivery

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

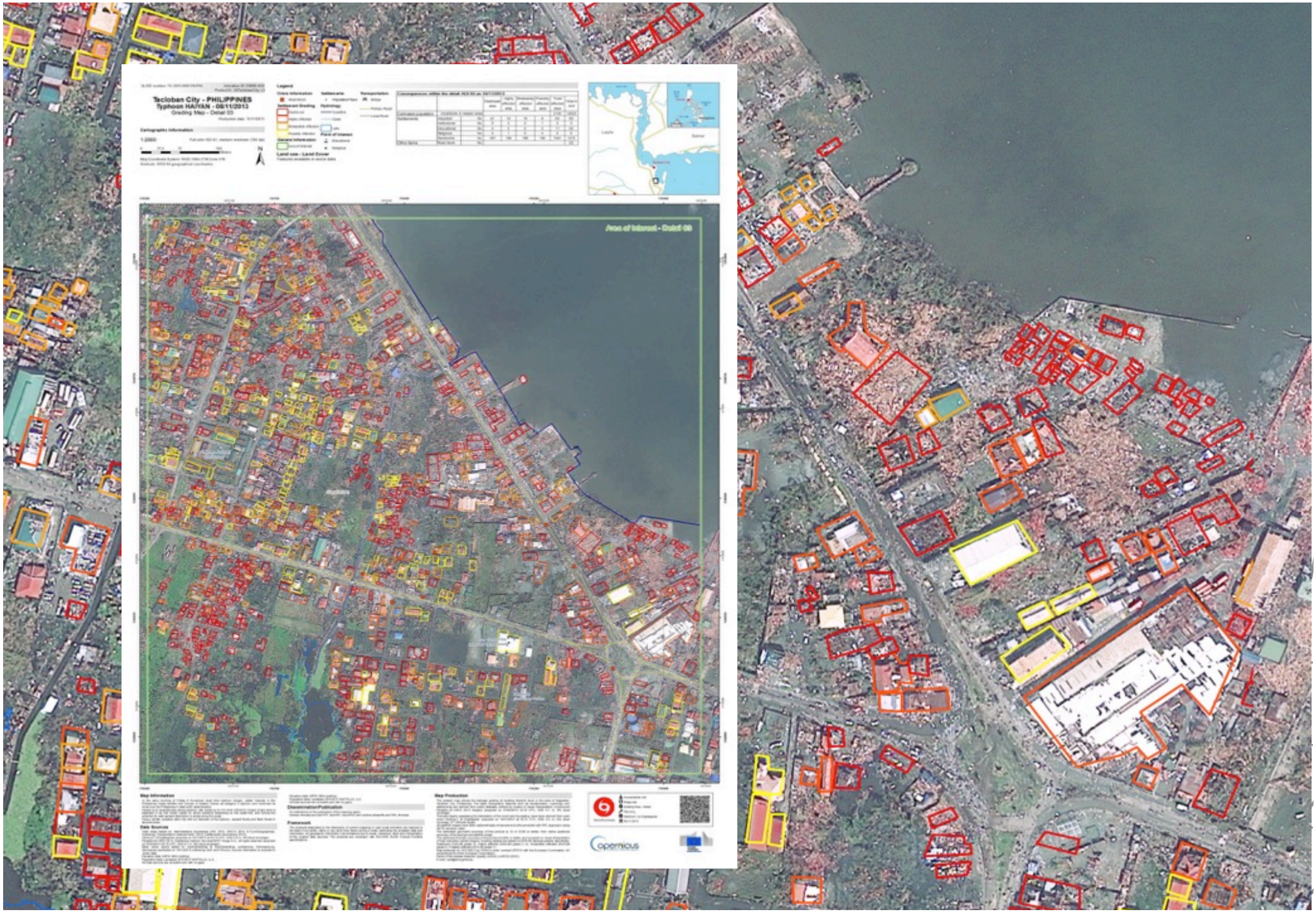
European Commission

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)

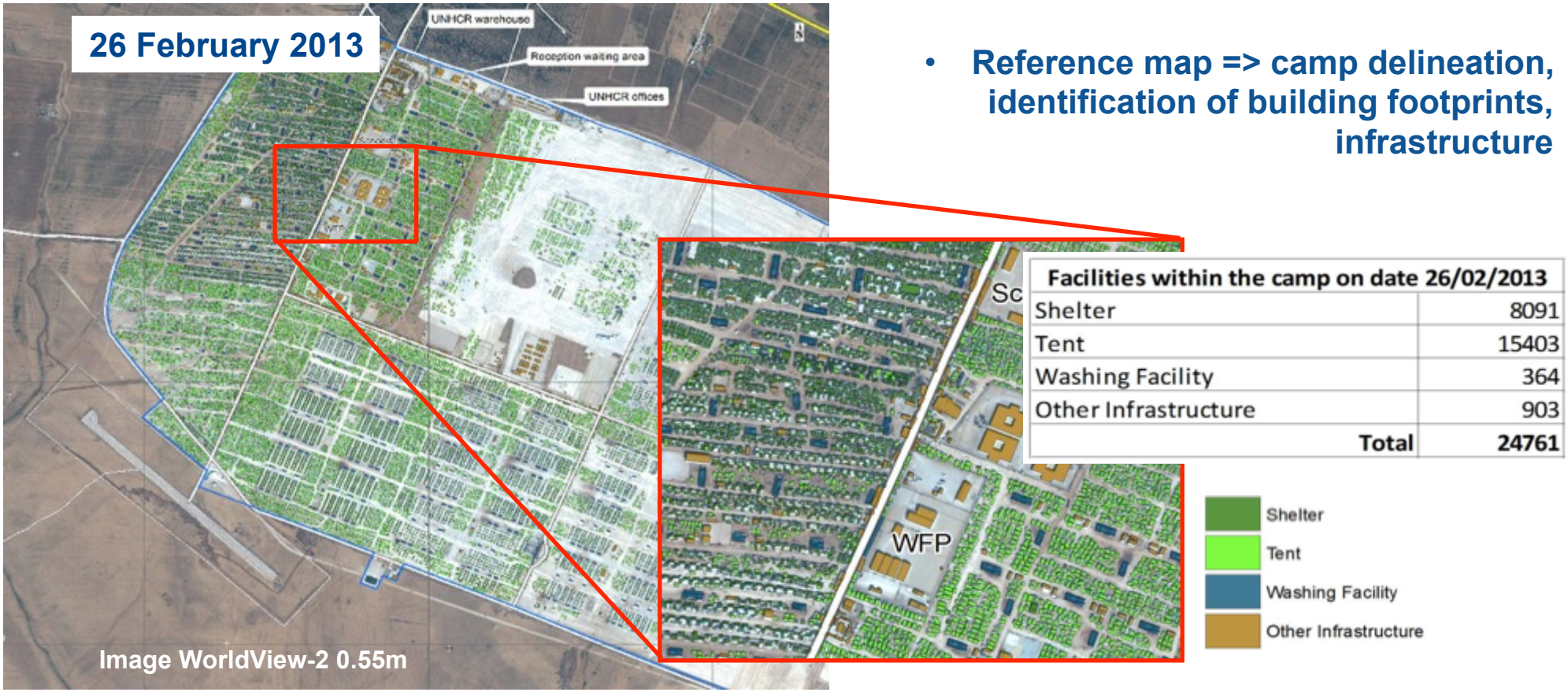
Total number of maps:

20 reference, 6 delineation, 13 grading maps


Tacloban City - PHILIPPINES
Typhoon HAIYAN - 08/11/2013
Grading Map - Detail 05
Area of Interest - Detail 05
Copernicus

Humanitarian Aid

IDP camp near Al Mafraq (Jordan)



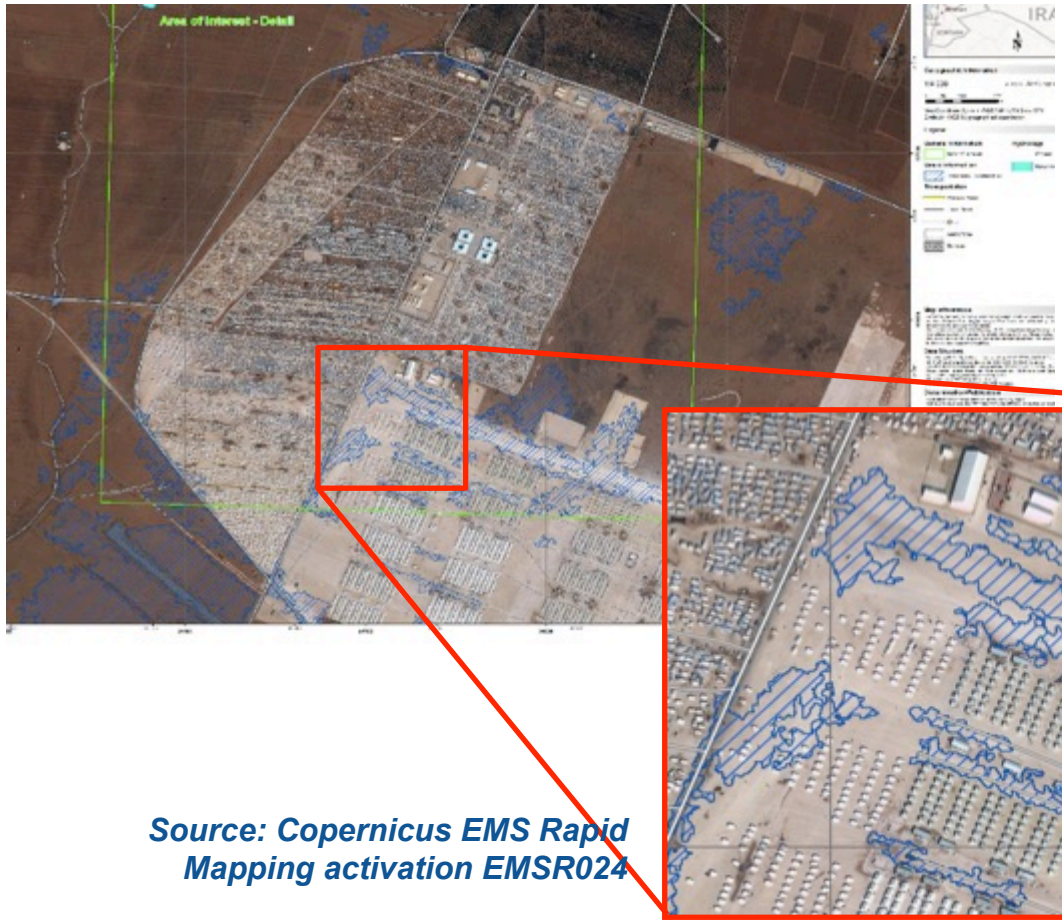
Facilities within the camp on date 26/02/2013	
Shelter	8091
Tent	15403
Washing Facility	364
Other Infrastructure	903
Total	**24761**

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

Source: Copernicus EMS Rapid Mapping activation EMSR025

Humanitarian Aid

IDP camp near Al Mafraq (Jordan)



- **Delineation of potentially flooded areas after extended periods of heavy rain in January 2013**
- **The map assisted the German Federal relief Agency (THW) in the planning of drainage works**

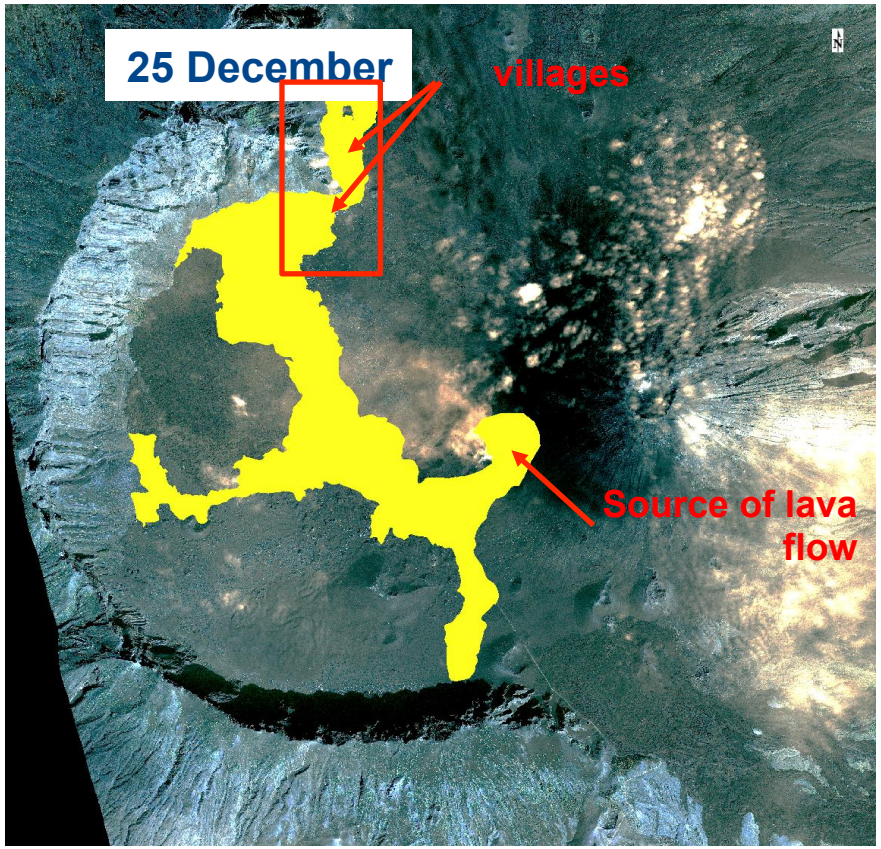
Crisis Information

Potentially Flooded Area

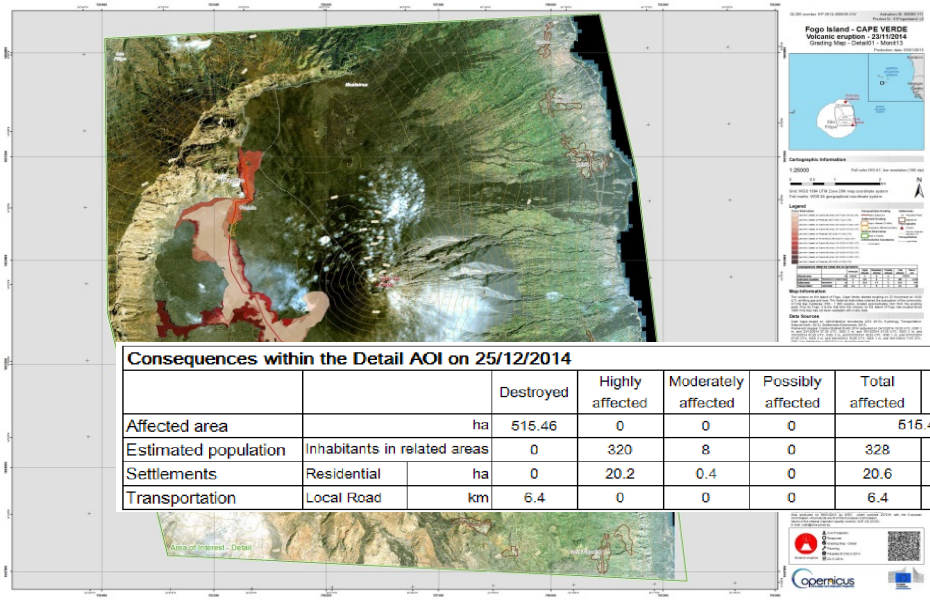
Source: Copernicus EMS Rapid Mapping activation EMSR024

Volcanic eruption

Fogo Island (Cape Verde), November-December 2014

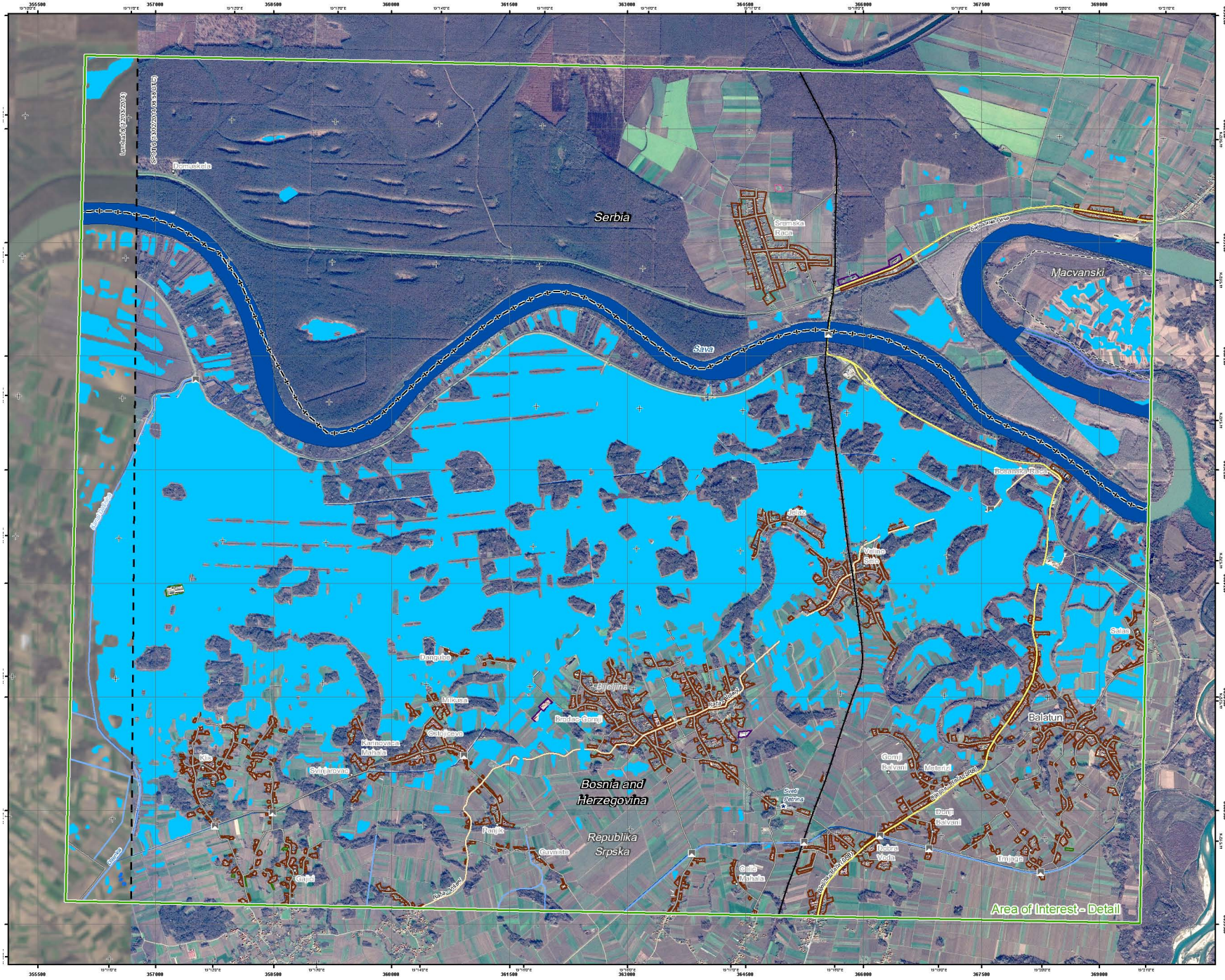


- Monitoring of the lava flow extent for one month mainly from Radar data
- Evacuation of two villages in the caldera



Consequences within the Detail AOI on 25/12/2014

			Destroyed	Highly affected	Moderately affected	Possibly affected	Total affected	Total in AOI
Affected area		ha	515.46	0	0	0	515.46	
Estimated population	Inhabitants in related areas		0	320	8	0	328	4 919
Settlements	Residential	ha	0	20.2	0.4	0	20.6	324
Transportation	Local Road	km	6.4	0	0	0	6.4	42

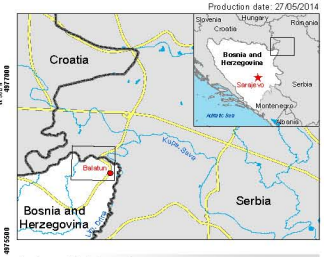


GLIDE number: FF-2014-000059-BIH

Activation ID: EMSR087
Product N.: 07Balatun, v1

Balatun - BOSNIA AND HERZEGOVINA
Flood - 13/05/2014
Delineation Map - Detail

Production date: 27/05/2014



Cartographic Information

1:22500

Full color ISO A1, low resolution (100 dpi)

0 0.5 1 2 km

N

Grid: WGS 1984 UTM Zone 34N map coordinate system
Tick marks: WGS 84 geographical coordinate system

Legend

Crisis Information
- Flooded Area 24/05/2014 16:31 UTC

General Information
- Area of Interest
- Sensor Footprint

Administrative boundaries
- International Boundary
- Region

Settlements
- Populated Places
- Residential
- Agricultural
- Cemetery
- Industrial
- Religious
- Transportation

Hydrology
- River
- Stream
- Canal
- River
- Lake
- Reservoir

Point of Interest
- Religious

Transportation
- Bridge
- Railway
- Primary Road
- Secondary Road
- Local Road

Consequences within the dated AOI on 24/05/2014

			Affected	Total in AOI
EMSR087 AOI01			ha	3022.1
Estimated population			inhabitants	1960	9143
Settlements	Residential	ha	1.1	472.9
	Agricultural	ha	0.7	3.7
	Cemetery	ha	0	0.8
	Industrial	ha	1.2	9.3
	Transportation	ha	0	4.4
	Religious	ha	0	0.5
Transportation	Primary roads	km	0.3	16.6
	Secondary roads	km	1.8	11.6
	Local Roads	km	7.6	96.6
	Railways	km	0	11.6
	Bridges	No.	1	13

Map Information

On 13 May 2014, heavy rainfalls and widespread flooding hit large parts of Bosnia and Herzegovina. Heavy rainfall continued to affect large parts, in particular the region of Doboj and Zenica. The core users of the maps are Disaster Response Authorities involved in operations

Data Sources

Inset maps based on: Administrative boundaries (JRC 2013, GISCO 2010, ©EuroGeographics), Hydrology, Transportation (Natural Earth, 2012, CCM River DB © EUJRC 2007), Settlements (Geonames, 2013).
Sentinel-1A (acquired on 24/05/2014 16:31 UTC, GSD 10 m) provided by the European Space Agency.
Pre-event SPOT6 © Airbus Defence and Space (acquired on 13/02/2014 08:58 UTC, GSD 2.6 m, 0% cloud coverage), all rights reserved, Landsat © U.S. Geological Survey (acquired on 12/03/2014, GSD 15 m, approx. 0% cloud coverage).
Base vector layers based on OpenStreetMap © OpenStreetMap contributors, GeoNames (approx.: 1:10.000, extracted on 21/05/2014), refined by ITHACA. Source information is included in vector data.
Population data: Landscan 2010 © UT BATTELLE, LLC.
Elevation data: EU-DEM (25 m posting). Height in meters above mean sea level.
All Data sources are complete and with no gaps.

Dissemination/Publication

No restrictions on the publication of the mapping apply.
Delivery formats are GeoTIFF, GeoPDF, GeoJPEG and vectors (shapefile and KML formats).

Framework

The products elaborated in the framework of current mapping in rush mode activation are realized to the best of our ability, within a very short time frame during a crisis, optimising the available data and information. All geographic information has limitations due to scale, resolution, date and interpretation of the original data sources. The products are compliant with GIO EMS RUSH Product Portfolio specifications.

Map Production

The present map shows the flood delineation in the area of Balatun (BOSNIA AND HERZEGOVINA).
The basic topographic features are derived from public datasets, refined by means of visual interpretation of pre-event orthoimagery from SPOT6 © Airbus Defence and Space (acquired on 13/02/2014 08:58 UTC, GSD 2.6 m, 0% cloud coverage).
Thematic layers, assessing the delineation of the event have been derived from post-event image Sentinel-1A (acquired on 24/05/2014 16:31 UTC, GSD 10 m) provided by the European Space Agency.
All satellite images have been radiometrically enhanced and coregistered to the pre-event image.
The estimated geometric accuracy of this product is 6.6 m CE90 or better, from native positional accuracy of the background satellite image.
The estimated thematic accuracy of this product is 85% or better, based on previous experience in using high-resolution SAR for flood extent delineation. Please be aware that the thematic accuracy might be lower in urban and forested areas due to known limitations of the analysis technique.
Map produced on 27/05/2014 by ITHACA under contract 257219 with the European Commission. All products are © of the European Commission.
Name of the release inspector (quality control): OAF AG (ODO).
E-mail: rush@ems.gmes.eu

Map products available at http://emergency.copernicus.eu/mapping/list-of-components/EMSR087

Civil Protection
Response
Delineation Map - Detail
Planning
Sentinel-1A (c) European Space Agency
13-05-2014

Flood

Copernicus
The European Earth Observation Programme

European Commission

Workflow


Satellite imagery
European Response Coordination Centre
Map production
National civil protection
CRISIS
H24
Focal Point
Services providers
Map delivery
Web Gateway
End-users
Earthquakes & Volcanoes
Floods
Landslides
Fires
National Civil Protection
Humanitarian Aid
Reference maps
Thematic products

Copernicus Emergency Management Service

Which contribution can Risk and 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.** • 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** • 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** • 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

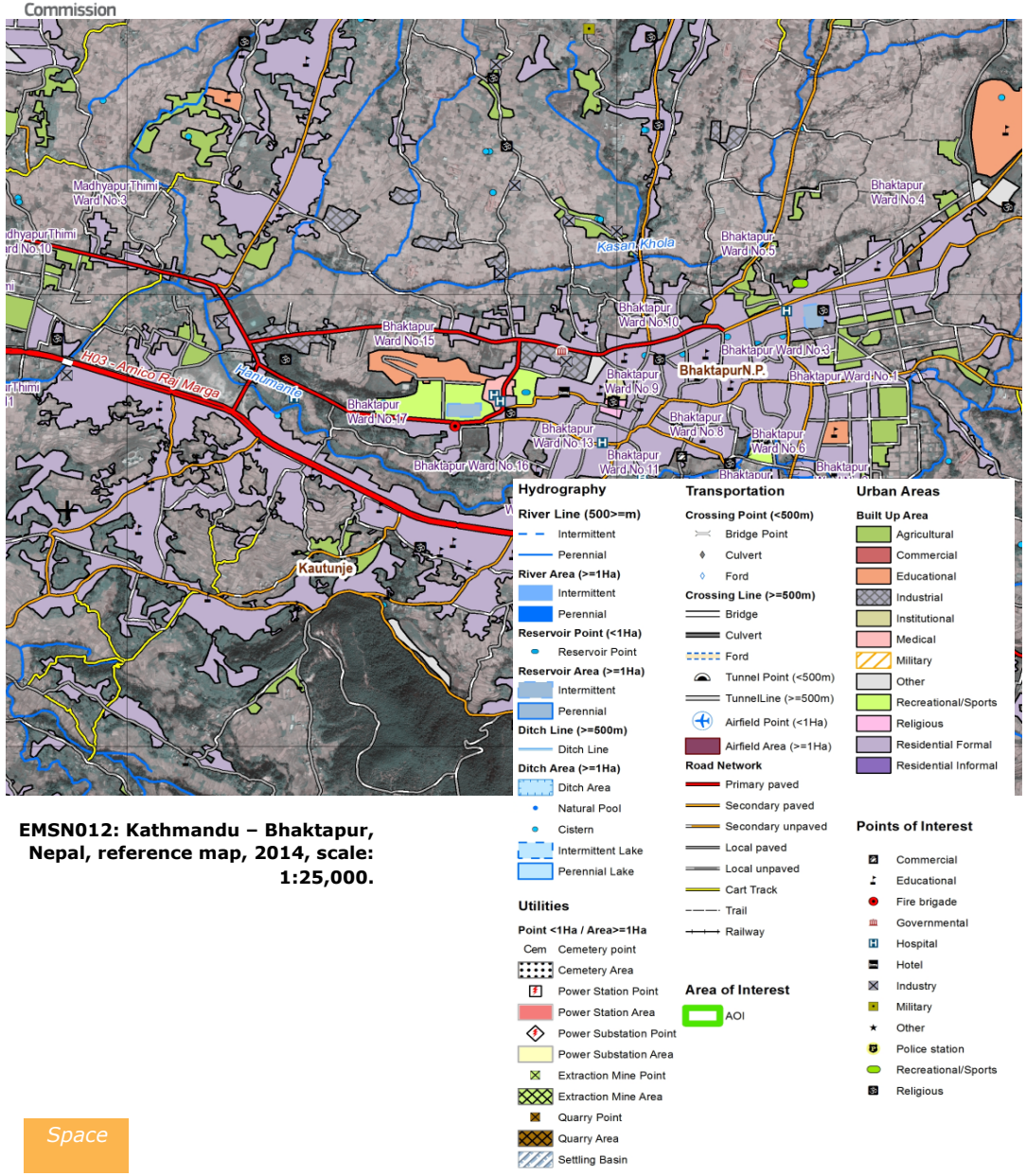
European Commission

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)

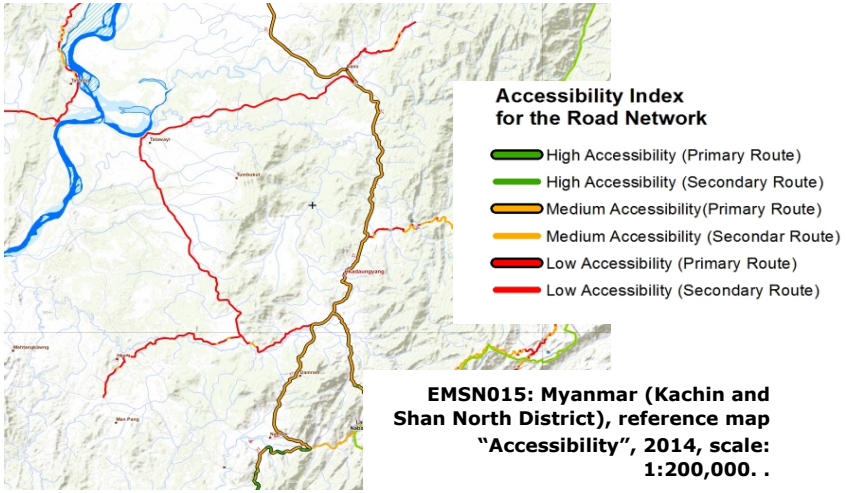
Hydrology	Transport	Population-related (incl. Industry & Utilities)	Land cover & Physiography
Rivers Canals Lakes Reservoirs Open Water Shorelines Dams Wells Ponds	Railways Roads Cart tracks Bridges River crossing points Airfields Runways Ports	Toponyms Administrative boundaries Built-up areas Settlements 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



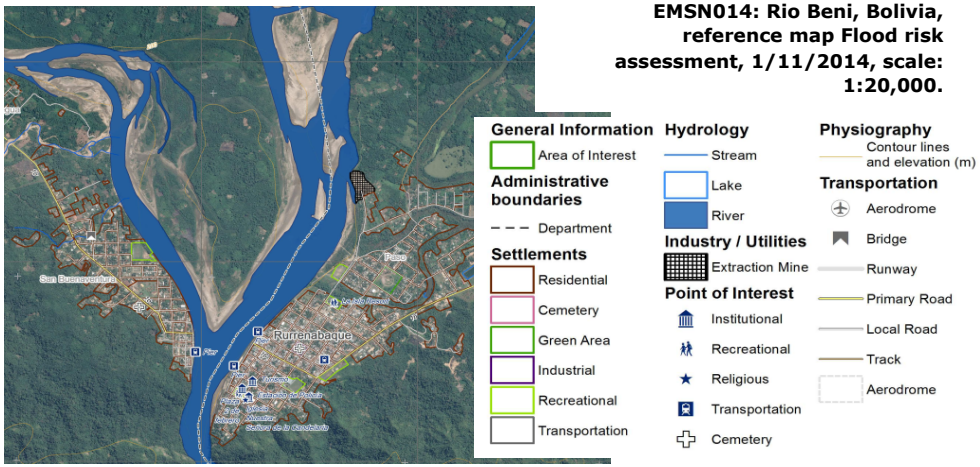
EMSN012: Kathmandu – Bhaktapur, Nepal, reference map, 2014, scale: 1:25,000.

Space

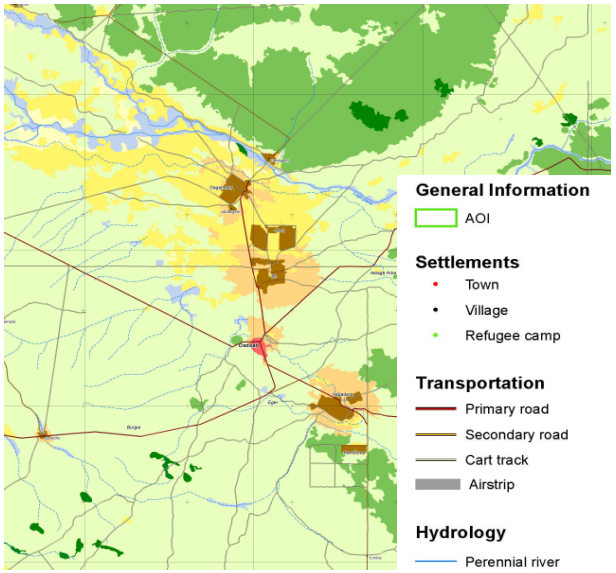
Reference map examples



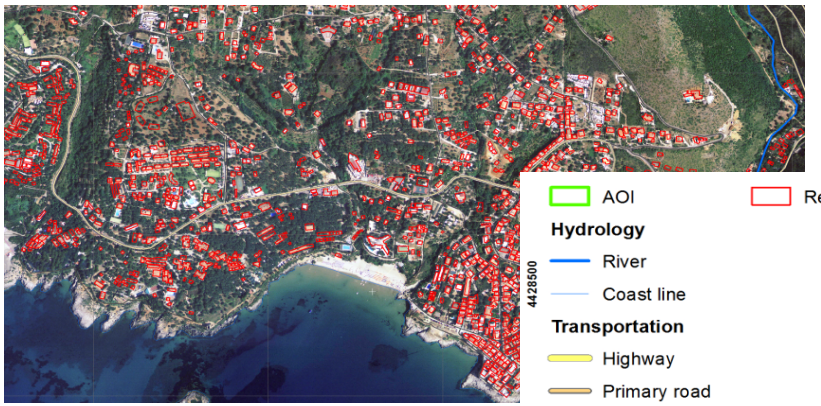
EMSN015: Myanmar (Kachin and Shan North District), reference map "Accessibility", 2014, scale: 1:200,000. .



EMSN014: Rio Beni, Bolivia, reference map Flood risk assessment, 1/11/2014, scale: 1:20,000.



EMSN011: Dadaab, Kenyia, reference map , including land use land cover, 2014, scale: 1:150,000. .



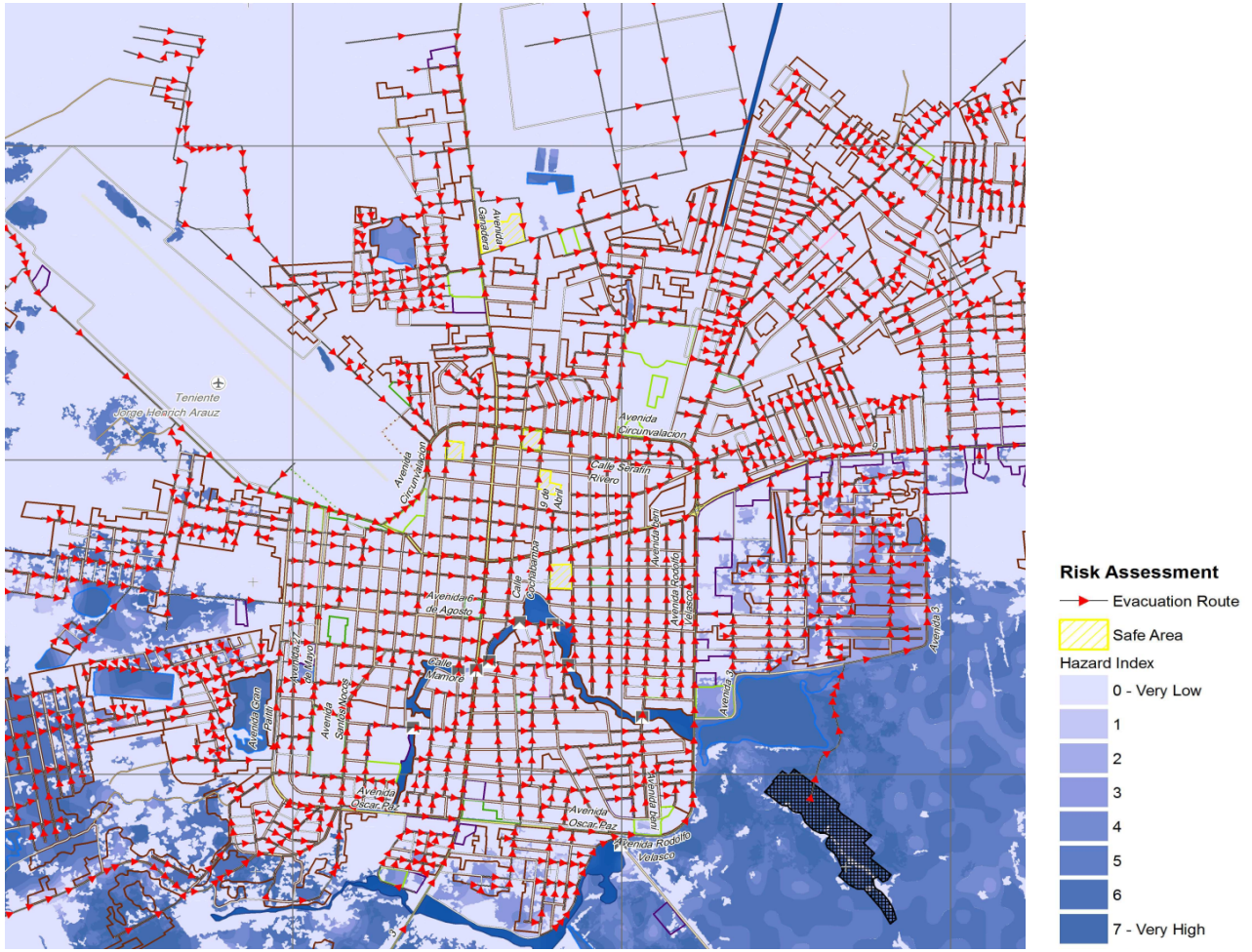
EMSN008: Marina di Camerota, Salerno, Italy, reference map for Tsunami risk (TWIST), 2013, scale: 1:7,000. .

Pre-disaster maps

European Commission

★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



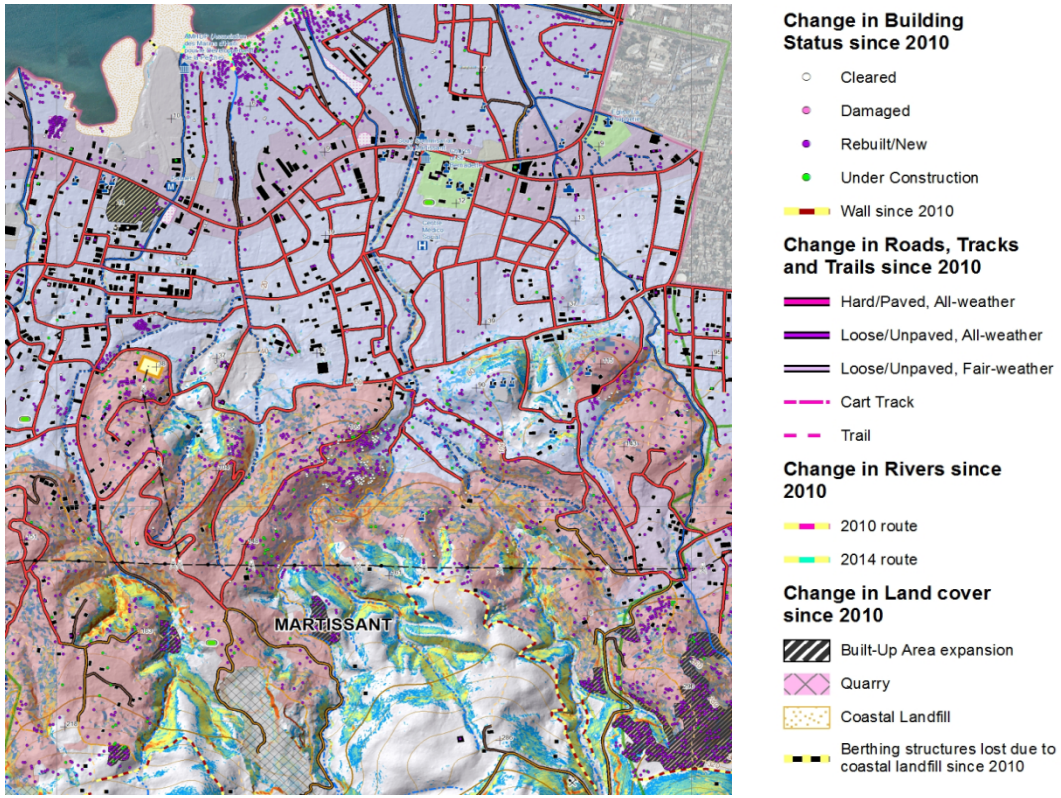
EMSN014: Rio Mamore, Trinidad, Bolivia, Flood risk asessment, 1/11/2014, scale: 1:20,000.

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

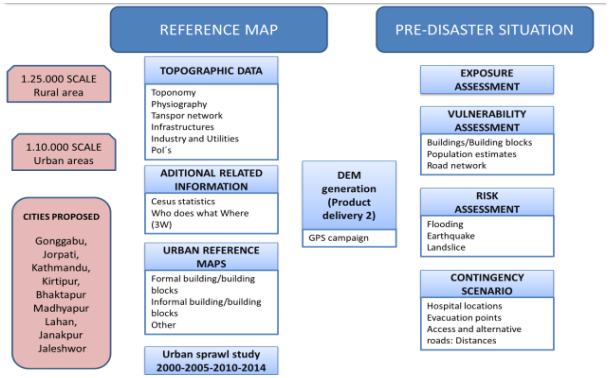
Examples:
Hazard exposure and vulnerability and risk status of (in particular) new assets.
Post-disaster needs assessment, recovery plans, reconstruction/rehabilitation monitoring



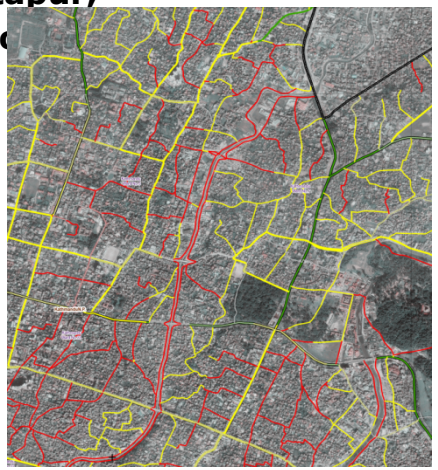
EMSN013: Martissant/Carrefour Feuilles/Baillergeau, Haiti, Reference Map Thematic Change 2010 - 2014, scale: 1:10,000.

European

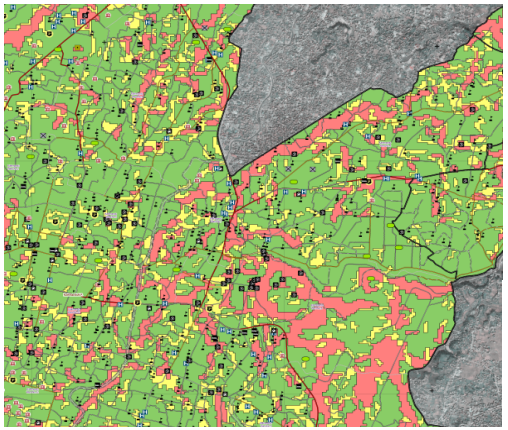
Example - EMSN012: Preparedness, disaster risk assessment and disaster risk reduction covering districts of: Kathmandu/Bhaktapur, Dhanusa, Siraha and Mah



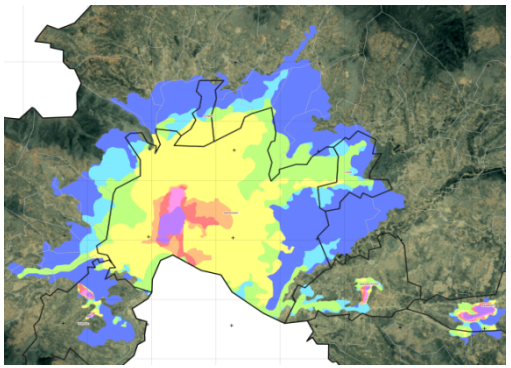
EMSN012: Kathmandu – Bhaktabpur, Nepal. Overview of generated products. Next to a map set of reference maps, several pre-disaster map sets have been created, covering exposure, vulnerability and risk assessment including a contingency scenario. In addition a DEM has been derived.



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



EMSN012: Kathmandu – Bhaktabpur, 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 – Bhaktabpur, 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

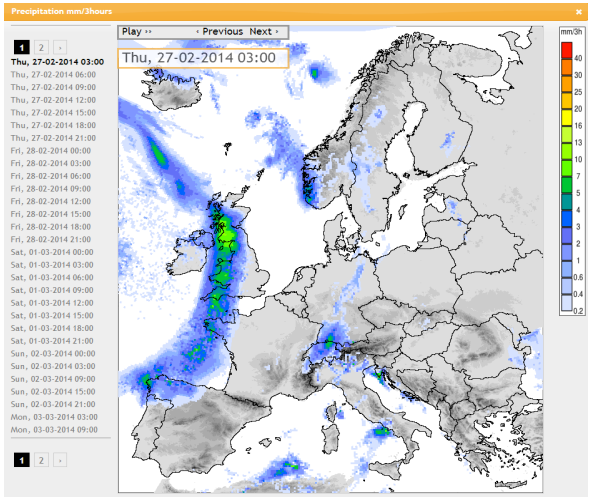
Space

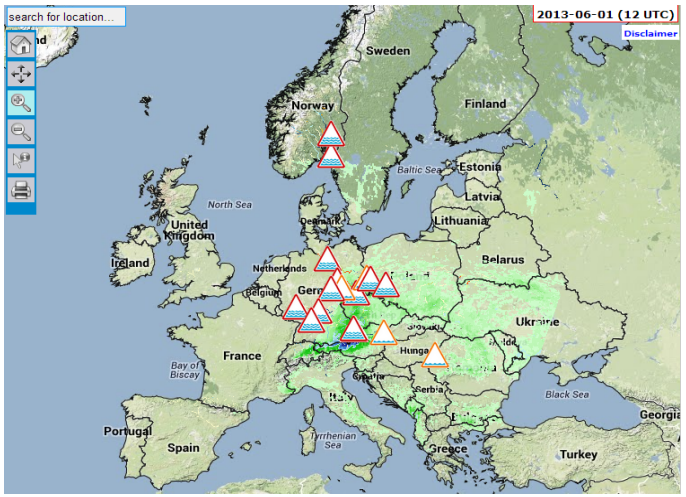
European Flood Awareness System (EFAS), the early warning system for floods

★ 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)**

EFAS

European Commission

Balkan Floods May 2014: EFAS performance

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

EFAS Flood/Watch/Flash Flood Watch issued

ERCC Activation

EFAS General rule:
EFAS alerts are send 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**
- **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**

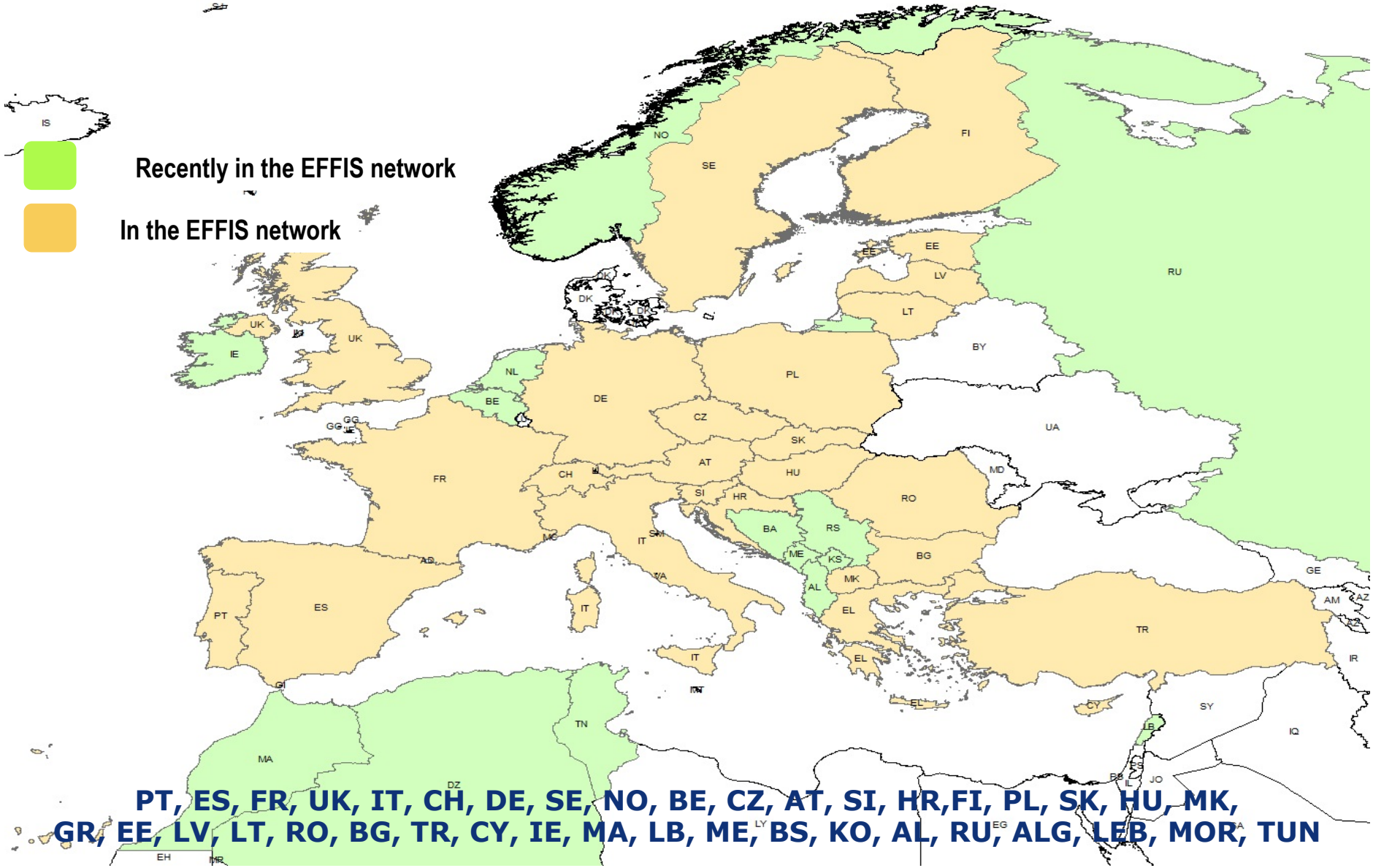
Space

Copernicus Europe's eyes on Earth

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



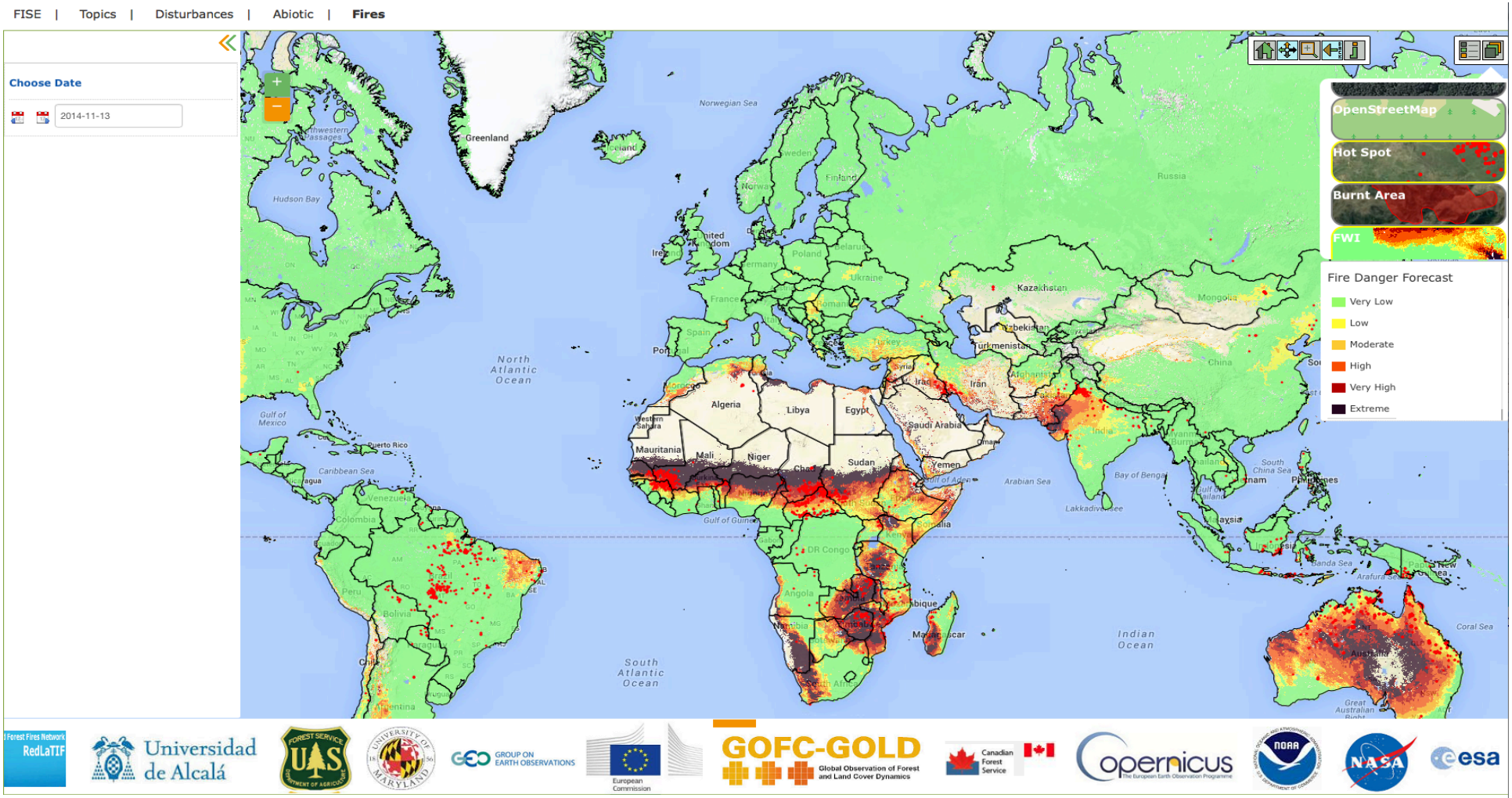
PT, ES, FR, UK, IT, CH, DE, SE, NO, BE, CZ, AT, SI, HR,FI, PL, SK, HU, MK, GR, EE, LV, LT, RO, BG, TR, CY, IE, MA, LB, ME, BS, KO, AL, RU, ALG, LEB, MOR, TUN

GWIS

European Commission

EFFIS → to global scale

Global Wildfire Information System



RedLaTIF | Universidad de Alcalá | Forest Service USA | University of Maryland | GEO Group on Earth Observations | European Commission | GOFC-GOLD Global Observation of Forest and Land Cover Dynamics | Canadian Forest Service | Copernicus | NOAA | NASA | esa

Space

Copernicus Europe's eyes on Earth

European Commission

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
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