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
"The Union Earth observation and monitoring programme"

Objectives

- Monitor the environment
- Foster downstream applications in a number of fields
- Help managing emergency and security related situations
- Facilitate adaptation to climate change
- Improve environmental policy effectiveness
- Increase general knowledge on the state of the Planet
- Protect people and assets
Activities now transfer from research to operations

R & D

Preparatory actions

GMES

Dedicated Sentinels

Copernicus operational programme

Operational services


Copernicus Timeline
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
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)

• 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
Sentinel-1A launched

Launch from Europe’s Spaceport in Kourou, French Guiana, on 3 April 2014
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
The 6 Copernicus Services

Monitoring of earth systems

Land

Marine

Atmosphere

Security

Emergency

Climate Change
Helping victims when disaster strikes
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
The Emergency Service

RARID 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
- POST-DISASTER SITUATION MAPS

VALIDATION

EARLY WARNING
- Floods: EFAS
- Forest Fires: EFFIS

CONTINUOUS ALERTS
Emergency Management Service (EMS) has two components:

- **Mapping**
  - Rapid Mapping
  - Risk & Recovery

- **Early Warning**
  - EFAS (floods)
  - EFFIS (forest fires)
Copernicus EMS Mapping - Users

**EC Coordination**

- **Level 1:** Authorised Users (AU)
  - National Focal Points
  - EC services
  - EEAS External service

- **Level 2:** Associated Users (ASCU)
  - Regional/public users
  - UN agencies, World Bank, NGOs
  - EU Delegations

- **Level 3:** General Public User (GPU)
  - Public, media, other users

**Emergency Response and Coordination Centre**
(at DG ECHO; DG GROW, DG JRC)

**Trigger, Inform**
EMS Mapping

- **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

Providing support to emergency response services

Situation maps, reference information

Flood and forest fire risk forecasts
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)**

<table>
<thead>
<tr>
<th>MAP TYPE</th>
<th>CONTENT</th>
<th>DELIVERY TIME*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SL1</td>
</tr>
<tr>
<td>Reference</td>
<td><strong>Detailed status of the territory &amp; assets prior to the crisis</strong>&lt;br&gt;e.g. Topographic features &amp; specific information</td>
<td>9h</td>
</tr>
<tr>
<td>Delineation</td>
<td><strong>Assessment of the event’s extent</strong>&lt;br&gt;e.g. delineation of burnt area, delineation of flooded area, earthquake impact area; estimations on the exposed or affected population and assets</td>
<td>12h</td>
</tr>
<tr>
<td>Grading</td>
<td><strong>Assessment of the damage grade &amp; its spatial distribution</strong>&lt;br&gt;e.g. for any disaster event, location of destroyed/damaged buildings and assets, and damage grading (possibly-moderately-highly affected-destroyed)</td>
<td>12h</td>
</tr>
</tbody>
</table>

* after satellite image delivery
Disaster

Activation of the service

Some hours to 30h

~2h

Satellite tasking

≤12h*

Satellite image delivery

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

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 Mafraq (Jordan)

26 February 2013

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

Facilities within the camp on date 26/02/2013

<table>
<thead>
<tr>
<th>Facility</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelter</td>
<td>8091</td>
</tr>
<tr>
<td>Tent</td>
<td>15403</td>
</tr>
<tr>
<td>Washing Facility</td>
<td>364</td>
</tr>
<tr>
<td>Other Infrastructure</td>
<td>903</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24761</strong></td>
</tr>
</tbody>
</table>

Source: Copernicus EMS Rapid Mapping
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

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
Workflow

Satellite imagery

National civil protection

European Response Coordination Centre

Map production

Map delivery

CRISIS
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)

<table>
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<tr>
<th>MAP TYPE</th>
<th>CONTENT</th>
<th>DELIV. TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCE</td>
<td>Detailed status of the territory and assets.</td>
<td>20d(#)</td>
</tr>
<tr>
<td></td>
<td>• E.g. Topographic features and specific information, e.g. land use zoning plans, mitigation measures</td>
<td></td>
</tr>
<tr>
<td>PRE - DISASTER</td>
<td>Relevant info to help planning for contingencies on vulnerable areas</td>
<td>20d(#)</td>
</tr>
<tr>
<td></td>
<td>• E.g. Hazard exposure to hazardous events; Vulnerability / resilience of settlements and buildings; Risk status for population and assets; Evacuation plans; Forecasts; Alerts</td>
<td></td>
</tr>
<tr>
<td>POST - DISASTER</td>
<td>Relevant thematic information, beyond the immediate response phase</td>
<td>20d(#)</td>
</tr>
<tr>
<td></td>
<td>• 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).</td>
<td></td>
</tr>
</tbody>
</table>

(#) 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)

<table>
<thead>
<tr>
<th>Hydrology</th>
<th>Transport</th>
<th>Population-related (incl. Industry &amp; Utilities)</th>
<th>Land cover &amp; Physiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers</td>
<td>Railways</td>
<td>Toponyms Administrative boundaries</td>
<td>Woodland Natural vegetation</td>
</tr>
<tr>
<td>Canals</td>
<td>Roads</td>
<td>Built-up areas Setlements Processing / industrial plants</td>
<td>Cropland Grassland</td>
</tr>
<tr>
<td>Reservoirs</td>
<td>Cart tracks</td>
<td>Bridges</td>
<td>Scrub</td>
</tr>
<tr>
<td>Open Water</td>
<td>River crossing points</td>
<td>Airfields Power lines Pipelines</td>
<td>Bare soil Snow/Ice</td>
</tr>
<tr>
<td>Shoreslines</td>
<td>Runways</td>
<td>Ports</td>
<td>Floodplains</td>
</tr>
<tr>
<td>Dams</td>
<td>Ports</td>
<td></td>
<td>Void Areas</td>
</tr>
<tr>
<td>Wells</td>
<td></td>
<td></td>
<td>Contours, spot heights</td>
</tr>
<tr>
<td>Ponds</td>
<td></td>
<td></td>
<td>Cliffs</td>
</tr>
</tbody>
</table>

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

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.

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. 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 – Bhaktapur, Nepal. Urban Sprawl. This map shows the urban sprawl of Kathmandu, Bhaktapur, Kirtipur, Madhyapur Thimi, Jorpati and Gonggam 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](http://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
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*
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

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