



PROGRAMME OF  
THE EUROPEAN UNION



# The Copernicus **Emergency** **Management** Service



Implemented by



## Contact information

Copernicus Emergency Management Service  
European Commission, Joint Research Centre (JRC)  
JRC.E.1 – Disaster Risk Management Unit  
Via E. Fermi 2749, I-21027 Ispra (VA), Italy  
EU-COPERNICUS-EMERGENCY@ec.europa.eu

## Copernicus Emergency Management Service

<https://emergency.copernicus.eu/>

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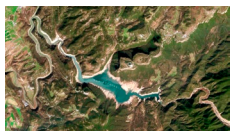
**Copernicus Emergency  
Management Service**

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# Contents



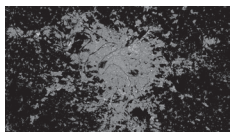
The Copernicus <b>Emergency Management Service</b>	3
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<b>1. CEMS Early warning and monitoring</b>	
The European and Global <b>Drought Observatories</b> (EDO and GDO)	10
The European <b>Forest Fire</b> Information System (EFFIS)	14
The European and Global <b>Flood Awareness</b> System (EFAS and GloFAS)	18



<b>2. CEMS On-demand mapping</b>	22
----------------------------------	----



<b>3. CEMS Exposure mapping</b>	26
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*Dry land at the La Viñuela reservoir, Spain, August 2022.*

# The Copernicus **Emergency Management Service**

The Copernicus Emergency Management Service, also known as CEMS, is one of the six services of Copernicus, the Earth Observation component of the EU Space Programme.



CEMS integrates satellite data, in situ observations, models, and aerial data to support disaster risk management for natural and man-made hazards.

## Copernicus at a glance

Copernicus is the Earth Observation component of the European Union's Space Programme. It monitors the Earth using its own dedicated constellation of satellites – the Sentinels – complemented by other satellites provided by Member States and third parties, as well as a range of non-space ('in situ') data sources. Copernicus offers six services: Emergency Management, Atmosphere Monitoring, Marine Environment Monitoring, Land Monitoring, Climate Change, and Security.



[www.copernicus.eu](http://www.copernicus.eu)  
**Copernicus:**  
Europe's eye on Earth

# “The goal is to save lives and protect assets and the environment

”

Since 2012, CEMS has been supporting all phases of disaster management by providing early warnings for floods, wildfires and droughts, monitoring ongoing disasters, providing timely emergency response information, and assisting with recovery efforts and the development of risk reduction strategies.

The service operates 24/7 and is accessible to EU Members States and the global community.

CEMS is implemented by the Joint Research Centre, the European Commission's science and knowledge service.



*Floods in Rochefort, Belgium, July 2021.*

## **Protecting lives, assets, and the environment**

The European Commission provides information and support to actors involved in relief aid, disaster and risk management, and emergency response activities.

Through CEMS, users have free and open access to the extensive amount of immediate and historical datasets from the Copernicus Programme, as well as information from our partner agencies. Emergency management professionals integrate these data into their preparedness, response, and recovery activities.



*Earthquake in Türkiye and Syria, February 2023.*





*CEMS supports actors dealing with natural hazards, man-made emergency situations, and humanitarian crises, as well as those involved in preparedness and recovery activities. The service improves people's safety and helps prevent loss of lives and assets, and damages to ecosystems before, during, and after disasters by providing crucial information about, for example, the extent of a flooded area, the spread of a forest fire, the damage caused by an earthquake, the type of and magnitude of risks, and the progress of recovery and reconstruction efforts.*

# The three CEMS components



## 1

### Early warning and monitoring

The **CEMS early warning and monitoring** component provides early warning, risk and impact assessment, and monitoring of specific natural hazards. Currently, it addresses forest fires, droughts, and floods at European and global level. It includes three thematic areas:

- ▶ The European and Global Drought Observatories (EDO and GDO).
- ▶ The European Forest Fire Information System (EFFIS).
- ▶ The European and Global Flood Awareness Systems (EFAS and GloFAS) and the Global Flood Monitoring (GFM). product.



2

On-demand  
mapping



3

Exposure  
mapping



2

On-demand  
mapping

The **CEMS on-demand mapping** component provides a wealth of mapping products for emergencies resulting from natural or man-made disasters through its activation services. It supports all phases of the disaster management cycle, from preparedness (or pre-event), to emergency response and recovery (post-event).

3

Exposure  
mapping

The **CEMS exposure mapping component** provides information derived from satellite and census data on the presence of settlements and population using the Global Human Settlements Layer (GHSL). The data from this component are used in the On-demand mapping and Early warning and monitoring products.

# 1. CEMS Early warning and monitoring

The European and Global Drought Observatories (EDO and GDO) provide drought forecasting and monitoring maps, analysis tools and periodical reports.



*Sau Reservoir, Spain,  
January 2024.*

## What is a drought?

Drought is a climate extreme characterised by persistent unusual dry weather conditions affecting the hydrological balance.

Drought is different from aridity, a long-term climatic feature, and from water scarcity, a situation where the available water resources are insufficient to satisfy water demand.

# The European and Global Drought Observatories (EDO and GDO)



The Observatories compute, forecast and monitor key drought indicators, based on a combination of satellite observations, hydro-meteorological models and in-situ data:

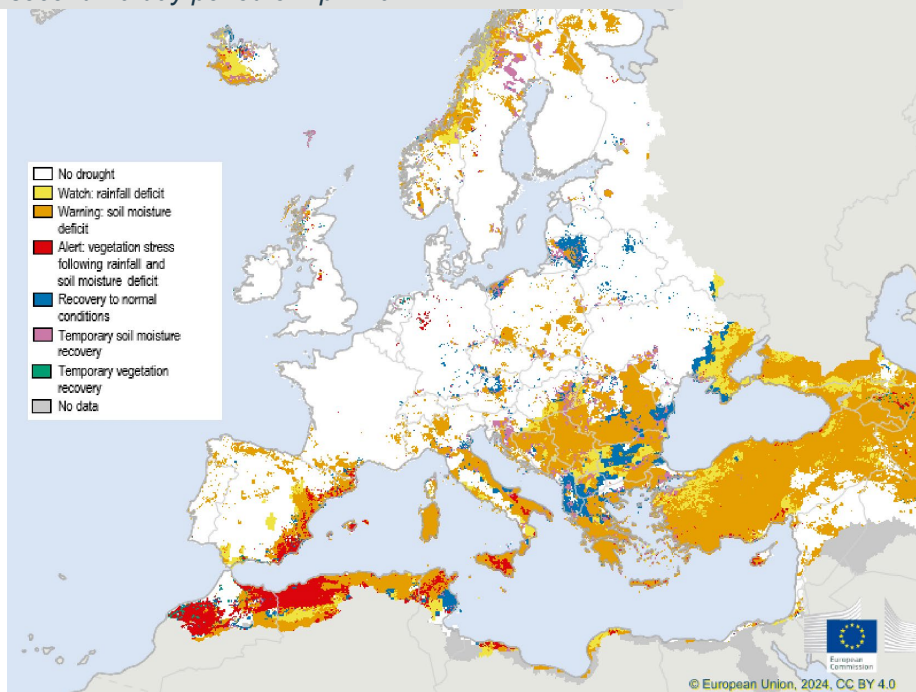
## EDO

- Combined Drought Indicator (CDI) for monitoring agricultural and ecosystem drought.
- Standardised Precipitation Index (SPI) for monitoring meteorological drought.
- Soil moisture and vegetation greenness for monitoring agricultural drought.
- Low flow in main rivers, groundwater for monitoring hydrological drought.
- Forecasts of extreme wet conditions.
- Daily temperature anomalies and heatwaves.

## GDO

- Sector-specific risk of drought impact (RDRI for agriculture).
- Meteorological drought based on precipitation (standardised precipitation index).
- Agricultural drought (soil moisture and vegetation greenness).
- Hydrological drought (groundwater).
- Forecast of extreme wet conditions.
- Daily temperature anomalies and heatwaves.

Map of the Combined Drought Indicator for Europe, second 10-day period of April 2024.



## Current drought situation in Europe

Every 10 days, EDO updates the drought indicators, including the Combined Drought Indicator or CDI that is used to identify areas affected by agricultural drought and areas with the potential to be affected.



europa.eu/!TqmMcp

## Drought in Europe

*Since 2011, EDO has reported the occurrence of 21 severe drought events. Of these, the 2022 drought was one of the most devastating.*

*At its peak during the summer, the 2022 drought affected one third of Europe and caused severe socio-economic impacts on agriculture, energy production and river transport, in addition to impacts on natural systems, with 63% of rivers experiencing below-average flows.*

## DROUGHT INDICATORS

updated every 10 days.

## MAPVIEWER

to explore the drought situation in Europe and globally.

## SPECIFIC REPORTS

on major drought events.

### Drought stages

- **Meteorological drought:** a period of unusual precipitation deficit, in relation to the long-term average conditions for a region.
- **Agricultural/ecological drought:** it occurs when a meteorological drought leads to a soil moisture deficit that limits water availability for natural vegetation and crops.
- **Hydrological drought:** it is associated with the effects of prolonged periods of precipitation deficit and reduced surface or sub-surface water.

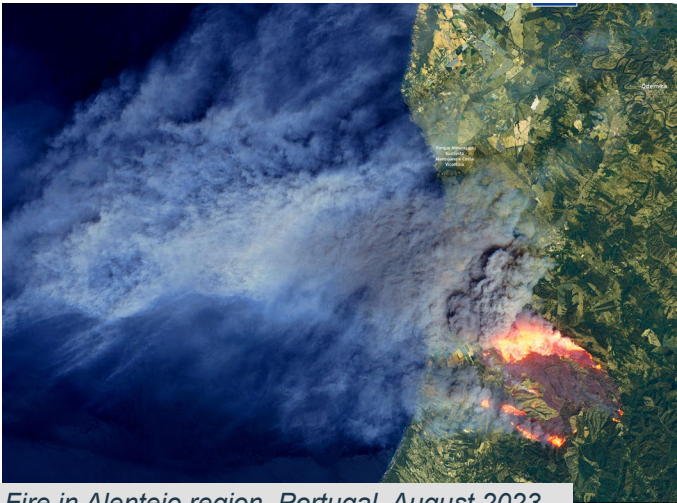


The European and Global  
Drought Observatories  
[drought.emergency.copernicus.eu](https://drought.emergency.copernicus.eu)

# 1. CEMS Early warning and monitoring

The European Forest Fire Information System (EFFIS) provides information on wildfires and their ecological impacts in the European, Middle East and North Africa regions. It encompasses the full fire cycle, from fire danger forecast to

active fires and burned areas, and post-fire damage assessments. It supports wildfire management at the national and regional level for EU Member States and across the Middle East and North Africa.



*Fire in Alentejo region, Portugal, August 2023.*



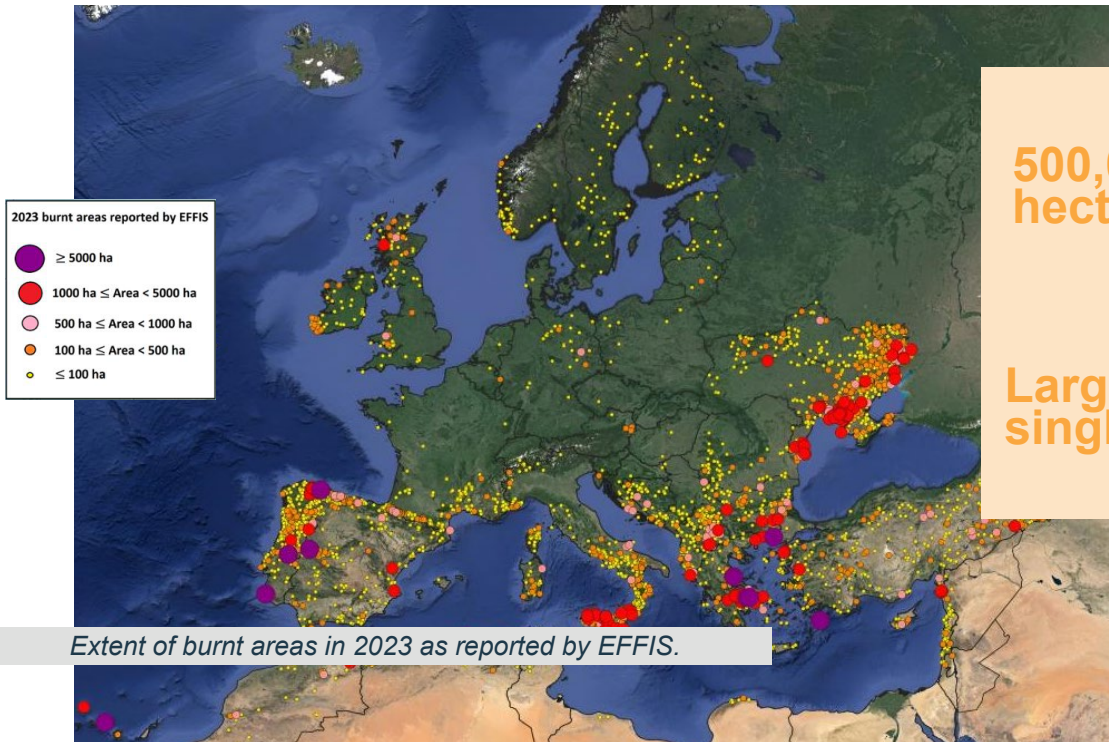
*Fire in Sicily, Italy, September 2023.*



# The European **Forest Fire** Information System (EFFIS)



Forest fires



Extent of burnt areas in 2023 as reported by EFFIS.

**500,000 hectares**

around twice the size of Luxembourg is the area burned in the EU in 2023.

**Largest single fire**

ever recorded in Europe since 1980s occurred in Greece in summer 2023.

## SITUATION VIEWER

to explore information on the fire season such as: fire danger forecasts and rapid damage assessment (active fires, burnt areas and fire severity).

## STATISTICS PORTAL

to visualise and download data and statistics.

## LONG TERM FIRE WEATHER FORECAST

providing monthly and seasonal temperature and rainfall anomalies up to 6 months.

## WILDFIRE RISK VIEWER

to visualise the Wildfire Risk Index, a meteorologically based index used to estimate fire danger.

EFFIS is supported by the Expert Group on Forest Fires, which consists of experts from 43 countries in Europe, Middle East and North Africa. It provides European Commission services and the European Parliament with updated and reliable information on wildland fires in Europe.




The European Forest Fire  
Information System

[forest-fire.emergency.copernicus.eu](http://forest-fire.emergency.copernicus.eu)

In the **autumn**, EFFIS publishes a **comprehensive study** on the preceding year's wildfires. The report includes official figures by the contributing countries detailing the number of fires, burnt areas, fire prevention efforts, and the analysis of fire danger and areas mapped in EFFIS. Prior to the full report, an advance report is issued, offering a preliminary assessment of the previous fire season.

## What are wildfires?

Wildfires are uncontrolled fires that occur in nature and are often exacerbated by climatic conditions. Long dry spells in particular increase the risk of wildfires breaking out, but other factors also have a huge impact, such as rain and wind, vegetation, the layout of the terrain, and forest management practices.



*Burnt forest in the department of Gironde, France, August 2022.*

# 1. CEMS Early warning and monitoring

The European and Global Flood Awareness Systems (EFAS and GloFAS) provide information on upcoming and ongoing flood events through maps highlighting potential areas at risk.

EFAS has been the first operational European early warning system for forecasting and monitoring floods. EFAS and GloFAS early warning probabilistic information based on models, satellite and in-situ data, with the aim to support national and regional authorities for the implementation of preventive measures before an disaster occurs.

## What is flooding?

A flood happens when water overflows or soaks land that is normally dry. It can develop in a many ways. The most common is when rivers or streams overflow their banks onto the surrounding land, leading to a riverine flood. Another type of flooding is flash flood, which is a sudden and rapid flooding generally caused by extreme rainfall. There are many other sources of flooding such as coastal and groundwater flooding.

*Areas affected by flooding in Italy,  
May 2023.*



# The European and Global Flood Awareness System (EFAS and GloFAS)



## MEDIUM-RANGE FLOOD FORECASTS

▶ **EFAS** medium-range flood forecasts provide an overview of upcoming riverine and flash flood events in Europe within the next **10 days**, including possible flood impacts.

▶ The forecasts are updated **twice daily** and serve to issue flood notifications to EFAS partners in the event of a high likelihood of flooding.

▶ EFAS can also alert the CEMS On-demand mapping component for a faster mapping of a flood through the so-called pre-tasking.

▶ **GloFAS** medium-range flood forecasts provide a global overview of upcoming riverine flood events for the next **30 days**, including possible flood impacts.

▶ The forecasts are updated **daily** and are used by national and international institutions for flood risk management around the world.

▶ When severe flood impacts are expected, the acquisition of satellite images through CEMS On-demand mapping component is pre-tasked to enable faster satellite-based flood mapping.

## HYDROLOGICAL OUTLOOKS

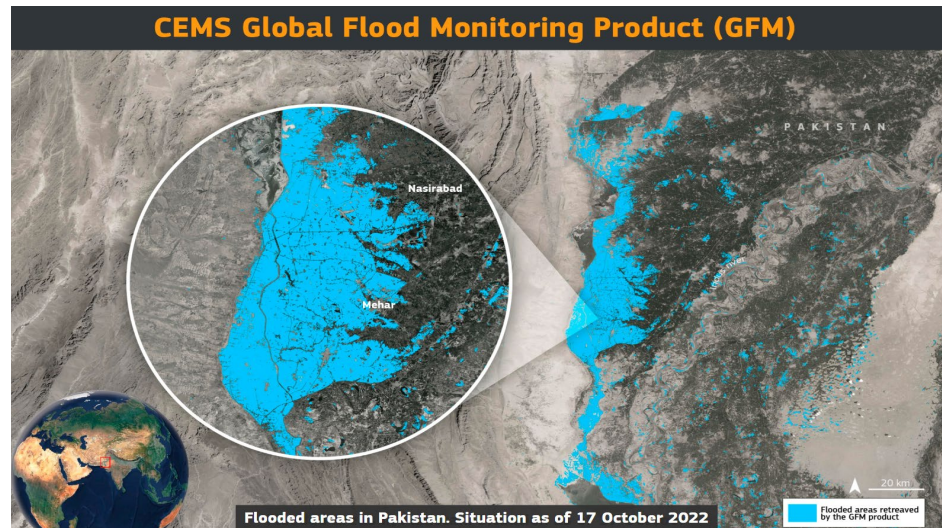
- ▶ **EFAS** sub-seasonal and seasonal hydrological outlooks summarise the hydrological situation over the next **6 and 8 weeks** respectively, and predict changes with respect to the hydrological extremes (high and low flows).
  - ▶ The sub-seasonal hydrological outlook is issued **daily**, while the seasonal outlook is issued **monthly**.
  - ▶ Outlooks can be used to support various water-related applications such as reservoir management, navigation, irrigation or drought risk management.
- ▶ **GloFAS** seasonal hydrological outlook summarises globally, for each river region, the hydrological situation over the next **4 months** and predicts changes to the long-term river flows.
  - ▶ The seasonal outlook is issued **every month**.
  - ▶ Outlooks can be used to support different national and global water-related applications such as reservoir management, navigation, irrigation or drought risk management.

All EFAS and GloFAS products are freely available. However, EFAS products become accessible after a 30-day embargo period, while real-time EFAS products can only be accessed by EFAS partners. This is to respect the responsibilities of Member States in issuing flood warnings. An **EFAS partner** is any authority that is legally responsible for providing flood forecasting services, or that has a national role in flood risk management within its country and the European Commission Services.

# Global Flood Monitoring (GFM)

Since 2021, EFAS and GloFAS have been complemented by a near real-time service, the **Global Flood Monitoring (GFM)** product. GFM provides continuous, systematic monitoring of all land surface areas potentially affected by flooding. It immediately processes and analyses all incoming Copernicus Sentinel-1 Synthetic Aperture Radar (SAR) satellite data using three flood detection algorithms.

Being a fully automated system, one of GFM's strengths is the rapid availability its products, as there is no delay caused by human intervention in the imagery production chain, and its capacity to map large areas affected by floods.



The Global Flood Awareness System  
[global-flood.emergency.copernicus.eu](http://global-flood.emergency.copernicus.eu)



The European Flood Awareness System  
[european-flood.emergency.copernicus.eu](http://european-flood.emergency.copernicus.eu)



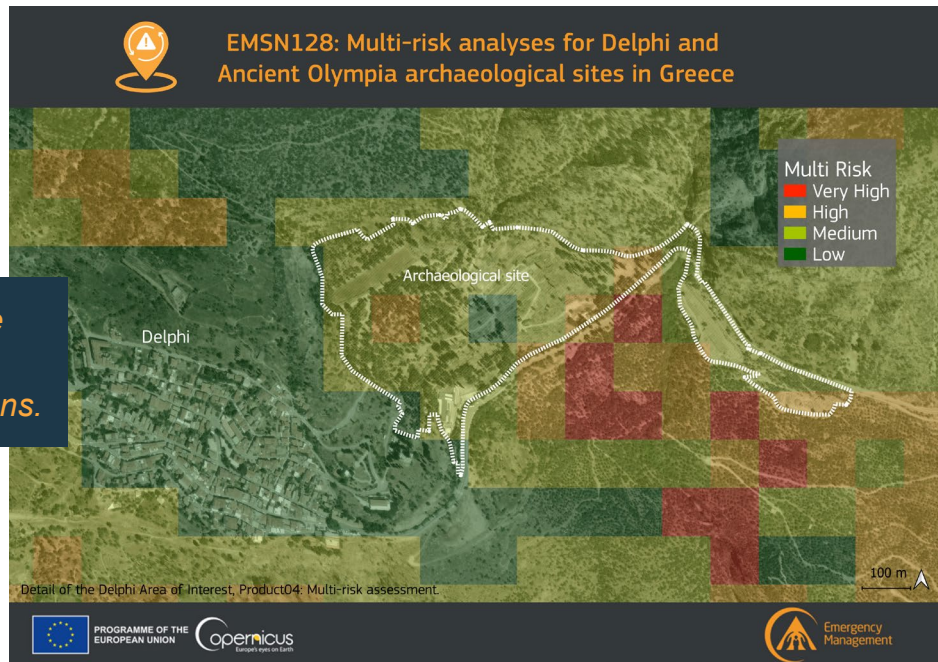
The Global Flood Monitoring  
[global-flood.emergency.copernicus.eu/technical-information/glofas-gfm](http://global-flood.emergency.copernicus.eu/technical-information/glofas-gfm)

## 2. CEMS On-demand mapping



The On-demand mapping component offers detailed geospatial information through its activation service, supporting all phases of the disaster management cycle, from **preparedness** to **emergency response** and **recovery**.

*Mapping activations can only be requested by authorised users, typically civil protection institutions.*



On-demand mapping  
[emergency.copernicus.eu/mapping](https://emergency.copernicus.eu/mapping)



# Mapping **activations**

An activation for preparedness (or pre-event) aims to reduce the impact of potential disasters through risk assessment analysis. It provides information on the exposure, vulnerability and risk of population and assets for all type of hazards.

An activation for emergency response rapidly assesses and monitors the extent and impacts of a disaster during its immediate aftermath.

An activation for recovery (post-event) assesses the impact of a disaster with detailed impact assessments and plans for developing and monitoring recovery efforts.

**Preparedness (pre-event)**

**Emergency response**

**Recovery (post-event)**

In 2022, CEMS launched the deployment of a new **aerial feature** in support of the On-demand mapping component. It includes both unmanned and piloted aerial image acquisition assets.

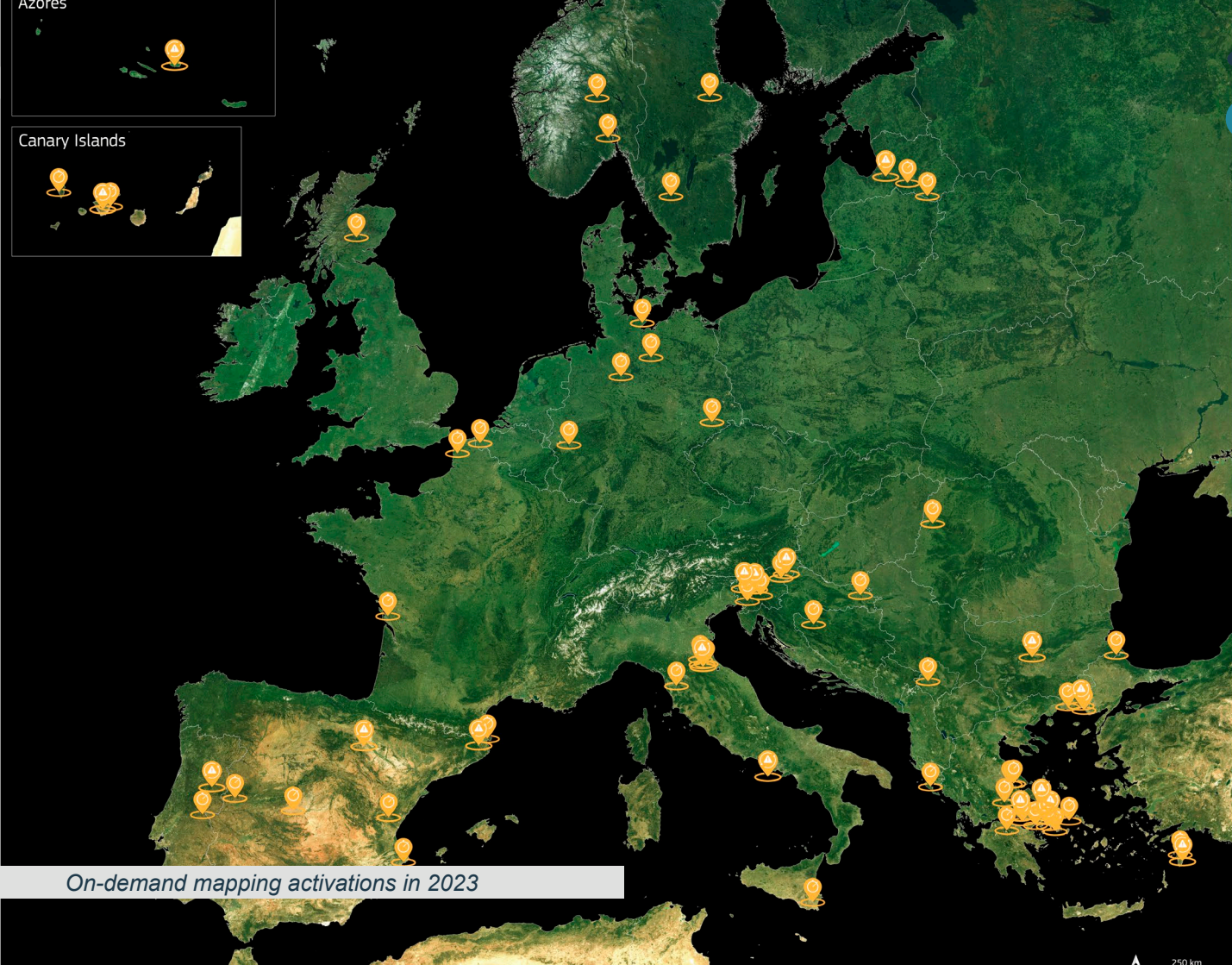
Aerial imagery provides significant added value for disaster management, as it enables acquiring extremely high-resolution imagery.

Aerial images have been used to identify the location and exact extent of landslides, to map biomass losses to forest fires or to work on preparedness activities for dam break scenarios.

*Landslide in Italy in 2023, as seen in the drone piloting interface.*



*In May 2023, heavy floods hit the Emilia Romagna region of Italy and CEMS experts calculated the damage extent. Later in June, thanks to detailed images from drones, they pinpointed the location and estimated the volume of the landslides, showing the impact they had.*



On-demand mapping activations in 2023

# 3. CEMS Exposure mapping



The exposure mapping component provides accurate and updated information on the presence of human settlements and population with the **Global Human Settlement Layer (GHSL)** derived from satellite and census data.

Outputs of this component are used in the CEMS On-demand mapping and Early warning and monitoring components. In addition, the information is relevant for many other application domains (e.g. Sustainable Development Goals monitoring, urbanisation, sustainable development) and are at the core of the “**Degree of Urbanisation**” endorsed by the United Nations.

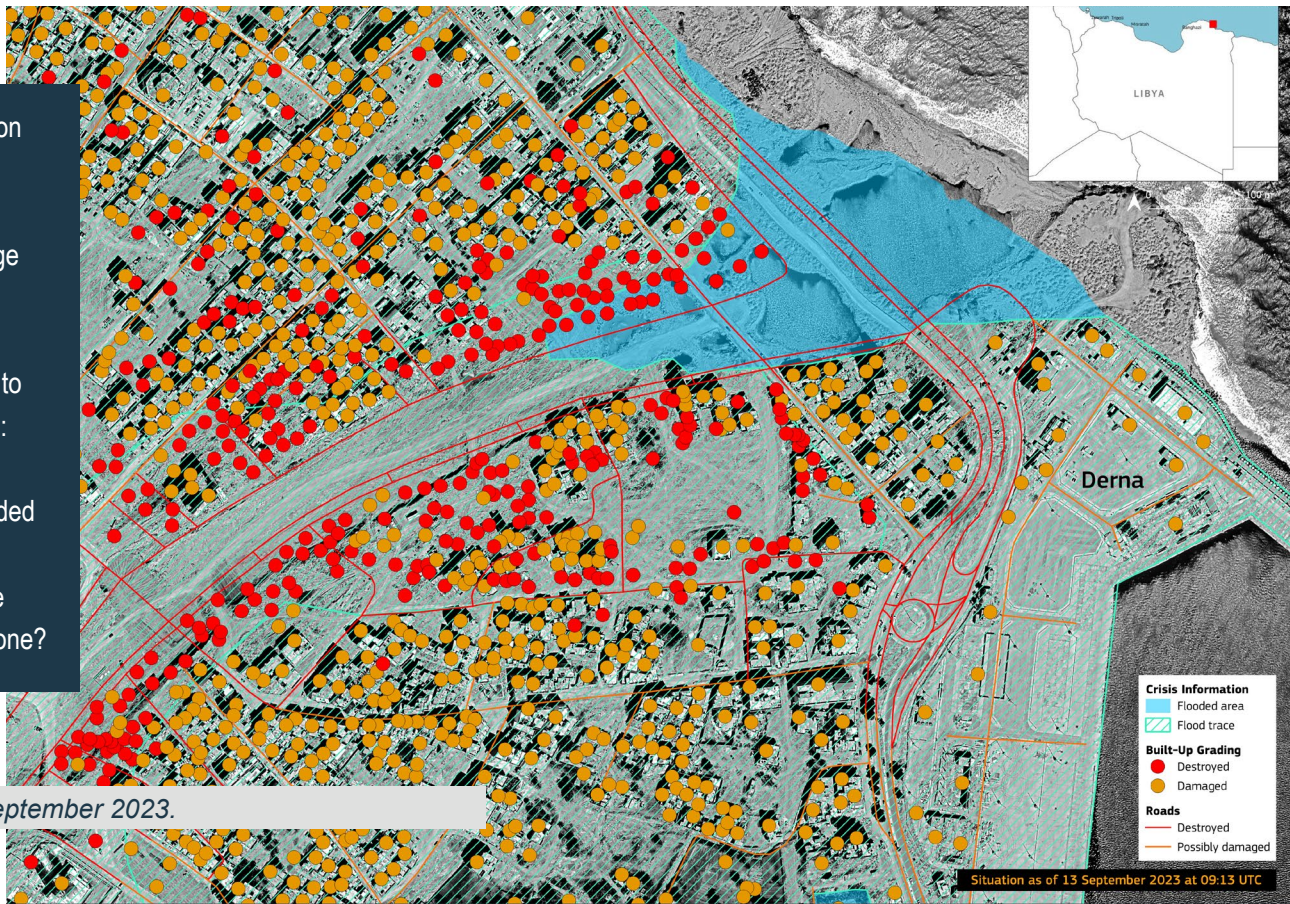


The Global Human Settlement  
Layer

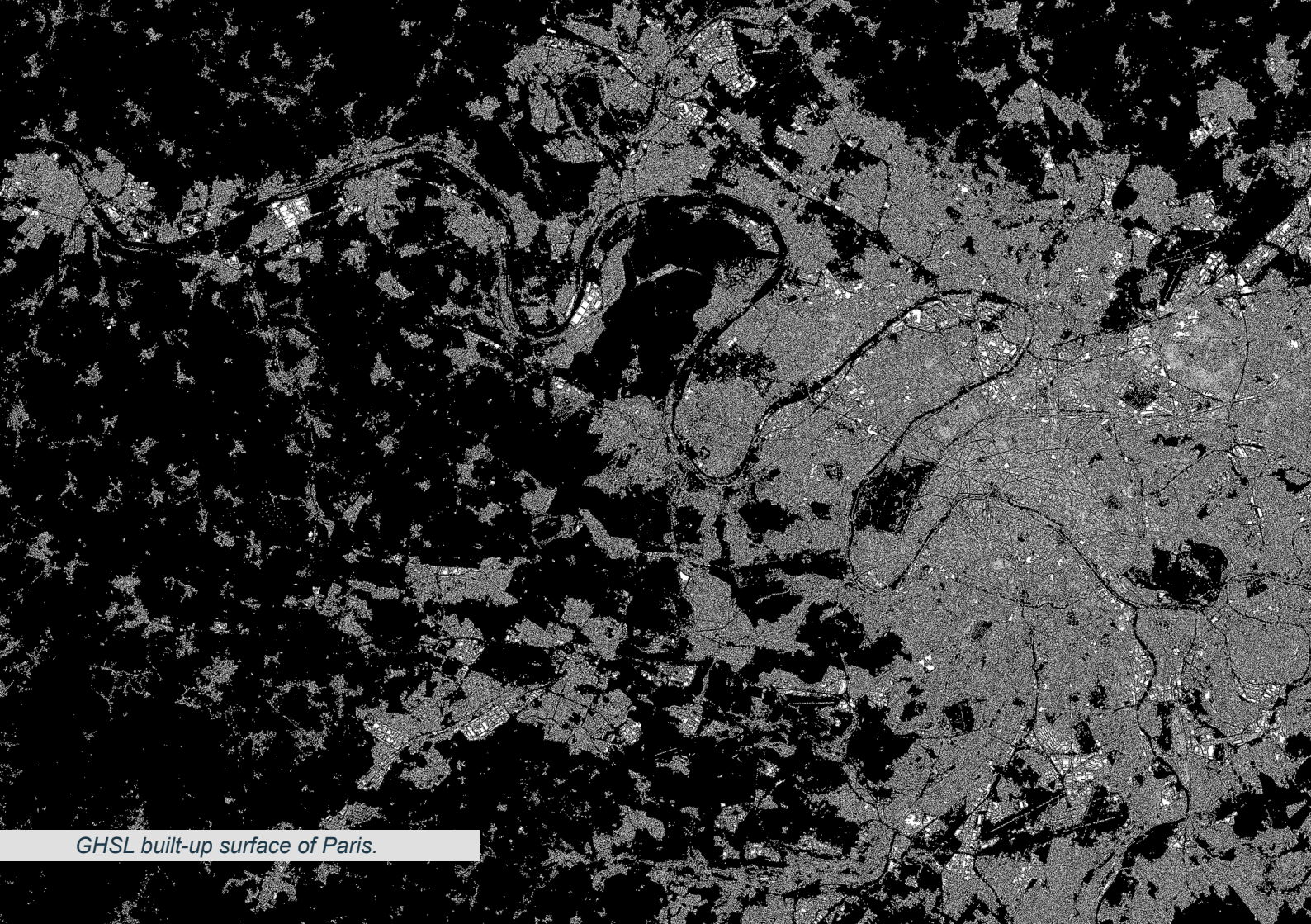
[human-settlement.emergency.copernicus.eu](https://human-settlement.emergency.copernicus.eu)



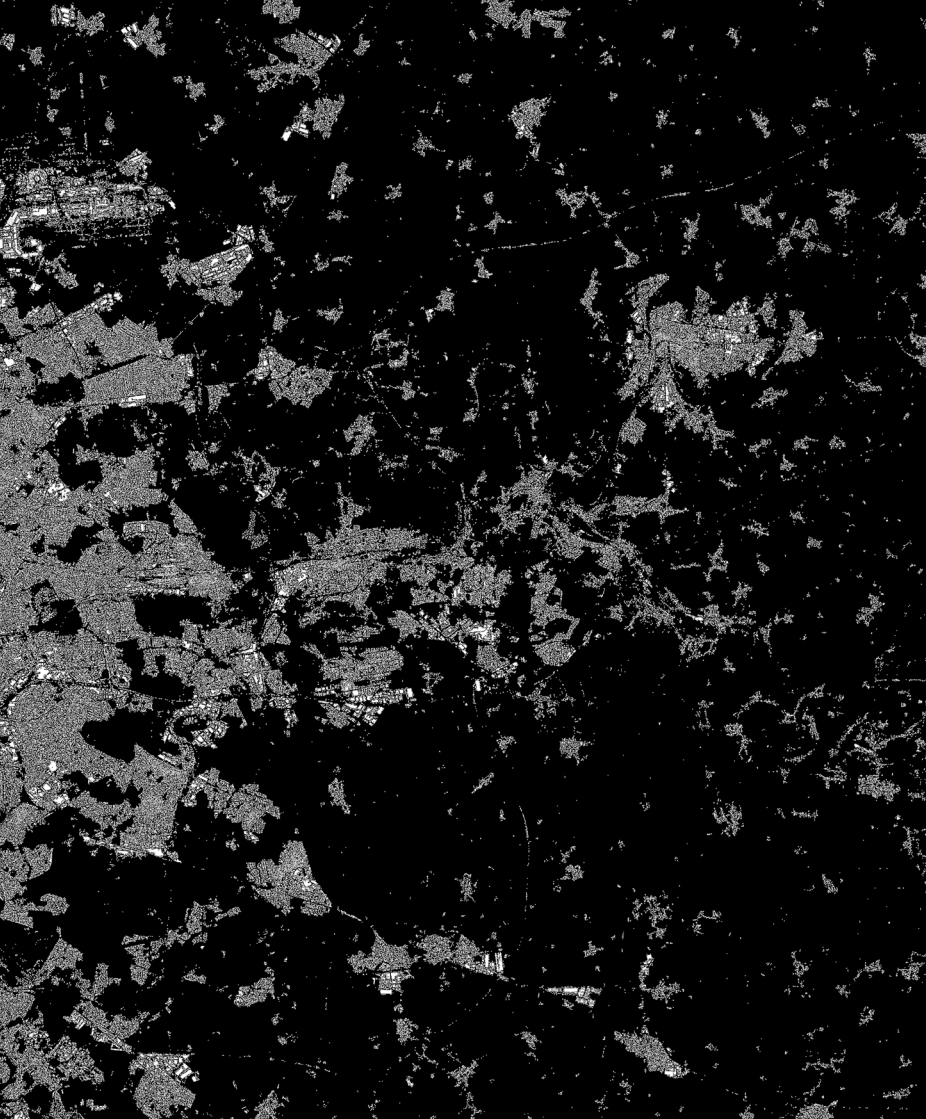
Detailed information on exposure is fundamental to adequately manage crisis and assess disaster risk. It provides answers to questions such as: How many people are living in a flooded area? How many settlements will be affected by a cyclone?



*Floods in Libya, September 2023.*



*GHSL built-up surface of Paris.*



The Global Human Settlements Layer (GHSL) enables the CEMS service to assess differences in global built-up surfaces since 1975. Residential (housing) and non-residential functions (commercial and retail buildings, industrial areas, plants, etc.) can now be better assessed thanks to the increased spatial resolution that the GHSL brings.



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