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Mapping for Crisis Management

DG-ECHO Daily/Situation Maps
January – March 2023

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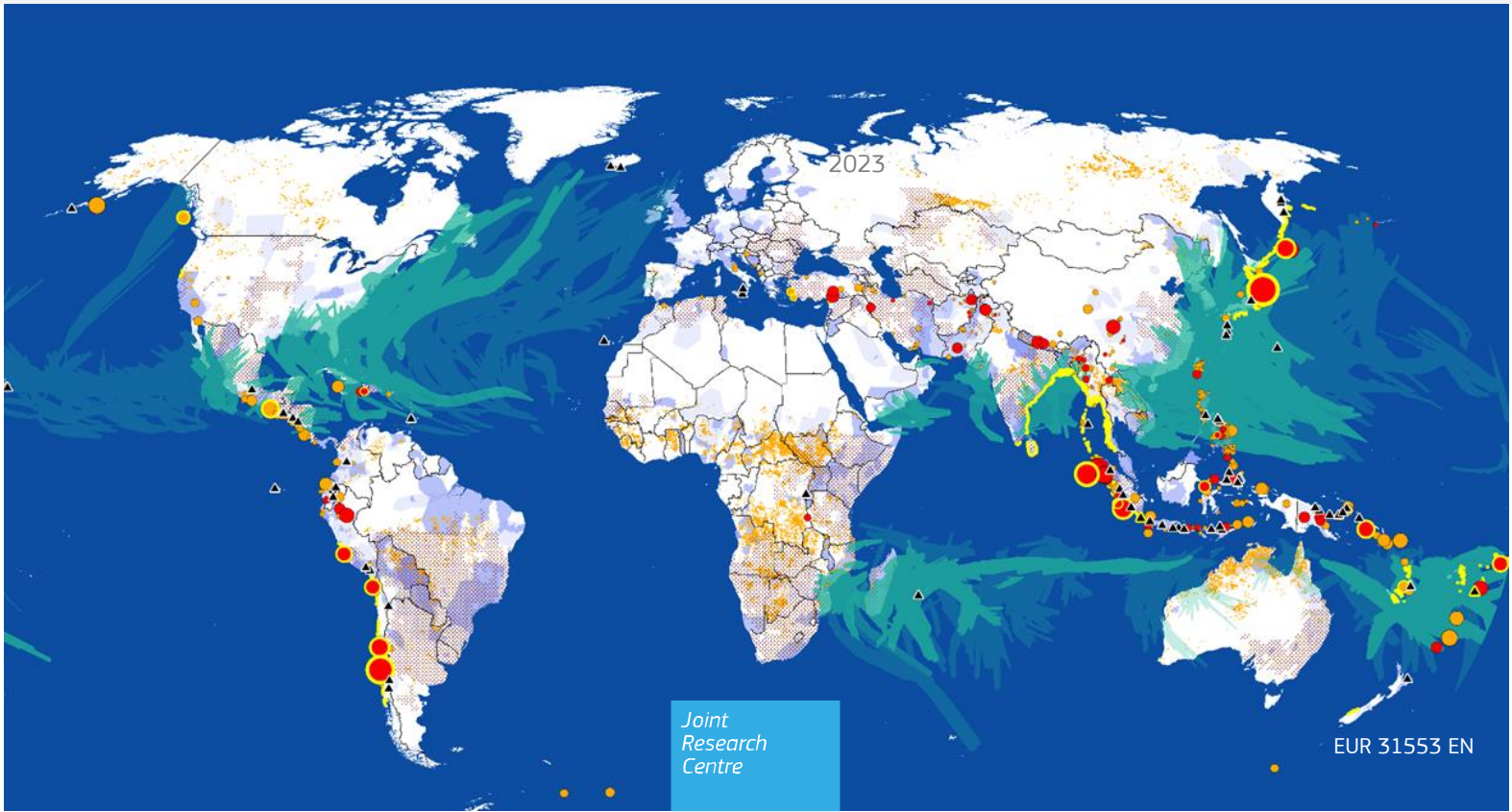

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Contents

Abstract

Disaster Risk Management (DRM) is a complex and interdisciplinary field that requires accurate, reliable visual products and reporting material to support the decision making process. In the disaster cycle there are two key phases to consider: before and after the event. Each phase consists of various components. The pre-occurrence phase focuses on risk assessment, prevention and preparedness, while the post-occurrence phase encompasses response to the event, damage assessment, and recovery/restoration.

The main objective of this quarterly report is to show how the European Crisis Management Laboratory (ECML) Mapping Team at the Joint Research Centre (JRC) contributes in delineating all the components of those phases with its daily situational awareness reports (ECHO Daily Flash and ECHO Daily Maps) and on-demand products (ECHO Situation Maps/Infographics). The team uses a variety of data sources (e.g. satellite imagery, geographical and ancillary data, statistical repositories), to produce maps and situational reports that depict the spatial distribution of hazards, vulnerabilities, as well as capacities in coping with them. In so doing it collaborates with experts from other fields inside and outside the European Commission.

Besides contributing to identifying high-risk areas, helping in prioritize interventions and facilitate the communication with stakeholders, these products also represent an essential tool used by the Emergency Response Coordination Centre (ERCC) at the Director General European Civil Protection and Humanitarian Aid Operations (DG ECHO) for its daily activity of monitoring disasters occurring all over the globe.

The function of the ECML Mapping Team is a crucial and challenging one that requires a multidisciplinary and collaborative approach along with the employment of various highly specialized skills and expertise. This report will introduce and explain the essential contribution of the team in maximizing the outcomes when analysing disaster events and their management.

1. Introduction

Maps and infographics play a fundamental role in Disaster Risk Management (DRM). From a practical standing point, they are key in identifying areas at high risk of being affected by a disaster (the so-called preparedness phase), planning for emergency management and humanitarian response in general and determining resources for coping with these events. In post-disaster conditions they are useful in damage assessment as well as monitoring the progress of recovery efforts. However, the importance of maps extends beyond just these practical uses. Maps also serve as a communication tool, raising awareness among communities about the risks they face and the steps they can take to prepare for disasters. In order to provide the most updated and reliable products, the team collaborates with experts from inside and outside the European Commission. Satellite imagery, spatial elaborations, and geographical data of any sort, are then harmonized and thoroughly put together to ensure the quality of the outcomes.

The above-mentioned ERCC at DG ECHO makes an extensive (and intensive) use of these products. In fact, maps, infographics and situational reports produced by the team are pivotal in its daily activity of monitoring disasters around the globe and efficiently managing effective responses by the Union Civil Protection Mechanism.

This report is the first release of a series of quarterly reports, and it shows the daily and non-daily activities of the ECML Mapping Team in support of DG ECHO as a whole and to the ERCC in particular.

The purpose of this document is to show the products collected in the ERCC portal and to highlight the main topics, related to natural disaster events or humanitarian crises, occurred over the last three months. The choice of the trimestral frequency is to try to detect early on possible trends in hazardous events (e.g., droughts, cyclones, famine), without waiting to analyse them only on an annual basis. The plan is to compile the four quarterly reports of 2023 into an overall annual report.

This document is intended to support the reader to have a knowledge of what happen periodically across the world, how many events occurred, and which are most/worst affected countries by one or multiple natural disaster events or crises. Moreover, it shows in a dedicated section, how the details of the humanitarian impact and the evolution of a natural event have been collected, considering that one of the main purposes of the activities is to use official sources as agreed with the ERCC. The present report includes the three pillars : ECHO Daily Flash, ECHO Daily Map and ECHO Situation Maps/Infographics.

The ECHO Daily Flash is a daily snapshot on unfolding disasters and main humanitarian crises, in Europe and the World. The product consists of short summaries of the main natural events of the past few days, presented in short bullet points, in neutral, simple language, sticking to facts and figures, with an emphasis on the Union Civil Protection Mechanism added value.

The ECHO Daily Map depict a significant event on a daily basis. Following a thorough analysis of the current situation (and supported by the Daily Flash), the ERCC decides what is to be mapped. At this point the team collects all the necessary information to produce the map that will be delivered at the end of the day. This high frequency of production determines the maps purpose: rather than providing a general summary of interacting factors for a prolonged period, they tend to represent specific events for short and fixed periods in time.

It should be noted that every request to the team and its deliverable is to be made and collected in the ERCC Portal**.** This is the one-stop point of access of all the interactions between the mapping team and ERCC.

Contrary to the daily production of both the ECHO products described above, ECHO Situation Maps/infographics are produced on-demand. ERCC Duty Officers, ECHO Field Officers, ECHO Geo-desks and everyone who have access to the service, can request a map via the ERCC Portal and upload the necessary information required for its production. At this point the system is activated, notifying the team that will proceed with the map-production. Not following a daily frequency, the majority of these maps are overviews of complex situations over medium-long time periods.

2. ECHO Daily Maps and ECHO Daily Flash

2.1. General aspects

One of the main goals of the ECHO Daily Maps and ECHO Daily Flash is to describe a given topic in the most reliable way, both for the geodata collection and the sources of the represented event. The ERCC strongly suggest using information and data derived from national authorities or humanitarian organization like DG ECHO, UN OCHA, WMO, WFP, and UNICEF instead of media that can over or underestimate the relevance of a particular event. For this reason, in all the Daily Maps, the figures of the humanitarian impact, the humanitarian response and the scientific contents are from official and authoritative sources.

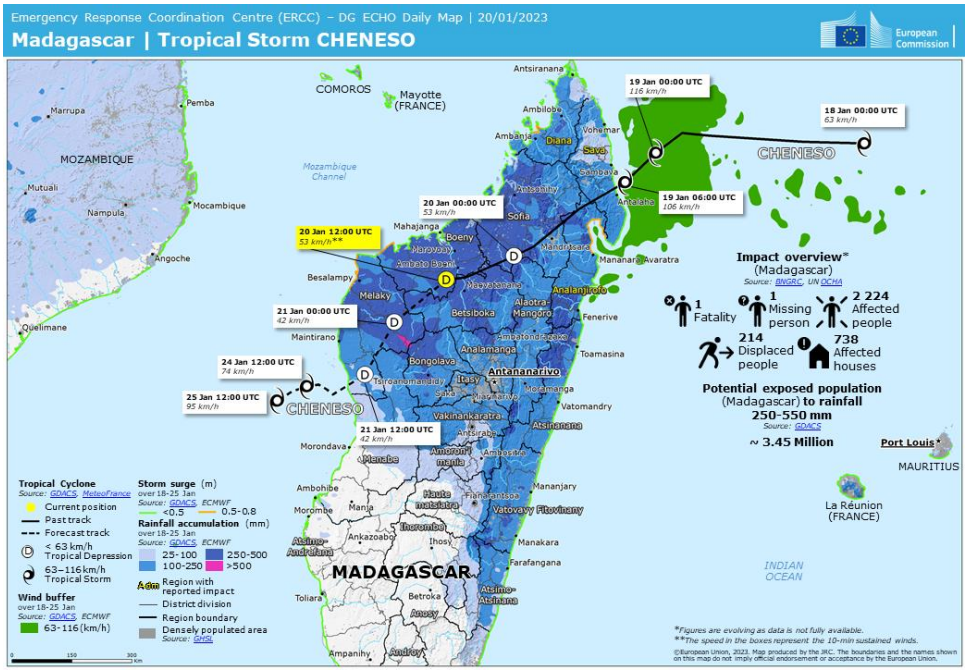
Regarding the humanitarian impact and the humanitarian response, DG ECHO is the main source (24 maps in this quarter), followed by the UN OCHA (12 Daily Maps). The figures provided by these two organizations have been used to describe the affected people in several events like the cyclone activities in southern Africa and the earthquake in Türkiye, the map of the global landslide events in the second semester of 2022, and the earthquake in Iran of 28 January 2023.

Concerning the scientific contents, the first data provider is the JRC itself, following the huge amount of data produced and delivered by the ECML team (GDACS data, above all) or by other teams within the –Disaster Risk Management Unit (JRC E.1), like GHSL (Global Human Settlement Layer), GWIS (Global Wildfire Information System), GLOFAS (Global Flood Awareness System), EDO (European Drought Observatory) and GDO (Global Drought Observatory). Is important to mention also other scientific data producers/providers, the most significant and global ones are NOAA, JTWC, HWRF, ECMWF, GFS and GPM for meteorological data (including tropical cyclones data), MODIS for floods and USGS for seismic data.

2.2. January significant events

The main represented topics of January 2023 are characterized by the global overview of earthquakes and volcanic events occurred during the second semester of 2022, the 2022 tropical cyclone season in the Western North Pacific Basin, the Copernicus activations (EMSR and EMSN) in 2022, and the world temperature anomalies during the whole 2022. As single event, it is important to highlight the tropical cyclone CHENESO that crossed from north-eastern to western Madagascar during the second half of January leading to more than 30 fatalities. Furthermore, the seismic activity in north-western Iran, that resulted in three fatalities and hundreds of injured people, represents a significant event over the period of concern.

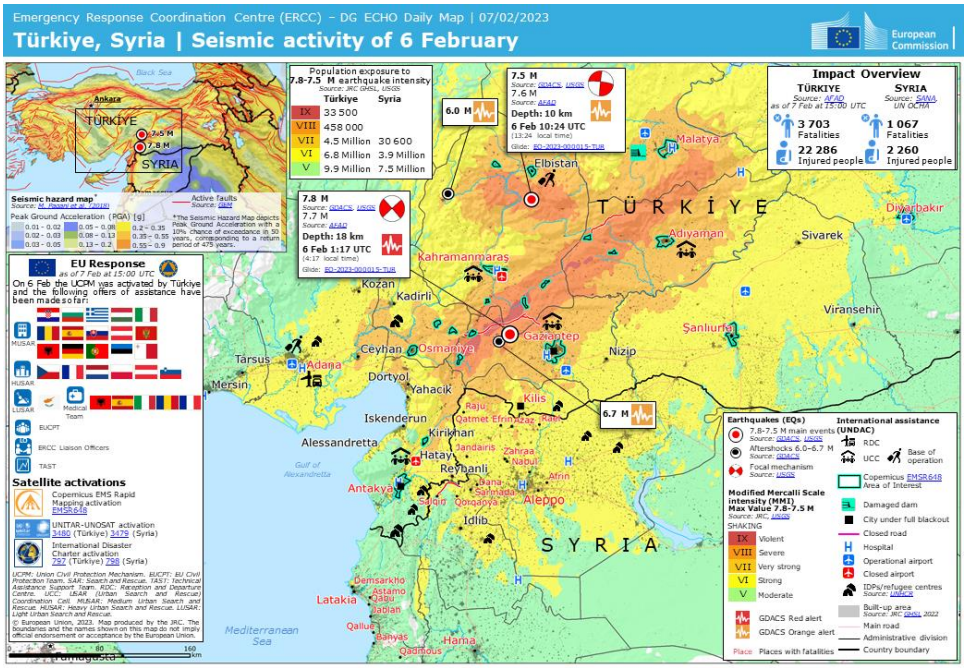
Figure 1. ECHO Daily Map of 20 January on tropical cyclone CHENESO. Source: ERCC portal.



2.3. February significant events

In February 2023, several daily maps have been produced on the intense and devastating seismic activity that hit southern Türkiye since 6 February, leading to thousands of fatalities and millions of displaced across several provinces of southern Türkiye and Governorates of north-western Syria. Other significant mapped natural events were the first phase of the activity of the tropical cyclone FREDDY, the severe wildfires situation occurred throughout central Chile and the severe weather conditions occurred in south-eastern Brazil.

Figure 2. ECHO Daily Map of 7 February on the seismic activity and EU response in Türkiye and Syria. Source: ERCC portal.



2.4. March significant events

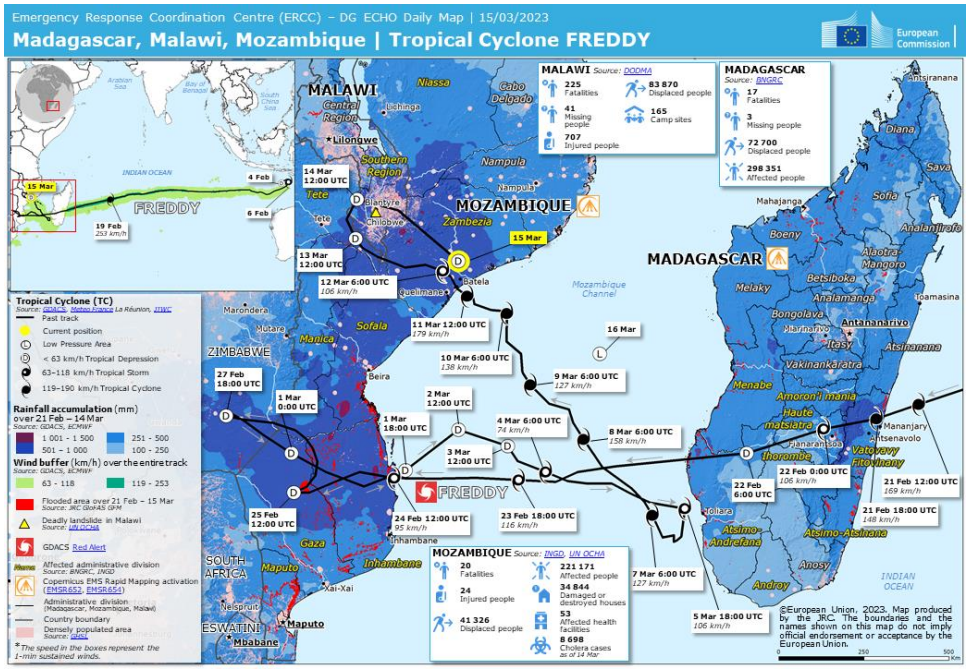
The most significant event represented during the last month of 2023Q1 is the evolution of the tropical cyclone FREDDY that affected Madagascar, Mozambique and Malawi and resulting in nearly 900 fatalities (where Malawi resulted the worst affected, with nearly 700 fatalities) and thousands of displaced people. Tropical cyclone FREDDY is the longest-lasting cyclone ever recorded, with more than 35 days of lasting, since it was named on 6 February off the coast of north-western Australia. Due to its relevance, between February and March a total amount of eight Daily Maps on the cyclone FREDDY were produced.

A further important event was the passage over eastern, central and southern Vanuatu of the two tropical cyclones KEVIN and JUDY during early March that affected more than 250,000 people countrywide.

Moreover, the team provided several updates of the Türkiye and Syria earthquakes following the ongoing EU Response for both countries.

Other mapped topics were the overview of temperature anomalies of February 2023, the severe weather events in Peru, earthquakes across Peru-Ecuador, Afghanistan-Pakistan and the landslide in Indonesia triggered by heavy rainfall that caused the deaths of over 50 people.

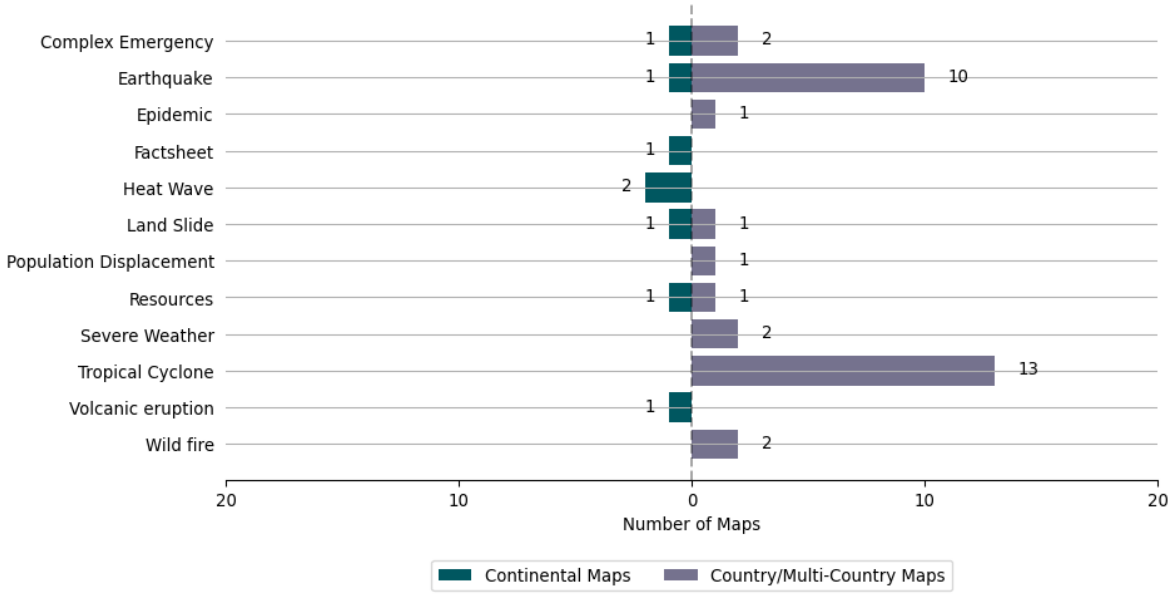
Figure 3. ECHO Daily Map of 15 March on tropical cyclone FREDDY. Source: ERCC portal.



2.5. ECHO Daily Maps by scale/event types and spatial distribution

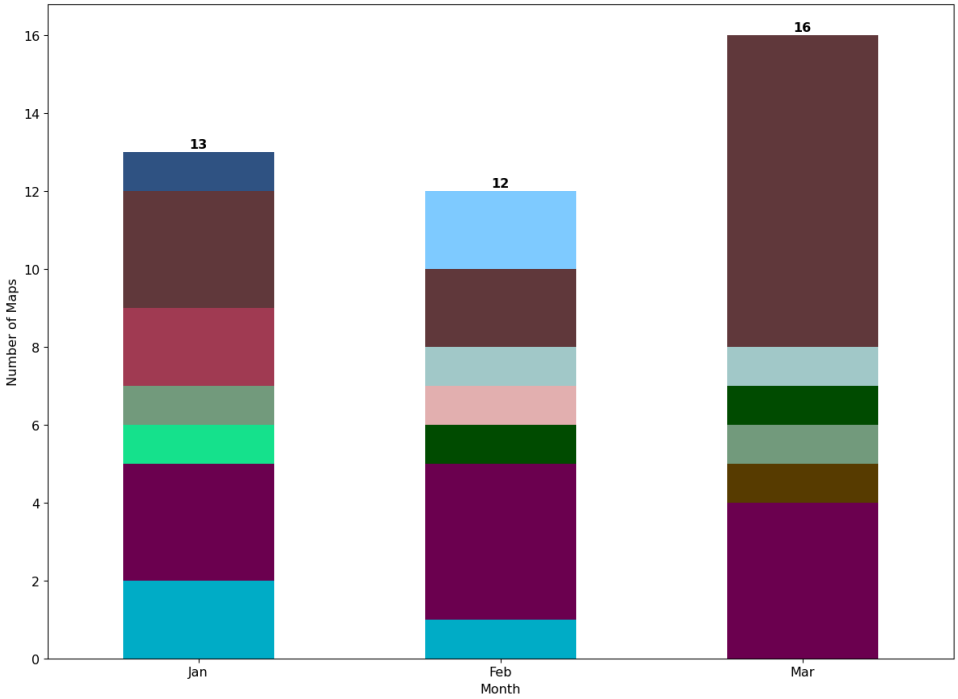
A total of 41 Daily Maps (including two maps produced in collaboration with the DG ECHO A3 Situational Awareness Sector) have been published in this first trimester. The Event Type with the highest number of maps is tropical cyclone followed by earthquake. The most depicted countries are Madagascar, Mozambique.

Figure 4. Event type prevalence in ECHO Daily Maps. Source: JRC-ECML.



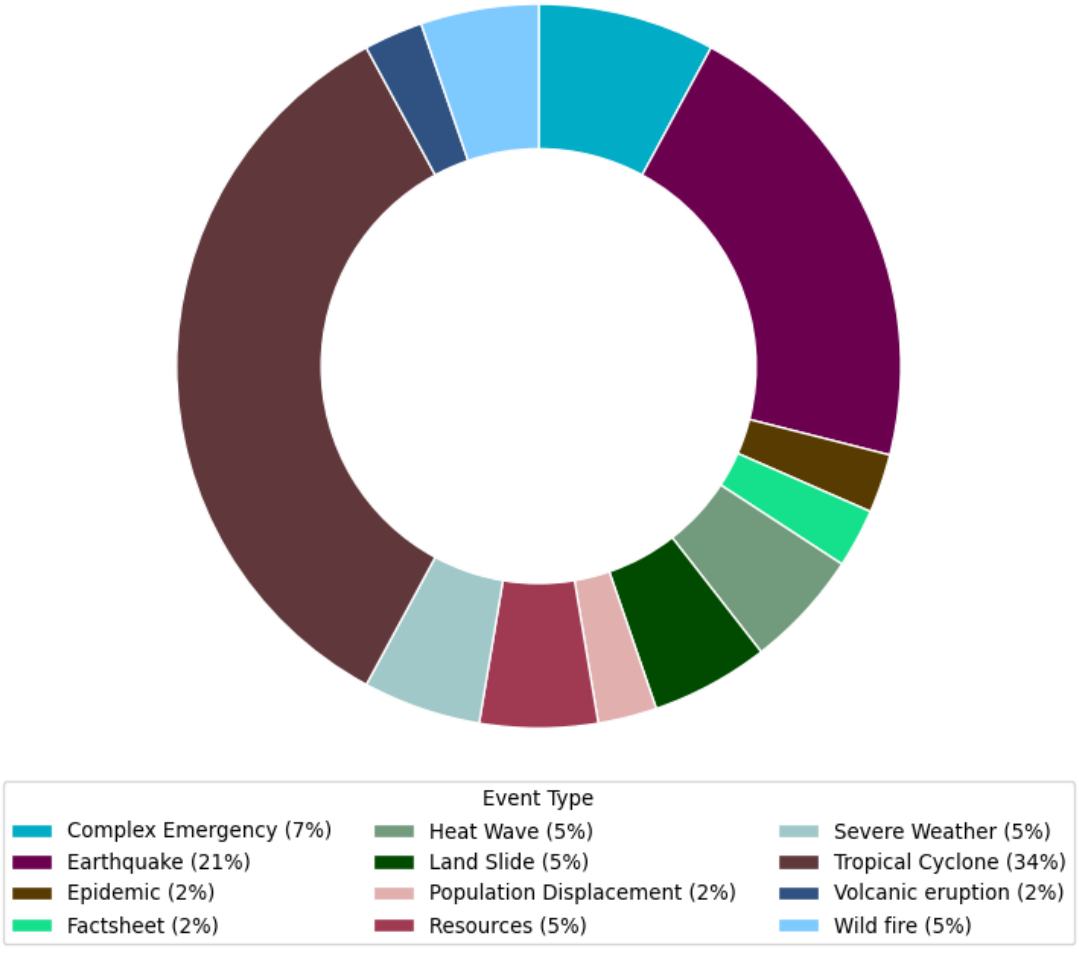
The team has worked also on eight global maps (as showed in the graph of Figure 4) related to the significant landslides, volcanic eruptions and earthquakes occurred over the second semester of the 2022, on the Copernicus activations and on the temperature anomalies of the whole 2022 and in February 2023. Furthermore, is important to mention a regional map on the tropical cyclone activity across the Western North Pacific.

Figure 5. Monthly distribution of ECHO Daily Maps per event type. Source: JRC-ECML.



In this trimester March was the month with highest number of Daily Maps produced by the JRC (15 in 23 working days). Due to the intense activity of tropical cyclone FREDDY (as previously mentioned, in more depth), March was characterized by an intense activity in terms of Daily Maps production. During this month, the JRC produced also two further Daily Maps on the seismic activity in southern Türkiye with the cooperation of the DG ECHO A3 Situational Awareness Sector. For these two maps, the JRC worked on the scientific contents as the ground displacement and the tectonic assessment of the area, and the DG ECHO A3 Situational Awareness Sector provided the humanitarian response.

Figure 6. Event type prevalence (%) in ECHO Daily Maps. Source: JRC-ECML.



In the 34% of Daily Maps with tropical cyclone as event type most of them represent the passage of tropical cyclone FREDDY (8 out of 12 maps, as mentioned in the paragraph 2.4) in southern Africa while in the 21% of Daily Maps with earthquake as event type, 4 out of 9 maps show the seismic activity in southern Türkiye.

Figure 7. Spatial distribution of single and multi-country ECHO Daily Maps by event type. Source: JRC-ECML.

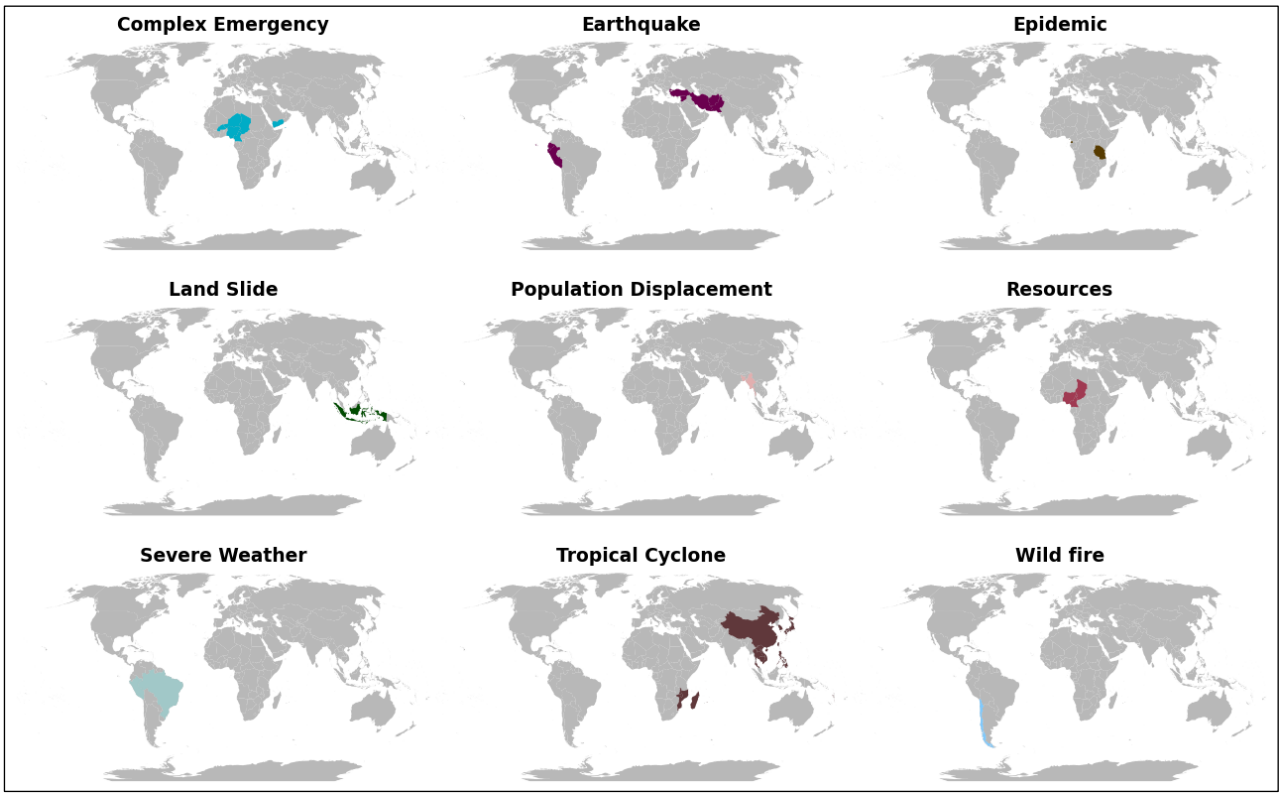


Figure 8. Country occurrence in single and multi-country ECHO Daily Maps. Source: JRC-ECML.

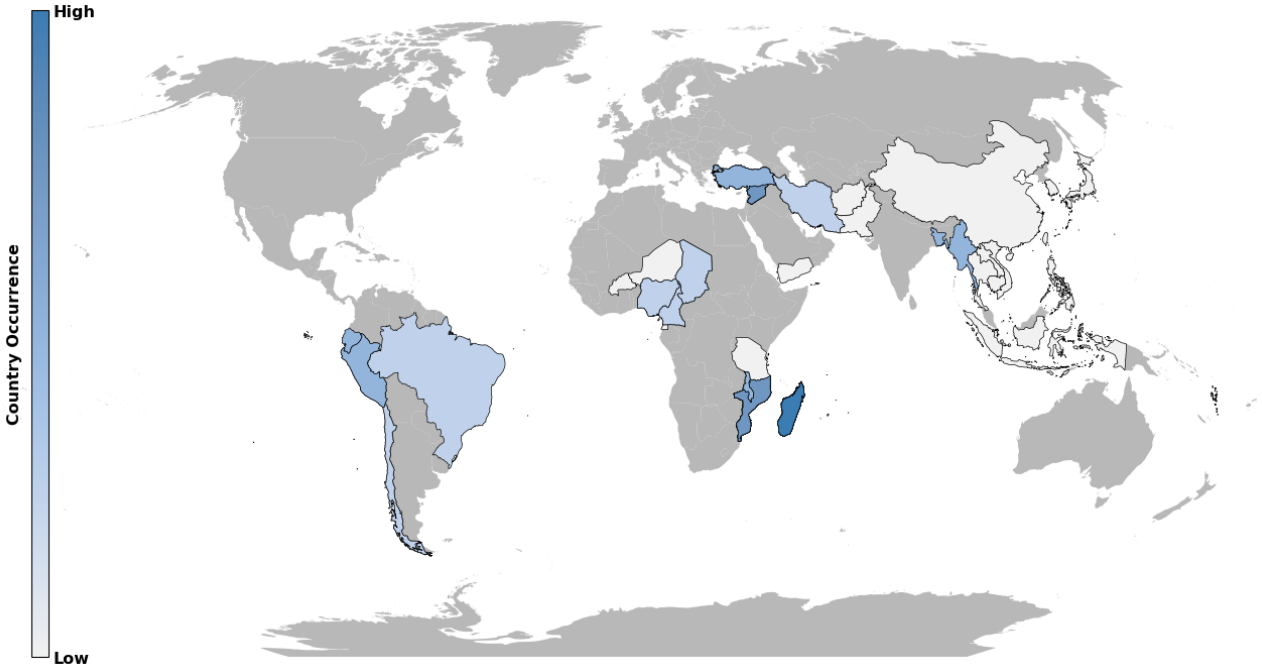
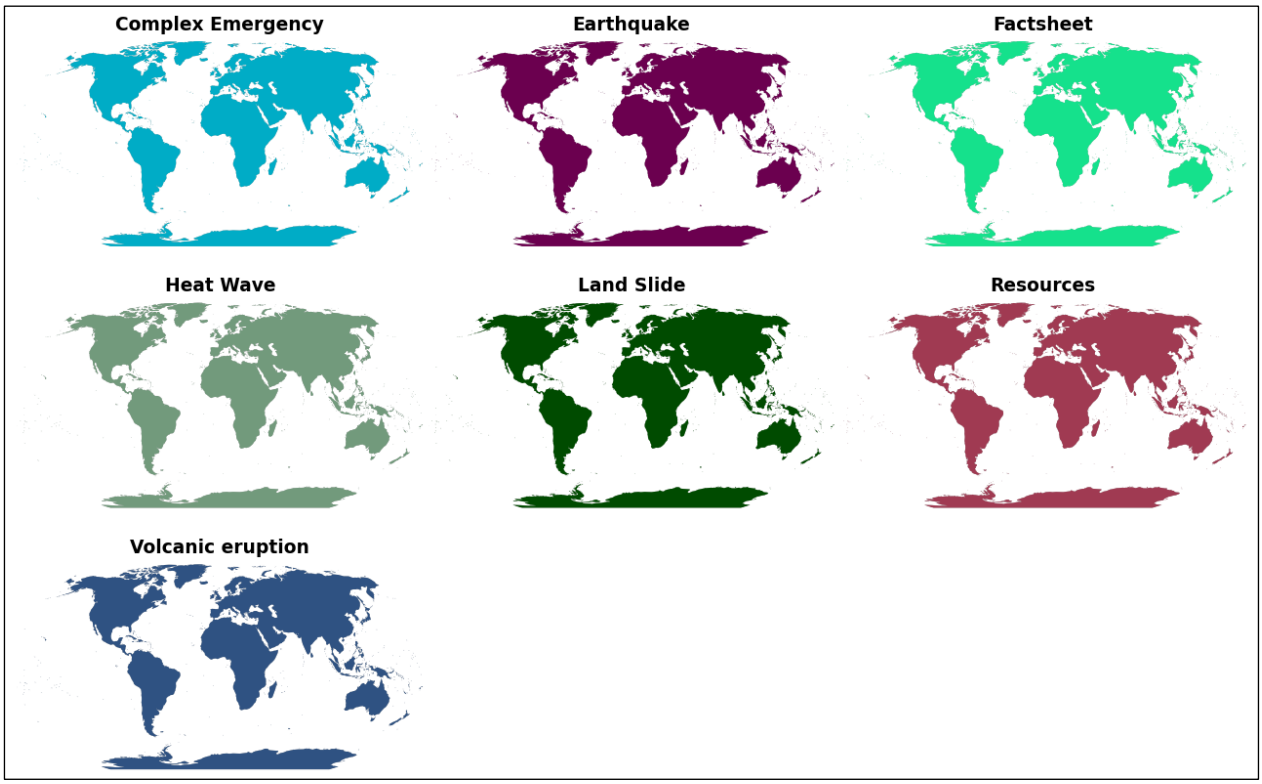


Figure 9. Spatial distribution of continental ECHO Daily Maps by event type. Source: JRC-ECML.



2.6. ECHO Daily Flash statistics

A total of 267 Items (considering that each Daily Flash is composed, generally, by a number of items between two and seven) have been produced in this first trimester of the year. The event type with the highest number of items is floods (70 items) followed by severe weather (52 items) and tropical cyclone (36 items). The countries with more number of items are Indonesia (26 items), Madagascar (24 items) and USA (18 items).

Figure 10. Countries with the highest number of ECHO Daily Flash items per event type. Source: JRC-ECML.

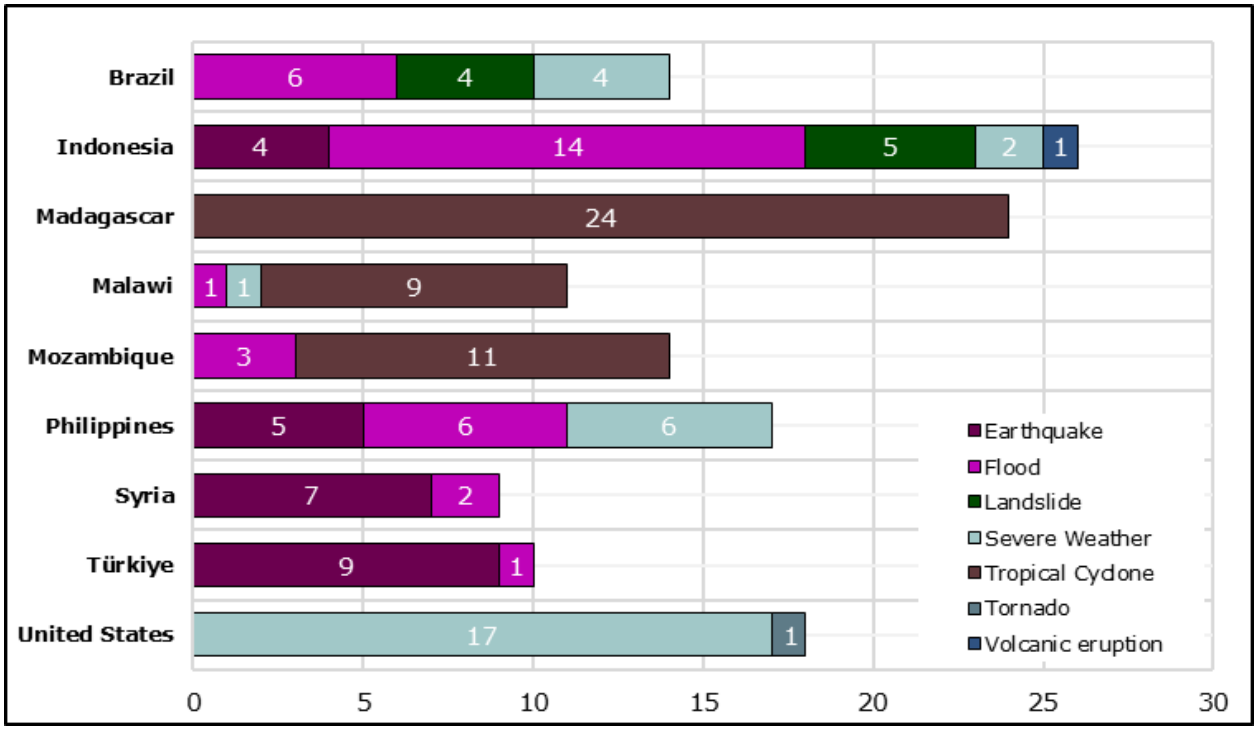
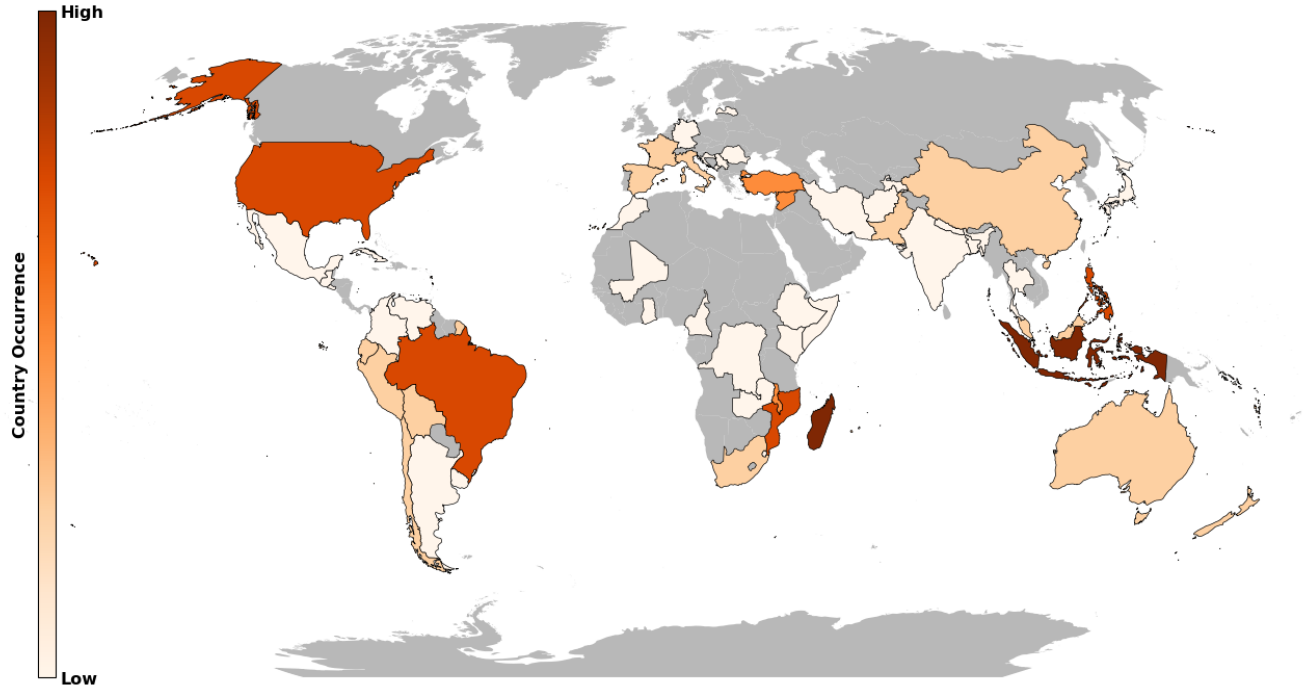


Figure 11. Spatial distribution of items of the ECHO Daily Flash per country. Source: JRC-ECML.

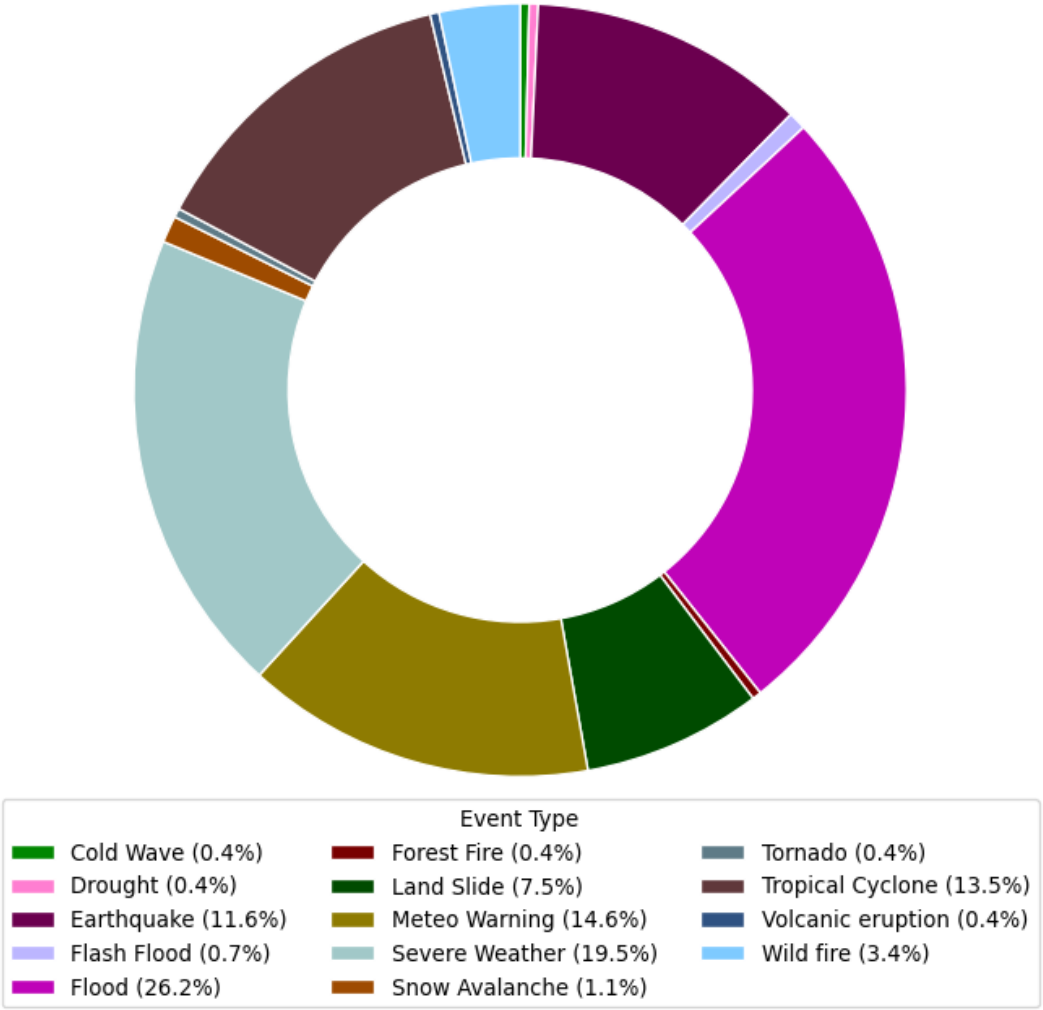


Over the period of concern, Indonesia has been affected by several events, most of them being floods and landslides that hit several provinces of the country. The worst single event, in term of human losses across the country, was a landslide occurred in northern Riau Islands (north-western Indonesia) where more than 50 people died.

Is important to mention also the countries of southern Africa that experienced an intense cyclonic activity following the passage of the two cyclones FREDDY and CHENESO that resulted in hundreds of fatalities across Madagascar, Mozambique and Malawi. Moreover, the team provided day by day updated items on the

devastating seismic activity that hit southern Türkiye and north-western Syria leading to more than 50 000 fatalities.

Figure 12. Event type prevalence (%) in ECHO Daily Flash. Source: JRC-ECML.



3 ECHO Situation Maps/Infographics

3.1 General usage

As previously mentioned, rather than monitoring single events over a specific area and for a short time, situation maps tend to be created to summarize the overall "situation" of countries, group of countries or continents, charting complex interactions between various events for prolonged periods.

According to the users' feedback few of the main usages of these maps over the last three months were:

- Internal and external presentations/briefs
- Visualize needs and DG ECHO partner coverage over a specific area
- Internal programming discussions
- Projects dissemination with other services

More specifically, in the first trimester these maps focused on:

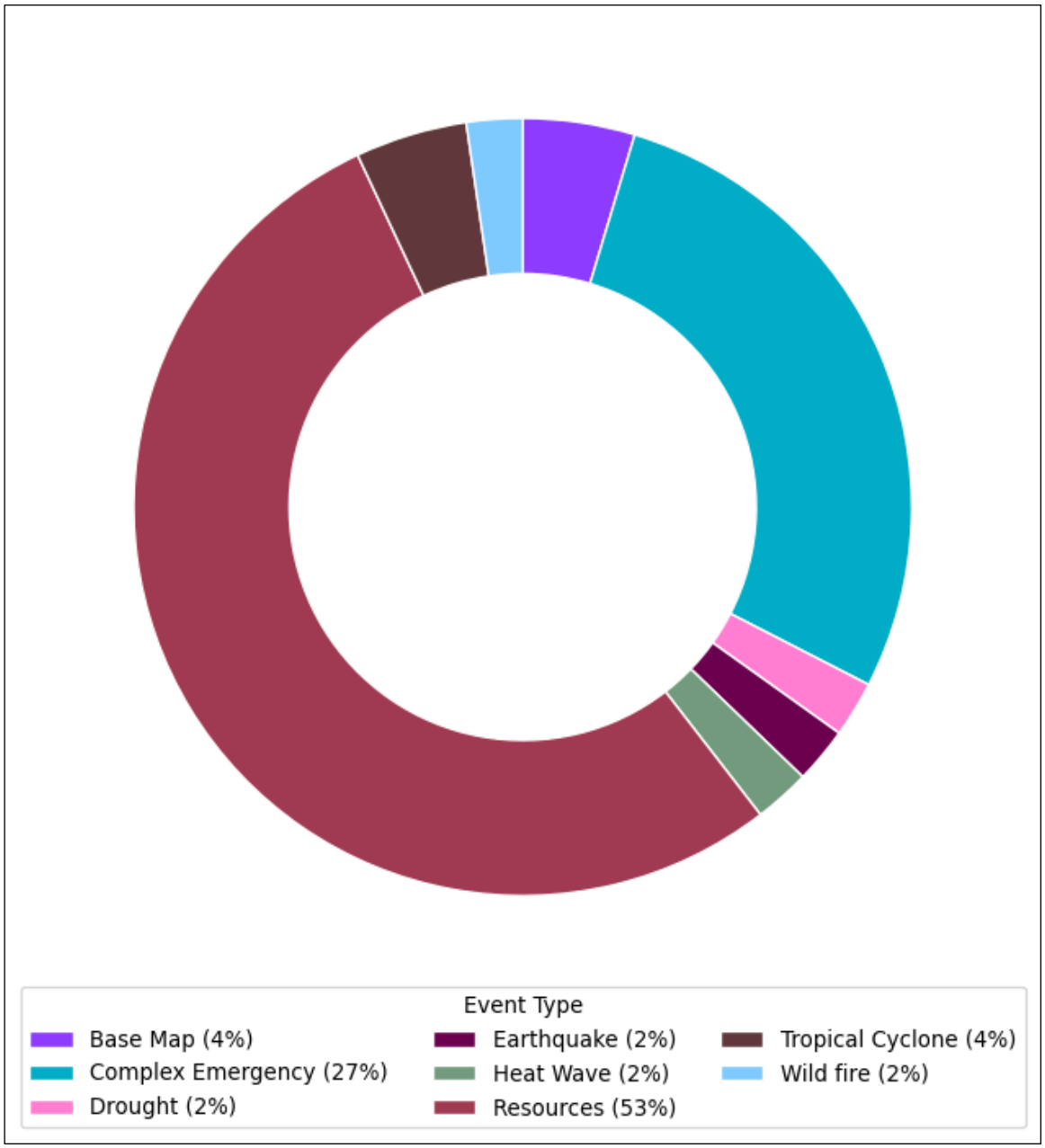
- DG ECHO Funding and humanitarian assistance (partners, sectors of intervention and locations)
- Complex humanitarian crisis:
    - Food insecurity (people at risk of food crisis, and in need)
    - People displacement (refugees, internally displaced persons, returnees)
    - Main conflicts, clashes and hostilities
- Overview of major catastrophic events:
    - Earthquakes
    - Tropical cyclones
    - Wildfires
    - Droughts
    - Heat waves

Since the purpose of the majority of them is to be used within the Commission for presentations and discussion, their nature is inherently internal (not freely accessible) rather than public. It is for this reason that we will not be showing them as we did with the daily maps described above, but rather we will be presenting a general statistics to describe their topics and main geographic distribution.

3.2 Overall Q1 ECHO Situation Maps production

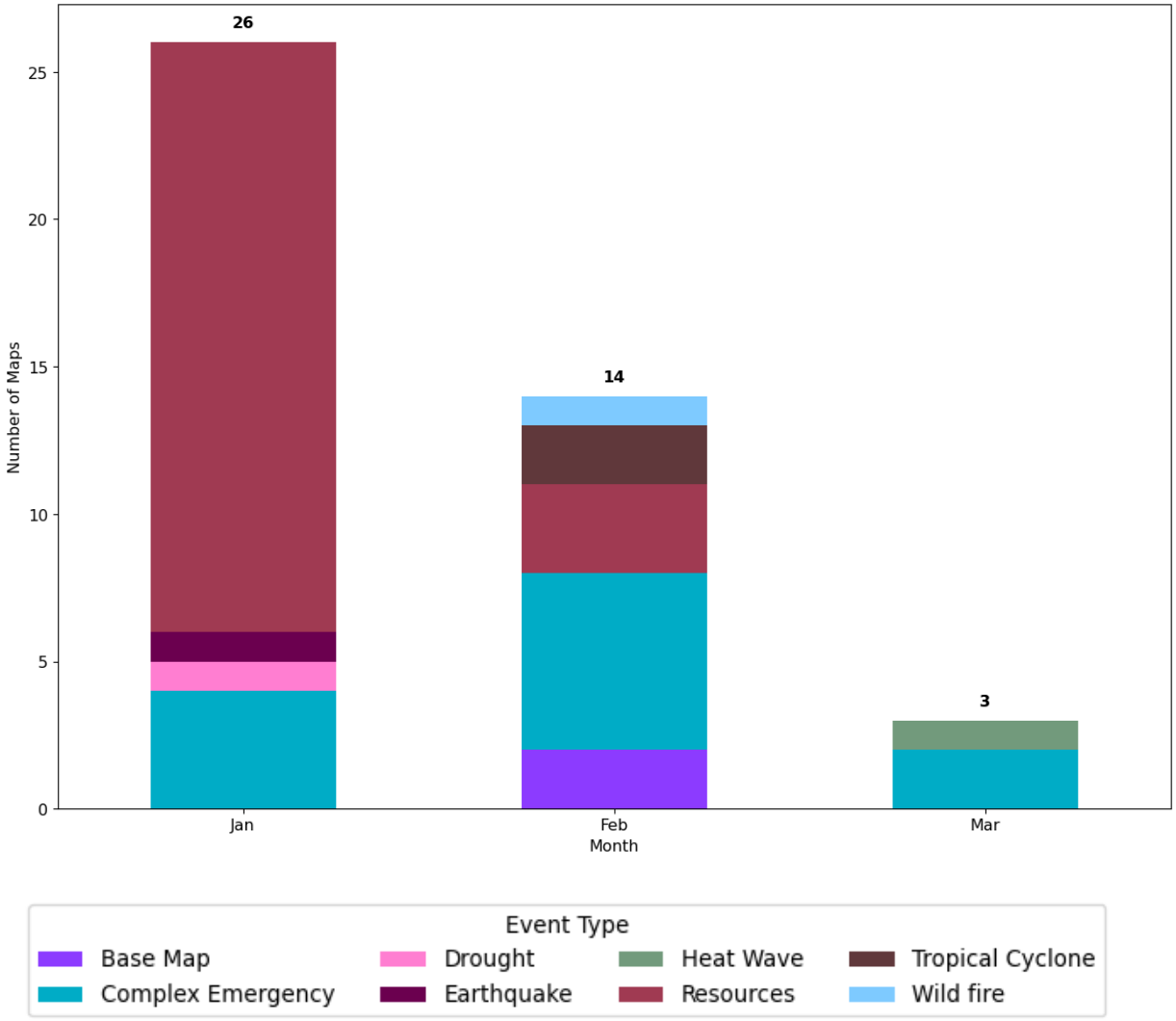
Throughout the first trimester of the year, the team created a total of 43 maps. As shows in Figure 13, the most prevalent event type (53%) is the one labelled Resources (type used to indicate those maps that are used to show funds allocation from DG ECHO Partners), followed by Complex Emergency (27%). The rest of the event types, which mainly fall into the category of single catastrophic event (Drought, Earthquake, Heat Wave, and Wildfire), are equally represented with a low percentages (around 2%). While still being less represented, Base Map and Tropical Cyclone each account for 4% of the total map production.

Figure 13. Event type prevalence (%) in ECHO Situation Maps. Source: JRC-ECML.



The prevalence of Resources-related maps indicates that the predominant role of situation maps is to chart economic interventions of DG ECHO Partners toward a specific area, while the high incidence of Complex Emergency reinforce the previously stated concept that these maps are prevalently used as a visual summary of events interactions rather than focusing on single ones. To give a temporal overview of the quarterly map production, Figure 14 shows the total number of maps produced each month by event type.

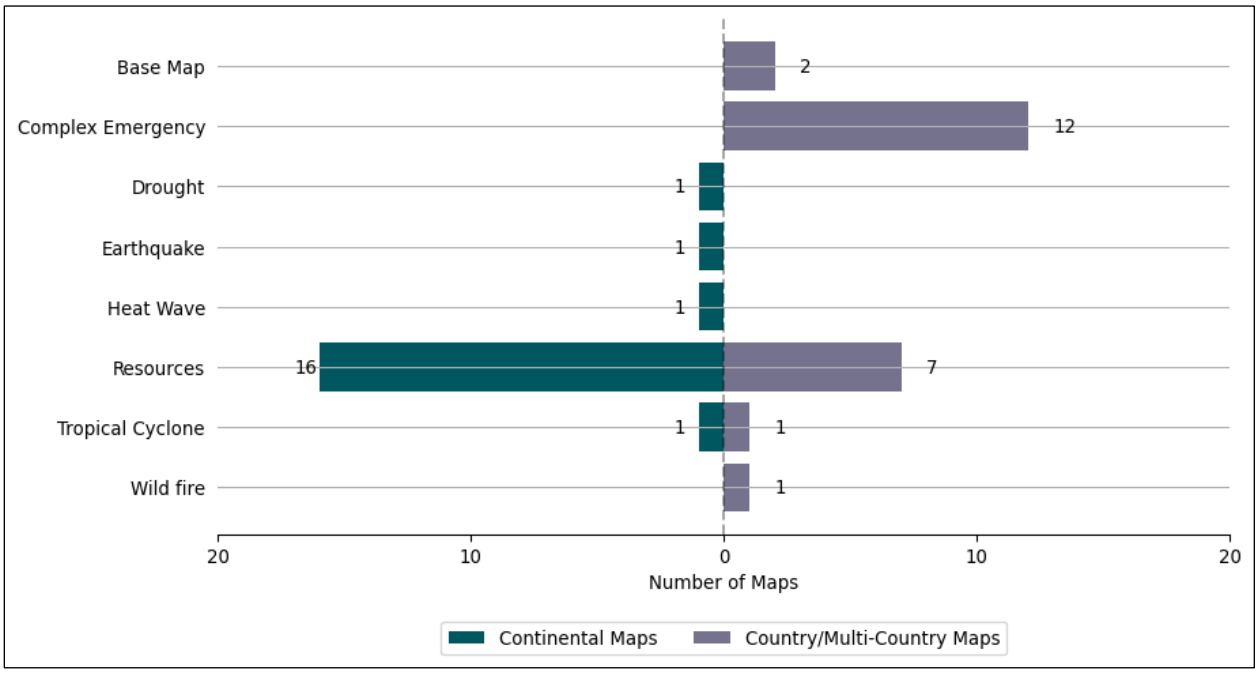
Figure 14. Total number of ECHO Situation Maps by event type for each month. Source: JRC-ECML.



3.3 ECHO Situation Maps by scale/event type

Situation maps can be analysed in different ways: by time, event type, and location. This allows us to see the occurrence and prevalence of events at different scales, such as country, group of countries, or continent. Out of a total of 43 maps, 23 were produced at the country and multi-country scale (15 and 8 respectively), while 20 were produced at the continental scale. Figure 15 shows this breakdown along with the classification by event type.

Figure 15. ECHO Situation Maps by scale/event type. Source: JRC-ECML.



3.4 Spatial distribution of event types

3.4.1 Country and multi-country ECHO Situation Maps distribution

When analysing the spatial distribution of event types of single and multi-country maps (Figure 16), we can clearly see that Resources and Complex Emergency are the predominant type (African Continent). The figure also highlights maps created on the Yemen Crisis (Asia) as well as the Ukraine Conflict (Europe). Due to the Commissioner Lenarcic's mission to Madagascar in March, many maps were produced for this country by the end of February. Resources, Complex Emergency and Tropical Cyclone as event types show that funds allocation, and the interactions of hazardous conditions were among the most charted events besides few about the Tropical Cyclone Freddy (the longest-ever recorded tropical cyclone). Wildfires (beginning of February) in Chile (South America) are also present, while few base maps were requested and produced for Colombia, Venezuela (South America) and Central America. As a complementary visualization, Figure 17 shows the occurrence of countries in these maps. Here we can see both the low occurrence of the Americas (Wild Fire and Base Map), and southern African countries. At the same time, what really stands out, is the considerably high occurrence of countries like Ukraine, Madagascar and those in the Sahel region and Horn of Africa in the African continent. All of these countries are highly represented with the Complex Emergency as event type: while Ukraine is mainly present because of the Russo-Ukrainian War (and the consequent humanitarian crisis), most of the African countries are more affected by the co-existence of famine, droughts, conflicts and population displacement with Madagascar also interested by tropical cyclones.

Not surprisingly no maps were requested/created on Türkiye and Syria even though those countries were hit by one of the largest earthquake ever recorded in the region. This is due to the fact that almost the entirety of the team's efforts were dedicated to the production weekly reports (starting at the beginning of February) monitoring this tremendous event (no specific map was requested/created because already part of these reports). Table 1 lists all the country and multi-country maps produced during the trimester (all the maps can be seen in the proper section of the ERCC portal).

Figure 16. Spatial distribution of event types in single and multi-country ECHO Situation Maps. Source: JRC-ECML.

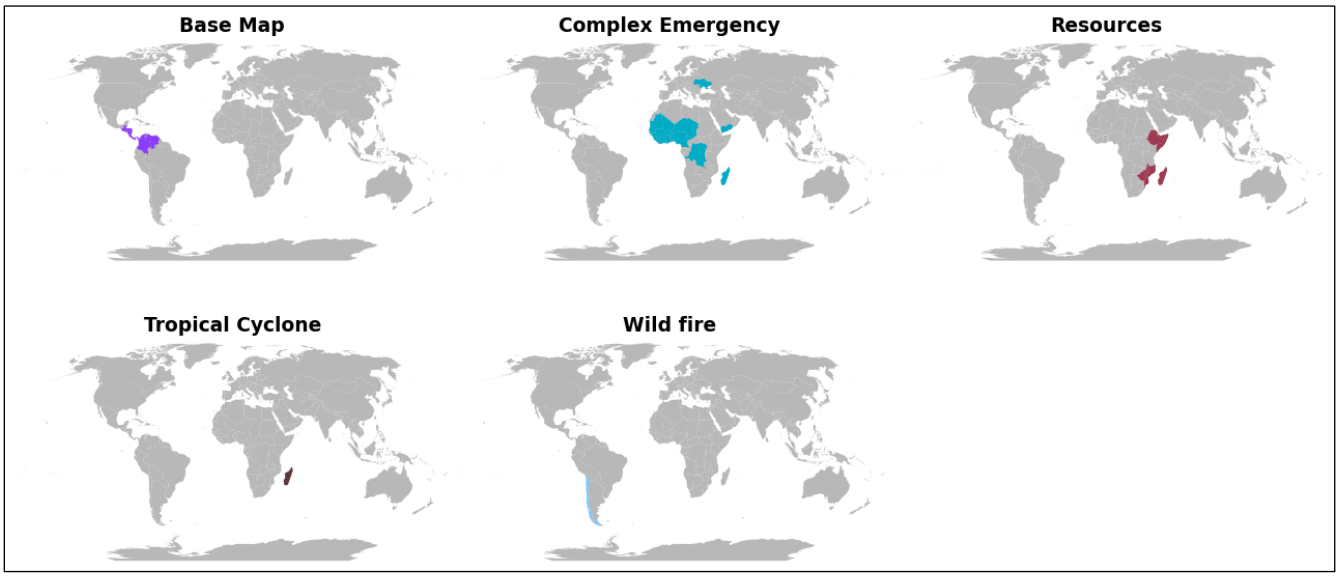


Figure 17. Country occurrence in single and multi-country ECHO Situation Maps. Source: JRC-ECML.

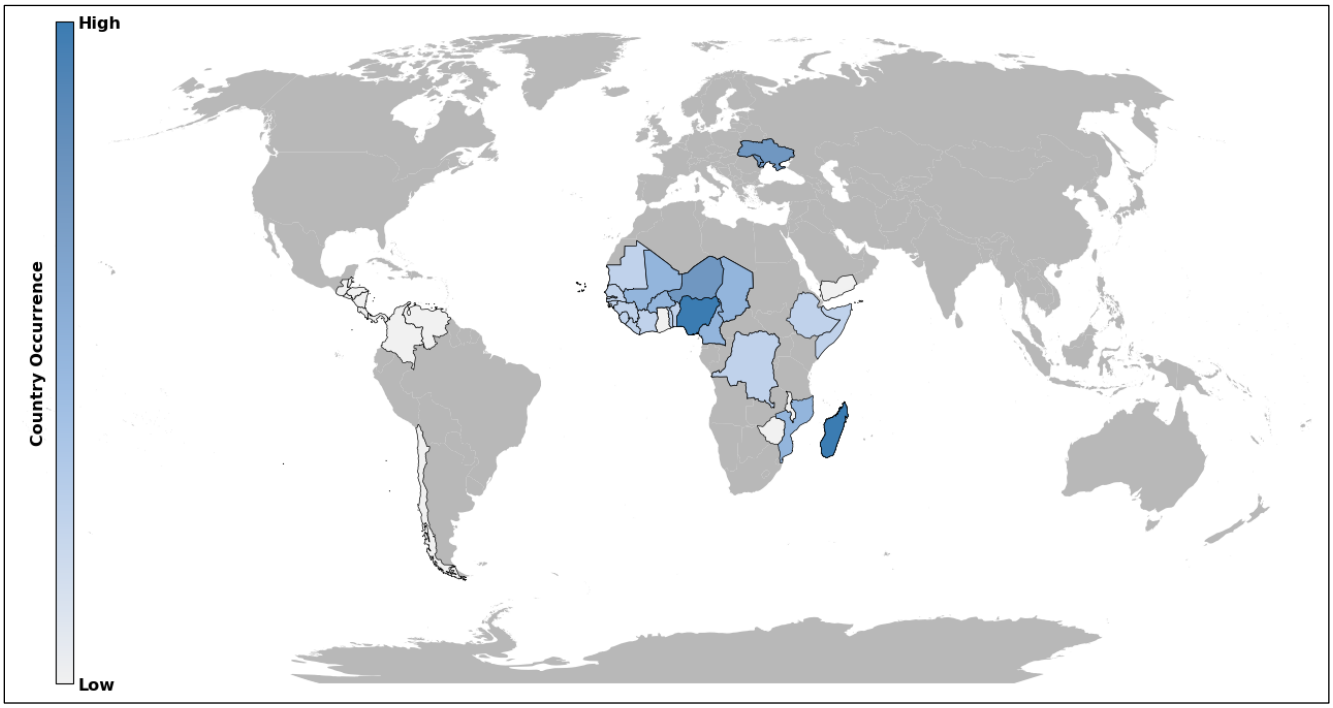


Table 1. List of country and multi-country ECHO Situation Maps in chronological order. Source: JRC-ECML.

Title	Publication Date	Event Type	Country/multi-country: continent
Ethiopia - DG ECHO response in 2022	3-Jan	Resources	Ethiopia
Madagascar - ongoing projects 2023	12-Jan	Resources	Madagascar
DG SAIO region - ongoing projects 2023 - Malawi	12-Jan	Resources	Malawi
Yemen | People in Need 2023	12-Jan	Complex Emergency	Yemen
Zimbabwe - ongoing projects 2023	13-Jan	Resources	Zimbabwe
ECOWAS countries - Complex regional crisis	17-Jan	Complex Emergency	Multi-country: Africa
MOZAMBIQUE - ongoing projects 2023	18-Jan	Resources	Mozambique
DG ECHO - funded humanitarian partners in Somalia	18-Jan	Resources	Somalia
Lake Chad complex crisis	19-Jan	Complex Emergency	Multi-country: Africa
Sahel and Lake Chad Complex Crisis	23-Jan	Complex Emergency	Multi-country: Africa
Colombia - Venezuela Base Map	2-Feb	Base Map	Multi-country: South America
Central America Base Map	3-Feb	Base Map	Multi-country: North America
09/02/2023 - Ukraine - Moldova | DG ECHO-funded humanitarian assistance update	9-Feb	Complex Emergency	Multi-country: Europe
West & Central Africa - complex crisis	14-Feb	Complex Emergency	Multi-country: Africa
Humanitarian Crisis in Eastern DRC	20-Feb	Complex Emergency	Congo, Democratic Republic of the
Chile | Wildfires and UCPM Activation	21-Feb	Wildfire	Chile
Humanitarian Crisis in Eastern DRC	23-Feb	Complex Emergency	Congo, Democratic Republic of the
Current humanitarian crisis in Madagascar	24-Feb	Complex Emergency	Madagascar
Madagascar - map of ongoing projects funded by DG ECHO	24-Feb	Resources	Madagascar
MADAGASCAR – Cyclone Season 2022/2023	24-Feb	Tropical Cyclone	Madagascar
Madagascar - Food Insecurity	27-Feb	Complex Emergency	Madagascar
Nigeria Complex Humanitarian Crisis	10-Mar	Complex Emergency	Nigeria
23/03/2023 - Ukraine - Moldova | DG ECHO-funded humanitarian assistance update	23-Mar	Complex Emergency	Multi-country: Europe

3.4.2 Continental ECHO Situation Maps distribution

When it comes to continental maps, the event types occurrence and their spatial distribution follow a slightly different pattern. As shown in Table 2 (also visible in Figure 18), for this kind of maps there is almost a complete predominance of Resources as event type while the most charted area is the whole World. While recognizing that the World is not typically considered a continent, for the sake of discussion throughout this document, we will consider it as part of the Continental subdivision.

The first trimester of the year is always characterized by a production of continental maps mostly related to an overview of the previous year. In fact, the majority of maps listed in Table 2 is about the DG ECHO Partners funding (worldwide) for the year 2022. Figure 18 also shows maps on drought in Europe as well earthquakes and tropical cyclones in Asia, all concerning a general overview of the previous year (2022). The only exception to this pattern is represented by the heat wave as event type for the entire world (temperature anomalies world maps – Table 2, last row - demand a more frequent monitoring and they can also be charted as monthly overviews in either situation or daily maps).

Figure 18. Spatial distribution of event types in continental ECHO Situation Maps. Source: JRC-ECML.

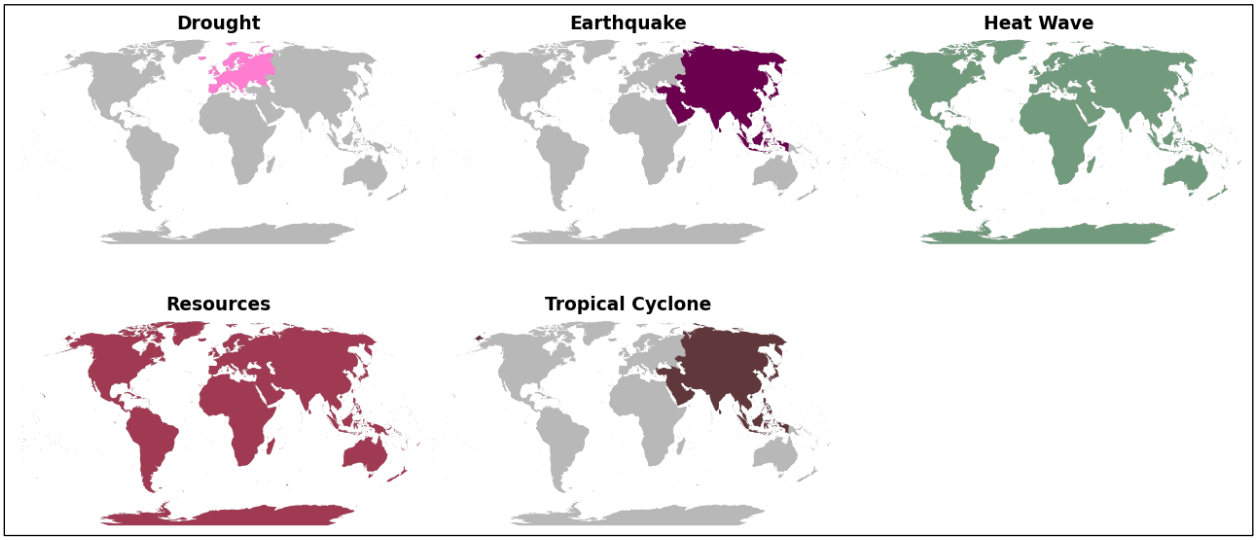


Table 2. List of continental ECHO Situation Maps in chronological order. Source: JRC-ECML.

Title	Publication Date	Event Type	Continent
Map request Europe | Drought and UCPM activations for wildfires in 2022	5-Jan	Drought	Europe
Asia Pacific- Earthquakes overview 2022	13-Jan	Earthquake	Asia
WHO – World Health Organization European Commission Humanitarian Funding 2022 (as at 10/01/2023)	16-Jan	Resources	World
ACTED European Commission Humanitarian Funding 2022	18-Jan	Resources	World
OCHA - Office for the Coordination of Humanitarian Affairs European Commission Humanitarian Funding 2022 (as at 18/01/2023)	23-Jan	Resources	World
IOM – International Organization for Migration European Commission Humanitarian Funding 2022 (as at 18/01/2023)	23-Jan	Resources	World
UNHCR European Commission Humanitarian Funding 2022	24-Jan	Resources	World
WFP - World Food Programme European Commission Humanitarian Funding 2022 (as at 18/01/2023)	24-Jan	Resources	World
FAO - Food and Agriculture Organization of the United Nations European Commission Humanitarian Funding 2022 (as at 18/01/2023)	25-Jan	Resources	World
UNICEF – United Nations International Children's Emergency Fund European Commission Humanitarian Funding 2022 (as at 18/01/2023)	25-Jan	Resources	World
Concern Worldwide European Commission Humanitarian Funding 2022 (as at 16/01/2023)	25-Jan	Resources	World
IFRC – International Federation of Red Cross European Commission Humanitarian Funding 2022 (as at 18/01/2023)	26-Jan	Resources	World
STC-DK - Save the Children Denmark European Commission Humanitarian Funding 2022 (as at 18/01/2023)	26-Jan	Resources	World
ICRC – International Committee of the Red Cross European Commission Humanitarian Funding 2022 (as at 18/01/2023)	26-Jan	Resources	World
ACTED European Commission Humanitarian Funding 2022 (as at 16/01/2023)	26-Jan	Resources	World
Red Cross National Societies European Commission Humanitarian Funding 2022 (as at 18/01/2023)	26-Jan	Resources	World
Red Cross National Societies European Commission Humanitarian Funding 2022 (as at 18/01/2023)	2-Feb	Resources	World
Asia Pacific – Tropical Cyclone Season 2022	10-Feb	Tropical cyclone	Asia
STC certified partners - European Commission Humanitarian Funding 2022	24-Feb	Resources	World
World | Temperature Anomalies in January 2023	16-Mar	Heat Wave	World

4 Conclusions

The present report (a first release of a series of quarterly reports) represents daily and non-daily activities of the ECML Mapping Team in support to DG ECHO and to the ERCC and it is a reasoned portfolio of all the situational awareness products (both in form of maps and brief reports) produced for and collected in the ERCC portal. This document aims to support the reader to have a knowledge of what happen periodically across the world, by means of an analysis of the three main pillars of the ERCC portal: ECHO Daily Flash, ECHO Daily Map and ECHO Situation Maps. This document is also meant to contribute to the deliverable "Enhanced Global Monitoring" of the JRC portfolio, "Enhanced Situational Awareness for Crisis Management", planned for the end of 2023.

The ERCC portal is partially an open access portal and reaches a very large general audience, mainly through the first two mentioned products (ECHO Daily Flash, ECHO Daily Map), but also by means of a number of ECHO Situation Maps with public access. Moreover, this latter product is mainly intended for a specialised audience/users (internal to DG ECHO, ERCC and the European Commission) and it is accessible for its large part with restricted access.

During the period of concern one of main common aspect between ECHO Daily Maps and ECHO Situational Maps is the significant number of maps representing a cumulative overview of different topics of the previous year or of the second semester of the previous year itself (i.e. global overview of occurred natural disaster, of DG ECHO funding, projects and resources and of EU and UCPM response).

Furthermore, we can say that there is a strict relationship between these two mapping products (ECHO Daily Maps and ECHO Situational Maps), that considered together are not simply a cartographic support to DG ECHO and ERCC but above all one of the most significant (also from a quantitative point-of-view) analytical product (among others, e.g. JRC Emergency Report) produced by the JRC for DG ECHO, ERCC and the European Commission.

List of abbreviations and definitions

DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
ECML	European Crisis management Laboratory
ECMWF	European Centre for Medium-Range Weather Forecasts
EMSN	Emergency Management Service - Risk and Recovery Mapping
EMSR	Emergency Management Service – Rapid Mapping
ERCC	Emergency Response Coordination Centre
GDACS	Global Disaster Alert and Coordination System
GDO	Global Drought Observatory
GFS	Global Forecast System
GHSL	Global Human Settlement
GLOFAS	Global Flood Awareness System
GPM	Global Precipitation Measurement
GWIS	Global Forest Fire Information System
HWRF	Hurricane Weather Research and Forecast System
JTWC	Joint Typhoon Warning Center
MODIS	Moderate Resolution Imaging Spectroradiometer
NOAA	National Oceanic and Atmospheric Administration
USGS	United States Geological Survey

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