Platform for Atlantic Geohazard Risk Management

AGEO DELIVERABLE D4.1

STATUS REPORT ON THE USE OF COPERNICUS EMS IN THE PARTICIPATING REGIONS

PARTNER REPORT – LNEG

Authors: Lídia Quental (LNEG) and Susana Machado (LNEG)

WP4 IGME –Inés Galindo (Coordinator) and Isabel Montes

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Partner name	Name	e-mail
Instituto Superior Técnico- Universidad de Lisboa.	Rui Pedro Carrilho Gomes	rui.carrilho.gomes@tecnico.ulisboa.pt
Associação Portuguesa de Geólogos	José Manuel Correia Romão	jromao@apgeologos.pt
La Palma Research Center	Ariadna Ortega Rodríguez	ariadna.ortega@lapalmacentre.eu
Instituto Geológico y Minero de España	Inés Galindo Jiménez	i.galindo@igme.es
Université de Bretagne Occidentale	Lucie Cocquempot	lucie.cocquempot@univ-brest.fr
United Kingdom Research and Innovation represented by its component body British Geological Survey	Kirstin Lemon	klem@bgs.ac.uk
University College Dublin	Gregory O'Hare	gregory.ohare@ucd.ie
Centre dÉtudes et d'Expertise sur les Risques Environnement Mobilité et Aménagement	LE DANTEC Nicolas	nicolas.le-dantec@cerema.fr
Laboratório Nacional de Energía e Geología	Lídia Quental	lidia.quental@lneg.pt

Universidad de La Laguna	Juan Carlos Santamarta Cerezal	jcsanta@ull.es
Laboratório Nacional de Engenharia Civil	Laura Caldeira	laurac@lnec.pt
Universidade de Madeira	Fátima Maria Pereira Gouveia	fatimampgouveia@gmail.com
Camara Municipal de Lisboa	Cláudia Filipa Narciso Pinto	claudia.pinto@cm-lisboa.pt

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EXECUTIVE SUMMARY

This works aims to establish the status of the Copernicus Emergency Management Service (EMS) in Portugal, based on multiple sources. EMS supports all phases of the emergency management cycle: preparedness, prevention, disaster risk reduction, emergency response and recovery, providing civil protection authorities and Humanitarian Aid Agencies, with timely and accurate geo-spatial information derived from satellite remote sensing and completed by available in situ or open data sources. It is composed of an on-demand mapping component providing rapid maps for emergency response (EMSR) and risk and recovery maps for prevention and planning (EMSN), as well as an early warning and monitoring component.

Of the 20 activations in Portugal until now, the predominant type of disaster is fire, followed by floods in EMSR and multiple hazard in EMSN, among others. The products have different formats and are available online. Geohazards, in the *s.s.* as disasters of geological origin, whether related to internal or external geodynamic processes, correspond to very few activations of EMSN, and exceptionally floods, as mixed natural hazard in EMSR activation.

A stakeholder survey designed by IGME to check the level of engagement with service provider's, still with a limited number of respondents, highlights that the majority of the stakeholders, both individual or organizations, demonstrate a medium to high knowledge about Copernicus EMS and had already requested Copernicus data. This was considered useful as well as the experience with the service. Although most of the stakeholders are not involved in the development or implementation of tools dedicated to geohazards, the overall engagement with these dedicated tools is remarkable.

Other activities such as a dedicated Copernicus workshop for AGEO increased the knowledge of Copernicus EMS through experts from the European Commission and Portuguese focal point and Authorised User to activate the service.

A few bottlenecks were identified through the Copernicus EMS activation chain such as time issues that can compromise the performance of the service and its effective support to the users for the disaster management. Another one is related to the availability of ancillary data that can compromise the result of the final product, relying solely on open access data or provided by the user.

Best practices of the Copernicus EMS were are also identified at several levels, i.e. concerning pre-tasking of satellite images using early warning systems and linking the two main components of EMS (monitoring and on demand), data sources, scale, easiness of activation and data accessibility.

1 INTRODUCTION

Copernicus is the European Union Space program[1], for the establishment of a European capacity for Earth Observation developed in three components: space, ground, and services relying on the former two. For monitoring the Earth for the ultimate benefit of the citizens, the services develop in six thematic areas: land, marine, atmosphere, climate change, emergency management, and security.

The Copernicus Emergency Management Service (EMS) is the dedicated service for the management of natural or human made disasters and humanitarian crisis throughout the world. Thus, it supports all phases of the emergency management cycle: preparedness, prevention, disaster risk reduction, emergency response and recovery. The Copernicus EMS provides all actors involved in the emergency management, e.g. Civil Protection Authorities and Humanitarian Aid Agencies, with timely and accurate geo-spatial information derived from satellite remote sensing and completed by available in situ or open data sources[2]. It is composed of an on-demand mapping component providing rapid maps for emergency response and risk and recovery maps for prevention and planning **(A)**, and of the early warning and monitoring component (**B, C** and **D**)[3] (Figure 1):

A. Copernicus EMS – Mapping

1. **Rapid Mapping (EMSR)** consists of the provision of geospatial information within hours or days from the activation in support of emergency management activities immediately following a disaster. Standardised mapping products are provided: e.g. to ascertain the situation before the event (reference product), to roughly identify and assess the most affected locations (first estimate product), assess the geographical extent of the event (delineation product) or to evaluate the intensity and scope of the damage resulting from the event (grading product).

2. **Risk & Recovery Mapping (EMSN)** consists of the on-demand provision of geospatial information in support of Disaster Management activities not related to immediate response, i.e. in a non-rush mode. This applies in particular to activities dealing with prevention, preparedness, disaster risk reduction and recovery phases. There are three broad product categories: Reference Maps, Pre-disaster Situation Maps and Post-disaster Situation Maps.

B. **The European Flood Awareness Systems (EFAS)** provides complementary flood forecast information to relevant stakeholders supporting flood risk management at national, regional and global level where overviews on ongoing and forecasted floods in Europe up to 10 days in advance [4].

C. **The European Forest Fire Information System (EFFIS)** provides near real-time and historical information on forest fires and forest fire regimes in the European, Middle Eastern and North African regions[5].

D. **The European Drought Observatory (EDO**), which provides drought-relevant information and early-warnings for Europe.

The Copernicus EMS has been operational since 1st April 2012 implemented by the European Commission DG Joint Research Centre (JRC). The products generated by the service are usable as supplied and available (e.g. as digital or printed map outputs in several formats to any citizen[6]) at the portal of the EMS for the case of EMS Mapping (Figure 1). They may also be combined with other

[1] https://www.copernicus.eu/en/about-copernicus; REGULATION (EU) No 377/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 3 April 2014 establishing the Copernicus Programme and repealing Regulation (EU) No 911/2010 (http://data.europa.eu/eli/reg/2014/377/oj)

[2] https://www.copernicus.eu/sites/default/files/documents/Copernicus_EmergencyMonitoring_Feb2017_0.pdf

[3] https://emergency.copernicus.eu/

[4] The Portuguese partner of EFAS is Instituto Português do Mar e da Atmosfera (IPMA).

[5] The Portuguese partners of EFFIS are Instituto da Conservação da Natureza e das Florestas (ICNF) and Autoridade Nacional de Emergência e Proteção Civil (ANEPC).

[6] The general public users are not authorised to trigger the service, but can be informed of an activation request and access service outputs through the web portal accessible to all, excluding activations for which security restrictions apply.

data sources (e.g. as digital feature sets in a geographic information system) to support geospatial analysis and decision making processes of emergency managers.

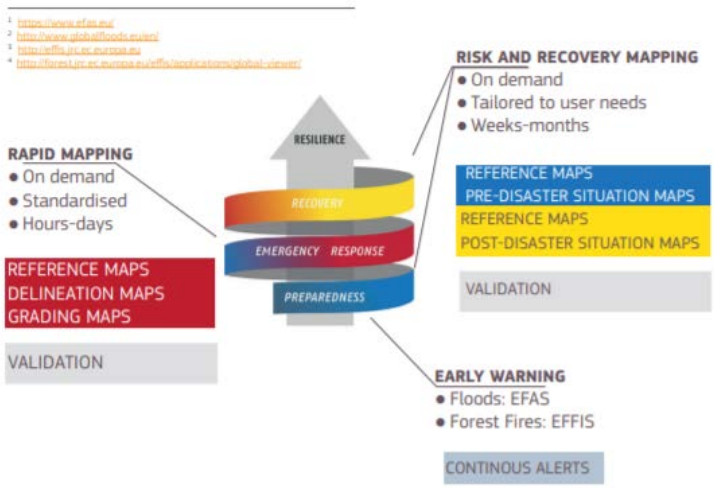

Figure 1. Copernicus EMS in a nutshell: Preparedness, emergency response and recovery, time frame and associated products. (https://emergency.copernicus.eu/mapping/sites/default/files/files/CopernicusEMS-High_Level_Brochure.pdf)

The **EMS can be triggered only by or through an Authorised User (AU)**. The AU include National Focal Points (NFPs) in the EU Member States and countries participating in the Copernicus programme, as well as European Commission services and the European External Action Service (EEAS). The activation, after accepted by the Directorate General–Joint Research Centre (DG-JRC), follows a detailed workflow, including validation procedures aiming to continuously improve the quality of the service (MOP, 2018, QSG, 2016)

The European Commission supports the open data policies making the data available specifically generated for the Copernicus, i.e. derived from Sentinel sensors. However, part of the program relies on the contributing missions in order to fulfil the requirements of the users with more detailed resolution whether spatial or spectral. This is the case of many of the imagery used in the Emergency Service, which is subject to copyright. However, once the program acquired the data, it can be made available for Public Authorities and for research purposes (CSDOFPA, 2016).

In this work, is provided an overview/ factsheet about the status of Copernicus EMS activations hazards in Portugal with focus on the ones related to geologic events, i.e. geohazards.

2 METHODOLOGY

The approach to acquire knowledge about the status of the use of Copernicus EMS is based on:

- open data and information available through public portals, e.g. https://emergency.copernicus.eu/
- country information acquired over time related to Copernicus data and services and national institutions
- a Copernicus workshop for AGEO held in Lisbon in 2019.
- results of a specific survey designed for AGEO in the framework of Work Package 4

Based on these sources the present status is analysed under the point of view of bottlenecks/constraints and good practices.

3 COPERNICUS EMS ACTIVATIONS HAZARDS IN PORTUGAL

The EMS activations in Portugal encompass both rapid mapping **Rapid Mapping (EMSR)** and **Risk & Recovery Mapping (EMSN)** (Figure 2).

The type of EMSR activations in Portugal were related to fires (wildfires/forest) and floods, as depicted in Figure 2. Humanitarian and storm corresponds to only one event each. In the case of EMSN the predominance was also related to fire, followed by multiple hazard, although the fire and landslide event could also integrate multiple hazards. Coastal flood and the fire and landslide event correspond also to only an event each.

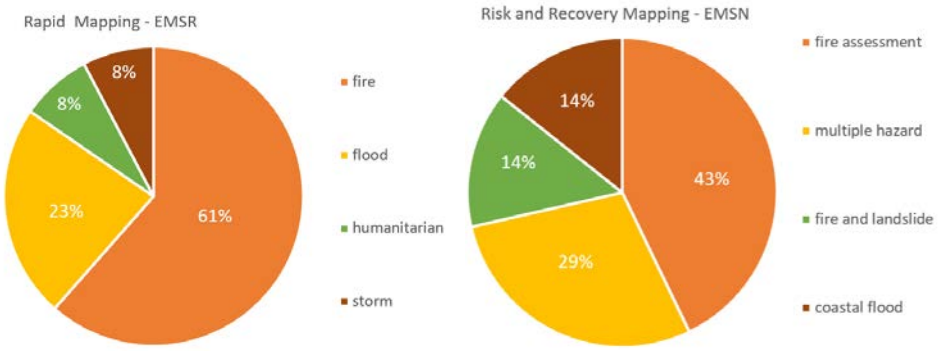

Figure 2. Copernicus EMS activations: Rapid Mapping (13) and Risk and Recovery mapping (7) since 2012 and distribution by hazard type on the geographic area of Portugal based in Tables 1 and 2

The activations of EMSR are identified by the code number, date of occurrence and hazard type (Table 1).

Table 1. List of EMSR Mapping Activations in Portugal (https://emergency.copernicus.eu/mapping/list-of-activations-rapid)

Act. Code	Title	Event Date	Type
EMSR417	Flood in Portugal	2019-12-19	Flood
EMSR395	Tropical Cyclone in Flores Island, Portugal	2019-10-02	Storm
EMSR386	Forest fire in Aveiro District, Portugal	2019-09-05	Wildfire
EMSR372	Fire in Castelo Branco, Portugal	2019-07-20	Wildfire
EMSR303	Forest Fire in Faro, Portugal	2018-08-03	Wildfire
EMSR250	Forest fire Portugal	2017-10-15	Wildfire
EMSR207	Forest fires in Leiria District, Portugal	2017-06-17	Wildfire
EMSR204	Fátima 100th Anniversary	2017-05-13	Humanitarian
EMSR175	Forest Fire in Madeira Island	2016-08-08	Forest fire, w...
EMSR072	Floods in central Portugal	2014-02-12	Flood
EMSR066	Flood in Portugal	2014-01-06	Flood
EMSR050	Fires in Braganca, Portugal	2013-07-09	Forest fire, w...
EMSR010	Forest Fire in Portugal	2012-07-18	Forest fire, w...

The number of products derived from EMSR activations are dependent of: 1) the type of hazard and products requested, generically may comprise reference, delineation and grading maps[7] (Figure 1), and 2) of the extent of the hazard (area and time frame). The mapping is derived by different types of

[7] https://emergency.copernicus.eu/mapping/ems/rapid-mapping-portfolio

imagery, optical and/or radar of high resolution or other, and ancillary data based on open data available or provided by other entities.

An example of a product of an EMSR activation (Code 072) is given in Figure 3 for the Alcoa River flood. The activation was triggered due to very heavy rainfalls and the Lis and Alcoa Rivers, on the centre of Portugal, have overflowed and destroyed some of the dykes on those irrigation districts on 2014-02-12. The Figure 3 depicts precise details of the area affected and type of land cover. The total amount of products generated by this activation was 08.

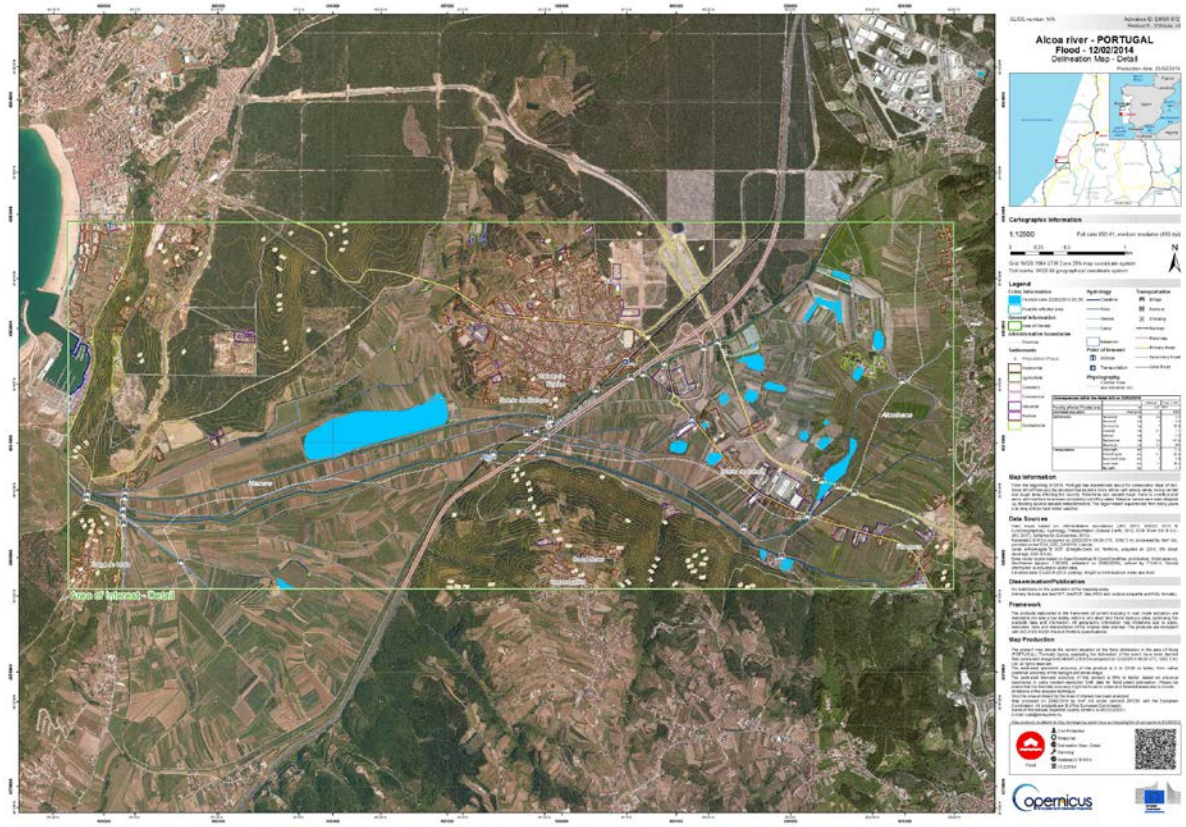

Figure 3. Copernicus EMSR072: Flooded area of Alcoa river derived from Radarsat -2 images post event 22/02/2014 and overlayed on aerial orthophoto of Direção Geral do Território (https://emergency.copernicus.eu/mapping/list-of-components/EMSR072)

In some descriptions of the activations, it is worth noticing that some events also demonstrate the quality evaluation, as some products required reprocessing, e.g. EMSR395-Tropical Cyclone in Flores Island, Portugal (MOP, 2018, QSG, 2016).

In Portugal, none of the EMRS events relates to geohazards as a result of internal geodynamics processes. However, Portugal was responsible for the activation of EMRS111 through the PT Authorized User (Autoridade Nacional de Proteção Civil-ANPC, now renamed for Autoridade Nacional de Emergência e Proteção Civil-ANEPC) for the Fogo Volcano eruption in Cape Verde (LNEC, 2015). The eruption started in 2014-11-23 and lasted for more than 2 months. The last map of 6 grading and 3 reference maps was published in 2015-01-12 and shown in Figure 4. The several monitoring episodes depicts lava flow advances making comprehensive the pathways during the time frame, in order to support the risk response of the local authorities. The eruption lead to the Chã das Caldeiras village evacuation and destruction. After activation triggered by the state laboratory of civil engineering (LNEC, 2015), the Portuguese researchers of different institutions accompanied the activation. This was done in close cooperation with Cape Verde similar institutions.

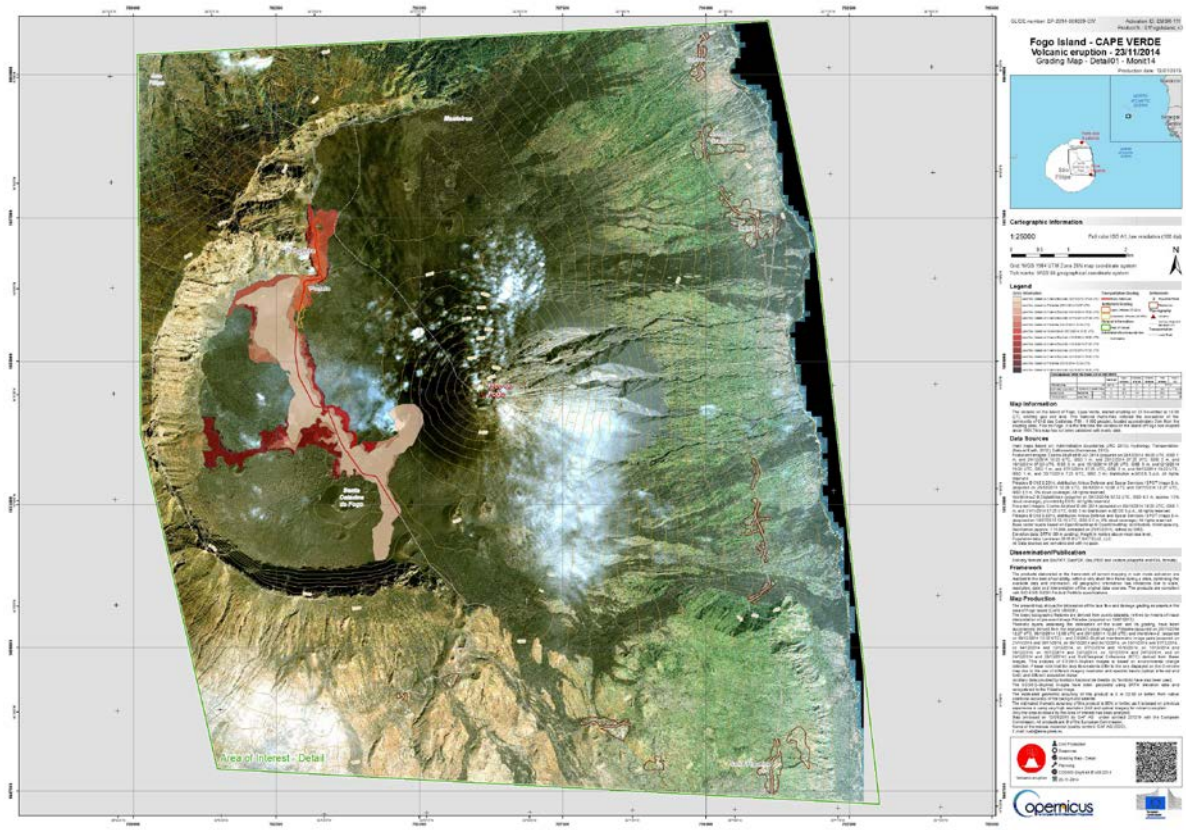

Figure 4. Details of the EMSR111 activated by the authorised user of Portugal (ANPC) for the volcanic eruption at Fogo Island (Cape Verde). The grading map depicts several episodes of lava flow progress through 14 monitoring episodes (https://emergency.copernicus.eu/mapping/list-of-components/EMSR111) .

Concerning Risk & Recovery Mapping (EMSN), in non-rush mode, Portugal had 07 activations as depicted in Table 2 and in % in Figure 2. As in the case of EMSR, the major hazard type is fire (4), followed by multiple hazards assessments (2).

One of the cases of the multihazard activation was EMSN018 for the Azores archipelago, which followed a Call of Expression of Interest (EOI) by the European Commission in 2015, requested by three Portuguese authorities: (I) Direção Regional Obras Públicas e Comunicações (DROPC), (II) Serviço Regional de Proteção Civil e Bombeiros dos Açores (SRPCBA), and (III) Centro de Informação e Vigilância Sismovulcânica dos Açores (CIVISA). Risk assessment products such as exposure, vulnerability and risk maps in order to support the mitigation and preparedness efforts needed to minimize casualties and economic impact by setting up an effective preparedness and response mechanism concerning the following hazards: Seismic hazard, Flash Flood hazard, Tsunami and Storm Surges hazard, Landslide and Erosion hazard, Lava Flow and Coastal Erosion hazard.

Through this activation were produced 2248 maps encompassing several islands described in detail in EMSN018 (2016), concerning imagery and models applied for the generation of the different products, e.g. lava flow, seismic hazard, vulnerability and others. In Figure 5 is the map of lava flow risk assessment for the Pico island, with decreasing risk from red to green. Another example is given in Figure 6 for coastal erosion risk map of the Faial island.

The validation reports EMSV023 (2016), highlight many aspects concerning this activation related also to the GeoDeliverables, as well as recommendations to follow (Section 6).

Table 2. List of EMS Risk and Recovery Mapping in Portugal (https://emergency.copernicus.eu/mapping/list-of-activations-risk-and-recovery)

Act. Code	Title
EMSN034	Coastal flood risk analysis for population and assets, Portugal
EMSN032	Forest fire damage assessment, Portugal
EMSN031	Forest fire damage assessment and landslide risk, Madeira Island, Portugal
EMSN020	Multiple natural hazard risk assessment - Planning and Recovery
EMSN018	Multiple natural hazard risk assessment - Planning and Recovery, Azores Islands, Portugal
EMSN017	Forest Fires 2015, Portugal
EMSN010	Forest fire damage assessment – Planning and Recovery Serra de Caramulo, Portugal

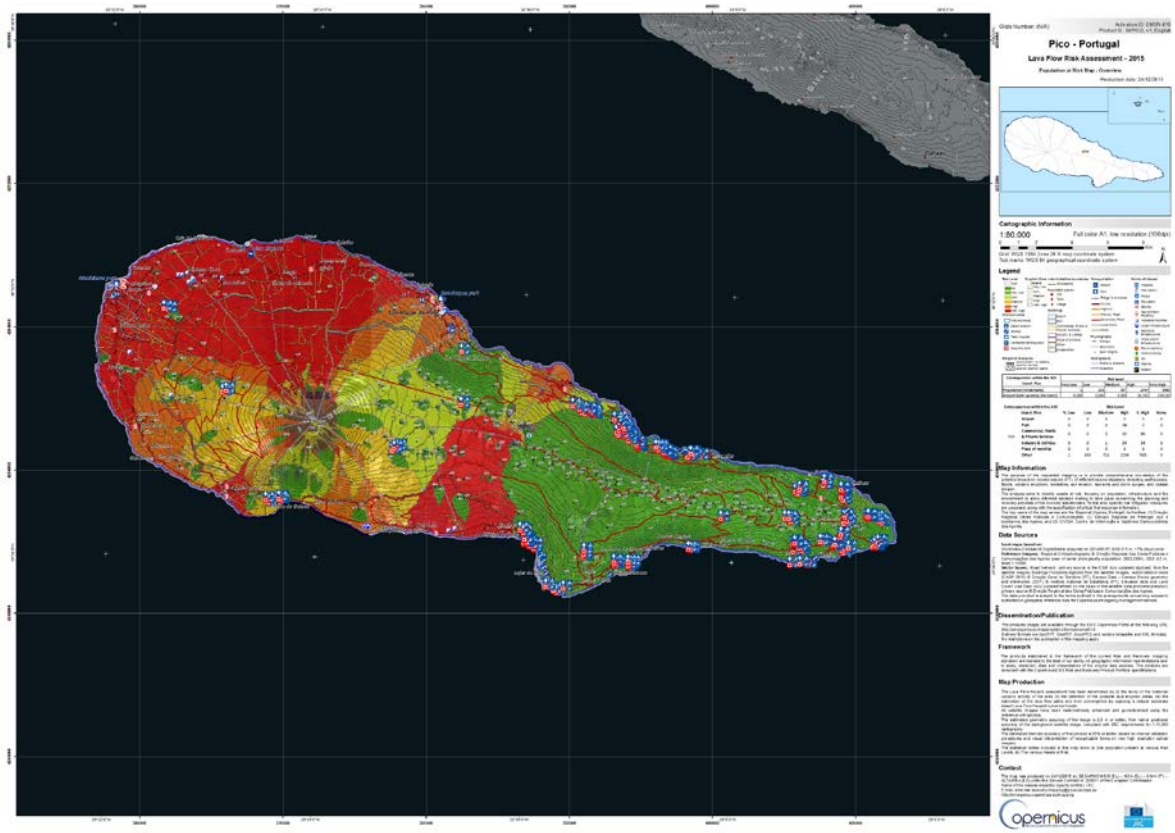

Figure 5. A map of EMSN018 of lava flow risk assessment for Pico island, decreasing from red to green (https://emergency.copernicus.eu/mapping/list-of-components/EMSN018).

A similar activation, EMSN020, was done for the Madeira archipelago following the same call for expression of interest as EMSN018 by Serviço Regional de Proteção Civil, IP – RAM regional Authority of the Autonomous region of Madeira (PT).

The request EMSN-020 was to generate: (1) Risk assessment products, including hazard, exposure, vulnerability and risk maps concerning the following hazards: Seismic, Tsunami, Forest Fire, Landslide and erosion, Flash Flood and Industrial accidents and (2) Mitigation measures with respect to all evaluated risks. For this scope, 502 maps were produced described in detail in EMSN020 (2016). For this activation, it has not been find validation reports available online. Figure 6 depicts an overview map of the Landslide Risk Assessment of Madeira Island as a product of the EMSN020.

In the case of EMSN-034 (Table 2), activated on 2017-04-21, the scope was to generate pre-disaster situation analyses and maps to provide thematic information supporting planning for contingencies on vulnerable coastal areas, such as Costa da Caparica (South of Lisbon), along with a European framework directive on the assessment and management of the flood risk (2007/60/EC). It also included a set of risk assessment products: exposure, vulnerability and risk maps and modelling scenarios for population and assets concerning the following hazards: - Tsunami and storm surges hazard, Coastal erosion hazard. Mitigation measures with respect to assessed risks were also evaluated and adequate measures according to the encountered circumstances were proposed. The general objective was to perform a proper risk assessment, as well as the evaluation of mitigation and preparedness efforts, to minimize casualties and economic impact in the selected area (EMSN034, 2017).

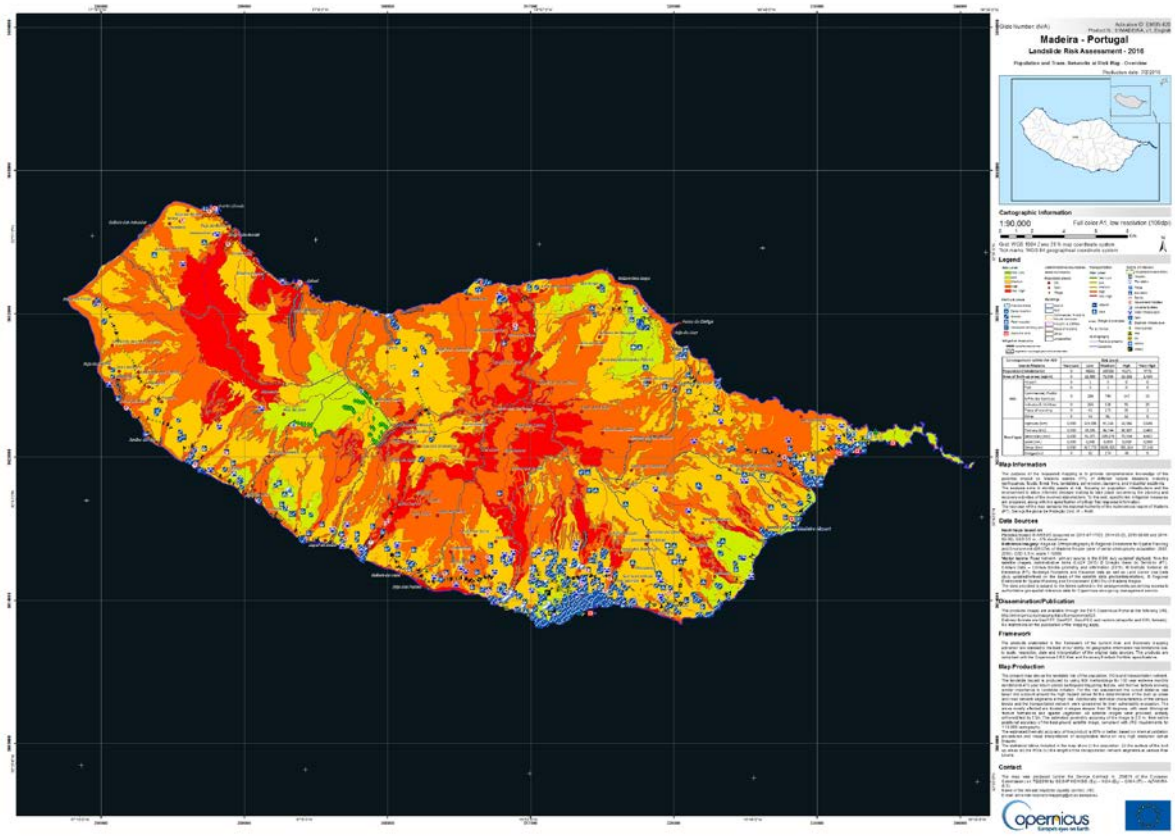

Figure 6. Map of EMSN020 of Landslide Risk Assessment for Madeira Island from very low (green) to very high (red).
(https://emergency.copernicus.eu/mapping/system/files/components/EMSN020_01MADEIRA_05LANSDRISK00POPTRANSPRISK_OVERVIEW_v1_100dpi.jpg).

The EMRN034 activation has the particularity to use Remotely Piloted Aircraft Systems (RPAS) of JRC for the generation of very detailed Digital Surface Model (UAV_DSM), 10 cm GSD, combined with ANPC Archive airborne ortho-photo imagery with the same resolution. A factsheet is also available with discrimination of each of the products generated (EMRN034FS, 2017).

In Figure 7 mitigation measures are proposed for the area of Costa da Caparica coastal flood risk such as relocation of sensitive buildings, public services, etc.; safe shelters and buildings; sand dunes protection; coastal prevention forests; coastal structures and others.

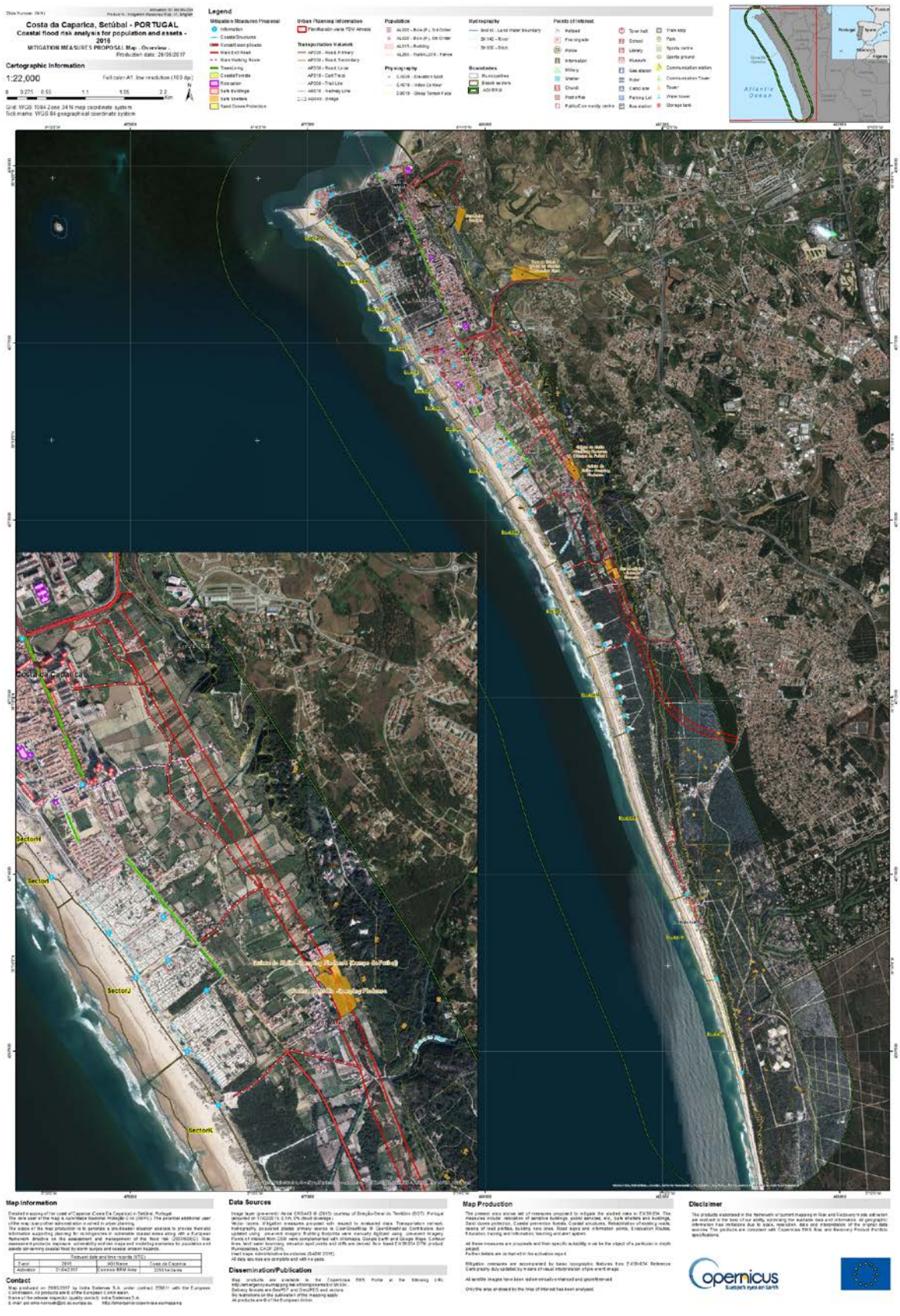

Figure 7. EMSN034 - Mitigation measures for the area of Costa da Caparica after coastal flood risk analysis, overlayed on aerial CROA10 (Direção Geral do Território) https://emergency.copernicus.eu/mapping/list-of-components/EMSN034

4 STAKEHOLDER SURVEY

4.1 SURVEY DESIGN

Questionnaires were arranged in order to check the level of engagement with service providers. The stakeholder`s feedback will let us know about data that they demand, interaction quality with Copernicus services, involvement degree, tools usefulness, users interests, needs and difficulties. They will give information about the efficiency of the service.

The stakeholder survey is available in four languages and it is structured in 5 sections (Appendix I): General information (Questions 1-9), Tools for geological hazards (Questions 10-15), Service Information (Questions 16-20), Copernicus Data Policy (Questions 21-25) and Suggestions (Question 26).

4.2 RESULTS ANALYSIS

Although also launched in the Portuguese idiom the results of the survey are provided in English aligned with the idiom of this report. The results presented were collected until 7th of February 2020.

The first part of the questionnaire is dedicated to general information, concerning the knowledge and use of Copernicus services. The general majority of the stakeholders demonstrate a medium to high knowledge about Copernicus and Earth observing systems, but half of them did not acquire specific training. Most of the stakeholder's organizations did already requested Copernicus data, with a moderate frequency, mainly for purposes related to risk prevention and emergency responses. These organizations develop activity in several geological risks, being landslides transversal to most of them. The individual stakeholders itself uses the Copernicus services for research projects.

The second part of the questionnaire is dedicated to the relation of the stakeholders with the tools for geohazards in the Copernicus services. Most of them are not involved in the development or implementation of these services. The Copernicus user interface is considered easy and the usefulness of its geohazards tools is high. The interpretation of the results from the Copernicus EMS is considered easy, and most of the responses do not indicate any new product or service that is considered necessary.

About the service information, introduced in part three of the questionnaire, the preferences regarding Copernicus EMS information products indicates both to further processing of the Copernicus service information to produce other value-added products and to download these products. The display format preferred for Copernicus EMS is web portal or mobile devices and the preferred way to download its information is the automated way. Most of the responses does not indicate which new tool could be incorporated into Copernicus EMS in order to improve the individual work. The purpose of using Copernicus EMS products and services is exclusively for risk management.

The last part of the questionnaire regards the Copernicus data policy. Most of the organizations had already downloaded data from Copernicus EMS, but it is not perceptible by the responses the reason that gave rise to the impediments to downloading information. The information provided by Copernicus EMS is useful for the majority of responses and the experience with this service, in general is considered useful.

In conclusion, the responses to the questionnaire about Copernicus products and services for geohazard risk reduction indicates that Portuguese stakeholders are reasonably involved with this program. However, it is worth noticing that this corresponds to a limited number of respondents for this first approach.

5 OTHER ACTIVITIES IN THE AGEO PROJECT FRAMEWORK

5.1 WORKSHOP COPERNICUS FOR GEOHAZARDS IN THE FRAMEWORK OF AGEO

Organised by LNEG and IST, the workshop held in 13th November 2019 at LNEG Campus of Alfragide, aimed:

- To provide an overview of the Copernicus space program,
- Disseminate the role of Copernicus in geohazards risk management,
- Disseminate the AGEO project,
- To exploit the application of Copernicus data and services to AGEO Citizens Observatories pilots,
- To identify bottlenecks of existent Copernicus data and Services
- To identify future requirements in Citizens Observatories, and
- To strengthen the links among different communities

The agenda was split into 4 sessions[8] with Copernicus experts from the European Commission and authorised user for Copernicus Emergency Activation in a total of 77 participants. This workshop promoted the knowledge and dissemination of Copernicus, through experts from the European Commission and EMS Portuguese national focal point and Authorised User, scientists, students and operationals of environmental agencies, and citizens in general.

The presentations and discussions were fruitful with clarifications and highlights about aspects of the activation of EMS, namely requests and timeline after activation procedures as well as some limitations, also concerning the availability of the images (Section 6). It was also discussed how the Copernicus EMS can potentially be a contribution for citizens observatories related to geohazards for the various pilots of the AGEO project.

6 DISCUSSION

6.1 GENERAL OVERVIEW

The Copernicus EMS service in Portugal has been activated 20 times (Figure 2), with 13 for EMSR and 7 for EMSN, excluding the one not related to the geographic area of Portugal (EMSR111). The predominant hazard type is related to fires, followed by floods in EMSR. In EMSN fire is also the most important, but it is followed by multiple hazard. Generically, this shows alignment with the type of activations worldwide, except that floods dominate, and fires are in second place, as seen in Table 3 for EMSR. At global level, Portuguese EMSR activations correspond to 3.07% of the worldwide activations, while for EMSN is 8.64% (in 61 events).

Table 3. Type of disaster and percentage of worldwide Copernicus EMS - Rapid Mapping Activations, adapted from EMS portal (https://emergency.copernicus.eu/mapping/#zoom=2&lat=26.47718&lon=-7.278&layers=0BT00) accessed on 06-02-2020

Type of Disaster	# of Activations	%
Flood	142	33.57
Fire (forest, wildfire)	104	24.59
Other	70	16.55
Storm	39	9.22
Earthquake	25	5.91
Wind storm	19	4.49
Humanitarian	8	1.89

[8] http://www.lneg.pt/download/14814/Workshop_Copernicus_Geohazard_framework_AGEO_FLYER.pdf

Type of Disaster	# of Activations	%
Industrial accident	6	1.42
Mass movement	5	1.18
Volcanic activity	4	0.95
Epidemic	1	0.24
[Total: 01.04.2012 - 06.02.2020]	423	100.00

The activations reflect to a certain extent the higher frequency of the type of disasters, e.g. floods and fires. However, a significant number 16.55% (Table 3), categorised as "Other", may also encompass disasters such as volcanic, landslide and flash floods as seen on the description.

It is worth noticing that geohazards, as disasters of geological events whether related to internal or external geodynamic processes, are only relevant in Portugal concerning EMSN activations (018, 020, 034 and partially 031), and exceptionally for floods in EMSR (072).

6.2 BOTTLENECKS

Throughout all the Copernicus EMS activation chain (QSG, 2015, MOP, 2018) a major bottleneck is related to time issues. This can minimize the performance of the service and its effective support to the users:

- EMSR - the fast answer since the request of activation is a key-issue, where emergency response from the service can provide a very effective support for management during the disaster or the aftermath for decision makers. After approval of the request, the satellite data ordering and reception may also be responsible for delays as well as map generation, depending on the characteristics and complexity of the event and/or atmospheric conditions in the case of optical data required (e.g. EMSR111)
- EMSN - delays on data delivery may have implications on the user concerning future planning. In the case of EMSN018 (2016) the foreseen timeliness of 1 month after signature contract were significantly exceeded (EMSV023, 2016) to 3.5 months, partially due to late delivery of satellite data. This can potentially compromise planning concerning mitigation measures and deadlines for funding.

Another potential bottleneck related to the best result of the final product is due to the fact that the Copernicus EMS uses ancillary open access data. In cases where the data cannot be provided by the user, even if the analysis of the hazardous event requires, this will not be considered at the final product with sequential lack of quality or incompleteness.

6.3 BEST PRACTICES

Best practices of the Copernicus EMS are identified at several levels:

Pre-tasking of Satellite Images using Early Warning Systems

A bottleneck referred in section 6.2 about delays in satellite data can partially be minimised concerning floods by a procedure in place since 2017, which uses EFAS flood warnings to pre-task image acquisitions without an official service activation. Overall, the procedure is expected to improve timeliness of Rapid Mapping, in particular by reducing the time required for obtaining post-event imagery and by optimising the acquisition time with respect to an event's evolution (flood peak time) (MOP, 2018).

Data Sources

Throughout the activations, the focus is on the acquisition of satellite/ remote sensing data as a space based service. The ancillary data used to fulfil the requests usually relies on what is provided by the

User or available as open data (section 6.2). In the case of EMSN034, main earth observation data, imagery and digital elevation models, were provided by the activator ANPC (airborne) and JRC also acquired Remotely Piloted Aircraft Systems (RPAS) (EMSN034 FS, 2017). This cooperation improves strongly the overall results of the activation by complementing diverse data sources and validation.

Scale

The Copernicus EMS works with variable scales according to the requirements of specific activations, making available different scale and resolutions, spatial and spectral, captured by spaceborne and airborne platforms, e.g. EMSN034 FS (2017).

Activation

The Portuguese Expert users highlighted the simplicity of Copernicus EMS activation, relying solely on the contact of the national focal point and authorised user, Autoridade National de Emergência e Proteção Civil (ANEPC) with very limited administrative issues.

Access to data

The European Commission follows open data policies for Copernicus data and products. When needed the data acquisition for the services from contributing Missions without open access, they can be available for the public administration research or academic activity (CSDOFPA, 2016).

7 CONCLUSIONS

The Copernicus Emergency Management Service (EMS) is the space dedicated service for the management of natural or human made disasters and humanitarian crisis and provides a wealth of information to support all phases of the emergency management cycle gathering different actors.

Among the several components for emergency response, the on-demand mapping component provides rapid maps for emergency response and risk and recovery maps for prevention and planning. Another component relates to the early warning and monitoring providing continuous alerts about fires, floods and drought.

The on demand mapping of the Copernicus EMS is well implemented in Portugal with reasonable abundance of activations, EMSR activations corresponding to 3.07% of the worldwide activations while for EMSN is 8.64%. The majority of the activations in Portugal were related to fires. Geohazards, in the *s.s.* as disasters of geological origin, whether related to internal or external geodynamic processes, correspond only to 4 EMSN activations (018, 020, 034 and partially 031), and exceptionally floods, as mixed natural hazard, in EMSR activation 072.

Through the stakeholder's survey, the Portuguese users demonstrated a reasonable knowledge and application of the Copernicus EMS data and products.

A few bottlenecks were identified through the Copernicus EMS activation chain (QSG, 2015, MOP, 2018), such as time issues that can compromise the performance of the service and its effective support to the users for the disaster management. Another one is related to the availability of ancillary data that can compromise the result of the final product, relying solely on open access data or provided by the user.

Best practices of the Copernicus EMS were are also identified at several levels, i.e. concerning pre-tasking of satellite images using early warning systems and linking the two main components of EMS, data sources, scale, easiness of activation and data accessibility.

Although focused on the present state of Copernicus EMS in Portugal, it is important to be aware of ongoing developments on another Copernicus services. This is the case of the land service with the foreseen EU ground motion service as useful tool to support geohazards.

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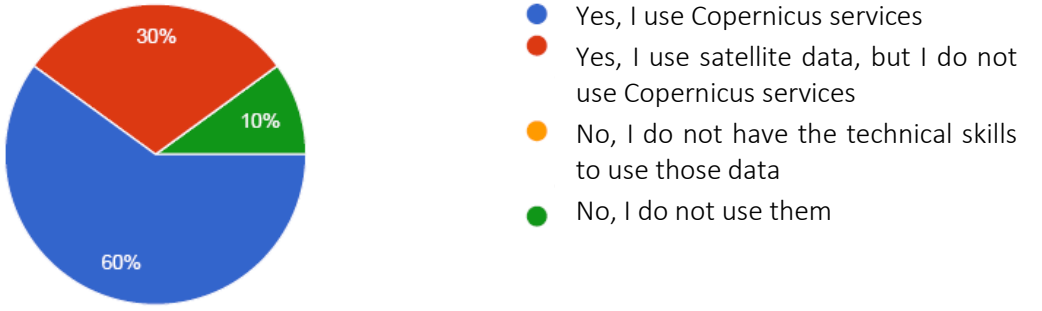
9 APPENDIX I –RESULTS OF THE STAKEHOLDER SURVEY UNTIL FEBRUARY 2020

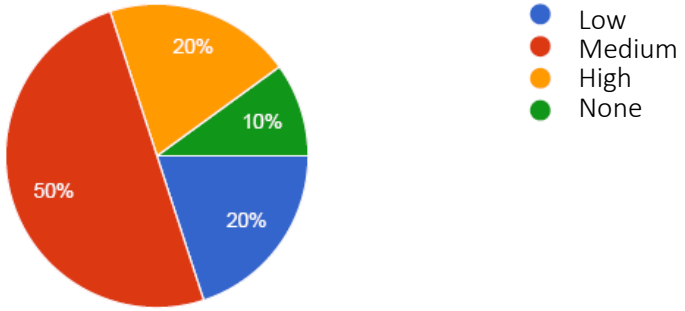
Portuguese responses to Questionnaire about Copernicus products and services among geohazard risk reduction stakeholders in the Atlantic Area.

General Information

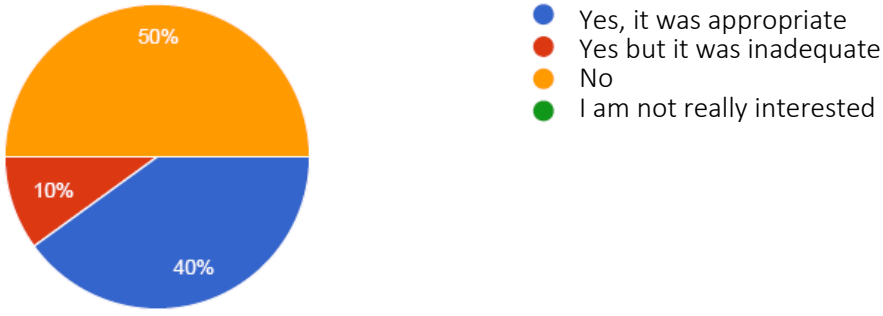
1. Are you aware of Copernicus or other Earth Observing Systems (Satellite images: Google Earth, SPOT, Landsat…)? (10 responses)



2. Please, classify your knowledge about Copernicus (10 responses)

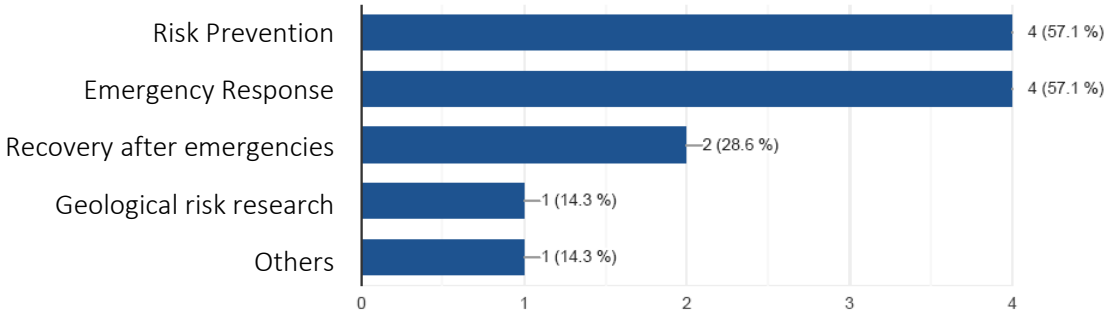


3. Have you completed any training on the use of data from the Copernicus Programme? (10 responses)

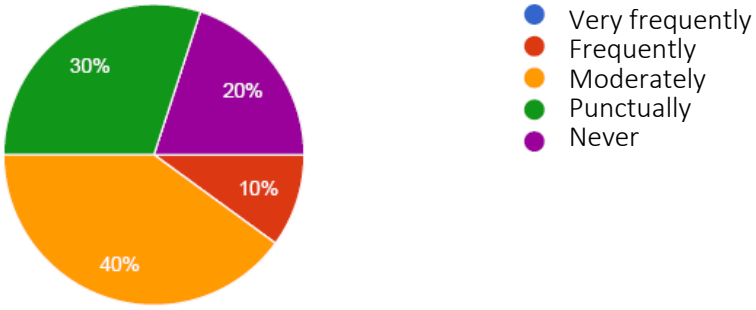


4. Has your organisation ever requested data from Copernicus Programme? (9 responses)

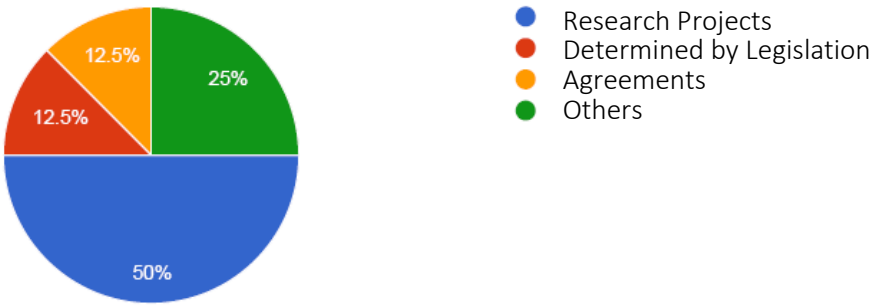
5. If you have requested data from Copernicus programme, please select the priority use for it (7 responses)



6. How often do you use Copernicus services? (10 responses)

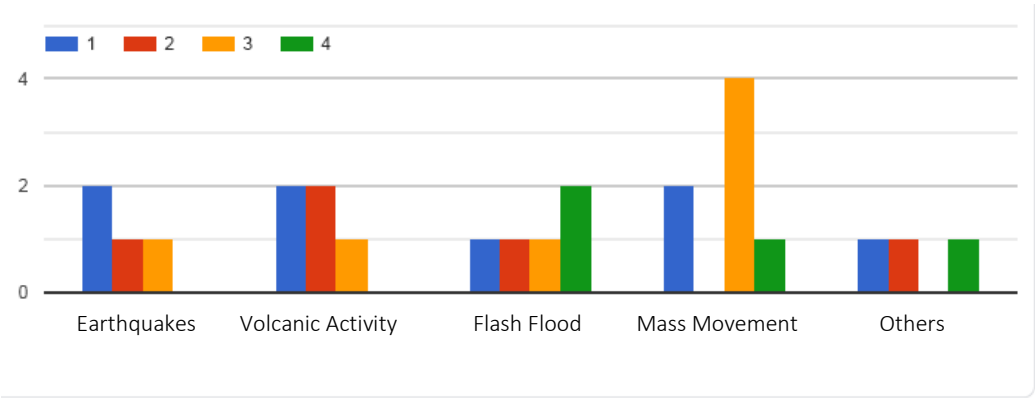


7. What is the primary reason for your use of Copernicus services? (8 responses)



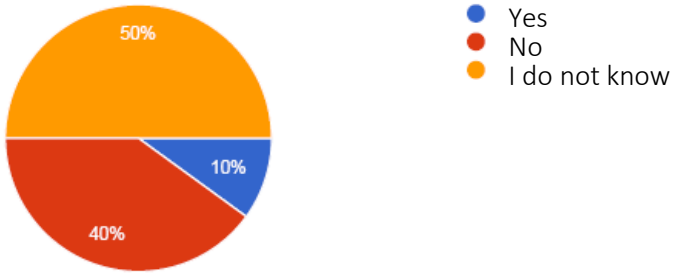
8. Do you have dedicated users for Copernicus services? (8 responses)

9. Please, select in order of frequency (1 is the lowest and 4 is the highest) the types of geohazards your organisation support in collaboration with public and private administrations

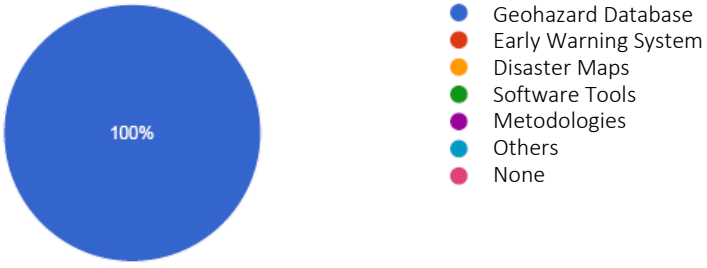


Tools for geohazards

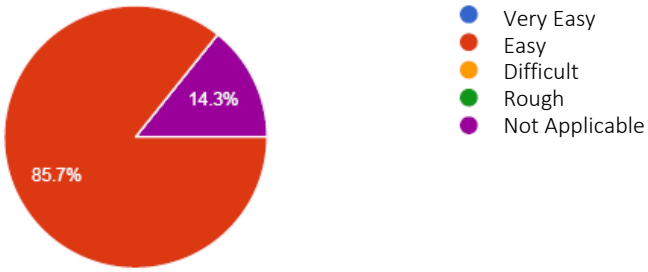
10. Does your organisation participate in the development and implementation of any tool in the Copernicus Emergency Management Service (EMS)?



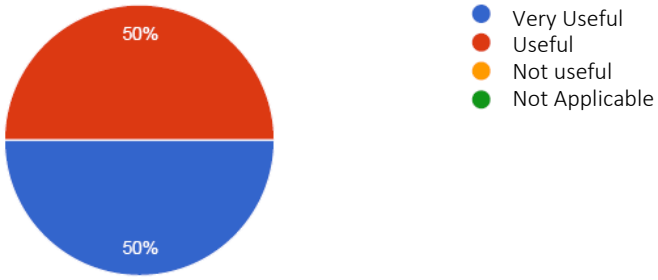
11. If you answered yes to question 10, please select which type of tool (1 response)



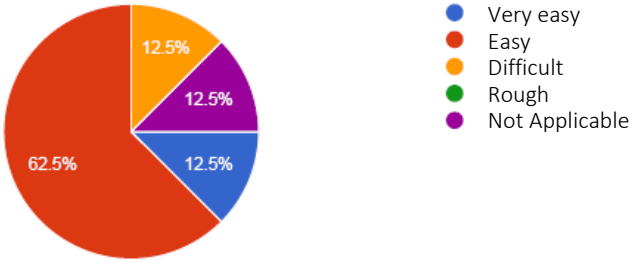
12. How do you consider the user interface of these tools? (7 responses)



13. How do you consider the usefulness of these tools? (8 responses)



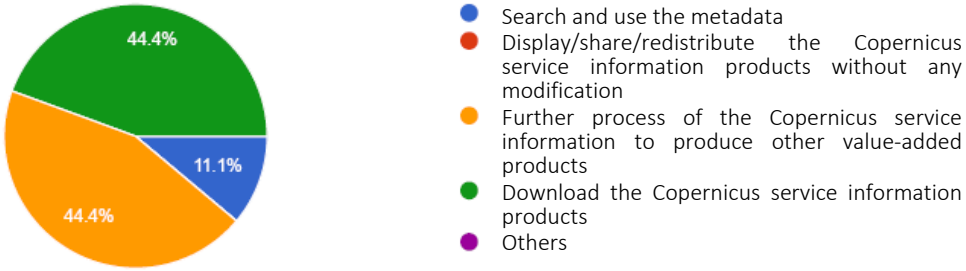
14. The interpretation of the results from Copernicus EMS is (8 responses)



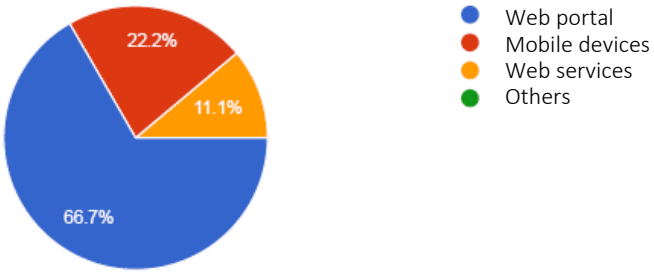
15. Is there any product or service that you consider necessary which is not currently included in Copernicus EMS? (2 responses)
"Nothing in special"
"InSAR monitoring for the prevention phase to which we hope to contribute with work in progress"

<u>Service Information</u>

16. Regarding Copernicus EMS information products, is your preference to (9 responses)



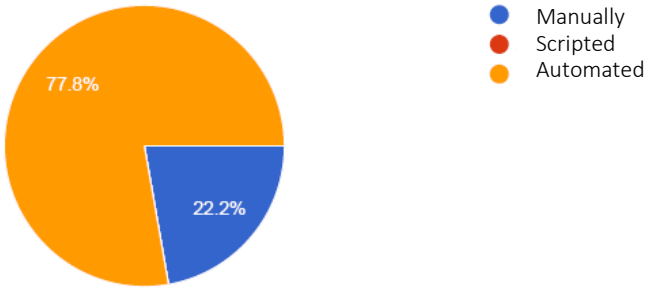
17. How would you like Copernicus EMS service information be made available? (9 responses)



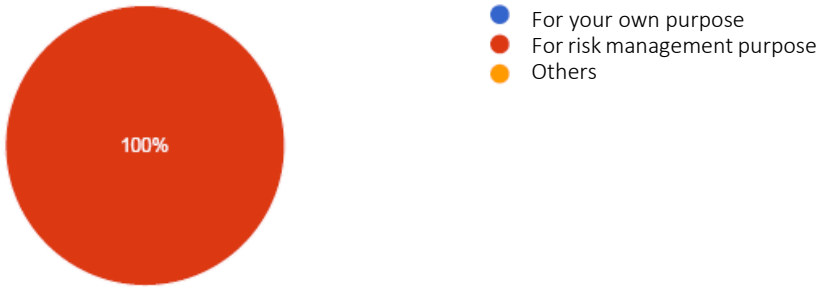
18. Which tool do you think could be incorporated into Copernicus EMS to improve your work? (1 response)

“access to the original images used in the final products”

19. How would you like to be able to download Copernicus EMS information? (9 responses)

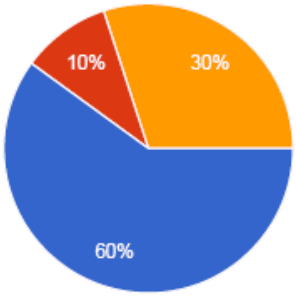


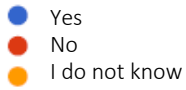
20. For what purpose would you like to use Copernicus EMS products and services? (9 responses)



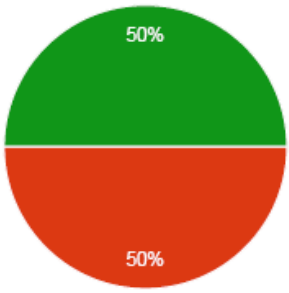
<u>Copernicus Data Policy</u>

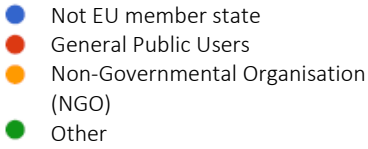
21. Has your organisation ever downloaded data from Copernicus EMS? (10 responses)



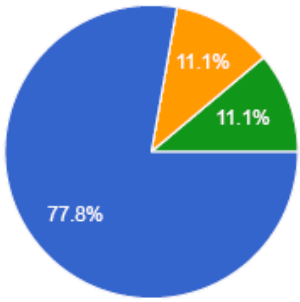


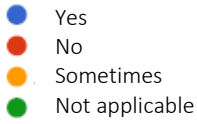
22. In the event that the data could not be downloaded, please indicate what type of restrictions were found. (2 responses)



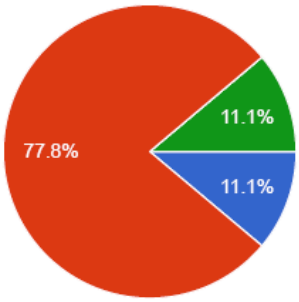


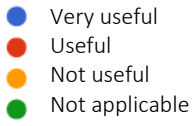
23. Do you think the information provided by Copernicus EMS is useful for an emergency plan? (9 responses)





24. How would you rate your experience with Copernicus EMS in general? (9 responses)





<u>Suggestions</u>

25. Do you have any suggestion to make in regards to this questionnaire? (0 responses)