Grant Agreement No. 783169
U-Geohaz – "Geohazard impact assessment for urban areas"

Deliverable D4.1: User requirements

A deliverable of WP 4 (Activity 4.1): Identification of User needs

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	
TN	Technical Note, not a deliverable, only internal for members of the Consortium	x

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EXECUTIVE SUMMARY

The actions defined and performed in the Activity 4.1 “Identification of user needs” are described in this document, which represents the first deliverable of WP3 “Tools and methods to support Early Warning System for Rockfalls”.

The main goal of the Activity 4.1 is to describe the needs coming from the involved CPA (i.e., Canarian Civil Protection Agency) to improve rockfall early warning management. This task benefits from the previous collaboration of IGME with the Canarian CPA in the framework of SAFETY project, where specific needs for rockfall hazard prevention in urban areas were evaluated. The user needs are defined considering Sendai Framework for Disaster Risk Reduction 2015–2030, identifying the most efficient and effective way to integrate U-Geohaz products and services into the CPA prevention actions. “*User Needs*” will be converted into Requirements for effective product and service developments.

The user needs will be identified considering the following activities:

- The review of international and EU strategies and Directives;

- The analysis of existing natural risk prevention procedures of the CPAs involved in the project.

The output will be organized in a list of user requirements, useful to support Civil Protection Authorities to increase the knowledge and the ability to manage and reduce geological risks.

The list of user requirements plays a crucial role as starting point and guidance for the development of the products and will be updated during the project. Additional useful input to the list could arise from the close collaboration among users, scientists and technological partners during the phases of the project.

REFERENCE DOCUMENTS

N°	Title
RD1	DoW Part B

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1 INTRODUCTION

Damages and fatalities caused by geohazards have considerably increased in Europe during the last decades; urban pressure has led more people to live in flood plains, around seismically active areas and in zones prone to landslides. In many countries, a lack of regulatory mechanisms and regulations able to manage geohazards within the ambit of urban planning, and poor prevention products and services, have increased the risk and intensified the effects of natural disasters. Geohazards in Spain cause significant economic and social losses. Every year, nearly 25 people are killed and economic losses exceed 0.23% of GDP (Mateos, 2013). Indirect economic costs are not evaluated, but they can be relevant. Very few works have estimated indirect economic losses caused by geohazards. Geohazards are considered in the Spanish legislation in the framework of the land regulations and the civil protection management, both handled by the 17 autonomous communities of the country. This results in a large heterogeneity in approaches for geohazard mapping and different regional attitudes on how to integrate efficiently geoscience knowledge in the land-use, urban development policies and natural risks prevention actions. On a smaller scale, Europe shows a similar situation, with heterogeneous policies across borders and a lack of common methodological guidelines to prepare and use geohazard maps. For this reason, it is essential to understand that geohazards are international problems that require collaboration and mutual understanding in the collective EU policy.

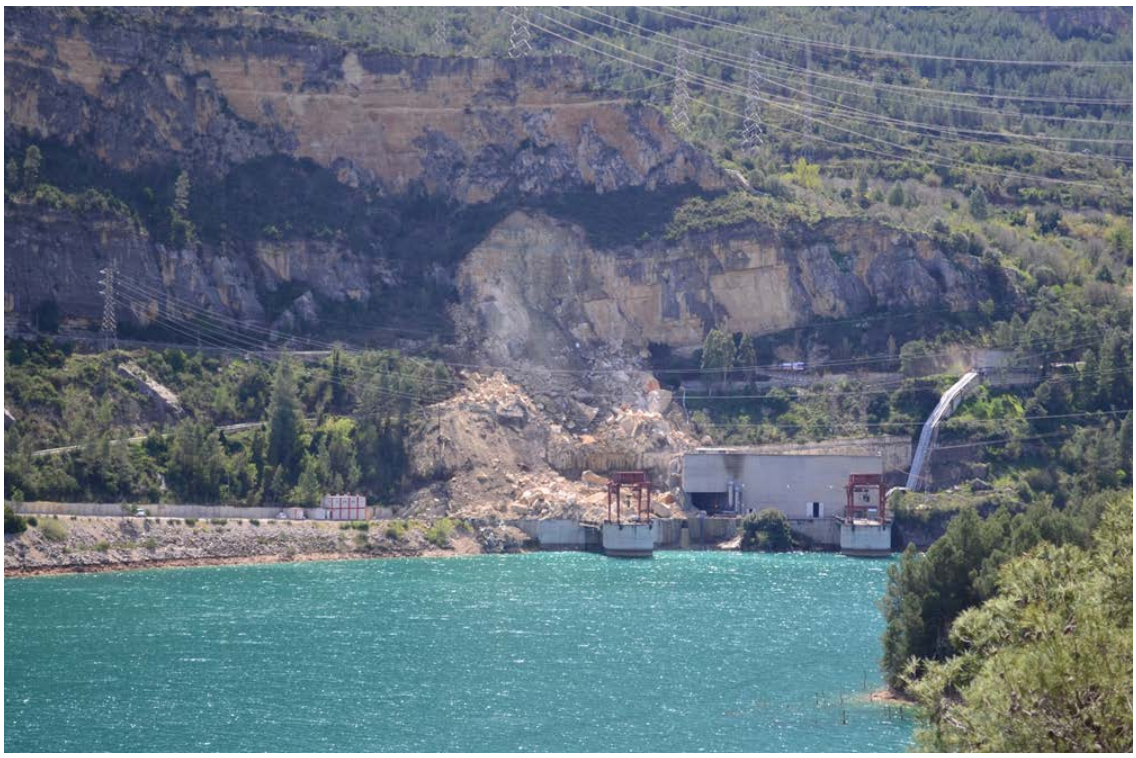

Figure 1: Rock detachment at Cortes de Pallás (April 6, 2015).

Landslides are the second significant geohazard in Spain causing significant damages to structures, infrastructures, roads, dams and buildings. Of special importance are the frequent rockfalls, which affect the transportation networks and associated with high repairing costs. Spain is the second most mountainous country in Europe with high cliffs for about 50% of the coastal line. In recent years, the population density along Spanish coastlines has increased and at the present about 50% of the population lives along the coast where the tourism is intensive (75.3 million of visitors in 2016). Over 30% of the Spanish coastline has faced recent touristic development resulting locally in an increase vulnerability. In the recent years, large number of rockfalls have affected resorts, dwellings, apartment blocks and infrastructures (Mateos et al., 2012; Notti et al, 2015; Mateos et al., 2016).

The need to improve efforts for the development of prevention products and services is part of an innovative approach that shifts from “disaster management” to “disaster risk management”. In this context, the U-Geohaz project activities have been well positioned within the context of the European and international initiatives related to risk prevention and management, (i.e., the EU civil protection mechanism and its legislation and the Sendai Framework for Disaster Risk Reduction 2015-2030). The Sendai framework aims to prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increasing the preparedness for response and recovery, and thus strengthening resilience.

Moreover, additional directives should be considered to identify efficient and effective ways to integrate U-Geohaz products and services into the CPA prevention actions. One of the goal of U-Geohaz is the development of cartographic products capable to support risk evaluation activities. For cartographic products the INSPIRE Directive is effective and already operative in the EU Member States. INSPIRE sets up a framework of data, technology, policies, standards, and human resources, necessary to facilitate sharing and using spatial information. However, the success of the INSPIRE implementation is greatly related to the community mobilization (i.e, EuroGeoSurveys), in order to make the best use of this framework and to develop their own infrastructure to serve the users’ needs. The contribution to the maintenance of the implementing rules will allow adopting this legislation for the user needs and the technologies.

2 GEOHAZARD MANAGEMENT IN SPAIN

Spain is a high-decentralized unitary state, identified with the Spanish constitution of 1978, with 17 autonomous communities and 2 autonomous cities, which represent the first-level political and administrative division. In Spain, land-use and civil protection planning is part of the state decentralization and the transfer of powers to the country´s autonomous communities. Town councils are responsible for urban planning but the final approval of areas subject to urban development is given by the autonomous community.

In Spain, geohazards topics are considered in the following two legislations:

1) Land and Urban Rehabilitation Bill, approved by the Real Decree 7/2015 of 30 October 2015. For the first time, the land bill includes the requirements to draw up natural-risk maps within the land-use planning. This is explained in the two following articles:

- Article 21. “Non-developable land is considered to be those with natural or technological risks, including floods or other serious accidents”. This means that those areas of the municipality identified as vulnerable to natural hazards, are considered no urban lands.
- Article 22.2. ”The environmental sustainability report of the urban development planning have to include a map of natural risks of the area to be managed".

Based on these regulations, geohazard maps are incorporated in the environmental studies of the territory and they have to be finally approved by the autonomous community. Usually these maps are elaborated by private companies: in urban areas they are mainly developed by architects whereas in no urban areas by environmental experts. They are referred as susceptibility maps but in most of the cases, only flood susceptibility is evaluated. The analysis of these maps reveals a large heterogeneity of mapping scales, methods and contents and a great confusion of concepts regarding susceptibility, vulnerability, hazard and risk, which leads to a large heterogeneity in approaches to geohazard mapping. To solve this problem, the Spanish Professional Association (ICOG) in 2008 elaborated a methodological guideline to prepare risk maps of natural hazards, including floods, landslides, land subsidence, expansive clays and others. For the moment, the guideline is not mandatory.

2) The Basic Civil Protection Regulation, approved by the Royal Decree 407/1992, of 24 April 1992. This bill establishes the drafting of territorial emergency plans for each autonomous community, which constitute the organizational and administrative framework for the emergency managements. In addition to the territorial plans, the Basic Regulations establish the possibility of producing in each region special plans for particularly significant hazards. These special plans are an important improvement, since they must necessarily involve detailed knowledge and characterization of geohazards prior to the operational structure in the emergency state. These special plans are based on quite thorough scientific researches, applying methodologies to study hazard and vulnerability. Results are used for the spatial zoning of risk, usually at a reconnaissance scale. Although territorial plans have been approved by all the autonomous communities, local special plans are developing more slowly and gradually. Most of the regions have already approved special plans for flooding, but seismic hazard is only contemplated in very few regions (Catalonia, Murcia, the Balearic Islands) and landslides in no one. The Canary Islands have implemented the Special Emergency Plan for Volcanic Hazards, which was activated during the El Hierro eruption in 2011. As in the development of the Land Bill, there is also a great heterogeneity in the geohazard maps elaborated for the special plans, without a common methodology and with a confusions between the concept of susceptibility, hazard, vulnerability and risk.

In parallel, many national and regional Spanish research centres have prepared documents and maps related to geohazards, and have collected an extensive number of papers on this topic. Unfortunately, most of this information is unknown to the land-use/urban/civil protection managers.

3 GEOHAZARD IN THE CIVIL PROTECTION SYSTEM

3.1 The Spanish Civil Protection system

The Civil Protection service is a complex system where the assistance and overcoming of emergency situations are assigned to several bodies and operative structures. The direct involvement of the Civil Protection Authorities, at different administrative levels (National and regional), in the U-Geohaz project is a good opportunity for strengthening the use of science and technology in policy-making. It is also relevant to become compliant with the prospective of Disasters Risk Reduction (DRR) and to develop services, procedures and products that can be easily integrated with other operative services at EU level and easily shared among EU Member States.

The Spanish Civil Protection and Emergency General Directory is a public service aimed to study and prevent collective high risk, disasters and public calamity situations that can suppose a risk for the citizens, as well as to protect the citizens and their properties when those situations arise.

The main functions include:

- Preparation of civil protection plans at national level or those whose competence will be assigned in emergency scenarios.
- Preparation and management of exercises and simulations in the framework of the aforementioned plans.
- Development of studies related to risk analysis and preventive pilot projects to back up emergency and disaster prevention plans.
- Preparation and broadcast of warnings to civil protection organizations and, where appropriate, to citizens.
- Management of subsidies and aid set aside to meet needs derived from disasters or catastrophes and preparation of the corresponding regulations.
- Theoretical and practical training in the management of risks and emergencies, including the training of managers and personnel of the services and organizations involved in the emergency actions, particularly fire and rescue services, health services and law enforcement authorities.
- Carrying out studies and information programs for the citizenship, promoting the self-protection of citizens and corporations and promoting social participation in activities of civil protection and emergencies and education programs for prevention in schools.

- Coordination of relations with the different Civil Protection Delegations and Sub-Delegations of Government and with the Regional Bodies and Local Administrations with competences in civil protection activities, as well as, the organization and maintenance of the Secretary of the Civil Protection National Commission, of its Permanent Commission and of its technical commission and working groups.
- Maintenance of technical relations with equivalent organizations from other countries, especially from the European Union, Mediterranean and Latin America.
- Request the intervention of the Military Emergency Unit in accordance with the Protocols on action that are set out for this.

The main objectives are:

a) To inform and prepare citizens through the self-protection actions.

b) To constitute an organization bringing together all public and private entities for the rescue of people and their goods, in cases of calamities or disasters.

c) To manage coordinated and effective interventions in situations of serious risk, catastrophe or public calamity.

The General Directorate acts mainly on various fields: floods, earthquakes, volcanoes, chemical plants, nuclear power plants and dangerous good transport, and its basic functions are:

- Precautions: to analyze the assumptions of risk, its causes and effects, as well as the areas that might be affected (risk inventory).
- Prevention: to take the necessary measures to avoid or to reduce the hazardous situations, with the means available.
- Planning: to develop emergency plans, and action lines to deal with serious risk situations, catastrophe or public calamity.
- Intervention: to coordinate and to direct the intervention of civil protection components for people and properties protection and rescue.
- Rehabilitation: to attend the relevant institutional bodies in planning measures to restore the essentials public services, socioeconomic and environmental conditions, essential to normalize the lives of the affected communities.

Canary Islands Protection system (CDPC)

The Canary Islands Protection system (CDPC) is under the responsibility of the Directorate General of Security and Emergency, which belongs to the Ministry of Territorial Policy, Sustainability and Security of the regional government of the Canary Islands. Its main competences are: (1) security; (2) coordination of local polices; (3) emergencies, Civil Protection and Marine Rescue; (4) training. The “112” emergency coordination service alerts for specific emergencies, evaluates and coordinates the necessary response.

Regional government in the Canary Islands is organized in nine different sections, called *Consejerías*, one of which is Land Policy, Sustainability and Security. One task of this *Consejería*

is the Environmental Policy, through which a General Management of Security and Emergencies is competent in the civil defence through a Civil Protection and Emergency Management Service.

This Service is also responsible for the Centre for Emergency and Security Coordination, *CECOES 1-1-2*, and the Emergency and Rescue Group (GES). *CECOES 1-1-2* is a public service that not only provides the adequate response to all the emergency calls that happens in the Canary Islands, but also knows in every moment, all the emergency means and resources required for a possible emergence situation. *CECOPIN* and *CECOPAL* have the same functions at insular and local levels, respectively.

On the other hand, GES is an action group in charge of searching and rescuing missions for the regional government. GES has the human and material resources required to achieve its goals, including five helicopters based in different islands. GES is aimed to give a quick response to every unexpected situation that could take place in the autonomous community.

In the Canary Islands, we can consider that the civil service works at four different levels (i.e., local, insular, regional and state governments) and each of them manages their own civil defense services.

In case of a rockfall emergency, when a rockfall event hits one of the islands, the “112” emergency coordination service collects the alert from the citizens. From this alert, an approximate geolocation (± 500 m) is provided to the insular government. Civil Department from insular government are in charge of the reparation of the damage and the municipality ensures the emergency assistance to the population, if necessary. Road maintenance services and reparation works are carried out by private companies supporting the insular Civil Department.

3.2 Prevention activities and procedures

National School of Civil Protection

Most of the prevention activities for geological risk are carried out by the National School of Civil Protection. The National School of Civil Protection, established by Royal Decree 901/1990, 13th of June, is part of the Directorate General of Civil Protection and Emergencies that plays, in accordance with the established in the Royal Decree 1181/2008 of the 11th of July, the following functions:

- To train and coach theoretical and practically the civil protection service personnel of Spain central state government and other public and private institutions.
- To serve as a meeting forum for technical officers and specialists in risk and emergency management.
- To promote the development of the social culture of prevention and self-protection of citizens.

Figure 2: National School of Civil Protection in Madrid

From a strategic point of view, the National School of Civil Protection mission is to implement training policies approved by the parties responsible for the national civil protection system in order to allow its members having the competence required for their role. The National School supports human resources belonging to the Civil Protection National System, which is made up by professionals and/or volunteers operating in their own organizations. However, each organization has the responsibility of the initial training of its own professionals, although the training public system of civil protection should homogenize it. The volunteer training should be planned, programmed and delivered by the mentioned public system, as well as the training devoted to the updating of those ones.

Canary Islands Government Tests and Simulations

The Canary Islands Government organizes different simulations to test and to verify the capability and the level of preparation in case of emergency (i.e., the efficiency with which the different organizations involved carry out their actions). Its aim is to check:

- Functioning and effectiveness of warning systems for the population and communications.
- Time of response from Action Groups and for the application of protective measures.
- Operation (in fictitious conditions) of Action Groups and a first evaluation of its effectiveness.

However, some aspects cannot be tested by simulations (e.g., the ability of an organization to cope with unforeseen events). Tests start from a predetermined emergency situation, and check the internal and functional mechanisms.

4 USER REQUIREMENTS FOR WP3 PRODUCTS

The U-Geohaz project is designed to set up useful products for Civil Protection user community at EU level (operating at different administrative and organizational levels, from local to continental). Further effort has been spent to define a list of realistic user needs for WP3 products, to make them suitable to be integrated also in different national contexts. The establishment of user requirements have been based mainly on:

- Analysis of U-Geohaz DOW.
- Interaction between U- Geohaz partners.
- User requirements from SAFETY project.
- Existing prevention procedures of CPA.
- Key contribution of the involved CPAs.

A specific coding scheme has been adopted to number uniquely the U-Geohaz user needs. This is a lesson learned from several other EU projects developed with similar purposes (e.g. SAFETY). Each single need is coded adopting the following labelling scheme:

WPX_DC_Y

where:

- X is the number of WP
- DC is the deliverable code (e.g. 3.5.1)
- Y is the progressive number of the requirement

At the scope, for each WP3 product, specific user needs are established to cope with the main necessities of CPAs (i.e., the users of the project). The relevant needs to make the project results effective and useful for CPA authorities are here listed as requirements.

The following tables describe the user requirements of the following products:

- Rockfall Information System (RIS)
- Map of the rockfall source areas (RSA)
- Rockfall modelling map (ROM)
- Empirical rainfall thresholds for rockfall events

WORK PACKAGE 3: TOOLS AND METHODS TO SUPPORT EARLY WARNING SYSTEM FOR ROCKFALLS			
Activity 3.3 Rockfall Information System "RIS"			
Short Description	**Product**	**ID Requirement**	**User Requirements**
Rockfall Information System "RIS" to enable the periodic assessment of rockfall hazard, will be designed to collect and update the necessary input information.	Rockfall Information System (RIS)	WP3_3.3.2_1	U-Geohaz will provide a description of the collected data.
		WP3_3.3.2_2	U-Geohaz provide RIS in Database Format.
		WP3_3.3.2_3	U-Geohaz provides evaluations of the quality and uncertainty of the data included in RIS. It can be included in the database or specified in the deliverable.

WORK PACKAGE 3: TOOLS AND METHODS TO SUPPORT EARLY WARNING SYSTEM FOR ROCKFALLS			
Activity 3.4 Enhanced rockfall modelling and zonation in the Canary Island			
Short Description	**Product**	**ID Requirement**	**User Requirements**
Mapping the locations of rockfall source areas using a statistical approach will be performed. Then, a rockfall modelling map will be carry out using deterministic approaches starting from the probabilistic recognition of source areas.	Source area map (RSA)	WP3_3.4.2_4	U-Geohaz provides RSA in raster format. This products will be Inspire-compliant.
		WP3_3.4.2_5	U-Geohaz provides a description of the procedure/method used to identify RSA.
		WP3_3.4.2_6	U-Geohaz provides evaluations of the quality and uncertainty of the RSA.
		WP3_3.4.2_7	U-Geohaz provides RSA at the scale and resolution of the DEM available in the study area. The DEM resolution should range between 5 and 20 meters.
	Rockfall modelling map (ROM)	WP3_3.4.3_8	U-Geohaz provides ROM in raster format. This products will be Inspire-compliant.
		WP3_3.4.3_9	U-Geohaz provides a description of the procedure/method used to prepare ROM.
		WP3_3.4.3_10	U-Geohaz provides ROM scenarios.
		WP3_3.4.3_11	U-Geohaz provides ROM at the scale and resolution of the DEM available in the study area. The DEM resolution should range between 5 and 20 meters.
		WP3_3.4.3_12	U-Geohaz provides ROM in a specific layout ready to be printer for field activities. The layout should contain a brief description of the product.

WORK PACKAGE 3: TOOLS AND METHODS TO SUPPORT EARLY WARNING SYSTEM FOR ROCKFALLS			
Activity 3.5 Rainfall thresholds for the possible initiation of rockfalls			
Short Description	**Product**	**ID Requirement**	**User Requirements**
Empirical rainfall thresholds for the possible initiation of rockfalls will be evaluated.	Empirical rainfall thresholds	WP3_3.5.2_13	U-Geohaz will provide cumulated event rainfall-duration (ED) thresholds for different exceedance probabilities.
		WP3_3.5.1_14	U-Geohaz will provide a description of the used data source.
		WP3_3.5.2_15	U-Geohaz will provide an evaluation of the uncertainty associated with the threshold parameters.
		WP3_3.5.2_16	U-Geohaz will provide a description of the statistical method used to calculate empirical rainfall thresholds.

ANNEX A

U-Geohaz project is focused on monitoring geohazard-associated ground deformations specifically addressed to urban areas and critical infrastructures. Several work packages consider the production of different kind of maps to assess the potential of geohazard activity. Analysing INSPIRE directive these products can be included in Natural Risk Zones theme of Annex III.

Data Specification on Natural Risk Zones- Technical Guidelines stablish the practical implementation of these data according to INSPIRE Directive. This document stablish:

- Data content and structure
- Reference System, units of measure and grids
- Data quality
- Data-level metadata
- Delivery
- Data capture
- Portrayal

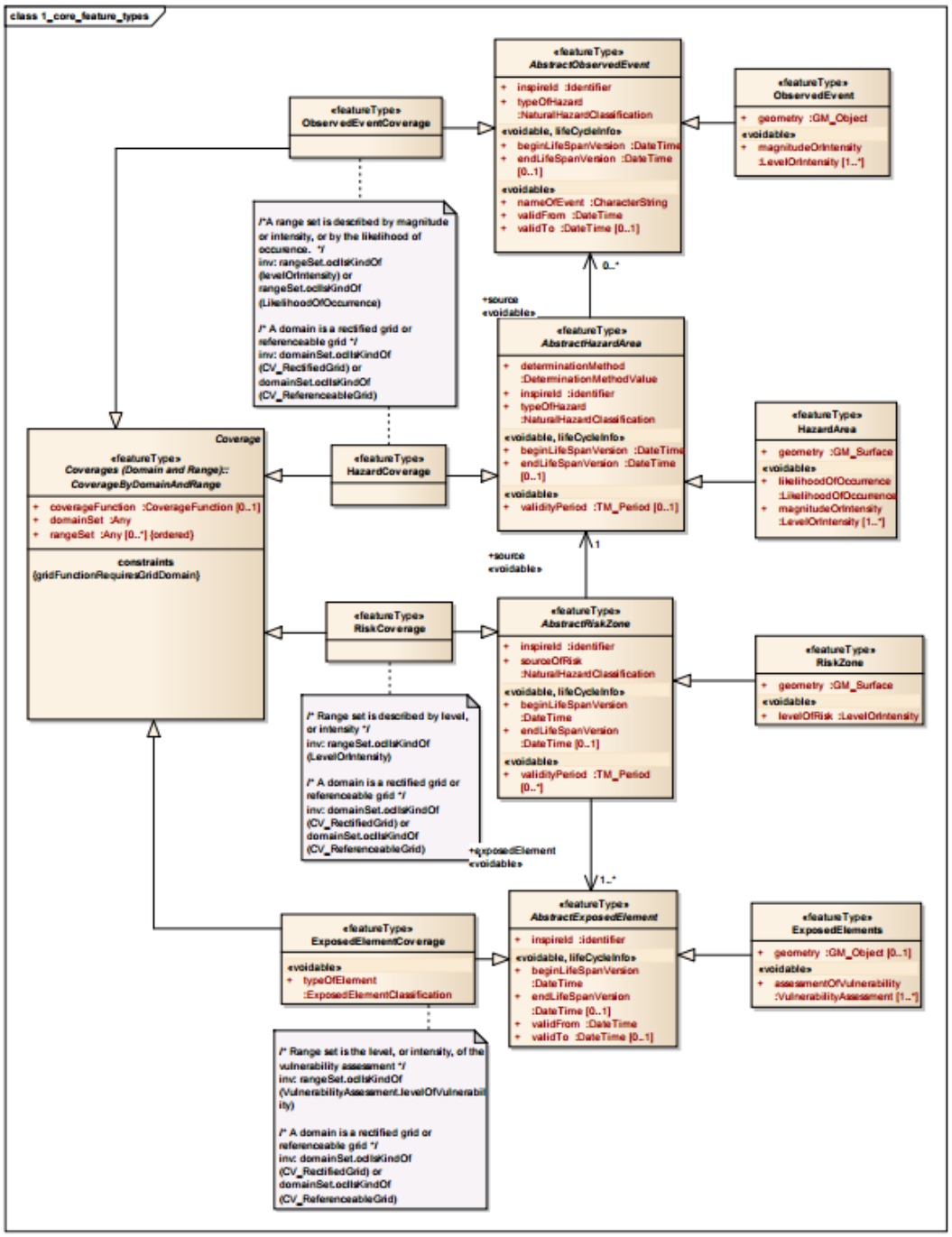

Figure 3: Overview of Natural Risks Zones application schema

ANNEX B

The purpose of this annex is to provide a reference scheme for the graphical return of the U-Geohaz products. The scheme is inspired by the outputs obtained at the end of the SAFETY project and based on the maps currently delivered by the Copernicus EMS service (http://www.copernicus.eu/main/services).

Delivering a map in a standardized raster format is extremely useful for end users, especially for Civil Protection actors, because of the possibility of having available a printable and ready-to-use product.

In Figure 3 a layout proposal for U-Geohaz product is reported. This schema is composed of different sections containing different levels of information. The content of every section is explained below.

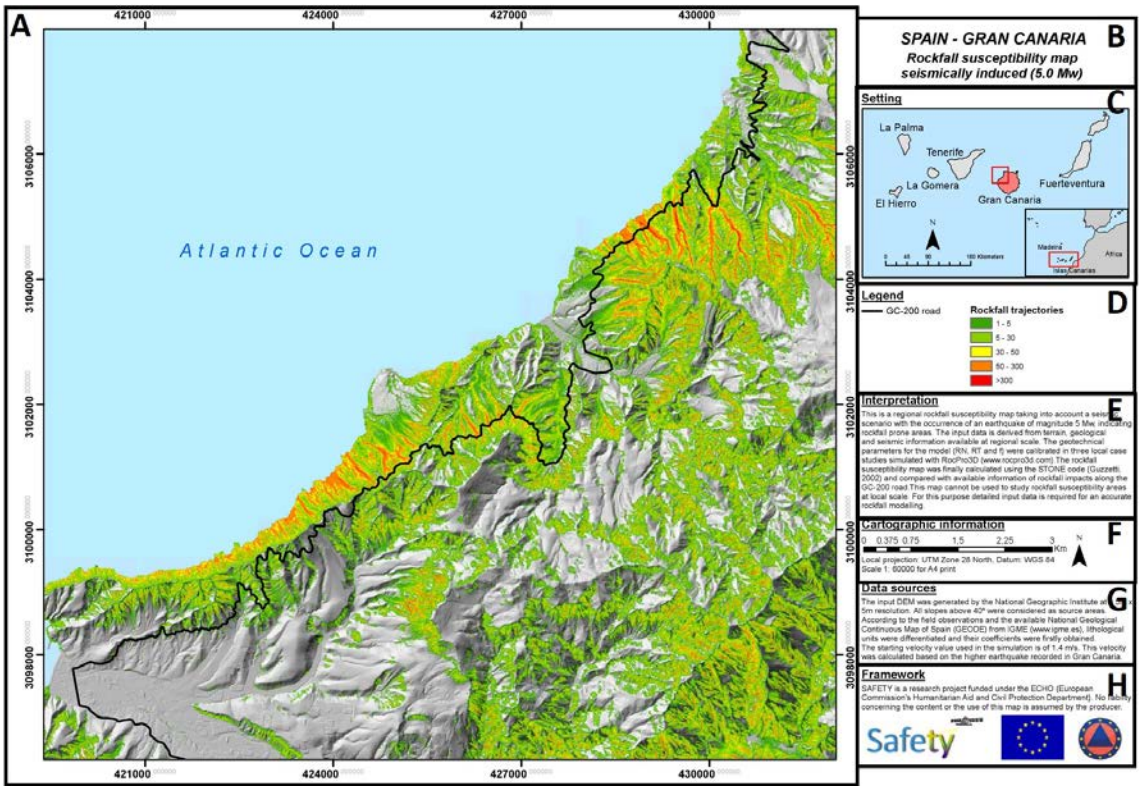

Figure 4: Layout proposal for U-Geohaz products. The background image comes from one of the deliverables of the SAFETY project.

Section A: is the core of the layout and contains the results of an Action. Satellite images, aerial orthophotos, digital elevation models or shaded reliefs can be used as background image. The map must highlight political boundary (municipalities, regions, etc…), main roads and place names guaranteeing the readability of the map and depending on its scale. A reference grid has to be drawn outside the image border. The scale of the image has to be selected depending on

the type of output and of the information to be deliver to the end users; images with different scale can be prepared.

Section B: is the name of the map and its location.

Section C: represents the geographical location of the site. Both national and regional geographical frameworks shall be shown.

Section D: is the legend of the map. The legend has to enable the identification of the general information described in Section A.

Section E: contains a brief interpretation of the map. In this section simple and effective information about what can be seen in the image have to be proposed. A small review about the main outcomes connected to this map can be added.

Section F: is the cartographic reference of the map. This section contains the scale bar and north direction referred to the image of Section A. Moreover, the reference cartographic system is shown.

Section G: describes the data source. In this section, the input data are briefly described.

Section H: describes the framework of the map. Simple information about U-Geohaz and the position of the product in the framework of the project are given. All the necessary logos can be added at the end of this section.

All the maps produced within U-Geohaz should be deliver in .pdf or in other standard image formats (.jpeg, .tiff, etc…).

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