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CITIZEN OBSERVATORIES APPLIED TO GEOLOGICAL RISK MANAGEMENT

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The European Interreg AGEO project focuses on the management of geological risks in different areas of European countries with territories in the Atlantic area. AGEO will launch several Citizen's observatory pilots on geohazards according to regional priorities. The aim is to engage with local communities to actively participate in risk preparedness and monitoring and incorporate local capacities into risk management systems. Experiences gained during the implementation of the Citizen's Observatory pilots will be used to formulate recommendations for the creation of future observatories in response to the widest range of hazards (both natural and human-induced) in the Atlantic region. That is why the project has several partners formed by countries of the Atlantic Area, including Portugal, Spain and Ireland. In each of these countries, a specific geological risk is studied, where the aim is to implement citizen participation. Since the project duration is 3 years, the way to implement the citizen observatory in the different pilots is through the following aspects: a) unification: common definition of the concepts of risk and vulnerability for geological risks that are similar within the project; b) dissemination: conducting outreach activities aimed at raising awareness of the project to society and relevant authorities; c) commitment: establishment of links and networks with the emergency services and local authorities related to geological risk management, in order to create synergies that help to manage risks more effectively, in addition to society being more involved in such events; d) creation of a mobile app through which citizens can report through photographs and providing their geographical coordinates, where and how the geological fall they have seen has occurred, in order to create citizen science among all. With the collection of data by citizens, the following results are achieved: involving people in local risk management, speeding up the intervention of emergency services more quickly due to improved connectivity between those involved, better monitoring of events by scientists, who manage to have a greater amount of data than they would normally have if they had not involved citizens in these processes.

keywords: [geological risks](#), [citizen observatory](#), [rockfalls](#), [atlantic](#).

CITIZEN OBSERVATORIES APPLIED TO GEOLOGICAL RISK MANAGEMENT

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Abstract

The European Interreg AGEO project focuses on the management of geological risks in different areas of European countries with territories in the Atlantic area. AGEO will launch several Citizen's observatory pilots on geohazards according to regional priorities. The aim is to engage with local communities to actively participate in risk preparedness and monitoring and incorporate local capacities into risk management systems. Experiences gained during the implementation of the Citizen's Observatory pilots will be used to formulate recommendations for the creation of future observatories in response to the widest range of hazards (both natural and human-induced) in the Atlantic region. That is why the project has several partners formed by countries of the Atlantic Area, including Portugal, Spain and Ireland. In each of these countries, a specific geological risk is studied, where the aim is to implement citizen participation. Since the project duration is 3 years, the way to implement the citizen observatory in the different pilots is through the following aspects: a) unification: common definition of the concepts of risk and vulnerability for geological risks that are similar within the project; b) dissemination: conducting outreach activities aimed at raising awareness of the project to society and relevant authorities; c) commitment: establishment of links and networks with the emergency services and local authorities related to geological risk management, in order to create synergies that help to manage risks more effectively, in addition to society being more involved in such events; d) creation of a mobile app through which citizens can report through photographs and providing their geographical coordinates, where and how the geological fall they have seen has occurred, in order to create citizen science among all. With the collection of data by citizens, the following results are achieved: involving people in local risk management, speeding up the intervention of emergency services more quickly due to improved connectivity between those involved, better monitoring of events by scientists, who manage to have a greater amount of data than they would normally have if they had not involved citizens in these processes.

Keywords: geological risks; citizen observatory; rockfalls; Atlantic region.

1 INTRODUCTION

The European Union is interested in developing citizens' observatories, and one of its tools for promoting these initiatives is through the financing of European projects. The University of La Laguna and 12 more European entities are involved in a project called "Interreg Atlantic Area - Platform for Atlantic Geohazard Risk Management (AGEO)", which focuses on the management of geological risks in the European Atlantic area. The participating countries in this project are the following: Portugal (Lisbon and Madeira), Spain (Canary Islands), Ireland (Dublin), United Kingdom (Northern Ireland), and France (French Brittany).

The specific objectives of AGEO are:

- To promote the adoption and use at regional level of the products and services provided by the European Spatial Data Infrastructures (Copernicus or the European Geological Data Infrastructure, EGDI)

- To create a cooperation and resource platform on risk assessment, preparedness, mitigation and prevention of geohazards in the Atlantic
- To undertake case studies to confirm the capacity of Citizens' Observatories to improve risk management systems

The geohazards studied in the AGEO project vary according to the country under analysis. In the case of Spain, the risk considered is rockfall. Rockfalls are recurrent events in the Canary Islands that are more likely to occur after episodes of rain or strong winds (González de Vallejo et al., 2020; Melillo et al., 2020) but also linked to seismic activity (Llorente et al., 2015). Sometimes rockfalls occur in the natural environment and no personal or material damage is to be regretted. However, on other occasions, falling rocks cause material damage (Figure 1) and/or personal injuries, as they affect roads, buildings and/or people passing through the area affected by the landslides.

Despite the fact that the phenomenon of rockfalls has historically occurred in the Canary Islands, it is important to bear in mind that climate change increases risks affecting human and natural systems and the processes of instability of slopes, with their consequent rockfalls, form part of these risks (Budetta & Nappi, 2013). The evolution of the climate may lead to changes in the intensity and frequency of torrential rains and therefore affect the incidence of instability events.



Figure 1. Transit route affected by rockfall in the Canary Islands

2 METHODOLOGY

We could define a citizen observatory as a collaborative space between the inhabitants of a given geographical area, who come together to actively participate in the management of a subject. One of its most notable advantages would be the active involvement of the citizens in the space around them, also functioning as a prevention and monitoring mechanism.

Every participating country has selected the study areas to which the citizen observatory for geological risk management will apply. In the case of the Canary Islands, an archipelago composed of eight islands and several islets in the Atlantic Ocean and belonging to Spain, the geological risk analysed in these pilots will be rockfalls. Although the pilot will be launch for the whole archipelago, the project will focus on three pilots areas located on different islands (Tenerife, Gran Canaria and El Hierro) have been proposed where rockfalls are common (Figure 2). On the other hand, the geological risk analysed in these pilots will be rockfalls.



Figure 2. The three pilots proposed on the islands of El Hierro, Tenerife and Gran Canaria for the observation of rockfalls

The Canary Islands are part of the Macaronesia region, which is made up of the Canary Islands, Madeira, the Azores, Cape Verde and the Savage Islands. All these islands are characterised by their volcanic origin and similar climate. For this reason, some of the conclusions drawn in this project can be taken as a starting point for a project with similar characteristics in the Macaronesian region and other volcanic islands in the World.

Landslides are sudden falls of blocks that go down the slope bouncing or rolling. The origin of these events is caused both by factors intrinsic to the slope itself (geometric, geological, geotechnical and hydrogeological) and by external factors (rain, wind, earthquake and human actions). This phenomenon is very quick and nearly unpredictable. The phenomenology of instability of blocks and stones is very variable, which makes it very difficult to establish simple and concrete methodologies or procedures which allow the study and analysis of this problem. To this day, the estimation of the risk of this type of phenomena has been quantified using empirical methodologies since this approach is considered the most operational for responding to this complex phenomenology in which a multitude of factors intervene. These methods are based on the assessment of a series of quantitative and qualitative parameters that allow risks relating to rock falls and their probability of occurrence to be evaluated in order to facilitate decision-making and the prioritisation of the investment available at any given time.

However, rockfalls, especially those associated with adverse weather conditions, can occur in many places at the same time. Citizen collaboration can help to collect more data, improving the probabilistic analysis of this geological risk. Furthermore, the training actions within the framework of the AGEO project will help to improve the perception of risk and resilience.

3 RESULTS

Whether the instability has already occurred or whether it is a slope whose condition is to be verified, a survey of the site must be carried out and citizens can help in this process. If the instability has already occurred and the rockfall is affecting a road, it will be important for citizens to be able to access an application in their mobile phones, from which they can report the observed rockfall. This application will send the citizen's warning to the local road protection services and help a quick response to the event and also a warning to the rest of users of the road to notify them about the event.

For this purpose of citizen contribution to the development of local science, there will be an application that can be installed on their mobile phones, so that users will be required to register, activate their Global Positioning System (GPS) locator, and provide photographs of the event observed.

Furthermore, this information will be useful not only for the emergency services, but for the scientific community. It is interesting to have records of the landslides in the Canary Islands, their recurrence

period, the most affected areas, the size of the blocks, their trajectories, etc., due to the consequences of these events for the management of public assets, transit routes and territorial planning.

Moreover, in addition to the help of citizens, Europe has an interesting platform of land survey called Copernicus (<https://www.copernicus.eu>) that it is implemented in the AGEO project as well. The Copernicus tool, through its various satellites, allows information to be obtained on geological and meteorological phenomena, fires, etc., providing the emergency and management services with an extra tool that gives them information on the event in real time.

4 CONCLUSIONS

As rockfalls are local phenomena, the participation and involvement of all stakeholders (technicians, public officials and the population) in the region concerned is particularly important, in order to achieve the best and greatest knowledge about the phenomenon and its risks and to address the management of the problem with greater guarantees and effectiveness.

Furthermore, although this is a pilot carried out in the Canary Islands, the citizen's science obtained from it can be applied to rockfall in all the Macaronesian region.

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REFERENCES

- [1] Budetta, P., & Nappi, M. (2013). Comparison between qualitative rockfall risk rating systems for a road affected by high traffic intensity. *Natural Hazards and Earth System Sciences*, 13(6), 1643–1653. <https://doi.org/10.5194/nhess-13-1643-2013>
- [2] González de Vallejo, Luis I.; Hernández Gutiérrez, Luis E.; Miranda, Ana; Ferrer, M. (2020). Rockfall Hazard Assessment in Volcanic Regions Based on ISVS and IRVS Geomechanical Indices. *Geosciences*, 10, 1–20. <https://doi.org/10.3390/geosciences10060220>
- [3] Llorente, M.; Galindo, I.; Paredes, C. (2015). Desprendimientos de rocas en la Isla de El Hierro. In *Ingeniería Geológica en terrenos volcánicos: métodos, técnicas y experiencias en las Islas Canarias* (pp. 333–366).
- [4] Melillo, M.; Gariano, S.L.; Peruccacci, S.; Sarro, R.; Mateos, R.M.; Brunetti, M. T. (2020). Rainfall and rockfalls in the Canary Islands: assessing a seasonal link. *Natural Hazards and Earth System Science*, 20, 2307–2317. <https://doi.org/https://doi.org/10.5194/nhess-20-2307-2020>