ID: 388

Transferring experience on responding to unrest in long repose period volcanoes. La transmision de experiencia en la gestion de emergencias en volcanes con periodos de reposo largos.

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One of the most important challenges posed by volcanoes with long response periods is the inexperience of most stakeholders - and crucially that of the scientists in charge. Inexperience can lead to delays in identifying unrest, evaluating and choosing forecasting models, problems collaborating and cooperating with colleagues and ultimately in reaching consensus on forecasts and scenarios. Personal awareness of issues arising during volcanic emergencies is a valuable skill which is lost through generations in volcanoes with long repose periods, both in less and more developed countries alike. Transferring knowledge and practice in data collection and analysis is standard in observatories and research centers, but transferring intangible, non academic knowledge is an important but often forgotten aspect of training for response. More efforts should be made for experience and capacity exchange and transfer. These include resources to facilitate direct stays and shadowing in observatories with frequently active volcanoes, regular simulation exercises or the adoption of tools like body worn cameras and machine learning technologies like immersive virtual reality or to bridge this gap. Examples of the latter confirm its value and potential.

ID: 213

We volcanologists are becoming more useful! :-)

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Fifty years ago, volcanologists predicted eruptions based on pattern recognition, with or without understanding underlying processes. Then we required conceptual models of what was controlling a volcano's behavior. And then numerical models. Geologists, seismologists, geodesists, and gas chemists told each other what their data implied, and then made predictions. The volcano will/ will not do the following within timeframe X.

Then we started making probabilistic forecasts of multiple outcomes, roughly quantified. That was scientifically more honest, and a better reflection of nature.

We also talked more about effects of eruptions. We used to say "ask someone else, that's not my expertise." Now, effects on human life, crops, jet engines, and critical infrastructure all get considered.

Since data are often scarce, we now consider analogue volcanoes. Some think considering analogues is irrelevant; I think it's wise, capturing not only a wider range of activity, but also ideas from more scientists.

With data mining and AI, generalists like myself can either embrace or be replaced by vastly more information. A priori probabilities from the volcano of concern get refined by information from analogues, or vice versa. Available data far exceed any one person's or team's memory. WOVOdat is an example, just beginning to be tapped by AI.

Imagine this: Those at risk define threshold probabilities of EFFECTS important to them. Volcanologists can quantify hazard in space and near-realtime, and subject-by-subject translation from hazard to effects will deliver probabilities and/or color codes for any RISK, any place you specify. Interactively. Imagine!

ID: 309

Mobile-based warning systems to enhance volcanic warnings fast and far

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Volcanoes produce multiple hazards affecting people across significant distances and differing temporalities, making rapid and targeted warnings challenging for scientists and emergency managers. Typically, volcano observatories and the surrounding vulnerable communities develop long term relationships that enable trust and credibility to enable quick information updates via information statements, bulletins, or alert levels to have significant impact on the decision-making and actions of vulnerable populations. However, often the challenge remains as to how to reach everyone in danger quickly and in a cost-effective manner?

Mobile-based warning systems provide an essential tool to notify vulnerable populations rapidly of critical information. In 2022, 95% of the world's population had access to mobile broadband networks, and three quarters of people owned a mobile phone. This makes mobile networks a powerful communication channel to alert populations about an imminent hazard. Two complementary technologies have been developed: 1) location-based SMS sends a message to all mobile phones detected in an area, and; 2) cell-broadcast uses a different network than SMS, enabling messages to be sent immediately to millions of people without network congestion in an at-risk area.

Mobile warnings are adaptable to specific requirements, e.g. a user's language, disability requirements, or travelling location. Redundancy is key for technologically based warnings alongside sirens, billboards, radio, TV, mobile alerting apps, and social media. As per the UN led Early Warnings for All Initiative, every person globally should be protected by an early warning system by 2027, and this should include volcanic hazards.

ID: 409

Mitigating the highest volcanic risk in the World: a multidisciplinary strategy for the Neapolitan area

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Neapolitan volcanic area is by far the highest volcanic risk one in the World, due to the presence of three active volcanic areas (Vesuvius, Campi Flegrei, Ischia) with an extreme population density: three millions people live within 20 km from a possible volcanic vent. Volcanic risk in these areas is strictly associated to seismic risk, and to other secondary risks as landslides and flooding.

The mitigation of such an extreme risk can only be afforded by considering volcanological, as well as economical, urbanistic and social issues. All these highly multidisciplinary aspects must be jointly recognized and shared by both volcanologists and decision makers, in a global, effective risk reduction policy.

We start considering the very high number of people living in the 'red zones' (the most risky areas, in terms of the actual emergency plans) of Vesuvius and Campi Flegrei, and the economic losses linked to a complete evacuation of these areas. We then demonstrate, from volcanological considerations, that evacuated people could not come back in the red zones in short times, but rather after years or decades, perhaps never again.

From such basic considerations, we proceed to propose a multidisciplinary, effective mitigation strategy and emergency planning, which can significantly decrease the volcanic and associated risks in the area and to make effectively feasible and sustainable an evacuation, in case of high probability for an impending eruption. The proposed strategy also uses the most advanced Artificial Intelligence methodologies to plan an optimal, complete relocation of the population living in the most risky areas, in case of sudden as well as progressive evacuation. In addition, our mitigation strategy takes into account other key demographic and economic issues: problems affecting several internal areas of Southern Italy, which can help to handle the problem of risk mitigation, and to possibly jointly solve them.

ID: 572

The DIGIVOLCAN infrastructure: a tool for automated real-time prediction of eruptions in the Canary Islands

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The 2021 Tajogaite eruption (La Palma) marked a turning point in managing volcanic emergencies. The short duration of the precursors and the characteristics of the eruption well above the expected typology made clear that the scientific management of volcanic eruptions requires an automated, quantitative approach to detect eruptive precursors and to determine the probability of an oncoming eruption.

For this reason, in 2022, a consortium of five Spanish institutions and enterprises launched the DIGIVOLCAN (A digital infrastructure for eruption forecast in the Canary Islands) project, intending to develop a pilot digital infrastructure to automate the analysis of volcanic monitoring data coming from multiparametric surveillance networks and discrete field surveys.

One of the main tasks of this project is the design, implementation, validation and operation of a multiparametric database collecting geo-referred time series, images and processed data. This database will be provided with a friendly and flexible web interface to make the multiparametric accessible for different typologies of users comprising scientists, civil protection, local authorities and the general public.

In this work, we present the preliminary structure of the database, the data processing flow and the interactive web interface.

ID: 576

Characterising the sources of volcanic tremor during the 2021 Tajogaite eruption (La Palma, Canary Islands) through Distributed Acoustic Sensing

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In recent years, the use of Distributed Acoustic Sensing (DAS) in seismology has gained extensive usage in different applications. A High-Fidelity DAS system (HDAS) was deployed during the 2021 Tajogaite eruption on Cumbre Volcano (La Palma, Canary Islands), allowing the recording of most of the syn-eruptive and post-eruptive seismicity. The eruption lasted from Sep. 19th until Dec. 13th of 2021. The HDAS was installed on Oct. 19th and is still operating.

The HDAS was installed around 10 km from the eruptive vent and was connected to a submarine fibre optic cable directed toward Tenerife Island and recorded thousands of local earthquakes as well as regional and teleseism events.

The HDAS was also able to record the low-frequency (<2 Hz) component of the volcanic tremor up to a distance of tens of kilometres from the volcano. We show how, using different array-like techniques (MUSIC and BEAMFORMING), apart from the primary source originating from the Strombolian activity at the vents, it has been possible to detect and characterise numerous components within the volcanic tremor wavefield. In particular, we evidence the strong scattering effects due to the regional topography and bathymetry and the evidence of possible deep sources related to the magma transfer along the plumbing system.