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Communication strategy for volcanic hazard understanding in Italy: The role of INGVvulcani team

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Abstract

Communication by public institutions about volcanoes and their activity is crucial in Italy, where many active volcanoes are in inhabited areas. In recent years, in addition to traditional conferences, science festivals, open days, and seminars, communication efforts towards the public have been carried out through 2.0 and 3.0 web activities, based on blog and social media, to establish a dialogue with non-experts. This is particularly important for research institutes like the Istituto Nazionale di Geofisica e Vulcanologia (INGV, National Institute of Geophysics and Volcanology), which is responsible for monitoring Italian active volcanoes and collaborates with civil protection authorities in emergency planning. Since the birth of INGV in 2000, the many branches of the institute have been strongly involved in communication with media and outreach activities. Recently, INGV has improved its communication about volcanoes. The blog ingvvulcani.com was launched in 2018, followed by associated INGVvulcani Facebook, Twitter, and Instagram pages. According to modern volcano risk communication practices worldwide, the INGVvulcani blog and social media are used to provide comprehensive and timely information on volcanic activity and its impacts, particularly focusing on Italian volcanoes. We publish a range of content including real-time updates on volcanic eruptions and activity, bulletins, scientific analyses, educational articles, and multimedia resources, adapting our strategy to volcanic activity levels, providing general information during dormancy and real-time updates during crises. INGVvulcani's approach prioritizes transparency, accessibility, and engagement, using blogs and social

media to foster informed discussions. Social media insights highlight strong public interest and trust, but further qualitative analysis, including sentiment studies and surveys, as well as professional engagement could help to address challenges like misinformation and enhance communication strategies in the future. Our aim is to disseminate scientific knowledge, enhance awareness of volcanic hazards, and promote a culture of preparedness and safety, especially for people living in areas near active Italian volcanoes who need to be accurately and constantly informed about volcanic hazard and monitoring, in collaboration with national and local Civil Protection authorities.

Keywords: Volcanic hazard; INGVvulcani; Communication strategies; Social media; Public engagement

1. Introduction

Italy is a country with a remarkable volcanic history, as it's home to some of the world's most well-known volcanoes. Italian volcanoes have not only strongly characterized landscapes but, as for Stromboli and Vulcano, they have also given their names to scientific terms used internationally to describe volcanic phenomena. Mount Vesuvius, another iconic volcano, is renowned for its catastrophic eruption in 79 AD that buried the cities of Pompeii and Herculaneum, leaving a lasting imprint on global perceptions of volcanic activity. Meanwhile, Etna periodically and dramatically captures media attention due to its spectacular paroxysmal activity, which can have a significant impact on the surrounding area and air traffic due to the dispersal of erupted ash. The variability of volcanic events that have occurred over time in Italy has significantly influenced the way these events are perceived, understood, and discussed, not only within Italy but also on a broader scientific and cultural level.

Italy's volcanoes display a range of activity levels and eruptive styles. Some are dormant for long periods, while others exhibit near-constant activity. Eruptions can be effusive, with lava flowing steadily from a vent, or explosive, releasing ash, gas, and pyroclastic material into the atmosphere. Moreover, most of Italy's active volcanoes are located near or within highly populated areas. For example, the region near Vesuvius is one of the most densely populated in Italy, with a high

demographic risk based upon population density that is more than 10,000 inhabitants per square kilometer [Pesaresi et al., 2008; ISTAT website[1]]. Similarly, the area of Campi Flegrei is partly included in the city of Naples. In the smaller volcanic islands, like Stromboli, population density is lower but even here the proximity of these communities to the volcanoes poses significant risks, especially in the summer tourist season [Italian Civil Protection Department website[2]; De Lucia et al., 2021].

In these complex environments, the need for effective communication is fundamental. The main issues that citizens need to be aware of are: the kind(s) of eruption that will happen, when they will happen, and, what citizens should do to reduce their own risks and those of their families and livelihoods [Barberi et al., 2008; De Lucia, 2014]. Communication about volcanoes and their activity is developed in different languages, adapted to different target groups, and conveyed through various channels, from traditional media such as television, to popular science magazines, museums and science festivals [De Lucia, 2014] and, more recently, via social media [Sennert et al., 2015]. In this article, we limit our analysis to communication aimed at general non-expert audiences, thus leaving out special audiences such as administrative, technical and civil protection authorities.

There are many actors involved in communication about volcanoes. Among these, research institutes have the difficult task of tracking and disseminating correct and authoritative scientific messages. One of the key challenges is ensuring that the public receives timely, clear, and accurate information about volcanic activity, especially when the message might include unpleasant or alarming news. This is a challenge because many researchers, although experts in their respective fields, are not experts at dialogue with the public. They often use academic language, overly technical language or jargon understandable only to other experts, making it difficult for the public to understand [Fearnley et al., 2018]. However, clear communication is essential to raise public awareness and inform communities about the hazards and the risks of living near active volcanoes [Fearnley et al., 2018; Todesco et al., 2022].

Fortunately, much has changed in recent years. Volcanologists have improved their communication skills, sometimes adding communication experts to the research institute teams involved. They have also moved away, at least partially, from the traditional "deficit" communication model [The Royal Society, 1985] and adopted a relationship-based communication approach that facilitates multi-directional information flow [Barclay et al., 2008; Graham et al., 2022]. The "deficit", typically top-down, communication model has proven to be sometimes ineffective or

[1] https://ottomilacensus.istat.it/provincia/063/ (accessed 20 February 2025).
[2] https://www.protezionecivile.gov.it/en/approfondimento/what-know-stromboli/ (accessed 20 February 2025).

generate negative attitude toward science [Bauer et al., 2007]. Greater scientific knowledge does not necessarily lead to more enthusiasm for science-based technologies. Moreover, trust and respect must be built rather than assumed. This requires openness to dialogue. This shift is reflected in the 2002 closure of the United Kingdom's Committee on the Public Understanding of Science (COPUS), which acknowledged that its top-down approach to science communication was no longer suitable for the evolving landscape.

Nowadays, the way in which scientists and research institutes dialogue with the public increasingly relies on established narrative techniques to communicate complex ideas in an engaging and relatable way. By incorporating storytelling, analogies, emotional framing, and visual elements, they transform abstract concepts into compelling narratives that capture public interest and foster a deeper understanding of science. In the case of volcanologists, these range from sharing interesting stories and facts about volcanoes and volcanology to providing urgent and accurate information during volcanic crises. Also, more and more scientists are using social media to communicate with the public through both their institutional and personal social media accounts and channels.

The rise of social media has transformed how information about volcanic activity is shared, creating both opportunities and challenges. Social media allows information to spread quickly when a significant or dangerous volcanic or seismic event occurs, but this rapid spread of news often includes a mixture of reliable information, misinformation, and sensationalized or click-baiting content. This flood of information can make it difficult for people to discern what is accurate and what is not. In this framework, reliable, trusted sources of information can provide a steady flow of factual updates, offering a valuable reference point for the public and media in the often-confusing coverage of volcanic events [Graham et al., 2023].

Since 2010, social media have become an essential tool for emergency and hazard communication in Italy and worldwide [Dufty, 2015; Sennert et al., 2015; Todesco et al., 2022; Graham et al., 2023]. In addition, their use has increased even further in recent years, partly due to restrictions on face-to-face communication activities during the COVID-19 pandemic. Social media platforms are used to disseminate bulletins, reports of volcanic and seismic activity, and warnings, as well as to coordinate disaster response and recovery efforts, and raise public awareness about various hazards, including volcanic activity. However, the effectiveness of communication on these platforms can be difficult to measure, and the efficacy of a given strategy may vary depending on the context in which it is deployed [Mani et al., 2023]. This is because social media trends and the platforms themselves change and evolve over time.

This article describes the communication activities carried out by the Istituto Nazionale di Geofisica e Vulcanologia (INGV, National Institute of Geophysics and Volcanology), through their INGVvulcani team. The INGVvulcani group, created in 2018, focuses on transparent and accessible communication regarding volcanic activity, with educational content and updates about volcanic activity. The group aims to make scientific research more accessible to the public, promoting active dialogue. The author is a member of the group and served as its coordinator from 2021 to 2025.
The article also presents some data about number of views and viewers, age, gender and distribution of followers, where available. These insights are valuable for developing tailored content and themes of interest for of our blog and social media pages.

2. INGV's communication about volcanoes

The INGV has the important task of monitoring and studying seismic and volcanic activity in Italy, as well as researching in geosciences and environmental issues. All INGV branches, spread throughout the Italian territory, are involved in both scientific research and in the dissemination of information and public outreach on geoscientific topics, including volcanology and related risks. This activity has a twofold purpose: firstly, to disseminate knowledge about the studies and research carried out at the Institute and, secondly, to improve the understanding of geological and geophysical phenomena, with the aim of raising hazard awareness among the population[3,4].
For volcanic issues, the INGV communicates with the public through its website and those of its branches, in particular the Osservatorio Vesuviano (Vesuvius Observatory)[5] in Naples and the Osservatorio Etneo (Etna Observatory)[6] in Catania. In these websites reports for civil protection purposes on volcanic activity and periodic bulletins on the multi-parameter monitoring of Italian volcanoes are available. In addition, for the Sicilian volcanoes, the website of the Etna Observatory provides images from video surveillance cameras, both in the visible and thermal spectrum, located at various points on Etna and the Aeolian volcanoes. On these websites it is possible to access the database of recorded seismic events and to observe real-time seismic signals. General information is also available on the

[3] https://www.ingv.it/en/index.php (accessed 20 February 2025).
[4] https://iononrischio.protezionecivile.it/en/ (accessed 20 February 2025).
[5] https://www.ov.ingv.it/ (accessed 20 February 2025).
[6] https://www.ct.ingv.it/ (accessed 20 February 2025).

status and eruptive history of the Italian volcanoes, as well as updates and news on the results of studies and research.

The INGV was among the first research organisations to recognise the communication potential of social media. Since 2010, the working group belonging to the INGV Earthquake Department, INGVterremoti, has been running a blog and over time has opened several social media channels to quickly inform the public of earthquake occurrences [Pignone et al., 2022]. The INGVterremoti social media are a well-established reality in the panorama of scientific communication in Italy, with Facebook and X accounts with approximately 250,000 and 320,000 followers respectively. In 2018, the INGV created the "INGVvulcani" working group. This group is involved in public communication activities about volcanoes and volcanology, as well as about research and monitoring of volcanoes. The INGVvulcani team consists of researchers working at different branches of INGV, including the Vesuvius and Etna volcano observatories. The group's main goal is to provide reliable, accessible scientific information, enhancing citizen preparedness and supporting emergency response efforts. INGVvulcani also shares official surveillance communications from INGV's institutional websites. These objectives are performed mainly through a thematic blog and social media, to engage the public and responding to queries, multimedia content to illustrate volcanic activity, monitoring and research, educational and outreach programs. INGVvulcani's communication strategy is based on the guidelines for Italian public administrations, which focus on transparency, accessibility and democratic participation of citizens.

A landmark development in INGV's web communication strategy was the launch of the volcano-focused blog[7] in 2018, together with the parallel ingvambiente.com blog, focused on environmental issues, to complement the existing seismic-focused blog INGVterremoti.com. Ingvvulcani.com aims to be a comprehensive source of information on volcanic activity, focusing primarily on Italian volcanoes and related in-depth scientific research topics (Figure 1). In conjunction with this website, INGV created social media profiles on Facebook, Twitter, and Instagram under the "INGVvulcani" banner, as well as the Youtube INGVvulcani channel.

The "INGVvulcani" blog and social media serve multiple purposes. First, they provide real-time updates on volcanic eruptions and other significant natural events occurring in volcanic areas, both by sharing official releases from the two volcanological observatories on social channels, and by producing their own summaries and updates. These updates are crucial for people living in hazardous areas, as they provide timely and accurate information about current or potential

[7] https://ingvvulcani.com/ (accessed 20 February 2025).

hazards. The platform provides scientific analysis of volcanic phenomena, breaking down complex geological processes into understandable explanations for the public. The INGVvulcani communication platform also serves as an educational resource. The blog publishes articles on volcanology and the impact of volcanic activity. These resources are enriched with multimedia content, including photos and videos that provide insight into volcanic processes and monitoring activities. YouTube videos are also often used for didactical purposes by schools.

Figure 1. *The layout of the INGVvulcani blog homepage, as it appeared on 18 October 2024. On that day, the highlights featured the article about the outreach event "Iononrischio", organized by the Italian Civil Protection Department in collaboration with INGV. Articles about volcano monitoring and surveillance are available on the right, while photo-news updates appear on the left. Further content is available by scrolling the page. Static pages are accessible through the upper menu (red background), while published articles are listed in the "category menu" (white background).*

One of the key roles of the INGVvulcani team is to bridge the gap between the scientific community and the public. The team aims to make volcanology more accessible to the public. This involves introducing the public to INGV researchers and explaining their work in a clear and engaging way. Content is tailored to different audiences, ranging from casual readers interested in volcanic facts to more technical information for those seeking in-depth knowledge of volcanic phenomena.

The use of social media encourages a two-way flow of communication. Social platforms allow users to engage with the institute through comments, shares, likes, and direct messages. Moreover, this interaction creates dynamic conversations where feedback, opinions, and ideas can be exchanged instantly, also among users. As an example, we report here the dialogue occurred when the weekly monitoring bulletin for Campi Flegrei on 14 January 2025 was shared on the INGVvulcani Facebook account. A reader wrote: 'From the graphs it seems to me that from October to December 2024 the uplift was "only" 20 mm. Am I wrong?' Our reply to clarify the doubt expressed was: 'Considering that in that period the average value of the uplift rate in the area of maximum deformation is about 10±3 mm/month at the GNSS station of Rione Terra (RITE), in three months it is about 30 mm'.

3. Analysis of the INGVvulcani blog

The INGVvulcani blog started back in July 2018 with the idea of sharing static pages containing information on Italian volcanoes and, at the same time, proposing dynamic content through articles about different subjects regarding volcanology. Articles are written mainly in Italian as most readers are Italian; translation into English or other languages is ensured via the Google Translate plugin. Events of past and ongoing volcanic activity in Italy and abroad are reported, along with scientific research performed by INGV. The blog is designed to provide volcanological information to the public using simple yet appropriate terms. The editorial process of every article is based on a collaborative and multidisciplinary approach among researchers involved in the INGVvulcani editorial board. The article is reviewed on a shared platform by at least five experts from various geological disciplines. The process is transparent, allowing reviewers and authors to see and respond to each other's comments, fostering constructive discussions. This helps clarify complex points for non-experts and improves the text for publication. The review is iterative and may be repeated multiple times. Some reviewers also have journalistic training, and this enhances the article's readability. The INGVvulcani team focuses on maintaining a consistent flow of information and providing content that varies in style, length and complexity. Very detailed and in-depth articles are posted to provide basic volcanological knowledge and a solid framework for interpreting volcanic events. These articles are mostly published during "quiet" periods, of minor or no volcanic activity.

In 2020, the blog was redesigned in a magazine format, which groups articles into more specific categories such as 'Eruptions and volcanoes' and 'Volcano monitoring and surveillance'. This simplifies the search for articles for website

visitors. The new format has also introduced another type of content: photo-news or short posts on volcanic surveillance. These short articles are particularly popular during volcanic or seismic crises in volcanic areas, as they are read to get quick updates on the ongoing activity, especially from citizens in the affected volcanic areas. As an example, the article 'Communication from the Director of the Vesuvius Observatory, seismic swarm update in Campi Flegrei, 27.09.2023, 6.30 am', had 74,200 views in just three days.

From July 2018 to 22 October 2024, the blog recorded 2,238,401 views and 1,395,797 visitors, with website traffic peaking during volcanic emergencies such as the eruptions of Mt. Etna and Stromboli, and seismic events occurring during the ongoing bradyseismic crisis at Campi Flegrei [Tramelli et al., 2024] (Figure 2, data refer to 2018–2022 years).

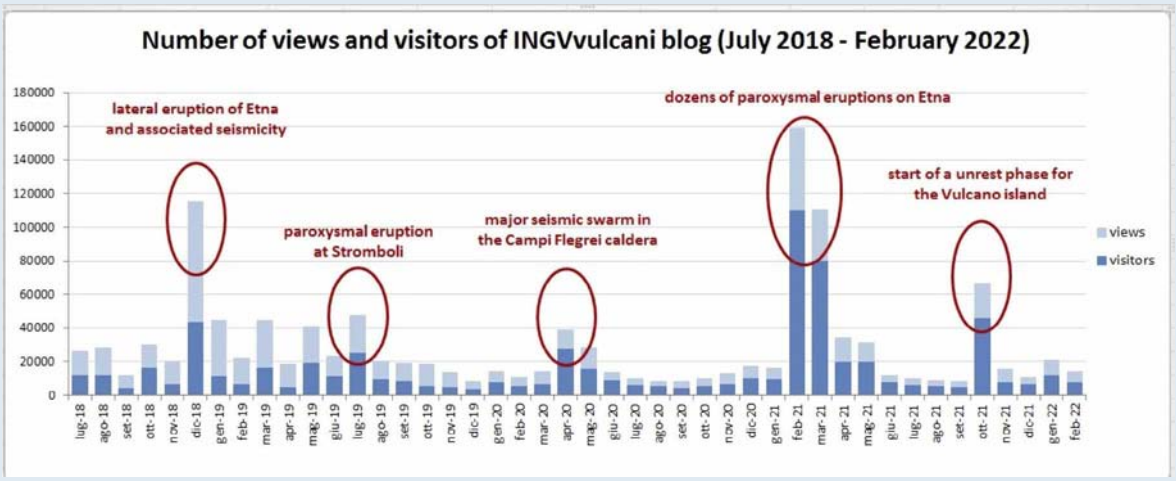

Figure 2. *INGVvulcani blog's monthly views and visitors, from July 2018 to February 2022. Peaks of the number of views and of visitors during volcanic crises are observed, particularly those involving Etna [from: Todesco et al., 2022].*

The blog's readers are above all between 25 and 45 years old (Figure 3a, data refer to the year 2021), and mostly come from Italy, with a clear predominance of Sicilian cities (Figure 3b, data refer to the year 2021). This is reasonable considering that Sicily is the Italian region with the most active volcanoes. In 2021, Etna experienced dozens of volcanic paroxysms and there was a volcanic unrest phase at Vulcano, in the Aeolian islands and thus in the territory of the region of Sicily.

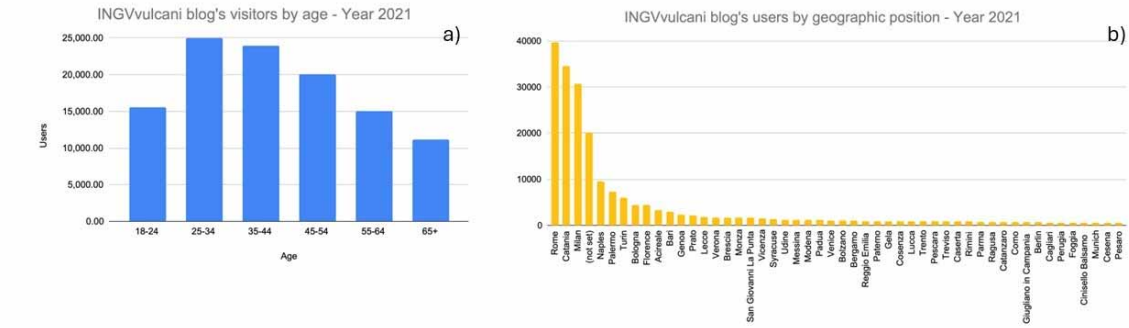

Figure 3. *(a) Age distribution of blog visitors in 2021. (b) Geographic locations of INGVvulcani blog visitors, in 2021 [from: Todesco et al., 2022].*

The blog is accessed largely via mobile phones. This is particularly the case during events related to volcanic or seismic activity, when people need quick access to up-to-date and timely information.

Posts on the blog are shared via INGVvulcani social media. Comments on the blog are not allowed but readers and followers can share their views and comments via social media. The INGVvulcani blog is considered as a trusted source of reliable information for volcanic crisis. News items disseminated via INGVvulcani channels are frequently reposted and amplified by conventional media outlets, especially if the content is clear, concise and accompanied by high quality footage. This amplification effect can significantly increase the audience reached by INGVvulcani's posts, not only through traditional media, but increasingly through sharing social media posts, thus further disseminating accurate information on volcanic activity.

It should be noted that much of the data and related graphs presented in this article for the INGVvulcani blog refer to the year 2021, as statistical data from Google Analytics were only accessible for that year. In the following years, we had to eliminate this service because it does not guarantee the security of users' personal data, according to the protection standards laid down by European legislation.

4. INGVvulcani social media and public engagement

As already written, social media platforms allow for rapid dissemination of information, which is critical during volcanic emergencies, when timely updates can

help prevent panic and promote rational behaviour. Moreover, these platforms provide a forum for a two-way communication between scientists and the public [Sennert et al., 2015]. INGVvulcani manages channels on three social media platforms: Facebook, X (previously Twitter) and Instagram, plus a YouTube channel. Followers of the INGVvulcani social media may leave comments, ask questions, share experiences, and receive clarification on volcanic and other phenomena. Integration of social media into INGV's communication channels has proven particularly effective in fostering public engagement. Facebook, X and Instagram each play a distinct role in this system. The INGVvulcani Facebook page serves as a platform for longer posts and discussions. As of 21 October 2024, it has 50,644 followers (Figure 4). Of these, 53% are women and 47% are men. The most represented age group is between 35 and 54 years. In terms of origin, approximately 85% of followers are Italian, with the largest number coming from Catania, followed by Naples. This is not surprising, given that these are large cities near significant active volcanoes.

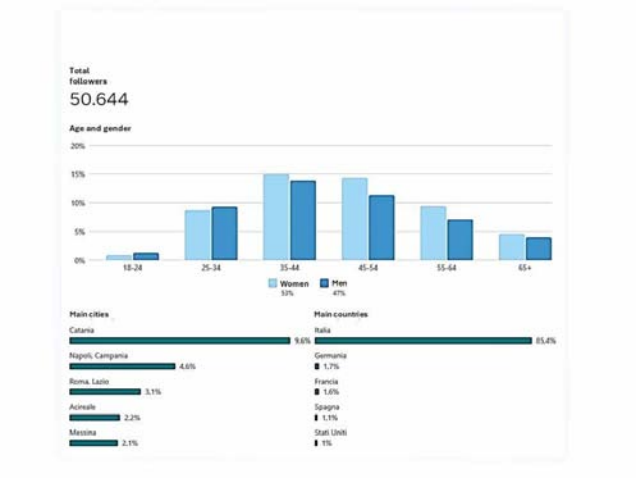

Figure 4. *Age and gender distribution of followers of INGVvulcani Facebook account on 21 October 2024 (upper part). On the lower part of the figure the five main provenance localities (left) and countries (right) are listed.*

X, with its real-time and concise format, is ideal for rapid updates and brief announcements during volcanic events, and to share existing web/blog pages. As of 23 October 2024, the INGVvulcani X account has 21.671 followers. Instagram, with its visual emphasis, is used to share striking images and videos of volcanic landscapes, eruptions, and monitoring activities, making them more accessible to

a wider audience. The INGVvulcani Instagram page has 26.898 followers as of 21 October 2024 (Figure 5). Followers are 51% women and 49% men. As regards age, the most represented age group is between 25 and 44 years. Regarding origin, approximately 91% of the followers are Italian, and the most represented province is Naples, followed by Rome and Catania.

Figure 5. *Age and gender distribution of followers of INGVvulcani Instagram account on 21 October 2024 (upper part). On the lower part of the figure the five main provenance localities (left) and countries (right) are listed.*

Peaks in post views are consistently observed for all INGVvulcani social media channels during times of eruptive activity of Etna or Stromboli, or seismic activity in the areas of Vesuvius and Campi Flegrei. For example, in Figure 6 we observe a correspondence between peak views for the Facebook channel with paroxysms of Etna, which were very frequent in 2021.

All the above-mentioned channels are used to share articles from the "ingvvulcani.com" blog. Finally, INGVvulcani manages a YouTube channel. As of 23 October 2024, the INGVvulcani YouTube channel has 6.300 subscribers and 207 videos. The channel facilitates the understanding of volcanic phenomena through videos and animations. It allows the rapid dissemination of images of ongoing eruptive activity, including volcanic emergencies such as paroxysms, thus contributing to public awareness and scientific education.

All these media enhance trust in the INGV by demonstrating transparency in the activities carried out to study and monitor volcanoes. Moreover, they are tools for direct communication with the public, who can interact and ask questions.

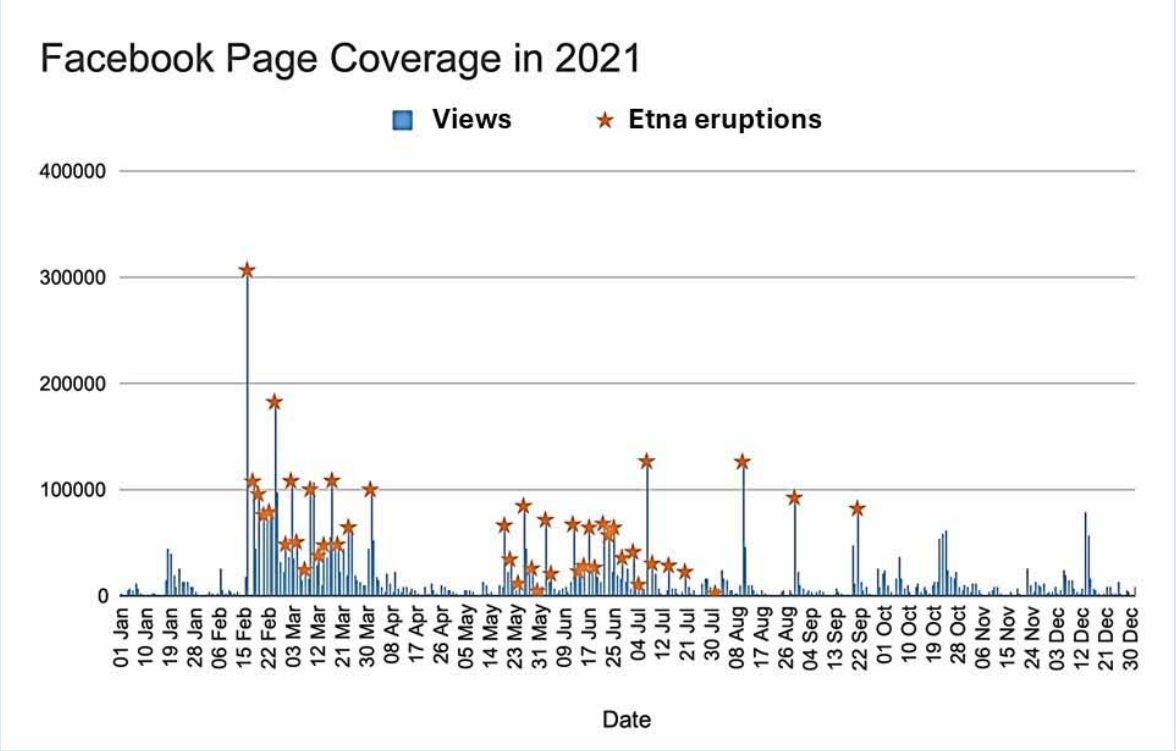

Figure 6. *Views achieved by the Facebook page INGVvulcani in 2021. Stars indicate the timing of Etna eruptive activity [from: Todesco et al., 2022].*

In addition to the statistical data and the analysis of the rate of change or increase of the number of followers over time, often linked to phases of volcanic or seismic activity in the Italian volcanic areas, the qualitative review of the comments left by users on our pages is very interesting and provide useful insights about recurring themes that we believe should be emphasized. In broad terms, comments on INGVvulcani's social channels, such as Facebook and Instagram, reflect a mixture of curiosity, concern and scientific interest from the public. In general, the following is found:

- Curiosity and scientific interest: Many users are fascinated by volcanic phenomena and ask detailed questions about eruption dynamics and technical aspects of monitoring, showing interest in volcanological issues.
- Concerns and requests for clarification: During significant volcanic or seismic activity, some comments express concern and request up-to-date information, especially from people living in areas close to the featured volcanoes.
- Appreciation and support: Many users leave comments of thanks and appreciation for the work of the INGV, recognising its commitment to

disseminate accurate information to local communities. This was particularly the case when live videos were taken during paroxysmal activity.
- Scepticism and doubt: Some users write sceptical or polemical comments on the information disseminated by the account, asking for more transparency and/or expressing doubts about the official communication.
- Interaction among followers: Very often, comments or questions from INGVvulcani's followers are answered by other followers. Often, these replies are relevant and correct, as there are many experts and scientists among the followers. This dialogue is very constructive and particularly useful in the case of negative or sceptical comments.

The INGVvulcani team responds to comments on social media in a professional and polite way, adapting the tone and content to different users:
- Informative and educational responses: When comments express scientific curiosity, the INGVvulcani team answer with clear and detailed explanations, trying to make technical language understandable to the public. This approach provides accurate information and engagement.
- Calm tone during volcanic or seismic events: In the situations of emergency or significant volcanic activity, INGVvulcani provides timely updates, explaining what is occurring, and trying to limit the spread of fake news and alarmism. Responses often include guidance on where to find more detailed information or official updates.
- Acknowledgements and positive interactions: In these cases, INGVvulcani responds by thanking and acknowledging users for their support. It is believed that this helps to build a relationship of trust and closeness.
- Dealing with criticism and scepticism: The INGVvulcani team tries to respond patiently and transparently to critical or sceptical comments, providing explanations and clarifications based on scientific data, trying to dispel doubts with objective and professional answers, and demonstrating transparency in communication.

At present, the basic quantitative analysis provided by the social media platforms is not sufficient as a reliable measure of the effectiveness of the team's communication activities and needs to be combined with an in-depth analysis of the comments. Based on the evaluation carried out with the access statistics of the different platforms and a basic analysis of the comments, the response of the public to the efforts of INGVulcani is largely positive, demonstrating a strong need for accurate and reliable information on volcanic activity in Italy [Todesco et al., 2022].

5. Discussion and conclusions

Evolving communication efforts on volcanic activity demonstrate a growing awareness of the complexities involved in disseminating scientific information to diverse audiences. In Italy this is an essential task, particularly given the presence of active volcanoes near densely populated areas. The INGV, through its blend of traditional outreach awareness-raising activities and modern digital platforms, is focussed on conveying to citizens the importance of understanding volcanic hazards, the role of monitoring systems, and the need to adopt correct and rational behaviour to mitigate risks. The evolution of INGVvulcani's approach reflects a commitment to transparency, accessibility and engagement. The integration of a blog with other digital platforms has enabled a more dynamic exchange of information, fostering a more engaged public. It has been found that timely, accurate and accessible information is essential for both decision-makers and the public, especially those living in proximity to active volcanoes. Communication strategies should be scientifically accurate, culturally sensitive, and tailored to different audiences, ranging from local communities to international followers.

The analysis of traffic statistics, such as those relating to volcanic unrest and emergencies, shows how the blog and social media are used and accessed, especially in times of crisis. Predominantly positive public participation, ranging from scientific curiosity to requests for clarification and appreciation, reflects a widespread interest in volcanic activity and a need for timely and accurate information, as well as a prevalent trust and confidence in INGVvulcani's communications. The role of the team in managing comments and responses, especially during times of emergency, is also important in maintaining constructive dialogue.

One of the key aspects of INGVvulcani's communication strategy is the flexibility to adapt their messaging based on the current state of volcanic activity. During periods of dormancy, the communication focuses on maintaining a connection with the public, providing general information about volcanoes, and promoting scientific understanding. This helps to keep the public informed about volcanic phenomena even when no immediate threat exists.

In contrast, communication during volcanic crises is more urgent and focuses on providing real-time updates about ongoing events. During these times, INGVvulcani ensures it provides accurate information about the development of volcanic activity, offering timely updates when available, together with the necessary scientific context. This dual approach guarantees that the public has greater opportunity to stay informed about the current hazards and also to understand the broader volcanological processes behind them.

Although the quantitative data from the social platforms provides an interesting insight, a more complete assessment of INGVvulcani communication could be achieved by supplementing this information with a more rigorous qualitative analysis of comments and interactions (sentiment analysis), surveys, analysis of citations and shares, focus groups and interviews. This could improve communication strategies. However, challenges remain, particularly in ensuring that non-experts fully understand scientific issues and related uncertainty, and in managing the rapid spread of information in the age of social media. This requires a careful and deliberate communication strategy that prioritises clarity and reliability. Full-time professionals dedicated to public engagement could improve interaction with the public. Continually adapting and refining communication efforts in accordance with Civil Protection authority guidelines will be critical to improve public preparedness for volcanic events, ultimately contributing to safer communities.

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