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ROADMAP

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Fifth periodical bulletin

ROADMAP in a nutshell

The ROADMAP (EuROpean observAtory on Disaster risk and crisis MAnagement best Practices) Project, is a 18 months project funded by DG-ECHO under the call UCPM-2020-KN-AG. The project started on the 1st January 2021 and the main objective is to establish a European "Doctrine on disaster risk and crisis management", funded on the mutual cooperation between scientific communities and DRM authorities. The doctrine, that is intended as "a shared understanding of disaster management between decision-makers and scientific actors", will be based on selected experiences, best practices and implemented solutions in EU Member States.

- **Advisory Group**
  The Advisory Group (**https://roadmap.ci3r.it/advisory-group/**) is formed by selected experts on both science and decision-making in DRM from several Countries, covering different risks and phases of DRM cycle. The networking activities between the Project Consortium, that is composed by recognized research institutes, competence centres for disaster risk reduction and Civil Protection authorities, and the Advisory Group will result in the establishment of a European think tank/ observatory on disaster risk and crisis management good practices that could represent a first step towards a Community of Practice to operate within the Union Civil Protection Mechanism, in collaboration with the Disaster Risk Management Knowledge Center.

Project updates

In these last months of the project many activities have been carried out, in particular:

- on-going work on the definition of the Solutions Explorer web platform: a mockup was presented at the 5th DRMKC annual seminar on 18th November - SESSION 5: Co-designing the Science Pillar;
- on-going work on the content of the three thematic papers that will be published during 2022;
- on-going work on the content of the Vision Paper that will be published in June 2022;
- the 2nd webinar, entitled "Communication issues in DRM", was held on December 6th, at 10 AM (CET) (**https://roadmap.ci3r.it/publications/**);
- constant engagement with the AG through the AG meetings in September and November 2021 and February 2022, to achieve the objectives of the project.

RISK – Good practices

Earthquake	Forest fires	**Volcanic**
Hydrogeological	Biological	**Climate**

This fifth bulletin focuses on the management of emergencies from volcanic eruptions and the risks associated with them, such as earthquakes, air pollution, tsunamis, etc. Indeed, of all the geophysical threats, volcanic activity is unique in having a particularly large and diverse portfolio of associated risks and hazards capable of causing death and injury, societal and economic disruption and damage to population centres and attendant infrastructure.

It is currently estimated that there are about 1500 potentially active volcanoes worldwide. Volcanic activities and associated wildfires affected 6.2 million people and caused nearly 2400 deaths between 1998-2017[1].

Globally, it is estimated that more than 600 million people live in areas susceptible to volcanic hazards alone[2]. Volcanic activities and associated wildfires affected 6.2 million people and caused nearly 2400 deaths between 1998-2017[3]. With a growing population living in volcanically vulnerable areas, it is likely that in the future more people will be affected by volcanic eruptions.

Volcanoes can cause multiple types of cascading hazards. Besides syn-eruptive threats (e.g., lava, pyroclastic flows or ash fall), other adverse events such as landslides or lahars can occur at any time[4]. Moreover, volcanic plumes can carry large amount of gases and particles towards the atmosphere[5,6]. The most volatile elements leave the magma body as gaseous species (H2O, CO2, SO2, HCl, HBr, HI) while the most refractory (Si, Al, Mg, Sr etc.) are emitted as constituents of solid particles. Both may have significant impact on the environment, influencing the air quality levels and as well as the chemical composition of precipitation, on climate change either increasing the reflection of radiation from the sun back into space (e.g. sulphate aerosol) or enhancing global warming through the greenhouse effect (e.g. CO2) and on the human health due to the toxic properties of some of the substances emitted, that in proximity of the eruption may cause asphyxiation, respiratory diseases and skin burns.

Notwithstanding the picture outlined above, to date much of the thinking around risks caused by volcanoes follows a simple paradigm: the bigger the eruption, the worse it will be for societies. In their work Mani et al. (2021) indeed argues that too much focus is on the risks of massive yet rare volcanic explosions, while too little attention is paid to the potential domino effects of moderate eruptions in key parts of the planet. Indeed, eruptions ranking up to 6 on the VEI (Volcanic Explosivity Index), rather than the 7th and 8th that tend to occupy catastrophist thinking, could easily generate ash clouds, mudflows and landslides that damage undersea cables, leading to financial market shutdowns, or destroy crop yields, causing food shortages[7].

As an example, the events of 2010 in Iceland, where a VEI 4 eruption happened from the Eyjafjallajökull volcano, saw plumes of ash carried on northwesterly winds close European airspace at a cost of US$ 5 billion to the global economy. As comparison, when Mount Pinatubo in the Philippines erupted in 1991 with a magnitude 6 -that is about 100 times greater in scale than the Iceland eruption- its distance from vital infrastructure meant that overall economic damage was less than a fifth of Eyjafjallajökull one (i.e. Pinatubo would have a global economic impact of around US$ 740 million if it occurred in 2021)[7].

1 WHO: https://www.who.int/health-topics/volcanic-eruptions#tab=tab_1
2 Auker M.R., Sparks R.S.J., Siebert L., Crosweller H.S., Ewert J.J. (2013) - Appl. Volcanol. 2, 2.
3 WHO: https://www.who.int/health-topics/volcanic-eruptions#tab=tab_1
4 Thierry P., Neri M., Le Cozannet G., Jousset P., Costa A. (2015) - Preface: Approaches and methods to improve risk management in volcanic areas. Natural Hazards and Earth System Sciences, 2015, 15(2), pp. 197-201.
5 Mather, T.A. (2008) - Volcanism and the atmosphere: The potential role of the atmosphere in unlocking the reactivity of volcanic emissions. Philos. Trans. R. Soc. A Math. Phys. Eng. Sci. 366, 4581–4595. https://doi.org/10.1098/rsta.2008.0152
6 Mather, T.A., Witt, M.L.I., Pyle, D.M., Quayle, B.M., Aiuppa, A., Bagnato, E., Martin, R.S., Sims, K.W.W., Edmonds, M., Sutton, A.J., Ilyinskaya, E. (2012) - Halogens and trace metal emissions from the ongoing 2008 summit eruption of Kılauea volcano, Hawaìi. Geochim. Cosmochim. Acta 83, 292–323. https://doi.org/10.1016/j.gca.2011.11.029
7 Mani et al. (2021) - Global catastrophic risk from lower magnitude volcanic eruptions. Nature Communications, 12:4756 | https://doi.org/10.1038/s41467-021-25021-8

Independently from the magnitude of the event, to manage these threats efficiently, three key objectives must be jointly addressed:

1) improving prevention tools, through the collection and acquisition of data on hazards and risks, and its dissemination as maps and scenarios;
2) improving crisis management capabilities, based on monitoring and early warning systems, but also reliable communications systems; and
3) reducing people's vulnerability and developing recovery and resilience capabilities after an event has occurred.

In terms of good practices, the recommendations gathered from three International Volcano Observatory Best Practices (VOBP) workshops held in 2011, 2013 and 2016 are particularly important. These GPs. were collected and grouped around three main themes, according to the list below (Pallister et al., 2019)[8]

Long-term volcanic hazard assessment

1. *Geologic information, model results, analogous eruptions are foundations for assessment.*
2. *Statistical models aid hazard mapping; complex numerical models inform understanding.*
3. *Global databases inform and validate long- and near-term assessments.*
4. *Next-generation hazard assessments are portfolios of products tailored to meet user needs.*
5. *Conceptual models aid in hazard assessment.*
6. *Event trees are logical probabilistic frameworks that aid in hazard analysis.*
7. *All scenarios are important to emergency managers (even those with low probability); showing vulnerable infrastructure on hazard maps is also important.*
8. *Hazard mitigation requires guidance from stakeholders and relationships with decision makers; institutional responsibility determines roles of observatories in mitigation.*
9. *Communicating probabilities requires a practice of dialogue and mutual understanding.*
10. *Long-term hazard assessments, while obviously necessary for risk analysis, are also informed and prioritized by evaluations of vulnerability and risk.*

Near-term eruption forecasting

1. *Minimal monitoring of all hazardous volcanoes is needed; prioritization is based on threat ranking; multi-parameter monitoring reduces uncertainties.*
2. *Eruptions are difficult to forecast with certainty; hence, probabilistic methods with uncertainties are recommended.*
3. *Forecasts are improved by sharing data and experiences, and by comparative studies, which rely on databases; databases should strive for compatibility and open-access.*
4. *Roles for use of forecasts to mitigate risk should be clearly defined.*
5. *Universities and Research Centres are natural partners for volcano observatories. Responsibility for communication of hazards lies with the observatory.*

Volcanic hazard communication

1. *Observatory leader(s) seek the best knowledge and consensus, ensure documentation of decisions, speak with a single/common voice. Rapid consensus facilitated by practice.*
2. *Observatories convey hazard information in standardized formats, use probabilistic analyses and direct modes of communication.*
3. *Observatories communicate regularly with mitigation authorities, work with communities to build trust and credibility and engage with stakeholders at all phases of the emergency cycle.*
4. *Sharing of data and expertise, exchanges between observatories, participation in workshops and training programs enhance observatory capabilities.*
5. *Education programs with civil-protection partners increases community resilience.*
6. *Roles and responsibilities for hazard and mitigation communication must be clearly defined.*

[8] Pallister et al. (2019) - Volcano observatory best practices (VOBP) workshops - A summary of findings and best-practice recommendations. Journal of Applied Volcanology (2019) 8:2. https://doi.org/10.1186/s13617-019-0082-8

Stories of good practices

Good practices in Icelandic crisis communication during volcanic eruptions: development of a tentative framework[9]

An analysis carried out by Bergþóra Njála Guðmundsdóttir (Faculty of Life and Environmental Sciences, University of Iceland) in 2016, investigated what practices have been successful and what practices need improvement in official communication prior to, during and after volcanic eruptions in Iceland. Furthermore, the Authors analyzed to what extent previously identified best practices within the crisis communication literature are applicable to the Icelandic situation. A qualitative interview research was conducted on experiences of public information officers, experts, spokespersons and crisis managers as well as journalists working during the Bárðarbunga seismic activity and the Holuhraun eruption in Iceland that started in August 2014 and ended in February 2015. It revealed nine elements (Table 1) that are considered important and/or successful in communication efforts during recent eruptions, here suggested as a tentative framework for best practices in crisis communication in Iceland.

Best practice	Pre-crisis	During crisis	Post-crisis
1. Integrating communication into the managing process	x	x	x
2. Cooperating on an institutional level	x	x	x
3. Coordinating messages	x	x	x
4. Providing truthful, honest and transparent information	x	x	x
5. Communicating in a proactive way		x	
6. Being accessible and having a good relationship with the media	x	x	x
7. Understanding, informing and cooperating with the audience	x	x	x
8. Improvising if necessary		x	
9. Planning, preparing and documenting the crisis communication	x		x

Table 1 - Framework for best practices identified by Guðmundsdóttir (2016).

The Health Hazards of Volcanic Ash: A Guide for the Public[10]

In 2007 the International Volcanic Health Hazard Network (IVHHN), Cities and Volcanoes Commission, GNS Science and the United States Geological Survey (USGS) preepared a guide to promote the safety of those who experience volcanic ashfall. This guide explains the potential health effects of volcanic ash and gives details on how people can protect themselves and their family in the event of a volcanic ashfall. Some precautions indicated in the document are: · limit driving · keep all doors and windows closed · wear effective dust masks · wear goggles or corrective eyeglasses · filter off the ash particles before drinking · wash ash-covered vegetables with water.

Tsunami Preparedness. Civil Protection - Good Practices Guide[11]

The Mediterranean and the North-Eastern Atlantic and connected seas (NEAMTWS) are among the regions of the world with higher tsunami risk, mainly due to earthquakes, but in part also related to volcanic eruptions. A good practices guide on tsunami preparedness was developed by UNESC primarily for Civil Protection authorities in the NEAMTWS region with the support of the European Commission Directorate General Humanitarian Aid & Civil Protection. In the

9 https://www.semanticscholar.org/paper/Best-practices-in-Icelandic-crisis-communication-of-Gu%C3%B0mundsd%C3%B3ttir/d5b8bf55e11ff87db9c4c9f9907c41ffecb033c8
10 https://pubs.er.usgs.gov/publication/70170800
11 https://unesdoc.unesco.org/ark:/48223/pf0000220802

past, several notable tsunamis with high level of destructiveness affected the shores of those areas. The apparent low-frequency of these events led to low preparedness among population and authorities. Recent events in the Pacific and Indian Ocean led to an increase awareness of the importance of tsunami hazard in coastal areas. A group of guidelines is summarized and proposed in this report to help civil protection authorities and coastal communities understand their exposure to tsunami hazards and to mitigate the resulting risk through awareness, preparedness information and land use planning. This report is essentially intended to facilitate/help in emergency and planning interventions in the case of major tsunami events which may require major responsive actions.

Exercise on the response to an explosive eruption in Iceland: outcomes from a European exercise[12]

The FUTUREVOLC project provided the opportunity to practice the response to an eruption in Iceland in much greater depth than the regular monthly exercises. The project was led by the University of Iceland together with IMO (The Icelandic Meteorological Office). A 3-day exercise simulating unrest and a large explosive eruption at Katla volcano, Iceland, was conducted in January 2016. A large volume of simulated data based on a complex, but realistic eruption scenario was compiled in advance and then transmitted to exercise participants in near-real time over the course of the exercise. The scenario was designed to test the expertise and procedures of the local institutions in charge of warning and responding to volcanic hazards, namely the volcano observatory, national civil protection, and the local university-science sector, as well as their interactions with the European science community and the London Volcanic Ash Advisory Centre. This exercise was the first of this magnitude and scope in Iceland and has revealed many successful developments introduced since the 2010 Eyjafjallajökull and 2011 Grímsvötn eruptions. Following the exercise, 90% of participants said that they felt better prepared for a future eruption.

Campi Flegrei exercise[13]

From 16 to 20 October 2019 the "Exe Flegrei 2019" exercise was conducted in Italy. The exercise was organized by the Italian Civil Protection Department (ICPD) and the civil protection structure of the Campania Region. During the exercise a series of activities were carried out such as: monitoring/evaluation of the state of the Phlegrean Fields (Campi Flegrei) volcano, progressive activation of the civil protection system, removal and assisted evacuation of the population of the affected municipalities. The objective of the exercise was to test the emergency planning for the Campi Flegrei area and the evaluation process that triggers the operational phases of the different alert levels.

Disaster Prevention Portal (Japan)[14]

Japan is one of the world's most earthquake and volcanic risk-prone countries, and has suffered repeated damage from such disasters as well as from tsunamis. To limit the extent of damage caused by natural disasters and support the prompt execution or related activities, the Japan Meteorological Agency provides disaster mitigation information via various channels to government disaster management agencies, local governments, the media and the public. The Japan Meteorological Agency has created the Disaster Prevention Portal Site to protect people and their property from disasters by monitoring and forecasting natural disasters. This multilingual website provides information on heavy rain, earthquakes, tsunamis and volcanic eruptions in fourteen languages.

The Volcano Disaster Assistance Programme-Helping to save lives worldwide for more than 30 years[15]

For more than three decades, countries around the world have called upon the U.S. Geological Survey's (USGS) Volcano Disaster Assistance Program (VDAP) to contribute expertise and equipment in times of volcanic crisis. Co-funded by the USGS and the U.S. Agency for International Development's Office of U.S. Foreign Disaster Assistance (USAID/OFDA), VDAP has evolved and grown over the years, adding newly developed monitoring technologies, training and exchange programs, and eruption forecasting methodologies to greatly expand global capabilities that mitigate the impacts of volcanic hazards. The program's mission is to assist foreign partners, at their request, in volcano monitoring and empower them to take the lead in mitigating hazards and risks at their country's threatening volcanoes. Since 1986, team members have responded to over 70 major volcanic crises at more than 50 volcanoes and have strengthened response capacity in 12 countries. The VDAP team consists of approximately 20 geologists, geophysicists, and engineers, who are based out of the USGS Cascades Volcano Observatory in Vancouver, Washington.

12 https://www.researchgate.net/publication/338434044_Practising_an_explosive_eruption_in_Iceland_outcomes_from_a_European_exercise
13 https://www.interno.gov.it/it/notizie/test-sistema-protezione-civile-exe-flegrei-2019
14 https://www.jma.go.jp/jma/indexe.html
15 https://pubs.usgs.gov/fs/2017/3071/fs20173071.pdf

DRM Initiatives & News

Within the ROADMAP project goal of establishing a European observatory on disaster risk and crisis management good practices, some recent initiatives at international level have been scanned and pertinent information was collected and hereafter briefly summarized.

- **Earthquake Countermeasures Technology Exhibition 3 - 4 February 2022**[16]
  Exhibition Technologies Inc. is organizing an exhibition representing seismic technology in Yokohama, Japan from 3 to 4 February 2022. The Earthquake Disaster Countermeasure Technology Exhibition is technology fair and symposium where people involved in earthquake and natural disaster countermeasures in Japan gather together.

- **British Columbia Provincial emergency exercise program**[17]
  During February 2022, the Emergency Management of British Columbia (EMBC) organizes the Coastal Response exercise. The goal of this response exercise is to test the province's coordinated response to an earthquake close to the city centre.
  The objectives for Exercise Coastal Response 2022 are to:
  - Practice response logistics and elements of supply chain management.
  - Identify, develop, and test succession plans and government continuity at all levels.
  - Conduct damage assessments, including a review of critical infrastructure.
  - Test and practice decision making for senior leaders.
  - Conduct joint communications and engagement with a focus on consistency of public information.
  - Practice mass-care response.

  The exercise will follow guidelines from the B.C. Earthquake Immediate Response Plan (PDF, 4 MB)[18] and will include workshops, presentations, emergency operations centre training, and a full-scale earthquake response.
  For more information on how to get involved with Coastal Response 2022, contact Exercise Specialist Rob Dodds at rob.dodds@gov.bc.ca.

- **JOIFF Industrial Emergency Services Management Conference 2022**[19]
  JOIFF In association with RelyOn Nutec are pleased to announce The JOIFF Industrial Emergency Service Management Conference 2022 will take place on March 1st & 2nd 2022 in Rotterdam, The Netherlands. The full range of industrial emergency management topics on technical advancements, case studies, technical presentations, live demonstrations, supplier presentations and supplier exhibitions will be covered during the conference.

- **World Water Day 2022 - Groundwater - Making the invisible visible**[20]
  World Water Day is on 22 March every year. It is an annual United Nations Observance, started in 1993, that celebrates water and raises awareness of the 2 billion people currently living without access to safe water. A core focus of World Water Day is to inspire action towards Sustainable Development Goal (SDG) 6: water and sanitation for all by 2030. This year's theme is on the importance of groundwater. During the Water Day many organizations hosts events and the UN World Water Development Report is released, focusing on the same topic as the campaign and recommending policy direction to decision makers.

- **International Conference on Earthquakes and Earthquake Hazards**[21]
  The International Conference on Earthquakes and Earthquake Hazards takes place between 21-22 April 2022 in Istanbul, Turkey. The conference aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Earthquakes and Earthquake Hazards. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Earthquakes and Earthquake Hazards.

16 https://10times.com/earthquake-disaster-countermeasures-technology-exh
17 https://www2.gov.bc.ca/gov/content/safety/emergency-management/emergency-management/provincial-emergency-exercise-program
18 https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/irp.pdf
19 https://www.joiff.com/joiff-industrial-emergency-services-management-conference-2022/
20 https://www.worldwaterday.org/
21 https://waset.org/earthquakes-and-earthquake-hazards-conference-in-april-2022-in-istanbul