



*Volcanic Unrest in Europe  
and Latin America:  
phenomenology, eruption  
precursors, hazard  
forecast, and risk  
mitigation*

# COLIMA VOLCANO EXERCISE

## ***“DEBRIEFING REPORT”***

**WP 9:** Decision-making  
and unrest management

**Task 9.6:** Simulation of  
unrest and decision making



In the period 17<sup>th</sup> – 24<sup>th</sup> November 2012, the first VUELCO exercise took place at the *Volcan de Fuego de Colima* in Mexico, in coincidence with the 7<sup>th</sup> edition of the international congress “Cities on Volcanoes”.

The exercise goals, development program and phases, as well as the list of the several participating institutions (both local and international), were synthetized in the “Colima Volcano Exercise Plan” elaborated together with the Mexican partners and released before the beginning of the exercise.

The following flow-chart (fig. 1) represents the working scheme of the exercise, in which a group of experts called “volcano team” periodically released possible monitoring signals to the official Colima Scientific Committee and to the VUELCO scientists group.

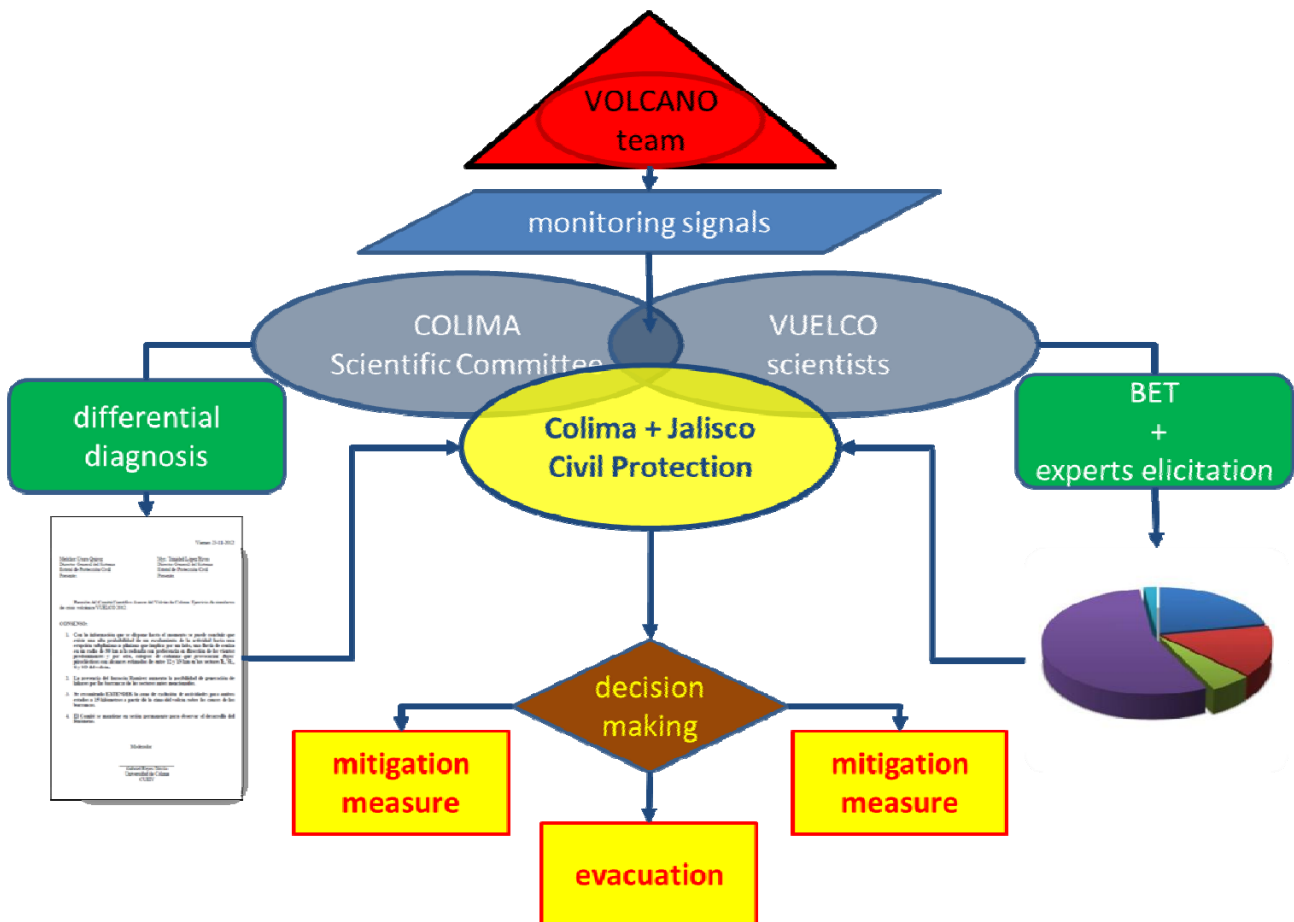


Fig. 1: Exercise working scheme.

After a joint discussion, these committees operated in two different ways: the first one performed a “differential diagnosis” as its usual, while the second tried to adopt some methods developed and proposed by the project (Bayesian Event Tree and experts elicitation).

After these processes, recommendations were given to the interested civil protection agencies in two different forms: in the first case through a document containing an assessment of the situation and the indication of the most probable scenario to be expected, in the second one, by means of a diagram showing an evaluation of the probability of occurrence of five different possible scenarios.

This process was developed and repeated across four subsequent meetings, each time simulating increasing monitoring signals and eruption precursors.

At the end of the exercise, the Civil Protection agencies of the States of Colima and of Jalisco, were asked for their opinions about the different ways of advice-releasing adopted, obtaining opposite responses.

At the conclusion of the Colima exercise, all participants were requested to turn a feedback report in, possibly structured in the form of a SWOT analysis.

This kind of analysis should provide comments divided into: Strengths, Weaknesses, Opportunities and Threats.

The feedback reports collection remained open for two months, until the end of January, thereafter the results were analyzed.

Out of a total of approximately 30 participants in the exercise, 11 reports were received (some grouping more people), representing approximately 30-50% of responses.

It was not possible to perform a complete SWOT analysis, but only points of strength and weakness were able to be identified. The comments were then gathered under the following four main themes:

## GENERAL ASPECTS

## SCIENTIFIC PROCESS

## COMMUNICATION SCIENTISTS-CIVIL PROTECTION

## CIVIL PROTECTION ASPECTS

For each theme a list of suggestions was provided, to serve as a lesson to learn for the future.

On March 6<sup>th</sup> 2013, during the mini-conference of the VUELCO project held in Barcelona (Spain), the phase F (debriefing) of the exercise took place: the results of the collected feedback reports were shared among the VUELCO members participating to the meeting, and a few further comments have been expressed and added to the present document.

In this paper, after the feedback reports collection and the group discussion developed during the phase F, final results of the debriefing process are summarized.

It is important to remind this was the first VUELCO exercise and that some of the results appear to be contradictory, because of the people with different cultures and experiences involved.

Moreover remember comments provided are not to be interpreted merely as a criticism, but as a way to point out and to understand possible troubles, in order to improve the process over the next exercises.

### STRENGTHS

- Impressive organization and huge effort produced by the Mexicans, with the active participation of a great number of stakeholders (scientists, Civil Protection agencies from two States, mass-media, army, police, population, ..) and their high level of engagement.
- Great helpfulness of Mexican scientists and civil protection officers.
- The opportunity, for many scientists (not used to be part of advisory committees) and for a great number of young researchers attending the COV7 (that could become the next generation of advisors) to take part in a realistic process of evaluation during a crisis.
- The possibility of participating in different aspects of a volcanic crisis (scientific discussion, communication to Civil Protection, people information, evacuation).

### WEAKNESSES

- Knowledge of the evacuation time, probably greatly influenced the advice-giving and the decision-making (in a real situation the evacuation would have been probably ordered earlier).
- It has been an exercise of the Mexican system, more than a project exercise.
- General weak coordination: in scientific committee meetings, people communication, media communication.
- The financial cost of running an exercise of this scale may limit the ability of countries with limited financial resources from undertaking a similar exercise.

### SUGGESTIONS

- Do not fix in advance the date for the possible evacuation.
- More actively involve Civil Protection organizations.
- Increase coordination throughout all phases.
- Needs of better communication in each level (scientists, civil protection agencies, ...) and between them.
- Local scientists could get useful information having a meeting with external experts who are not influenced by knowing that specific volcano and its behaviour.
- Decision makers need to have information easy to be used and all the scientific community should agree on these.

## STRENGTHS

- Vast bibliography provided by Mexican scientists on prior the exercise.
- Very well prepared monitoring data.
- Very high quality of scientific discussion.
- The last meeting have been very realistic of what happens in real situations.
- The possibility to interact with the local scientific committee, greatly accelerated the response of the VUELCO members to the occurrence of new signals from the volcano.
- The participation of the civil protection organizations induced the scientific committee to keep its role of scientific advisor and not to confusing scientific considerations with civil protection ones.

### From Mexicans participants

- Easy organization thanks to the very well organized seismic database.
- Very clear idea of the phenomena to prepare and their evolution.
- Certain divisions within the group, that sometimes in the past have been very apparent, did not arise during the exercise (positive sign for the future!).
- Opportunity to receive feedbacks from outside (on the monitoring system and risk mitigation practices).
- Very valuable brainstorming and ideas-sharing, thanks to the international staff of VUELCO.
- Opportunity to see how the different systems work when reacting to a crisis and if we can unify a crisis response all over the world.

## WEAKNESSES

### Preparation and Organization

- Logistics (set up of the room not appropriate for discussion, too many people attending, need of more microphones, time limitation, difficulty in reading images or graphs projected, ...).
- Not clear how the official Colima Scientific Committee is formally appointed. We were unable to retrieve a document (decree or similar) where names, roles and responsibilities are stated.
- Not very clear mandate, role and responsibility of the official Colima Scientific Committee (particularly if they are asked to answer to civil protection aspects or only to scientific aspects).
- Role of VUELCO scientists not well defined.

- Very weak emphasis on the unrest phase, the simulation started with very remarkable signals (in a real situation the Scientific Committee would have already been summoned before).
- The first simulation meeting began with the 3 nodes of the BET already overtaken (unrest, magma presence and eruption were already evident) precluding the possibility to test it and therefore missing the focus on the project needs. (Later a retrospective test was made with the imaginary data starting one month earlier). More contacts between WP7 and Mexicans needed before the exercise.

### **Development**

- Confusion on how to conduct the meetings; lack of guidance and structure.
- Not clear who was who: “volcano” group, official Colima Committee, VUELCO people, just public.
- Although the rough data were available, this was unclear to many VUELCO scientists.
- Lack of opportunity of deep interaction with the researchers from observatory, due to time limitation.
- Lack of background knowledge about the Colima volcano (for VUELCO scientists).
- Lack of discussion (especially in the first meetings): the real brainstorming took place only during the elicitation session .
- In the planning process it was decided to have only one extended scientific committee but in the end we had two.
- In fact the Colima Scientific Committee ran the simulation as its usual, therefore VUELCO scientists decided to run additional simulation sessions, in order to test the VUELCO products.
- Given the impossibility to perform the BET, VUELCO scientists decided to carry-out experts elicitation, but unfortunately the Mexican scientists didn't participate (except two) and so the elicitation was strongly affected by the absence of Colima experts.
- Misunderstanding on the evaluation process in Europe: at the end of the simulation, some Mexican scientists were persuaded that the elicitation is the usual way of evaluation adopted in EU, while it is just a procedure proposed by the project (given the impossibility of using the BET) for supporting (not replacing) the local experts!

- The elicitation process is designed to minimize group thinking and influences by stronger personalities, but such a dynamic can however occur.
- Disagreement of participants on how scenario planning should be performed (qualitative vs. quantitative).
- Very different risk perception between Mexicans and VUELCO scientists, but it wasn't clear if the Mexicans' behaviour was influenced by the prefixed time for evacuation (Europeans would have suggested the evacuation well before).
- Lack of infrasonic array in the monitoring system.
- Lack of ash dispersal models based on meteorological model for wind field forecasting (nowadays basing the ash fall-out prevision just on seasonal trends is out-of-date).
- Scientists should remove any social consideration by their advice-giving on risk assessment: it seems that monitoring signals has been considered as more likely to indicate an eruption, because of the presence of populations in the hazard area. This is a problem, because the presence of people will be considered also by decision-makers and therefore it will be taken into account twice, causing possible over-reaction.

#### **From Mexicans participants**

- Uncomfortable surroundings, lack of strong coordination, lack of definition of roles of the different people speaking.
- Lack of well organized data base for some parameters (gas, deformation, visual).
- The presence of VUELCO scientists slowed down the process and the consensus agreement (due to lack of Colima knowledge); it would have been better to allow VUELCO scientists intervene at certain defined moments.
- The definition of scenarios and expert elicitation was not of great use. It was more useful to compare the observations to the experience of previous eruptive episodes at Colima (elicitation surely will be useful in a different setting).
- It wasn't clear how the BET system can actually works or improve the Latino-American procedures.



## SUGGESTIONS

### For next exercise:

- Have an adequate and dedicated room.
- Clear identification of participants.
- Clear definition of role and mandate of different participants since the beginning.
- Decide if working with two or one Scientific Committee
- Better clarification about the use of BET and elicitation.
- More focus on: unrest phase, products testing and probabilistic scenario definition.
- More time for data analyses and scientific discussion.
- Keep stronger contacts between products developer and local system, before the exercise.
- Whatever method is used to assign probabilities (event tree, elicitation, ..) render the results in a hierarchical order, to be a useful decision-making tool.
- Elicitation should be developed considering the possibility of scientific objectivity being influenced by people exposure.
- Stronger coordination of the meeting.
- Guarantee easier access to rough data.

### For Colima Volcanic Observatory:

- Improve the monitoring and alert systems with: infrasonic array and ash dispersal models based on meteorological models for wind field forecasting.

### WEAKNESSES

- Communication protocols not tested (not yet developed by VUELCO).
- Lack of coordination between the local Scientific Committee and VUELCO scientists on a concerted approach on advise-giving.
- Weak interaction between local scientists and civil protection (although always present, Civil protection remained unengaged from the process, without asking for information, but merely waiting for instructions).
- The official written minutes of the Scientific Committee were delivered only at the end of the whole simulation, instead of after each meeting (legal implications in real cases).
- In the first meetings no maps have been shown.
- The 2 States Civil Protection agencies had very different sets of requests (NEEDS) to the scientists: while Colima's expected instructions on how to behave, Jalisco's showed more interest in a probabilistic scenarios evaluation (this can depend on different emergency plans, different organization and relationship with the communities, ...).

#### From Mexicans participants

- The interaction between the local committee and the Colima Civil Protection was very different from how it is in a real situation. We did not get realistic comments or other interactions.

### SUGGESTIONS

- Try to involve Civil protection as much as possible .
- Develop and test communication protocols for advice-giving (in comparison with local ones).
- Timely release of written statements and advices.
- The form of advice giving (qualitative/quantitative probability) should be agreed with the Civil Protection and its capacity and possibility to manage this kind of information.
- Clarify how the scientific advice should be used by the decision-maker (cost benefit analyses?) and if he is ready to manage this kind of information.
- Decision makers behaviour cannot be a tool of their understanding of the information given by scientists. In fact they could have more information not available to everyone. This means that Decision makers not necessarily do what scientist says, because they also do 'risk analysis', 'cost consideration', etc.

### STRENGTHS

- Simulation was a great opportunity to remind the population (both directly and through the media) that Colima is an active volcano.
- Opportunity for local authorities to verify procedures and evacuation plan.
- It was great to have different people in the role of scientists and decision makers (in some countries, like Indonesia, there is one person doing both works).
- Opportunity for VUELCO partners to take part in an evacuation exercise.
- Possibility to get in touch with local population from exposed villages.
- Well organized evacuation, with a great involvement of institutional and operational bodies.
- Permanent availability of shelters.
- State and people used to run exercises and know what to expect in real situation.
- The inclusion of local volunteers in the coordination of the evacuation.

### WEAKNESSES

- Some significant events, occurred during the simulation, appeared to be ignored by the civil protection (earthquake, hurricane).
- The phase of “people communication” wasn’t initially considered; in the end it was performed, but just as an educational meeting (not a simulation of warning release).
- Not clear how, possible contrasting opinion among scientists, are managed by the CP in media communication.
- During the visit to La Becerrera interaction with inhabitants suffered of language barriers (some more translators would have been useful).
- Some aspects of the evacuation remained unclear (is self-evacuation permitted or encouraged?).
- The adults who didn’t want participate in the evacuation were not allowed to keep their children. It is not clear how this would be done in real cases.
- The children were separated from their parents for the evacuation, without any adult from the village on their bus.
- Huge presence of army everywhere.
- Affected population was treated as a security threats. This may have deleterious effects on the cooperation of communities during emergencies.

- Shelters seem like refugee-camps: armed surveillance, fence, curfew, families divided, people segregated by gender. Moreover they are used only in emergency case.
- Cattle evacuation not considered.

### **SUGGESTIONS**

#### **For Colima State Civil Protection:**

- Continue in running periodic exercise.
- Try to involve more local people as a volunteers.
- Elaborate strategies and procedures for people and media communication.
- Encourage self-evacuation and self-sheltering (autonomous accommodation) where possible.
- Found solutions to maintain family unity since the beginnings: during evacuation and at the shelters too.
- Develop a research on the impact on communities of the forced segregation, and the militarized response. It may be useful in a single emergency, but in terms of communities that are faced with the prospect of multiple exposures to such policies, future compliance could be affected by this form of response.
- Limit the presence of army, entrust to civil bodies (civil protection, volunteers) the management of the shelters and avoid the curfew (surveillance and enclosure should protect from outside).
- Use the shelters also in ordinary time for other activities (social, cultural, educational), in order to guarantee their maintenance and to let people familiarize with them (organize free events).
- Consider possible cattle evacuation.

**List of materials collected and documents produced for the Colima volcano exercise:**

- Colima volcano exercise plan.
- Colima volcano bibliography.
- For each scientific committee simulation meeting:
  - ✓ Monitoring rough data;
  - ✓ Monitoring signals synthetic presentations;
  - ✓ Advice released by Colima scientific committee;
  - ✓ Elicitation results and resume by VUELCO scientists.
- Mexican communication strategies check-list.
- Press and web review.
- Photographs collection.
- Debriefing resume.

For further details please contact:  
[stefano.ciolli@protezionecivile.it](mailto:stefano.ciolli@protezionecivile.it)



Project web page:  
[www.vuelco.net](http://www.vuelco.net)

Follow us on:

