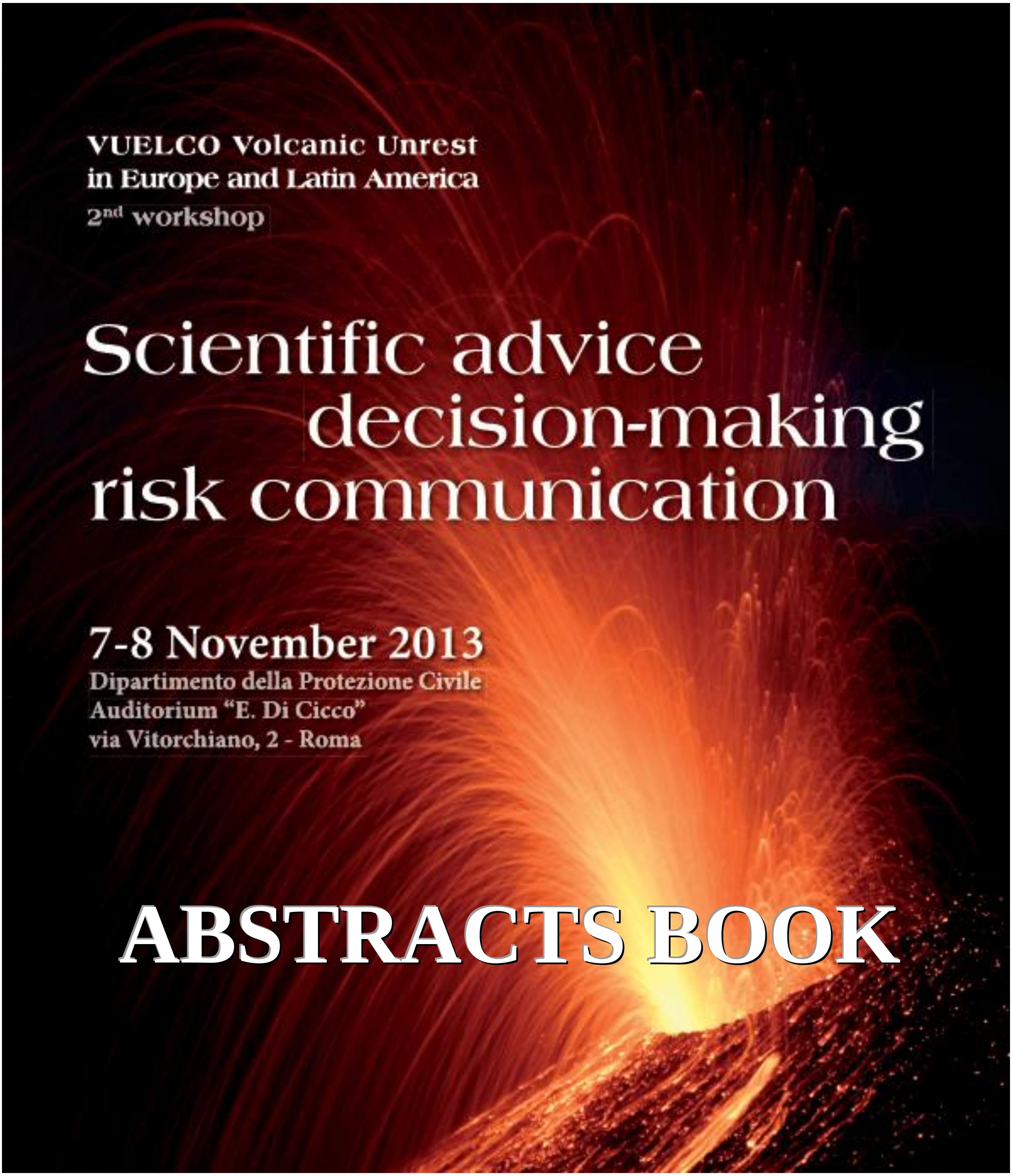

VUELCO

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

SEVENTH FRAMEWORK PROGRAMME

University of BRISTOL

organized by

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

Recommendations on volcano hazard communication issues, emerging from the 2nd Volcano Observatory Best Practice Workshop, Erice, November 2nd-6th 201

Paolo Papale – INGV – Italy - in representation of all workshop participants.

This communication aims at providing a summary of the major outcomes from 3.5 days of presentations and discussion in Erice, Sicily, on the theme of "Communicating Hazards", in the frame of the second VOBP – Volcano Observatory Best Practice workshop. The VOBP workshop series is designed to provide an adequate venue for discussing the techniques and procedures for volcano disaster risk reduction by the actual practitioners. The synthesis of knowledge and experience from widely scattered observatories serves to advance risk reduction practices much faster, as well as to develop a urgently needed network of consultation and assistance among the world's observatories. This meeting is organized on three discussion pillars represented by Knowledge, Responsibility, Practice. A list of relevant questions, discussed in Erice and summarized with this presentation, include the followings:

Knowlegde: What are the relative values of different types of information (e.g., monitoring data, eruptive history, modelling, expert interpretation, probabilistic analysis, etc.) to observatories for use during crises, for long- and short-term hazard analysis, and for hazard mapping; How can the uncertainties associated with data, interpretations and models be accounted for when formulating forecasts and evaluating hazards; How does the level of knowledge and understanding that can be provided from observatories compare with the expectations of the decision-makers and the society; and how can observatories improve their capabilities to meet expectations.

Responsibility: What are the respective roles and responsibilities of volcanologists and decision makers in volcanic hazard/risk management and during emergencies; how does this vary between different countries; is there a need and consensus for an internationally shared recommendation; What is the assumption of responsibility by scientists and what are the legal implications when communicating forecasts to civil authorities and/or to the media.

Practice: What's the minimum/recommended information that should be communicated during phases of unrest, crisis, eruption, recovery; and, is there a need for providing different levels of information through different means/channels; What are the relative values of different types of information (e.g., monitoring data, eruptive history, modelling, expert interpretation, probabilistic analysis, etc.) when communicating with civil defence officials and with the media and the public; How uncertainties should be effectively communicated; How is the urgent dissemination of information required by the media and society best managed when a crisis is approaching or ongoing; Are there established communication protocols in the different countries, and how much do they differ; would it be beneficial to have an international protocol to guide establishment of a communication framework in different countries.

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The Italian scientific advice system to civil protection

Mauro Rosi - Department of Civil Protection - Italy

The Italian National Civil Protection System (Sistema Nazionale di Protezione Civile - SNPC) is based on a combination of various agencies both public and private, which, in the event of an emergency, are coordinated by the Department of Civil Protection, structured within the Presidency of the Council of Ministers.

In the SNPC a central role is played by two interacting components: a scientific component, which is responsible for monitoring and evaluating risk situations, and an operational component which, on the basis of decisions taken by the Department Head, focuses primarily on safeguarding human lives and property.

The scientific component in turn is based on the interaction of a combination of participants: the "Centri di Competenza" are institutions responsible for monitoring, while the "Centro Funzionale", inner to the Department, has the task of translating scientific information into assessments of criticality intelligible and joined together with the operational component and issued to the local authorities. The "Centro Funzionale" operates under ordinary conditions and in situations that require immediate decision-making.

For situations of volcanic unrest, or in case of ongoing volcanic crises, the Department, for the purpose of decision-making, turns for support to expert committees entrusted with evaluation and formulation of opinions. The Department takes advantage of two types of committee: the High Risks Commission - Volcanic Risk Sector (CGR) and the Synthesis Groups (GS).

The CGR was established by decree of the President of the Council of Ministers and brings together the field's leading national experts. The CGR, decrees, on a scientific basis, the hazard level for the diverse active volcanoes and furnishes regular advice to the Department on issues particularly relevant or sensitive, responding to specific questions posed by the Department. The GS are more flexible committees, which are created to better respond to changing circumstances during a phase of crisis and to pull together more specific expertise.

The transfer of scientific assessment to the Department, or to the authority responsible for making decisions, always presents sensitive issues, especially linked to the uncertainties that accompany the assessments. The events surrounding the L'Aquila earthquake have dramatically highlighted this aspect and raise profound questions about the sharing of responsibilities and further burden an already difficult task.

This presentation wish to analyze these themes and to provide ways to discussion for the round table

Opening Pandora's Black Box – Subjecting hazard assessment and assessors to scrutiny

Richard Bretton*, Joachim Gottsmann, Ryerson Christie - University of Bristol - UK

Since about 1948 the term "Black Box" has been used to describe a device, system or object in respect of which we know the inputs and outputs but we do not know (or do not need to know) the internal process or workings (Latour 1987).

Separately, a distinction is often drawn between primary societal risks to members of the public and secondary institutional risks to the legitimacy of societal risk managers and their rules and methods of making decisions as a result of internal and external control, scrutiny and accountability (Rothstein 2006: Power 2004, 2007, 2009). Rothstein (2006) also describes an early stage societal risk governance environment with few scrutiny pressures characterised by the early stages of regulation or slack self-regulation. As societal risk governance becomes subject to greater scrutiny, the behaviours and failings of risk managers will be turned to potential liabilities. Tensions between first and second order risks will arise and escalate in what Rothstein (2006) describes as "the colonisation of risk regulation by risk".

We will suggest that in 2013 (post L'Aquila and recent case law in the European Court of Human Rights) the Black Box containing the practices of earth scientists engaged in governance of volcanic unrest (in particular the characterisation of volcanic hazards and their numerous uncertainties) will be opened shortly. The scientific community of volcanologists would be wise to undertake a candid assessment of its current role and practices and to find a way to evidence and justify the nature and quality of its contribution to the wider risk governance process in order to minimise foreseeable institutional risks (as well as societal risks).

We will identify aspects of the volcanic hazard assessment process that are likely to be scrutinised and why, and thereby provoke a discussion about what should be done, by whom and when.

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Volcanic Disaster Mitigation Framework of Japan - Volcanic Disaster Management Council, Volcanic Alert Levels and Evacuation Plan

Tomoyuki Kanno - Japan Meteorological Agency (JMA) – Japan

Japan is one of the most volcanic countries on earth, and has been suffered from volcanic disasters since the dawn of history. Japan Meteorological Agency (JMA) is responsible for monitoring volcanic activity and issuing volcanic warnings for disaster mitigation. JMA carries out centralized monitoring of the data from the observation equipment installed near 47 volcanoes selected by the Coordinating Committee for Prediction of Volcanic Eruptions. And when it is judged that the danger of the eruption increased, volcanic warnings are immediately transmitted to all relevant organizations and stakeholders including affected prefectures, and conveyed to local residents through municipalities, news media and JMA's website.

Deep low-frequency earthquakes increased around Fujisan in 2000. Volcanic Disaster Management Council of Fujisan was hurriedly organized, and it performed creation of a hazard map and examination of disaster measures. Then, the idea that JMA's volcanic information could be used to trigger specific disaster prevention countermeasures was summarized. This approach came into focus a bit later during study sessions covering "Disaster prevention countermeasures corresponding to specific volcanic information". Essentially, the scheme works as follows. Before a volcanic anomaly occurs, relevant organizations get together and share stages of predictions based on the volcano's past history of volcanic unrest (eruption scenario) and hazardous areas (volcanic hazard maps). They come to agreement on what criteria to use in deciding when to start evacuating people, when to prohibit people from hiking or climbing in the area, and other disaster responses. Note that these procedures are done during normal times when the volcano is quiescent. Later, if the volcano shows signs of unrests, JMA issues a Volcanic Alert Level reflecting the current state of volcanic activity based on its 24-hour volcano surveillance.

Specifically, Volcanic Alert Levels are divided into five stages depending on "areas that must be warned" and "responses that should be taken" for the volcano's current state of unrest: Level 1 signifies that no particular response or action is required; Levels 2-3 indicate that, while residential areas are not threatened, the volcano is off limits for hiking or climbing; Levels 4-5 reveal that residential areas are starting to be threatened by the danger of eruptions. Level 4 is the stage where people with special needs are evacuated and other local residents prepare to evacuate, and at Level 5, all local residents are subject to mandatory evacuation from threatened areas.

Volcanic Alert Levels System is outlined in the Basic Plan for Disaster Prevention of the Central Disaster Management Council in 2011. The scheme was further elaborated through linkage to Evacuation Plans (who, how, where, and when) drawn up through collaboration among members of Volcanic Disaster Management Councils consisted of all organizations and stakeholders in the prefecture including prefectural authorities, municipalities, meteorological observatories, erosion control (Sabo) departments and volcanologists. Thus, the local evacuation plans are closely integrated with the Volcanic Alert Levels system. JMA works on the organizations concerned and the volcanologists of the area from the usual time, and is promoting installation and holding of a Volcanic Disaster Management Council so that Volcanic Alert Levels may function united with the refuge organization of the area at the time of an eruption. Moreover, JMA is adjusting with the organizations concerned so that the "areas that must be warned" of a volcanic warning and the "range of an evacuation advisory" of an evacuation plan may be coincided.

The 2011 eruption of Shinmoedake volcano was the first moderate-large scale (VEI=3) eruption after the beginning of Volcanic Alert Levels, and various disaster prevention correspondences triggered by Volcanic Alert Levels were performed. Before the eruption, entry regulation around 1km of the crater had been performed on the level 2, and after subplinian eruptions, the level was pulled up to 3 and the evacuated area was extended. Under the circumstances, there was a mismatching between JMA's warnings and related municipalities' correspondences, because information-sharing about volcanic activities evaluation and residents' situation weren't performed. Then, the Government Assistance Team, consisted of officials of Cabinet Office, JMA and other ministries, entered there. The team reconstructed the Volcano Disaster Management Council and information-sharing organization, and supported making resident evacuation plans.

In Japan, large eruption has not taken place in about 100 years after two large eruptions occurred at the time of the beginning of the 20th century. Therefore, it is considered that some large eruptions will occur by the end of the 21st century. So, It is necessary to advance the countermeasures against such a serious volcanic disaster.

The emergency planning for volcanic risk at Vesuvius and Campi Flegrei

Fabrizio Curcio - Department of Civil Protection - Italy.

The Italian Civil Protection Service is a complex system that includes all national and local components and operational structures in charge of civil protection activities (forecasting, prevention, relief, contrast and emergency overcome).

According to the Italian legislation, the President of the Council of Ministers is responsible for the orientation, promotion and coordination of the entire system. The Civil Protection Department, which is a branch of the Presidency of the Council of Ministers, is the focal point of the National Civil Protection Service, especially for the management of emergencies at national level.

The Italian territory is subject to several natural and anthropic risks. In particular, volcanic risk directly affects 2 million people, about 1 million of them lives in Campania Region.

The first national emergency plan for volcanic risk was elaborated in 1984 after the bradyseism of Campi Flegrei, and in early 90s for Vesuvio.

The elaboration of such emergency plans requires a constant interaction with the scientific community for the definition of the eruptive scenario and the alert levels, and with local authorities and operational structures for the definition of strategies and operational measures to be adopted in order to face a possible eruption. Furthermore, the planning process foresees an information process to the population in order to increase the awareness on volcanic risk and the adoption of protective measures to be taken in case of eruption.

Vesuvio is located in a zone of the Campania Region with a very high population density; it is quiescent since 1944 and is perhaps the volcano with the highest risk in the world. Although the past 30 years have seen a demographic decrease, the spatial growth still continued. In fact, nowadays about 700,000 people are still exposed to the pyroclastic flows and the high risk of buildings collapse caused by the ash deposit (Red Zone). In case of an eruptive event, the population living in the red zone should be evacuated before the eruption's onset; in addition to that, hundreds of thousands of people would be exposed to the severe ash fallout and lahar hazards (Yellow and the Blue Zones).

The Vesuvius Emergency Plan is being currently reviewed and updated. The eruption scenario has been thoroughly revised as a consequence of the results of the research carried out in the past few years. The reference eruption is a Sub-Plinian eruption.

While elaborating an emergency plan, or managing an emergency several problems arising from the decision making process need to be taken into consideration; the uncertainty of the event prediction is one of them considering the possibility of false alarm. The consequence of false alarm can result in a consequent lack of reliability of the warning system also towards the population, economic loss caused by the actions undertaken to respond to.

Considerations in crisis management as Pinatubo prepared to erupt.

Chris Newhall and colleagues from PHIVOLCS and USGS

The giant Pinatubo eruption of 1991 began with a tiny steam-blast explosion on April 2, growth of a lava dome from June 7-12, and a series of sixteen moderate size explosive events from June 12-June 15. The climactic eruption occurred on June 15, lasted 3.5 hours at full strength, and produced about 10 km3 of frothy pumice and ash that were spread on the slopes of the volcano and across the South China Sea.

Earthquakes were felt nearby as early as mid March, and we know in retrospect from study of erupted rocks that injection of fresh basalt magma occurred around the same time, triggering a chain of other events and eventually the giant eruption in mid-June.

We knew early in the unrest that the volcano COULD erupt, but we didn't know whether it WOULD erupt, nor WHEN it would erupt. The stakes were very high – nearly 1,000,000 people lived around the volcano, and two large American military bases were also at risk. We were acutely conscious of the history at Soufriere Guadeloupe in 1976, where about 75,000 people were evacuated for 6 months and the eruption never proceeded beyond small phreatic events. In retrospect, magma at Soufriere Guadeloupe came close to erupting, but public opinion was hard on scientists who had recommended evacuation. False alarms damage scientists' credibility. But we were also acutely conscious of the 1985 disaster at Nevado del Ruiz, Colombia, in which the science was correct but the warnings were inadequate and nearly 25,000 people died.

We were trying hard to get the warnings right at Pinatubo– neither too early nor too late. A simple alert scheme was adopted in mid-May. Gas measurements started at that time indicated that magma was involved (alert level 2). Alert level 3 (eruption possible within 2 weeks) was raised on June 5, alert level 4 (eruption possible within 24 hours) was raised on June 7, and alert level 5 (explosive eruption in progress) was raised on June 9. In fact, that on June 9 was slightly premature but turned out to be a blessing in disguise because many people were waiting for the highest alert level before they would evacuate. After much hesitation, Clark Air Base was evacuated on June 10, the first large explosive eruptions began on June 12, and the climactic eruption occurred on June 15.

One also wants to forecast the CHARACTER AND SIZE of an eruption, i.e., its explosive magnitude, to determine the size of the hazard zone and any recommendation of evacuation. We knew from aerial photos and some prior geologic reconnaissance for geothermal development that Pinatubo erupted only rarely -- once every 500-1000 years or so – and that nearly all eruptions were "very large." In other words, if it did erupt, it would PROBABLY be a very large eruption. That call was easier at Pinatubo than for most volcanoes. A hazard map was drawn to represent a worst-case scenario but, in retrospect, we learned that the largest eruptions of Pinatubo had been even worse. Fortunately, the 1991 eruption turned out to be relatively small for Pinatubo. To simplify the hazard zones, a set of concentric circles were used by PHIVOLCS to recommend areas for evacuation. PHIVOLCS recommended evacuation of areas within the 10 km radius circle from April until June 7, then out to 20 km between June 7 and June 9, to 30 km on June 14, and 40 km during the climactic eruption on June 15. The largest radii were nearly double the length of the longest known pyroclastic flows of Pinatubo.

Might diagnostic features in the monitoring data indicate that a giant eruption is pending? Perhaps, but there were no other cases of giant plinian eruptions in the history of volcano monitoring, so we didn't know exactly what to look for. In reality, most precursors were NOT distinctive. The only diagnostic monitoring observation – strong, shallow, magma-related long-period earthquakes-- didn't begin until just 1 day before the climactic eruption began.

In such crises, scientists must have the courage to outline even worst-case scenarios and, at the same time, the wisdom to put those in proper context with smaller events. To keep people safe, scientists must also accept the risk of giving false alarms. For their part, public officials must be willing to act quickly on the scientists' concerns. And both the public officials and the general public must understand and be willing to accept uncertainties and the risk of false alarms. All must act as a team. Much credit for that team is owed to the late Dr. Ray Punongbayan of PHIVOLCS. Teamwork saved >10,000 lives and averted > USD 0.5 billion of property damage and other economic disruption. Costs incurred to mitigate deaths from the eruption were a few million USD.

Understanding contexts of insecurity for at-risk communities to shape communication strategies.

Ryerson Christie - University of Bristol - UK

Peoples' perceptions of the risks associated with natural hazards are not developed in isolation from the broader social environment. This paper advocates an approach to understanding risk perception within the context of their perceived broader insecurities. In turn, the perceptions of insecurity, and the confidence (or lack thereof) in state institutions, and other authorities, in addressing these insecurities impacts on their willingness to adapt mitigative behaviours promoted by technical experts in relation to natural hazards. This paper, drawing on over 300 interviews in communities within the lahar High Risk zone from Cotapaxi, demonstrates the importance of perceived insecurities to understanding volcanic risk perception. In turn it will be argued that this demands that communication strategies take these perceptions into account.

Risk communication via mass media.

Marco Cattaneo - "Le Scienze" – Italy

The importance of risk communication and risk assessment communication arose to the public debate in Italy after the dramatic earthquake occurred in L'Aquila on April, 6, 2009, and the trial for manslaughter that involved seven representatives of the High Risk Commission, the committee linking the scientific community, mostly represented by the National Institute of Geophysics and Volcanology (INGV), and the Department of Civil Protection.

The way information is driven to the public by media has been discussed and is still discussed as the trial proceeds, but it seems that many leaks in the overall process are still an open issue.

Late last January, thousands of citizens spent a night outdoor following a tweet alert by the official account of Lucca Province and the suggestions of some mayors of the area of Castelnuovo Garfagnana.

It seems that panic was spread by a misunderstood communication between the different subject involved in the event, and local authorities seem to have decided for evacuation also for the apprehension of being eventually involved in ambiguous situations in case of casualties.

Both these incidents emphasize the need for establishing a single, communication structure that should have the responsibility for informing both authorities and media, even with a wise use of social networks, with clear and unequivocal messages, in order to clarify eventual risks and citizen behavioral advice.