

L'Aquila earthquake prediction judgment: an eye-opener

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The L'Aquila earthquake prediction judgment is an eye-opener and should galvanize as a trend-setter for better R&D, communication and disaster (pre-, co- and post-) monitoring and management strategies. Self-noting failures are the beginning of knowledge. The opposite closes the mind and turns away from knowledge. A closed mind tandem to closure of understanding. Extensive knowledge imbibes simplicity and leads to the realization how little is known, and converse with the reverse. However, we claim as a perfect science in terms of knowledge this accounts only for the partial truth, because knowledge is relative and dynamic and relates to humans and truth relates to nature, a constant and absolute. Our research knowledge gamut is a search process of truth, a never-ending and everlasting, under such a scenario.

Vexatious prediction and allied coinage by default connotes an element of definitive uncertainty; encompassing its ability is beyond human comprehension. All professionals are embodied in its ambit and geologists have no exemption for any discount. Professional service providers: financial advisors, accountants, insurance brokers, builders, marketing consultants, designers, architects (all include a term: subject to market fluctuations), judiciary, solicitors (judgments, including by the highest judiciary are pronounced based on evidences, if evidence changes at a later date and punishment executed, including irreversible, none are accountable), medical doctors (there are several diseases, which the medical fraternity is unable to cure and predict and no questions are asked), GDP growth or fall (erratic fluctuations are ascribed to human manipulations and/or nature's vagaries), etc. Similarly earthquake prediction is to be viewed.

Background

The L'Aquila verdict and prison sentence, condemned by many, including International Council for Science, International Association of Seismology and Physics of the Earth Interior (IASPEI), Euroscience, among others, by strongly

voicing support for scientists in the L'Aquila case, as they firmly believe that the treatment meted out to them is grossly unfair, as an involuntary manslaughter for seven prominent Italian scientists and members of the Great Risks Commission of the Italian Civil Defense, is shocking. This sentence which was awarded due to negligence and errors in the evaluation and communication of the seismic crisis preceding the L'Aquila earthquake of 6 April 2009, resulting in the unfortunate death of 309 people, forces one to conclude that earth scientists should have super power.

Science doctinaire

Time and again, humans have witnessed and experienced that civilization can exist only with the full consent of geology. The Earth is a dynamic, evolving system with complex interactions of internal and external Earth processes. Natural systems are complex and unpredictable. Geologists have absolutely no control over geologic processes but can only try to predict hazards and attempt to reduce the risks and loss of life and damage to property. They still need more rigorous scientific research to understand and possibly help forecast future geological hazards. However, there are also strong views on earthquake prediction. Ramanamurthy¹ articulated the following: (1) That the mind-set 'impossible to predict needs rethinking and the scientists should contribute and science should move on, otherwise scientist's existence becomes questionable'. (2) Earthquake prediction has been explicitly and implicitly implied and implicated for accuracy of R&D and to be concentrated on multiple precursors on long, medium and short ranges, to start with mainly on symptomatic precursors. (3) Constituting Earthquake Research Authority (ERA) to help communicate when the prediction is fit for populace consumption and for proper pre-disaster management strategy. (4) Unwanted and undue overenthusiasm by scientists/armatures and journalists, including incidents like live telecast of an impending earthquake by the participation of the forecaster (as already wit-

nessed in India). (5) UN participation by establishing Global Universities chain as centres of excellence. Tremors should never be neglected, because these are precursors of imminence of an impending earthquake, as the Earth is experiencing disequilibrium.

The L'Aquila earthquake

In the L'Aquila case, *prima facie* it appears that the geologists were made victims, essentially for using their expertise in seismology to provide scientific advice (regarding evaluation of low probability of earthquake occurrence, which subsequently did occur) to public authorities. It is also to be wondered what charges the Italian court would have framed if the geologists predicted the probability of occurrence of a natural hazard like the famous event in 1982, when they predicted a volcanic eruption near Mammoth Lakes, California, but the predicted event did not come to pass. Such advisories can cause loss of tourist business and anxiety among the residents. There is clearly no doubt that the crucial importance of scientific advice helps in decision-making processes prior to an earthquake. If the seismic precursor impending imminence can be predicted, humans can come out to open places to save themselves. However, it should be clear that neither property damage nor earthquake occurrences can be prevented. Earthquake precursors is a legitimate area of scientific enquiry, but fixing responsibilities on scientists for rendering impartial scientific advice will certainly result in their shirking public advisory roles. Probably, it is time to re-evaluate and have clear-cut and defined roles for scientists, public authorities, the media and educators, and learn some lessons.

Against such a logical background, the just apt mute question glares at geologists: Can they play a super-human role? What went wrong in understanding the court verdict is an intriguing and mind-boggling query? Under such a circumstance it is prudent to have an unbiased critical evaluation of the verdict vis-à-vis forecasters' prediction? The prediction was that several small tremors were

recorded in the region. They ruled that it was impossible to determine whether the tremors would be followed by a large quake. One of the groups famously advised the residents to relax with a glass of wine. Thus, it reassured the residents. Just six days later, a 6.3 magnitude quake devastated L'Aquila and killed 309 people. The relevant point lies in the later part, 'relax with a glass of wine'. This was an over-confident statement and uncalled for. This statement gave support to the judicial verdict that they had provided an assessment of risks that was 'incomplete, inept, unsuitable and criminally mistaken analysis' that gave the residents of L'Aquila a false sense of security'. It is known that even minor tremors cannot be discounted for a future major quake. To the authors, it appears that the judgment is not a trial against science, but a case relating to responsible risk communication to the public. Having said so, given the huge uncertainties associated with earthquake prediction and issues regarding communicating risk, we feel that the case of the Italian scientists deserves support from the scientific community.

Responsibilities of scientists

Scientists have the expertise to determine where the probability of a natural hazard exists, and the possible effects of such a hazard when it occurs, and have reasonable access to monitoring the processes that can enable prediction. Having said this, we wish to point out that with all the advancements made in seismology, it is not possible to correctly predict the location, time and magnitude of an earthquake. Unless all three can be predicted, earthquake prediction would be a futile exercise. Scientists should make information available to public officials and can suggest ways to reduce vulnerability and risk, by providing zoning regulations and building codes to public officials. They should effectively communicate such warnings to public officials, who shall be responsible to communicate the same to the general public. Scientists must also

synthesize the data available in a simple form without scientific jargon and which can be understood by all concerned.

Responsibilities of public officials

Public officials need to be trained and educated about hazard assessment. They should be capable of deciding where and how resources should be allocated to minimize the risk. They can help reduce vulnerability by making appropriate planning and taking timely decisions. They should be responsible to inform the general public about imminent dangers, based on the predictions and warnings issued by the scientific community. Public officials must put in place plans for evacuation, emergency response, rescue and recovery. They must be able to communicate effectively with the scientific community as well as the general public to disseminate information without distortion and clearly mention the limitations of such predictions.

Role of the media

Media persons are generally interested in the impact of a particular event on people than in its scientific aspects. The media should be sensitive about reporting on natural hazards and should not play up differences of scientific opinion while trying to weave a story. Reporters should provide accurate information that scientists have verified and there should be a high level of trust and communication between public authorities charged with sharing information and the media.

Role of teachers and educators

Teachers and educators have a pivotal role in educating the young generation about natural hazards and making them aware of the best possible responses when disaster strikes. Routine mock disaster preparedness exercises should be conducted in schools, colleges and universities with support from public

officials. In this connection, the recent decision of the University Grants Commission, New Delhi, to introduce an optional paper on disaster management at the undergraduate level across the universities/colleges in the country and the topic of disaster management in teacher training programmes offered by Academic Staff Colleges should be applauded.

Conclusion

The L'Aquila verdict should be viewed as a healthy eye-opener for remedial corrective action. We reiterate the need for the following: seismic symptomatic precursors R&D, followed by in-depth holistic R&D; constituting ERA is advisable to monitor R&D with confidentiality; Communicate when the prediction is fit for the public consumption; infrastructure building and logistics to be in place to deal with any 24 x 7 eventuality; disaster management strategies at various levels, especially pre-disaster management; adherence of building code, especially in seismic prone zones; forecasting by quacks and armatures should be dealt as deemed fit according to law; public education, especially for children and youth; mock earthquake occurrences at random intervals and locations, etc. Incidents like the L'Aquila case clearly demonstrate that proper risk communication in a language understandable to the general public, government authorities and media is of crucial importance. Such communication should also include the uncertainties associated with evaluations and projections.

1. Ramanamurthy, M. V., *J. Earth Sci. Eng.*, 2011, **4**, 941-946.

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