

How Earthquake Early Warning Systems can affect scientist's liability?

International perspective for domestic questions.

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ABSTRACT

Early Warning Systems (EWS) represent a technical-scientific challenge aimed at improving the chance of surviving of the population exposed to the effects of dangerous natural events. This improvement must necessarily face great difficulties in the application fields, because EWS may turn into serious responsibilities for people involved as scientists and engineers.

In this complex scenario is necessary to consider the differences among EWS (e.g. meteo, tsunami, earthquake) and their capability of predicting and avoiding the consequences of damaging events. The development of EWS in Italy is not homogenous.

Some of these systems, such as Earthquake EWS (EEWS), are in a testing phase and we really need to learn a lot from the comparison with other Countries that have been adopting these solutions for years.

This recognition is very important, because the tragic and deadly events of the L'Aquila earthquake, the landslide in Sarno, and the recent eruption of Stromboli volcano have taught us that the relationship between science and law in Italy is really difficult.

So, before entering in the operative phase of the EEWS is necessary to start from a recognition of the international and national legislative and jurisprudential frameworks that supports the assessment of criminal and civil liability in the event of a "wrong" technical-scientific response, unable to decrease the consequences for people and infrastructures.

The future application of EEWS in our Country must be supported by a study and research of solutions that allow scientists and engineers to operate with more awareness and less fear of the consequences of this not renounceable progress.

In this framework, the different roles of those involved in the development and dissemination of EEWS are also relevant: the responsibilities of scientists developing the tools are not the same as those of technical operators who are called upon to disseminate the alert.

In all these cases, however, the offer of an EEWS service represents a promise to the population to face the harmful consequences of certain natural and disastrous events.

This promise certainly creates a legitimate expectation that, where betrayed, can give rise to criminal and civil liability for adverse events (manslaughter, negligence, unintentional disaster etc.). Population, however, should not only expect to receive a correct alarm but must be put in the condition to understand the uncertainties involved in rapid estimates, to be prepared to face the risk, and to react in the right ways.



Prometheus
Bound (Aeschylus)

SCIENTIFIC DEVELOPMENT AND RELATED CRIMINAL RESPONSIBILITIES

Scientific and technological developments need instruments aimed at saving the lives of people exposed to the consequences of natural hazards such as earthquakes.

This development, however, generates a paradox. The more science is adopted to face risks previously considered unavoidable, the more the scientists are likely to be held responsible for the consequences linked to the failure of such systems.

This may also be the case with Earthquake Early Warning Systems

THREE CASES OF CRIMINAL LIABILITY FOR NATURAL DISASTERS:



1) THE L'AQUILA "GREAT RISKS COMMISSION" TRIAL (2009)

Scientists were called in the Court to justify the opinions expressed in the official meeting which took place 6 days before the deadly earthquake in L'Aquila (2009). According to the public prosecutors, they expressed an incorrect and reassuring prediction of the seismic event which would have pushed the population to take harmful decisions.

As known, The Court of First Instance in the "Great Risks" trial, convicted the so called "L'Aquila seven" (scientists and Civil Protection officers) to six years of imprisonment for involuntary manslaughter. The Court of Appeal overturned the verdict, acquitting all defendants, except one. The vice-head of Italian Civil Protection Dept. was convicted (reduced sentence) also in the Appeal and in the Supreme Court verdicts. The responsibility for not having foreseen the earthquake is, in fact, the *fil rouge* that connects the entire trial at the Great Risks Commission.

The Supreme Court affirms that, when the information is given by a particularly qualified source (such as a scientist), he or she must predict all the harmful event related (the death of citizens from building collapse). In other words, in the Great Risk trial, Judges affirm that there are two segments of predictability, strictly connected:

ONE: the suitability of the message to reassure the population and make them abandon the usual precautions;

TWO: the correlation between this dismissal of precautions and the death caused by the "seismic event" in the night of April 6th, 2009.

Since the territory of L'Aquila is characterized by "high seismicity", the Court tells us that the predictability judgment must also include the possible consequences of an unpredictable phenomenon (the earthquake). In a few words, the vice - head of the Civil Protection should and could have predicted that his assurances might have resulted into unwise behaviours, endangering the population in the event of an earthquake.



2) THE DISASTER OF SARNO (1998)

If we look closely at the judgement criteria expressed in the L'Aquila sentence, they find their **antecedent in the trial for the Sarno disaster** (a mud flow hit the city on May 6th 1998, causing 160 fatalities).

In 2010, the Italian Supreme Court **annulled the acquittal verdict** of the Mayor of Sarno, stating that he could have predicted the intensity and consequences of the mud flow.

The Court of First Instance and the Court of Appeal, sustaining the unpredictability of the event and consequently stating the **innocence of the Mayor**, had affirmed: **“even the scientists ignored the possibility that those rapid flows of mud** (that represented the cause of the deaths occurred in our case) **would occur!** How could Mayor B. - even if he was a professional engineer - have the necessary specialist **knowledge, that even scientists with experience in these areas, have not shown to have?”**

On the contrary, the Supreme Court, denying the innocence of the defendant and submitting to other Court of Appeal the decision on the case, affirmed:

A. the **unpredictability** of a disaster “is not a justification but, on the contrary, a confirmation of criminal liability”.

B. **no matter if the mud flow was predictable or not, because** : “If the fundamental characteristics of a natural phenomenon are not known - in particular the causes, the possibilities of evolution, the possible effects - the **caution** that must be used in eliminating or reducing its consequences must be **the greater ones**, precisely because the most destructive effects cannot be excluded, with an *ex ante* evaluation based on reliable scientific knowledge”.



3) THE MACALUBE VOLCANELLI TRIAL (2015)

The Court of Agrigento ruled on the responsibility for the tragic death of two children swept away and killed by the mud, escaping from the explosion of a mud volcano, in the Nature Reserve of the "Macalube of Aragon".

For the fact the director of the nature reserve was accused, together with the guardian of the area, charged by the director to carry out the monitoring, and the manager responsible for the sector "Management and business relating to protected areas of nature" of the Regional Department of the Environment of Sicily Region.

All three were accused of the crime provided for and punished by articles 113, 40 cpv., 589 and 61 no. 3 because, by culpably cooperating with each other, each aware of the negligent and imperishable conduct of the other, they caused the death of two children, caused by the so-called overturning of the mud volcanic hill within zone A of the integral nature reserve of the Macalube of Aragon, established by ministerial decree no. 290 of 1944 and granted in management to Legambiente.

The Court of Agrigento considered D.F. and D.G. responsible for the manslaughter, sentencing them respectively to 6 years and 5 years and 3 months of imprisonment and ordering the prohibition of both from public office. The Court acquitted F.G. because "the fact does not constitute a crime".

Although the debate has ascertained, therefore, that neither the phenomenology nor the methods of triggering the phenomenon are known, and also that an event of such magnitude had never occurred to the detriment of a visitor, nor that at that time were in the act of the recognizable precursors, the judge considered that the tragic event that occurred to the two young visitors was not fortuitous but fully predictable.

Thus, recognizing the existence of a position of guarantee of the director and custodian of the Park with respect to the life and physical safety of visitors, the judge ruled the culpable responsibility of the defendants precisely because of the knowledge of the danger and predictability of the event.

1. THE PARADOX OF RISK SOCIETY

Our **Risk Society**, once abandoned the fatalistic approach of the early 20th century, is **increasingly focused on the criminal and civil liability for the consequences of natural disasters**.

After every disastrous event, the same questions arise:

- **Could we have foreseen it?**
- **What countermeasures should or could have been taken?**
- **Who should have protected the population and the infrastructures?**
- **Who is responsible for the disaster?**

2. WHAT IS REALLY PREDICTABLE AND WHAT IS AVOIDABLE BY THE HUMAN BEHAVIOR? DIFFERENCES BETWEEN SEISMIC EARLY WARNING AND TSUNAMI EARLY WARNING

Determining what is really predictable and what is avoidable by the human behaviour is extremely difficult! In Italy, we approach the use of EEW systems in the absence of a set of predefined rules that allow us to establish *ex ante*, before the event, what phenomena we can predict and what consequences we can avoid.

EEWs is profoundly different from tsunami EWs, which are included in an international system coordinated by UNESCO's IOC- This system dictates, at an international level, a set of rules determining the technical and scientific boundaries of tsunami warning systems, as well as the limits of the service.

In the EEW systems this framework of discipline is missing. Therefore, in a system of responsibility such as the Italian one, there is the risk of leaving to the judge the decision of what the defendant could and should have done according to the idea of the *post hoc ergo propter hoc*.

3. HOW CAN WE MANAGE THIS VACUUM?

Within this dangerous regulatory vacuum, we are looking at the scientific and technical rules, laws and best practices adopted in other countries for the implementation of EEW systems. Particular attention is devoted to the disciplines of Japan and California.

A. JAPAN

The Japan Meteorological Agency (JMA) provides residents in Japan with Earthquake Early Warnings. On 1 October 2007, JMA launched the Earthquake Early Warning service for provision through a number of media outlets such as TV and radio, as part of J-Alert, launched by Japan's Fire and Disaster Management Agency (FDMA): an early warning system that transmits instant emergency information about earthquakes, tsunamis and ballistic missile via sirens, so that people can respond immediately.

The JMA is very clear about **Limitations of the Earthquake Early Warning, including:**

Timing - False alarms - Magnitude estimation - Seismic intensity estimation.

JMA continues improving the accuracy and timing of the Earthquake Early Warning, and also intends to make further efforts toward publicizing the Earthquake Early Warning". From <https://www.jma.go.jp/jma/en/Activities/eew.html>

B. CALIFORNIA

1. On October 17, 2019, the U.S.G.S. and the State of California kicked off the first statewide public test of the Earthquake Early Warning System, which is powered by the USGS-supplied earthquake early warning alerts called ShakeAlerts.

The alerts are provided by two independent methods, the first through the federal Wireless Emergency Alert (WEA) system and the second through the University of California Berkeley's MyShake smartphone application.

ShakeAlerts will be sent through the WEA to those throughout the state who may suffer potential shock damage of magnitude 5 or greater. With the expansion of the seismic network and the further development and testing of the ShakeAlert system and how alerts communicate, the speed, reliability and spread of ShakeAlerts will also increase.

The MyShake application, developed by the University of California, Berkeley, and funded by the State of California and the Moore Foundation, also sends alerts to people who may experience earthquakes of 4.5 magnitude or greater.

The USGS is building the ShakeAlert early warning system for earthquakes in California, Oregon, and Washington as a new tool provided by the advanced national seismic system.

See more:

https://www.usgs.gov/news/all-systems-go-first-statewide-testing-shakealert-united-states?qt-news_science_products=1#qt-news_science_products

2. A particularly interesting role should be reserved **for disclaimers** defining terms and limits of use: *"ShakeAlert notifications are a product of the USGS which makes no express or implied warranty as to their fitness for any particular purpose. USGS does not warrant that ShakeAlert will function at all times, in all geographic areas, be error-free or that any errors will be corrected. USGS shall not be liable for any errors, inaccuracies or delays in content, or for any actions taken in reliance thereon".* From <https://www.shakealert.org/implementation/shakealerttm-user-privacy-statement/>

Even more accurate is the disclaimer related to the conditions of use of the MyShake APP:

The conditions are available on the site:

<https://myshake.berkeley.edu/docs/MyShakeTOSV3.1.pdf>

GENERAL:

"Rapid notifications and earthquake early warning alert information is under development and is provided on an as-is basis. Myshake makes no warranty that rapid notifications and alerts will function at all times, in all geographic areas, be uninterrupted, be error-free or that any errors will be corrected. Myshake suggests drop, cover, and hold on as a general protective action, but is not responsible for injuries or loss of assets due to provided correct, false, or missed alerts"

LIMITATION ON LIABILITY:

"To the maximum extent permitted by law, in no event shall company (or our suppliers, or the regents of the univeristy of california) be liable to you or any third party for any lost profits, lost data, costs of procurement of substitute products, or any indirect, consequential, exemplary, incidental, special or punitive damages arising from or relating to these terms or your use of, or inability to use, the app, even if company has been advised of the possibility of such damages. Access to, and use of, the app is at your own discretion and risk, and you will be solely responsible for any damage to your device or computer system, or loss of data resulting therefrom.

To the maximum extent permitted by law, notwithstanding anything to the contrary contained herein, our liability to you for any damages arising from or related to this agreement (for any cause whatsoever and regardless of the form of the action), will at all times be limited to a maximum of fifty US dollars (u.s. \$50). The existence of more than one claim will not enlarge this limit. You agree that our suppliers will have no liability of any kind arising from or relating to this agreement. Some jurisdictions do not allow the limitation or exclusion of liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you”.

3. LATEST UPDATES

A smartphone APP has been allowed to be used that gives users throughout California the ability to view the countdown before the tremors arrive.

Available for iOS and Android phones, QuakeAlertUSA also offers the ability for phone owners to customize app activation even for weak shocks.

The Santa Monica-based Early Warning Labs app uses the same data source as the other two apps that have been available - the U.S. Geological Survey's ShakeAlert system, powered by hundreds of earthquake sensors across California.

The other available apps don't offer countdown or the ability to ignore weak and light shock warnings; they are UC Berkeley's MyShake app, which offers statewide coverage, and the City of Los Angeles' ShakeAlertLA app for users physically located in the State of Los Angeles.

The mildest shock that can trigger an alarm for the QuakeAlertUSA app is a weak shock, or Level 3 on the Modified Market Intensity Scale.

California authorities have also begun issuing SMS alerts through the Amber Alert-style Wireless Emergency System. These alerts do not require you to download an APP or own a smartphone, but the system may be slower than APPs and is only set to activate for relatively stronger shocks than smartphone APPs.

This is the counterpart of It Alert which will soon be widespread in our country.

See more:

<https://www.latimes.com/california/story/2020-02-12/californias-new-early-warning-earthquake-app-features-a-shaking-countdown>

4. CONCLUSIONS AND SUGGESTIONS FOR THE RESEARCH

- In the **Italian** legal system disclaimers are not a guarantee of impunity because the **precautionary principle** has entered more and more the Criminal trial and **upset the structure of liability**.
- Despite the limited effectiveness of the disclaimer policy in Italy, what we shall borrow from other systems is certainly the input for guidelines governing the early warning service and its application.
- From the legal frameworks of the other countries we intend to enucleate a set of rules to be followed as guidelines for the application of the EEWS.
- These guidelines could limit the criminal and civil liability of scientists and engineers, especially if they take the form of a regulatory act, which is one of my ongoing target activities.