

Living in the shadow of Italy's volcanoes

What is the earthquake hazard?

Catania is Sicily's second largest city after Palermo with a population of about 300,000 people. The city has been affected by several destructive earthquakes in the past.

- In 1169 a powerful earthquake estimated to have measured 6.4 – 7.3 on the Richter scale killed over 15,000 people.
- In 1693, an equally powerful earthquake devastated the city killing up to 20,000 people and destroying much of the city (Figure 1).
- Smaller earthquakes have occurred in 1818 (6.2M) and 1990 (5.8M).

Figure 1

Depiction of the 1693 earthquake



Image source: http://www.wikiwand.com/en/1693_Sicily_earthquake

The earthquake in Catania

Scientists have suggested return periods of 250 to 500 years for an event like 1693, and 40 to 90 years for an event such as 1818. Based on these estimates, the city is within the return time period for a significant earthquake.

What is the cause of Catania's earthquakes?

Sicily sits at a complex convergent (destructive) plate margin at the boundary of the African and Eurasian plates. It is a very seismically active plate margin and earthquakes are common in this part of the Mediterranean. According to the frequency and impact of the seismic effects suffered in the past, Eastern Sicily must be considered one of the most high risk areas in Italy.

What are the responses to the seismic threat?

1. Seismic zoning

Scientists have focused their attention on producing a seismic zoning map to identify those areas most likely to experience severe ground shaking. This gives an indication of the potential damage that might be caused by an earthquake.

Scientists have made use of historic records of past earthquakes together with the use of borehole data to study the soils and rocks beneath the city. Silts and clays can become jelly-like when shaken by an earthquake. This is called liquefaction and is a major cause of building collapse during an earthquake. It can also lead to damaging landslides and mudflows. A detailed ground shaking map has now been produced for northern Catania to help planners and emergency services plan for the next big earthquake.

In addition to ground shaking and landslide risk maps, scientists have also created maps identifying infrastructure at risk from earthquake damage. This map is a critically important management tool as access to the city for emergency services would be essential after an earthquake.

2. Early warning system

A seafloor observatory, placed off the Catania coast, has been established to pick up an early warning of an earthquake. It is hoped that this will provide enough notice for gas pipelines to be shut down to prevent fires that could break out after an earthquake.

3. Retrofitting

This involves strengthening existing buildings, such as ancient monuments and important public buildings identified as being vulnerable to structural damage. This can involve strengthening walls and floors and the insertion of seismic isolators (Figure 2) to reduce the effects of ground shaking.

Figure 2

Installation of seismic insulators



Figure 19: Squat columns in the original building before (a) and after (b) the insertion of the seismic insulators (After Caliò and Marletta [28]).

Image source:

http://www.researchgate.net/publication/258110759_Earthquake_Resistant_Engineering_Structures_VI_XIX_A_road_map_for_seismic_prevention_of_damage

Questions

Find out more about the impacts of the catastrophic earthquake of 1693 which killed thousands of people in Catania and beyond.

- What was the magnitude of the earthquake?
- What was the impact in terms of the Mercalli scale?
- Was a tsunami triggered by the earthquake?
- What were the economic, social and environmental impacts?

http://www.wikiwand.com/en/1693_Sicily_earthquake

Further details on seismic zoning can be found at:

http://www.researchgate.net/publication/258111657_On_the_Seismic_Microzonation_Assessment_of_the_City_of_Catania

http://www.researchgate.net/publication/258110759_Earthquake_Resistant_Engineering_Structures_VI_XIX_A_road_map_for_seismic_prevention_of_damage