



Seismic risk mitigation at Ischia island (Naples, Southern Italy): an innovative, complete approach to prevent catastrophic scenarios

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Ischia island, Naples province, is a densely populated volcanic island, in which small to moderate magnitude earthquakes occur that, due to their very shallow depth (less than 2 km), are able to generate serious damage and casualties, up to the complete destruction of urban centers within a small distance (2-3 km) from the epicentre. Earthquake at Ischia island almost all take place at shallow depth below the Northern slopes of the Mt. Epomeo horst, very close to the town of Casamicciola, which was in fact completely destroyed by the 1883 earthquake, experiencing intensities up to XI degree on the Mercalli scale. The 1883 earthquake, killing about 2300 people, was forerun in 1881 by a smaller earthquake, killing about 130 people; the whole sequence of moderate magnitude, destructive earthquakes, started in 1828, with an earthquake killing about 30 people. Similar sequences of destructive earthquakes, clustered in some tens of years, occurred in the former centuries. Seismicity in this island is hence peculiar, both because of the very shallow depth (which amplifies the effect with respect to normal tectonic earthquakes, though involving a small damaged area) and of the clustering in time. Despite such destructive character, seismic hazard in this area has been strongly underestimated till now by official hazard maps, which take into account only the effects of continental earthquakes, hence neglecting the most effective source of hazard, which is the local seismicity. On August 21st 2017, a moderate magnitude earthquake struck the area of Casamicciola, killing two people, injuring many more and causing huge damage and partial to total collapse of edifices locate just above the earthquake fault.

The maximum acceleration recorded for this earthquake exceeded the reference acceleration imposed to be sustained by edifices, according to official hazard maps, of a factor more than double. The observation of seismic accelerations overcoming the reference ones prescribed by hazard maps, and the difficulty to manage the vulnerability of ancient edifices, is common for many recent earthquakes in Italy, generally causing grief and destruction also for moderate magnitude earthquakes. A further problem of Ischia earthquakes, which make them very different from tectonic earthquakes occurring in the Apennine and Alpine chains, is that the stress accumulation times and mechanisms are absolutely unpredictable, because linked to complex volcano-tectonic phenomena. Clusters of destructive earthquakes can then occur in few years or decades, making urgent the securing of buildings in the most hazardous areas. We propose here a complete procedure to assess and mitigating the risk, which can be fast and cheap, avoiding further grief due to possible occurrence of other destructive earthquakes in short time. We further evidence the most likely building collapse and casualty scenarios, if new significant magnitude earthquakes should occur before securing the areas; just to show the imperative needing to act very fast. The proposed procedures for hazard assessment and for urban areas securing can be then generalized to the whole Italian peninsula, then mitigating the catastrophic character of most earthquakes in Italy, even of moderate magnitudes.