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A conceptual model of geological risk in the Ischia Island (Italy): highlights on volcanic history, seismicity and flooding

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During the last eight centuries the island of Ischia was hit by earthquakes, volcanic eruptions and floods producing heavy damages and numerous fatalities. Since the last twenty century the Ischia population is grown very fast, nowadays more than 56.000 people live in the island and 4 million of people visit it during the year, thus this area is characterised as an high geological risk territory.

The island is here presented as an interesting "laboratory" for volcanic, seismic and hydrogeological risks assessment, from which to draw lessons for planning in risk areas.

Ischia is a volcanic field, formed by the succession of effusive and explosive eruptions which formed lavas, welded and loose pyroclastic rocks. The succession of rock layers, with different permeability, promotes, during heavy rainfall, the formation of flows with high kinetic energy, which can produce devastating landslides.

In this context, the remarkable development of settlements in the island, occurred in recent times, and the lack of planning that bring attention to the vulnerability of the area, have produced an exponential risk increase.

Eruptions, earthquakes, flooding occurred in the island of Ischia in the past, have produced a wealth literature about catastrophic natural events. In general, the accounts of the events were recorded by various means, such as: newspaper, property disputes, historical and sociological analysis, poetic or artistic works, scientific analysis.

As regard volcanism, earthquakes, tsunamis, there are myths, legends, historical documents, archaeological findings and results of recent surveys. Documented descriptions of historical eruptive events are only available for the last eruption of 1301-1302, while there are records for eruptive events in the early centuries of the Christian Age.

More comprehensive accounts are available about historical seismicity. Information and documentations are available since the 1228 earthquake. However, more detailed and useful interpretations on the earthquakes refer to the events from the end of XVIII century. There is an exhaustive literature related to the 1881 and 1883 earthquakes occurrence, pointing out to the relationship between seismicity and the volcanic history of the island (i.e. "earthquakes as aborted eruptions"). These two seismic events occurred during an intense period of production of geological charts and maps, representing the physical characteristics of the territory. The effects of the earthquakes were classified using the former scale of intensity and different locations and mechanisms of the seismic source were suggested.

The information about hydrogeological disasters in the island arise from the sixteenth century, when a major flooding hits the island, in correlation to extreme weather conditions. An archetype phenomenon is the 1910 flood event which caused serious damages and morphology changes to involved areas. In recent times (2006, 2009) floods hit again the island producing debris flow which devastated its northern sector producing injuries, fatalities and heavy damages.

To obtain a conceptual model of geological risk we have done an integrated analysis of catastrophic events occurred in the island and its tectonic and morphological features.

Our analysis shows that the Casamicciola municipality, was the area affected by the heaviest damages due to earthquakes and floods.