Geophysical Research Abstracts,
Vol. 11, EGU2009-7104-1, 2009
EGU General Assembly 2009

The surface effects of the 1908 Southern Calabria - Messina earthquake (Southern italy)

V. Comerci, A.M. Blumetti, E. Brustia, P. Di Manna, D. Fiorenza, L. Guerrieri, M. Lucarini, L. Serva, and E. Vittori

ISPRA, Geological Survey of Italy / Land Protection and Georesources Department, Rome, Italy (valerio.comerci@apat.it)

The December 28, 1908, Southern Calabria - Messina earthquake (Intensity MCS XI, Mw 7.24; Stucchi et al, 2007) was the strongest seismic event of the 20th century in Italy and the most ruinous in terms of casualties (at least 80,000). According to Michelini et al. (2005) its epicentre was located at sea in the southern part of the Messina Straits. The damages were particularly catastrophic along the Calabrian coast, between south of Reggio Calabria and south-west of Scilla, and along the eastern coast of Sicily from its easternmost tip to south of Messina (Baratta, 1910; Boschi et al., 1995; Barbano et al., 2005). Messina and Reggio Calabria were almost totally destroyed.

Few minutes after the earthquake, both sides of the Straits were inundated by several tsunami waves, worsening the ruinous effects due directly to the earthquake.

We have collected and catalogued all the described coseismic effects on the environment by means of a careful screening of contemporary documents, i.e. technical and photographic reports, newspapers and other archive material. Inside 447 different testimonies of environmental effects, we have identified 290 independent occurrences.

Among these effects, particularly relevant were the changes in elevation (mainly ground lowering) along both sides of the Straits, partly due to the settlement of loose sediments and artificial filling (e.g., Messina and Reggio Calabria port areas), and partly ascribed to landslides and tectonic deformation.

Liquefaction phenomena, described as water, mud or sand ejection, occurred in the areas of Messina, lake Pantano (Ganzirri) and Reggio Calabria. Portions of the coast were lost, especially on the Calabrian side, most of them because of landslides and the combined action of the tsunami erosion and the earthquake shaking (at Lazzàro the shoreline retreated landward 175 m; Novarese, 1909). Ground cracks were reported in 69 localities, most of them in Messina, Reggio Calabria and Villa San Giovanni. 80 slope movements occurred in many Sicilian and Calabrian localities (especially between Reggio Calabria and Bagnara) mainly along coastal areas, but also inland.

An undersea telephone cable between Gallico (in Calabria) and Gazzi (in Sicily) was cut, likely by a submarine slide. 11 mass depositions on the sea floor were recognised. Several hydrological anomalies occurred in both regions: appearance or disappearance of springs, change of spring discharge, water temperature variations. Also descriptions of gas emissions have been collected as well as a number of testimonies of rumbles and lights.

It is readily evident that documented coseismic environmental effects are, as a whole, less than commonly expected for earthquakes of similar magnitude in that region (i.e., 1783 Calabrian and 1693 eastern Sicily earthquakes). The larger part of the collected effects is localised in the urban areas, which attracted the attention of the reporter, and along the coastal areas which were more easily accessible.

In particular, no coseismic effects described by contemporary witnesses have been definitely interpreted as an evidence of surface faulting. Therefore, the ground elevation changes, measured by means of geometric levelling soon after the earthquake (Loperfido 1909), remain, so far, the only evidence of tectonic deformation.

In 25 localities, where more diagnostic environmental effects occurred, we have applied the ESI 2007 scale (Guerrieri & Vittori 2007) in order to evaluate the intensity: in the Straits area the ESI values are one or two degrees lower than the MCS values (the maximum ESI value is X, while the maximum MCS value is XI). We have to consider that the ESI scale is calibrated on the MM and MSK scales, which provide intensity estimates lower than the MCS scale for the highest degrees. Moreover, the strong earthquakes that struck this area in 1894, 1905 and 1907 had certainly weakened the buildings, many of them constructed using fluvial stones and poor quality mortar, which had been badly restored afterwards. In addition, the seismic resistant construction standards

were often disregarded after the 1860, enhancing the buildings vulnerability.
The analysis of the contemporary sources allowed us to reconstruct a representative distribution of ground coseismic environmental effects of the 1908 earthquake, which was not available so far. This information is essential in order to better estimate the size of the event and the future impact of a similar occurrence on a region that has seen a strong urban and infrastructural growth since then.