

Early Warning of Volcanic eruptions and Earthquakes in the neapolitan area, Campania Region, South Italy.

Paolo Gasparini¹, Franco Barberi², Attilio Belli³

¹ **Università di Napoli Federico II, Centro Regionale di Competenza AMRA, Dipartimento di Scienze Fisiche** (paolo.gasparini@na.infn.it)

² **Università di Roma 3, Dipartimento di Scienze della Terra**

³ **Università Di Napoli Federico II, Dipartimento Urbanistica, Centro Regionale di Competenza AMRA**

ASSESSMENT OF THE PROBLEM

The city of Napoli and its neighboring towns are located within one active caldera (Campi Flegrei, last eruption in 1538) and on the slopes of Mt. Vesuvius (last eruption in 1944). The geological record indicates that both volcanoes are prone to erupt explosively with production of pyroclastic flows. Recurrence periods of major explosive eruptions are of the order of hundreds years at Mt. Vesuvius and thousands years at Campi Flegrei. More than one million of people live under the threat of one of the two volcanoes. Therefore, even if the eruption hazard is not particularly high, this area has the highest volcanic risk in Europe and one of the highest in the world. The neapolitan area is subject to ground deformation and earthquakes of volcanic origin (magnitude lower than 4.0 with in-town location of sources and swarm type occurrence) and to earthquakes of tectonic origin ($M < 7.0$) originated at more than 70 km of distance in the Apennine Range. The most recent relevant event in the area are the effects of the Irpinia earthquake of November 23, 1980 and a resurgence episode of the Campi Flegrei caldera which started around 1970 and had a climax of seismic activity and ground deformation in 1983-84. Since then the ground has been sinking but the recovery is not yet complete. The area of Napoli has been recently classified as second seismic category (expected maximum peak ground acceleration 0.25 g in the elastic field).

MONITORING SYSTEM

Geophysical and geochemical precursors of volcanic eruptions are routinely monitored by high tech instrumental networks by Osservatorio Vesuviano - Istituto Nazionale di Geofisica e Vulcanologia (www.ov.ingv.it). Seismic activity in the Apenninic Range is monitored by the national seismic network of Istituto Nazionale di Geofisica and Vulcanologia (INGV).(www.ingv.it). Whenever anomalous activity is recorded almost real time information is forwarded to the National Civil Protection, which is the organization in charge for the management of emergency in Italy. INGV is presently improving its seismic network. A denser seismic/accelerometric network around the Irpinia fault zone is being set up by the Regional Center of Competence on Analysis and Monitoring of Environmental Risk (CRdC-AMRA) (www.amra.unina.it).

PREPARADNESS TO EARLY WARNING

Several actions directed to improve the early warning capacity started in the early nineties when the Department of Civil Protection promoted the preparation of an emergency plan for the Vesuvian area (where about 700,000 people lived at that time). The preparation of the plan was a successful cooperation among scientists (from Osservatorio Vesuviano and Gruppo Nazionale di Vulcanologia – INGV), Civil Protection, Prefecture of Napoli and the mayors of all the municipalities involved. The plan included several actions according to the levels of alerts indicated by the patterns of geophysical and geochemical precursors. Intensive information and diffusion of the plan and of the risk problems were made essentially through the school system. The most extreme action foreseen by the plan is the evacuation of the whole area when the highest alert level is reached. One major problem is the long lead time needed to carry out the evacuation (7-10 days). This has the consequence of a high probability of false alarm. The plan was meant as an open continuously updated blueprint. In fact many new high quality data are continuously made available by researches supported by GNV and European Commission (for example the EU4 CT 98 0699 , EU-GNV Tomo Ves Project and several GNV projects) to better define the possible eruptive scenarios, to better define source characteristics of precursors phenomena and to quantify alert levels. Vulnerability of houses and strategic edifices to earthquakes was assessed for the whole territory and numerical simulations of the expected seismic effects of volcano-seismic activity on strategic structures were carried out. An analogous emergency plan was recently prepared to face a possible eruptive activity at Campi Flegrei, where intensive ground uplifting and seismic activity occurred from 1970 till 1984.

The problem of long lead time and high probability of false alarms has been approached by the Government of Regione Campania who is now preparing the Land Use Planning for the whole Campania. One of the main objectives of this plan is to decrease the lead time by decreasing the population density. A spontaneous about 10% decrease occurred from 1991 to 2001. On June 2003, the Regione Campania Government has approved a package of laws aiming at encouraging the transfer from the high risk municipalities toward other areas in Campania in several ways, for example giving economic incentives to young people wishing to do so.(published on Bollettino Ufficiale Regione Campania .31 del 14.7 03) (www.regione.campania.it/burc/pdf03/burc31) The final objective is that in about 20-30 years the lead time will be reduced to 2-3 days.

ACTIONS IN PROGRESS

The neapolitan area and Regione Campania are subject to many further hazards which have produced losses of properties and human life in the last decade. They include landslides, floods, industries. Regione Campania has finalized a EU-ESRD financial support to create a Regional Center of Competence on Analysis and Monitoring of the Environmental Risk (CRdC-AMRA) aiming at acquiring new high tech instrumentation and creating a synergy among the best expertise existing in the Universities and Research Organizations in Campania. The center will be the interface among scientific world, industries and other stakeholders (Civil Protection, Regional and National Environment Agencies, etc). One of its main objectives is to develop methods to approach the problem of risks in a comprehensive and quantitative way, giving public authorities comparative estimates of different

typologies of risk in different areas as a basis for mitigation actions, land use or urban plans. A further objective is the protection of strategic edifices of the town of Napoli, including schools, from damages due to tectonic earthquakes using high tech seismic early warning systems.

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