Early Warning System for Deep Strong Vrancea Earthquakes

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The deep earthquakes(Mw=7.9) generated in Vrancea area are particularly of interest for many countries in Europe since they cause destructive effects at large distances from Moscow to Roma. According to the number of people lost in earthquake during XX-the century as well as in a single (March 4,1977) earthquake during last century (1574 people lost,36 tall buildings collapsed etc.

- **Earthquakes in the Carpathian-Pannonian region are confined to the crust, except the Vrancea zone, where earthquakes with focal depth down to 200 km occur. Strong earthquakes in the Vrancea region occur between 70 and 200 km depth within an almost vertical column. On the other hand, the maximum intensity for strong deep Vrancea earthquakes is quite distant from the actual epicentre and greater than the epicentre intensity. In 1977 strong earthquake (Mw =7.5) at its epicentre, in the Vrancea region, the estimated intensity was only I=VII½ (MSK scale), while 170 km away in the capital city of Bucharest, the estimated maximum intensity was IX½ -X (MSK).**

Early Warning System(EWS) for Strong Vrancea Earthquakes

Innovative Content:

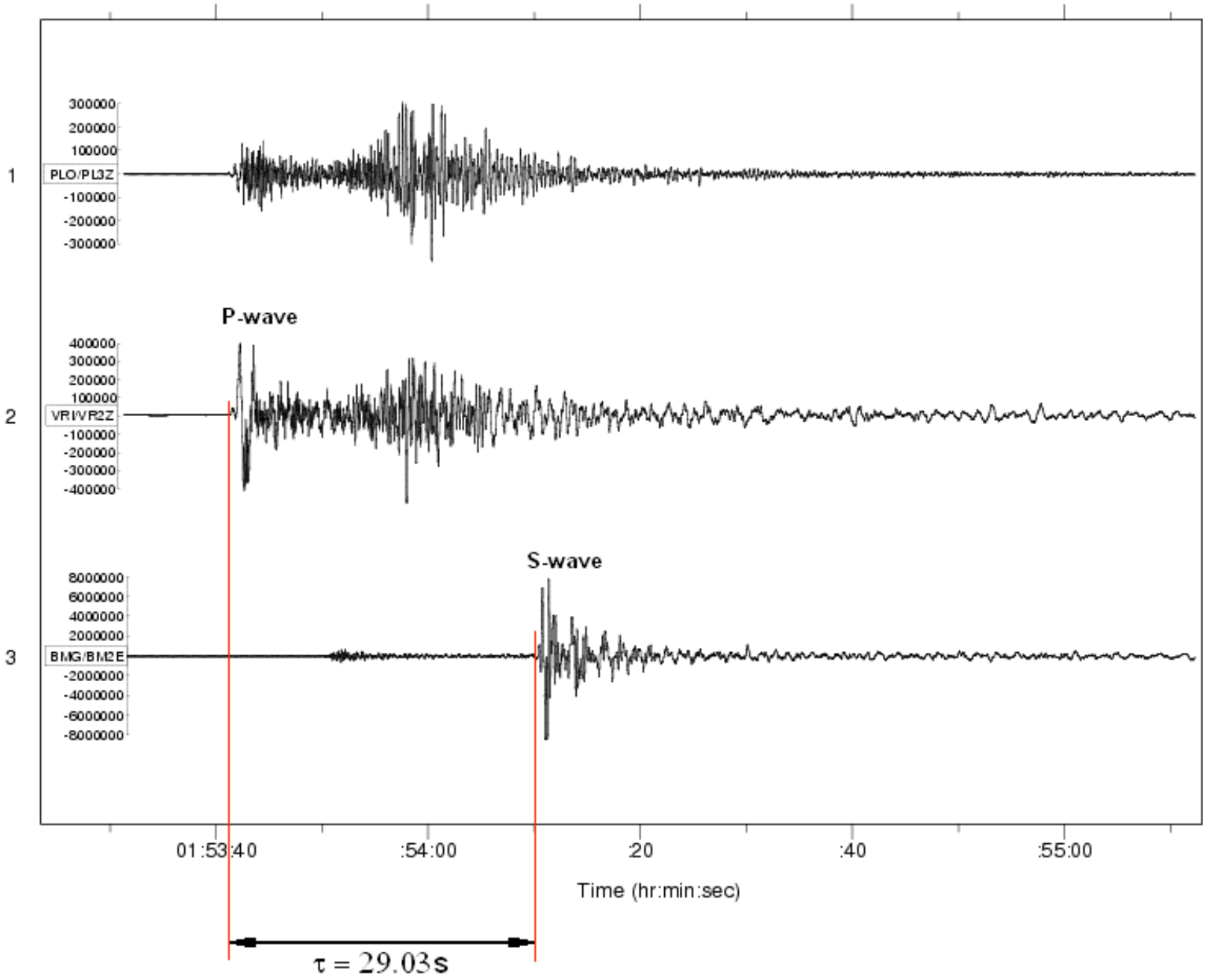
EWS is the first European information system for real-time early detection and warning of the seismic waves in case of strong earthquakes. A device for shutting down of the dangerous industrial processes before strong earthquakes arrives. EWS is more than a technological system to detect, monitor and submit warnings. It should be viewed as part of an European real-time information system that provide early warning, about an earthquake impeding hazard, to the public and disaster relief organizations seconds before.

What Does It Do?

EWS' development, made in collaboration with Karlsruhe University is based on new concepts and models of risks caused by seismic phenomena. EWS uses the time interval between the moment when earthquake is detected by the borehole seismometers, in the epicenter area, and the time of the wave arrival in the facility wanted to be alarmed earlier.

VRANCEA, ROMANIA

Date	Origin Time	Latitude	Longitude	Depth	MD
14.05.2005	1:53:21.22	45.637N	26.531E	148.5	5.8



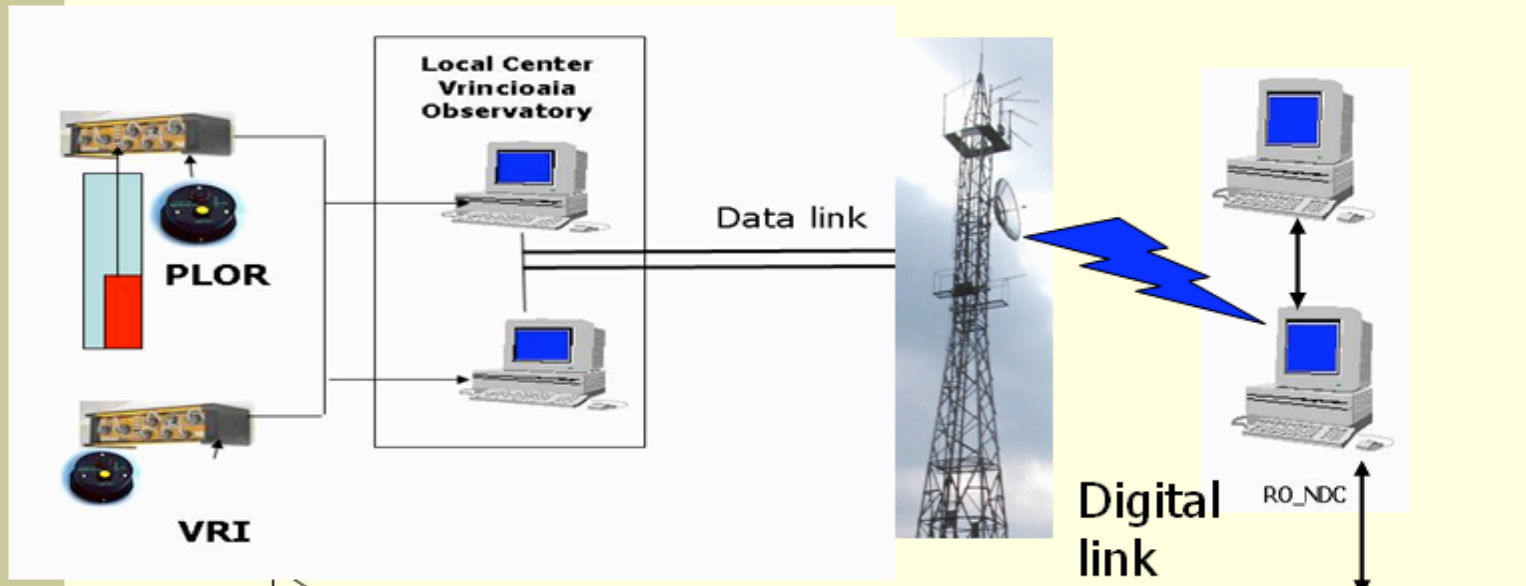
What Is Its Use?

- **EWS for different users provides automatically trigger measures: gas distribution nets (on 1977 strong Vrancea earthquake with magnitude MGR =7.2, there were 380 people burnt because of the broken gas pipes explosions), shutdown of computers, disk drives, airport operations, manufacturing facilities, nuclear power plants, refineries; rerouting of electrical power; stoppage of trains and elevators in a safe position; alerting of hospital operating rooms; opening of fire station doors; starting of emergency generators in hospitals etc. An irradiator nuclear installation from "Horia Hulubei National Institute of Physics and Nuclear Engineering" is using the EWS at this moment.**

For Whom?

EWS is meant to contribute for mitigation of the consequences of catastrophic seismic events in particular in large towns and highly populated areas. It can be included very easy in the user's infrastructure. The destination of the EWS includes large category of users for many industrial processes and finally, to save life of people. Our major vision is that this EWS as an intelligent integrated monitoring system, in combination with an active central control system which is installed everywhere on every structure and complex building like hospitals, oil pipelines, trains, energy facilities, gas distribution, refineries, nuclear power plant, national computers etc.

Shutdown Cobalt-60 nuclear radiation source in safe position at IFIN-HH Bucharest



Conclusions

- **EWS is a device for shutting down of the dangerous industrial processes before strong earthquakes arrives. EWS should contribute to the preparedness for, and the mitigation of, the consequences of catastrophic seismic events in particular large towns and highly populated areas in Europe. Despite its short warning time(28-32 seconds for Vrancea seismogenic area) earthquake early warning system is a useful tool in risk mitigation by its robust design and by using the regional tectonics.**

Conclusions

- **EWS is more than a technological system to detect, monitor and submit warnings. Early warning system should be viewed as part of an European real-time information system that provide rapid information, about an earthquake impeding hazard, to the public and disaster relief organizations before (early warning) and after a strong earthquake (shake maps). Shake Map, new product on work of National Institute for Earth Physics will provide a sound starting point for immediate loss estimation using such methods around of Europe for immediate post-earthquake decision-making.**

- **EWS was one of the 20 Nominees for "2006 European IST Grand Prize" and after it presentation to the European IST Prize Exhibition at the European Commission in Brussels (Nov.30-Dec.1, 2005), on March 16, 2006, at Vienna, the European Commission has selected it as Winner of the European Information Society (IST) Prize for 2006 (www.ist-prize.org).**

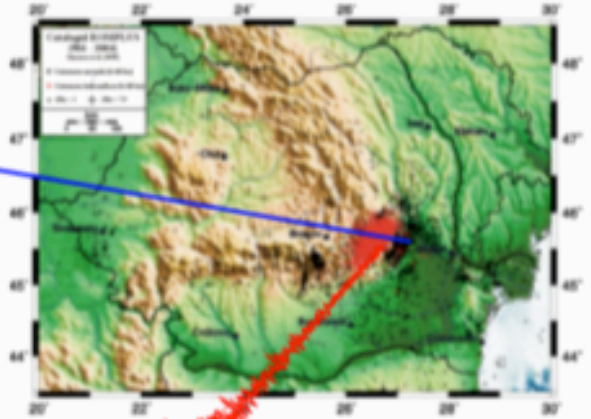

Hospitals


Nuclear Facilities


Gas


Elevators


Civil



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EARLY WARNING SYSTEM (EWS)

30 seconds

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