RAPID, AUTOMATIC EARTHQUAKE DETERMINATION AND EARLY DAMAGE SCENARIOS IN THE IGC SEISMIC NETWORK

X. Goula [1]; J. Jara [2]; T. Susagna [1]; C. Olivera [1]; N. Romeu [2]; S. Figueras [1]; J. Fleta [1] and A Roca [1].

(1) Institut Geològic de Catalunya, C/ Balmes, 209-211, 08006 Barcelona, Spain.
(2) GEOCAT (Gestió de Projectes, S.A.), Avda. Josep Tarradellas, 34-36, 3ª planta, 08029 Barcelona, Spain.

KEY WORDS: seismic network, automatic damage scenarios.

VSAT SEISMIC NETWORK

In 1999, a new concept of seismic network was designed and planned by the *Institut Geològic de Catalunya* (IGC) in order to provide rapid information for Civil Defence services and society in general and to obtain systematically high quality data for the scientific community (Goula et al, 2001). The project of the network has been developed in several steps. It was planned to create robust, high performance field infrastructures and install up to 21 stations equipped with three component broadband sensors and a high dynamic range. In 2009, 18 stations are operative, 14 BB and 3 accelerometer in land, and 1 BB on the sea bottom. A real time system based on a VSAT seismic network has been developed and is now operational for earthquake monitoring in Catalonia (Spain).
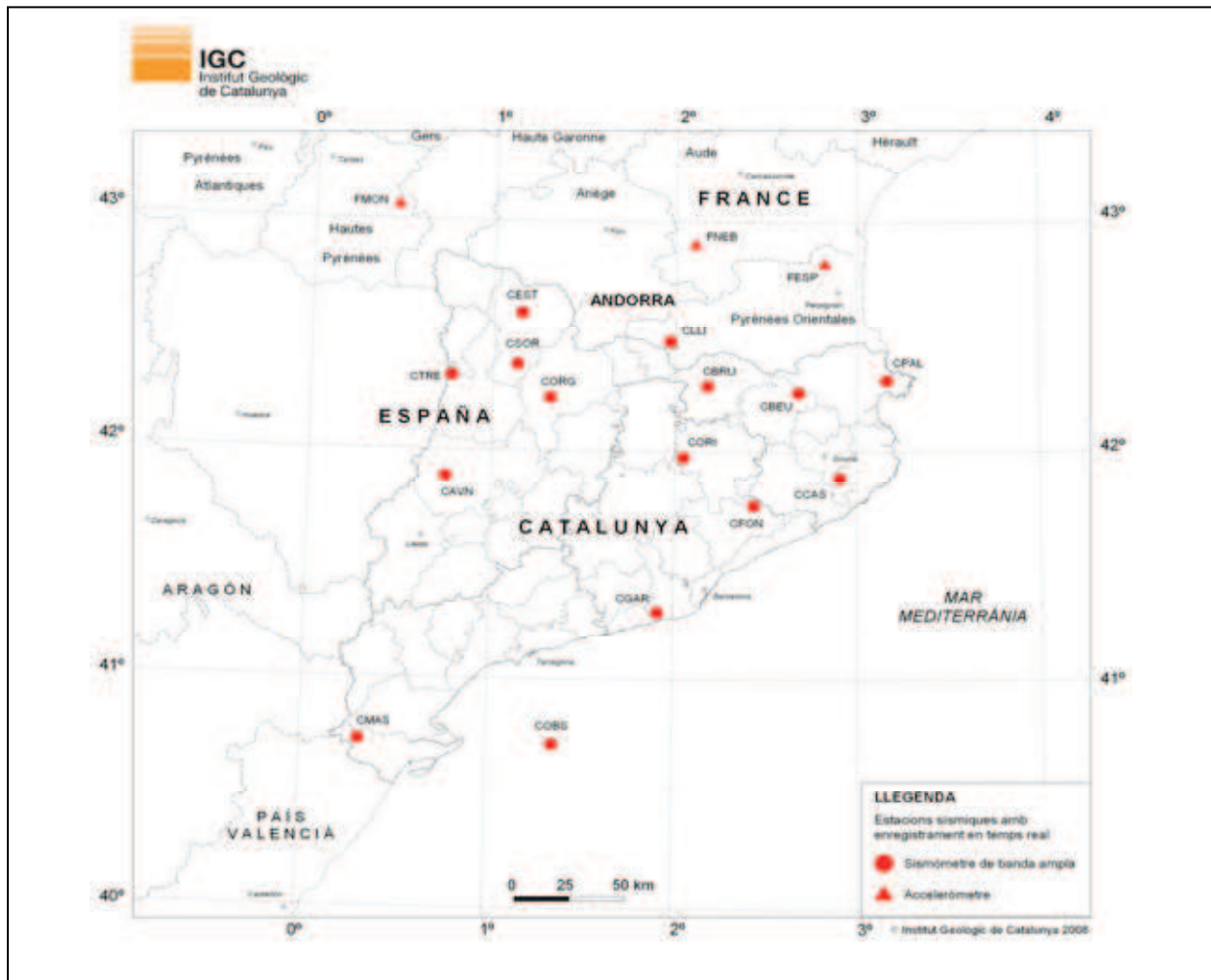

Figure 1: Map of situation of seismic stations of the Pyrenean VSAT Network .

Real time automatic processing system (DAS)

Real time continuous data are received at IGC satellite Hub (Barcelona). Data reception system modularity accepts different kinds of data formats and protocols, and allows data exchange with many institutions (Orfeus, IGN, etc...). A near real time automatic processing system has been implemented using.

Earthworm (USGS, 2005) and specific developed tools (Romeu et al., 2006). System flexibility guarantees its interoperatibility with others systems.

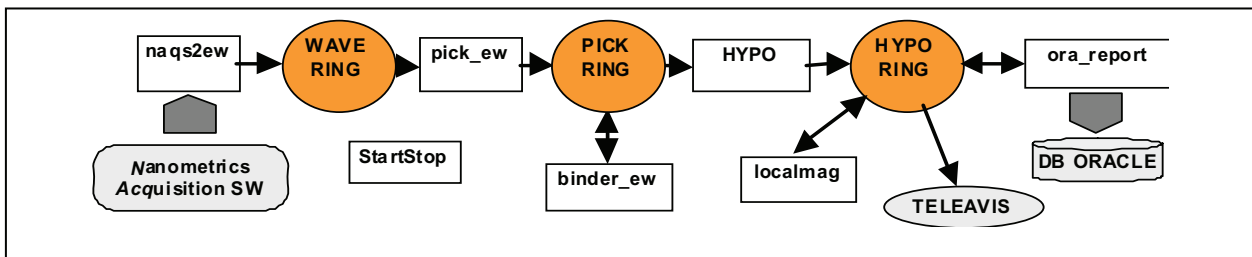A simplified diagram of its architecture is shown in Figure 2.

Figure 2. Simplified diagram of the Automatic Earthworm modules installed at Barcelona data centre

Generation of automatic damage scenarios (TELEAVÍS) SECTION

When an event is detected and located, the alert system sends an alert message according different criteria. The automatic generation of a seismic risk scenario based on vulnerability assessment methodologies, using GIS techniques has been developed and is implemented.

TELEAVÍS is an application designed for the automatic generation of reports from the hypocentre data of the earthquakes detected by DAS and for its transmission by fax, SMS, ftp and electronic mail. From the data received from DAS, TELEAVÍS develops an epicentral location map with planimetry of 1:250000 and other maps with the results of the damage scenario automatic computation and with the PGA and PGV computed from records of seismic stations. Damage scenarios have been computed (ESCENARIS soft) using methodologies proposed by Susagna et al. (2006), Roca et al. (2006) and those defined in the ISARD project (Irizarry et al., 2007).

Two different methods are used to compute automatic damage scenario, in function of data availability:

● Level 0 method is based on the following hypothesis:

 a) the unit of work is the total area of the municipality

 b) soil conditions are not considered

 c) EMS'98 scale is used to define vulnerability classes, and Damage Probability Matrices.

● Level 1 method:

 a) the units of work are differentiated polygons in each municipality,

 b) soil effects are considered,

 c) typologies are defined by structural and constructive criteria and vulnerability indexes and functions are used for each typology following RISK-UE methodology (Mouroux and Lebrun, 2006).

The application of these methods relays in the development of statistical distributions for both the vulnerability classes and the representative structural typologies of the studied regions. The distributions developed within the project are characteristic of the pilot zones considered. In order to apply these methodologies to other sites new statistical distributions should be developed. These methodologies had been included in an exercise to assess the applicability of different software packages to earthquake loss estimation in the context of rapid post-earthquake response in European urban centres (NERIES project) (Strasser, et al. 2008).

Acknowledgements

REFERENCES

GOULA, X., JARA, J.A., SUSAGNA, T. AND ROCA, A., 2001. A new Broad-Band Seismic Network with satellite Transmission in Catalonia (Spain). In: Observatories and Research Facilities for European Seismology, ORFEUS Newsletter, vol.3, nº1.

IRIZARRY, J., ROUSSILLON, P. GONZÁLEZ, M., COLAS, B. SEDAN, O. AND SUSAGNA, T. 2007. Escenarios transfronterizos de riesgo sísmico en el

Pirineo Oriental. 3er Congreso Nacional de Ingenieria Sísmica, Girona(Spain)

MOUROUX, P. AND LEBRUN, B. 2006. RISK-UE project: an advanced approach to earthquake risk scenarios with application to different european towns., In: C. S. Oliveira, A. Roca and X. Goula, (Editors), Assessing and Managing Earthquake Risk, Springer, 479 - 508

ROCA, A., GOULA, X., SUSAGNA, T., CHÁVEZ, J., GONZÁLEZ, M. AND REINOSO, E. 2006. A simplified method for vulnerability assessment of dwelling buildings and estimation of damage scenarios in Catalonia. Bulletin of Earthquake Engineering, 4, 141 -158

ROMEU, N, JARA, J.A., GOULA, X., SUSAGNA, T., FIGUERAS, S., OLIVERA, C. AND ROCA, A. 2006. Seismic Information Automatic Sytem. 5ª Asamblea Hispano-Portuguesa de Geodesia y Geofísica, Sevilla,

STRASSER, F. O., BOMMER, J. J., SESETYAN, K., CAGNAN, Z., ERDIK, M., IRIZARRY, J., GOULA, X., LUCANTONI, A., SABETTA, F., BAL I. E., CROWLEY, H. AND LINDHOLM C. 2009. A comparative study of European earthquake loss estimation tools for an earthquake scenario in Istanbul. Journal of Earthquake Engineering, In Press

SUSAGNA, T., GOULA, X., ROCA, A., PUJADES, L., GASULLA, N. AND PALMA, J.J. 2006. Loss scenarios for regional emergency plans: application to Catalonia, Spain. In: C. S. Oliveira, A. Roca and X. Goula, (Editors), Assessing and Managing Earthquake Risk, Springer, 463 - 478.

USGS, 2005. Earthworm Documentation Release 6.2, in http://folkworm.ceri. memphis.edu/ew-doc/.BURROUGH, P.A., 1996. Principles of Geographical Information Systems for land resources assessment. Clarendon Press, Oxford, 194 pp.