REAKT

Strategies and tools for Real Time EArthquake RisK ReducTion

Project Kick-off Meeting

Naples 20th-22nd September 2011

www.reaktproject.eu

OBJECTIVES

The general objective of the Project is to improve the efficiency of real time earthquake risk mitigation methods and its capability of protecting structures, infrastructures and people. REAKT aims at establishing the best practice on how to use jointly all the information coming from earthquake forecast, early warning and real time vulnerability assessment. All this information needs to be combined in a fully probabilistic framework, including realistic uncertainties estimations, to be used for decision making in real time.

REAKT will use a system-level earthquake science approach that requires that the various temporal scales of relevance for hazard and risk mitigation in the various WPs are integrated through common tools, databases and methods (as sketched in Figure 1).

The main specific objectives are:

1. a better understanding of physical processes underlying seismicity changes on a time scale from minutes to months;
2. the development, calibration and testing of models of probabilistic earthquake forecasting and the investigation of its potential for operational earthquake forecasting;

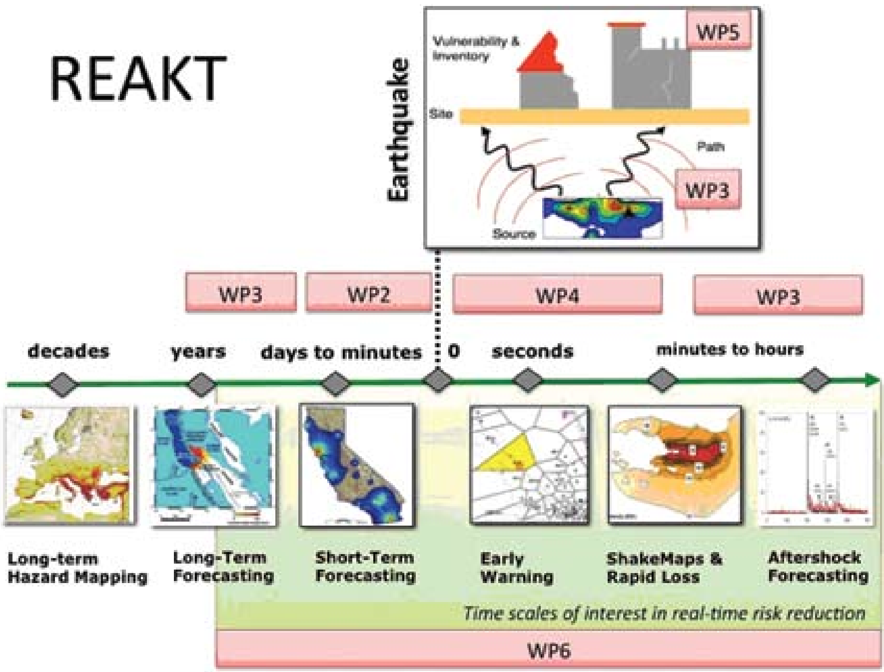

Figure 1. The earthquake risk reduction chain.

3. the development of time-dependent fragility functions for buildings, selected infrastructures, and utility systems;
4. the development of real time loss estimation models over the lifetime of structures and systems due to foreshocks, main shocks and their subsequent aftershock sequences.
5. the construction of a detailed methodology for optimal decision making associated with an earthquake early warning system (EEWS), with operational earthquake forecasting (OEF) and with real time vulnerability and loss assessment in order to facilitate the selection of risk reduction measures by end users;
6. the study of the content and way of delivering public communication, recognizing the value of a degree of self organization in community decision making;
7. the application of real time risk reduction systems to different situations (trains, industries, hospitals, bridges, schools, etc.).

THE CHALLENGE

All the components of a real time earthquake risk reduction system are treated jointly and coherently using a system level approach for the first time in REAKT (Figure 2). The decision system developed in WP6 will include information from operational forecasting models (WP3), early warning systems (WP4 and 7), rapid alert systems (WP4) and real time identification of physical vulnerability changes (WP5). The reliability of operational forecasting and early warning will be improved by information on the dynamics of earthquake processes and transient phenomena provided by WPs 2 and 4. Using a system level approach all uncertainties along the real time risk mitigation chain can be carried through to the various end-users, where decisions need to be taken in light of the uncertain knowledge. Critical to the success of REAKT is also the need to view the performance of the entire system from an end user perspective, which is why targeted applications (WP7) and close integration of end-users through the end-user group (EUG) are integral elements of the REAKT work plan.

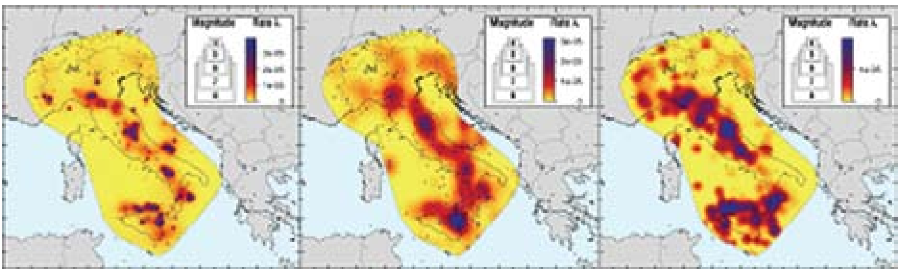

Figure 2. Examples of 1-day forecast maps of three models submitted to the Italian testing region of the EU CSEP Testing Centre.

EXPECTED RESULTS

- Advancement in estimating the capability of transient processes, such as strain variations, pore pressure, rate of seismic release, to trigger large earthquakes.
- Development of a 2nd generation of forecast models, accounting in principle for earthquake forerunners, that can be used for operational purposes.
- Implementation and testing of innovative earthquake early warning and rapid alert systems.
- Development of methodologies for real time dependent risk assessment of structures and systems of interest, combining time dependent hazard and forecasting with time dependent fragility functions.
- Feasibility study and network system design for citizen operated networks of embedded laptop motion sensors for rapid damage estimation.
- Feasibility of applications of early warning methods to protect different industries, public services, infrastructures.
- Increase the capability of project managers to take decisions under strong uncertainties.

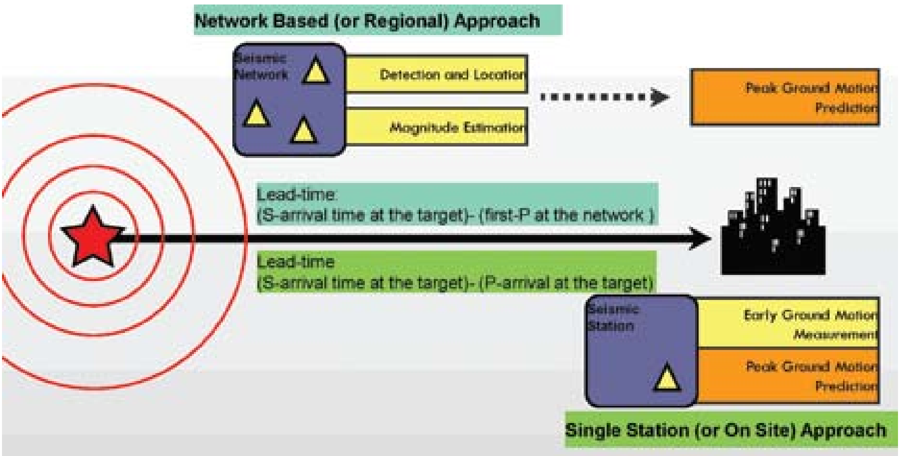

Figure 3. Basic concepts and measurements of earthquake early warning systems. WP4 proposes a new approach which integrates the network-based and on-site systems, providing with the real-time mapping of alert levels, defined upon threshold of measured early warning parameters.

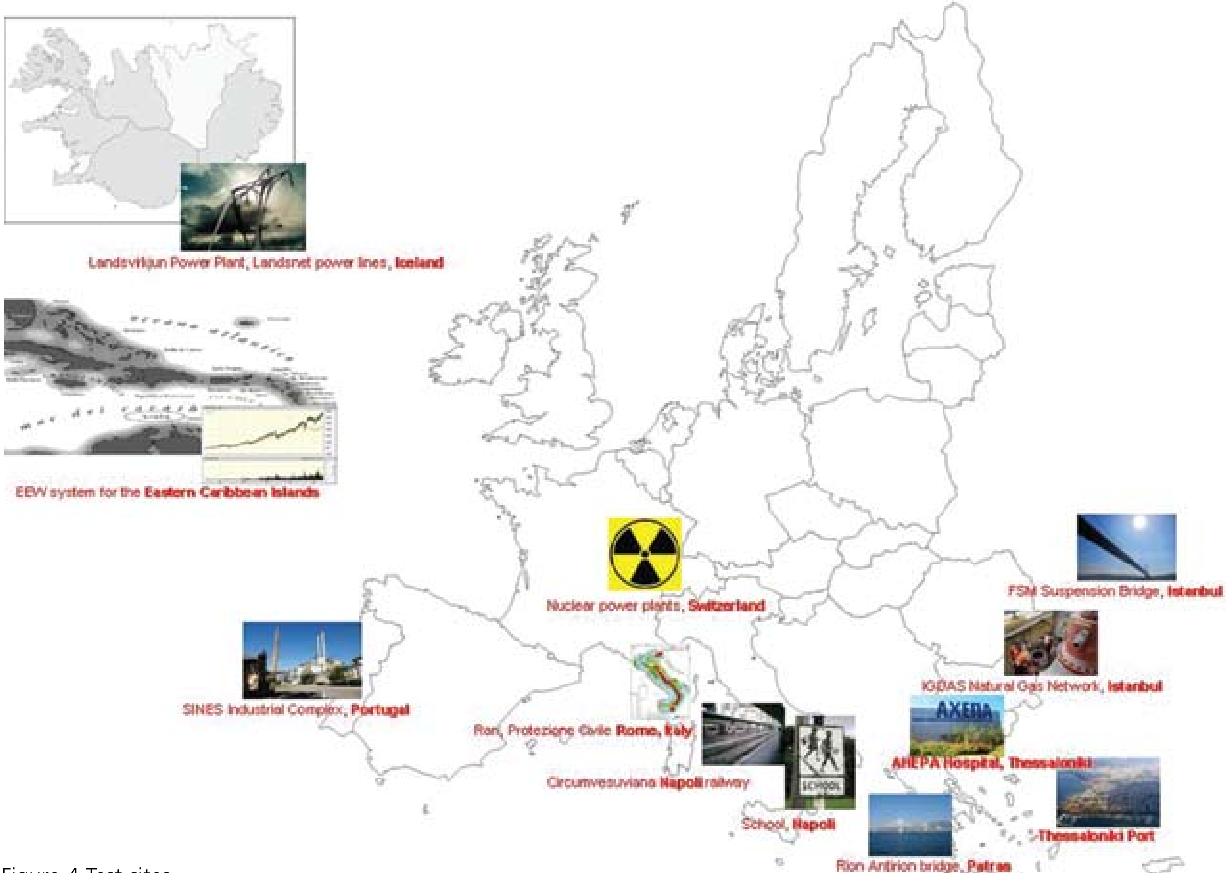

Figure 4.Test sites.

WP STRUCTURE

WP 1 – Project coordination and management
(A. Rossi Filangieri – AMRA)

- Task 1.1: Establish management and governance (P. Gasparini – AMRA)
- Task 1.2: Financial coordination (A. Rossi Filangieri – AMRA)
- Task 1.3: Monitor deliverable, attainment of milestones, progress reporting (A. Rossi Filangieri – AMRA)
- Task 1.4: Call and coordination of Project Meetings (A. Rossi Filangieri – AMRA)

WP 2 – Physics of short term seismic changes and its use for large earthquakes predictability
(P. Bernard – CNRS)

- Task 2.1: Instrumentation (P. Bernard – CNRS)
- Task 2.2: Observations and analysis (A. Deschamps – CNRS)
- Task 2.3: Modelling (M. Bouchon – CNRS)

WP 3 – Towards Operational Earthquake Forecasting
(W. Marzocchi – INGV)

- Task 3.1: Model building, calibration and testing (W. Marzocchi – INGV)
- Task 3.2: Building up a European framework that supports earthquake forecasting experiments (S .Wiemer – ETHZ)
- Task 3.3: Moving from earthquake probabilities to hazard models (W. Marzocchi – INGV)
- Task 3.4: Implementing Operational Earthquake Forecasting: Best practice guidelines and consensus building (W. Marzocchi – INGV)

WP 4 – Early Warning and rapid assessment of earthquake damage potential
(A. Zollo – AMRA/UNINA)

- Task 4.1: The physical grounds of early warning: Real-time estimation of seismic source properties, uncertainties and resolution (A. Zollo – AMRA/UNINA)
- Task 4.2: Engineering applications of early warning (I. Iervolino – AMRA/UNINA)
- Task 4.3: Mobile early-warning seismic network (S. Parolai – GFZ)
- Task 4.4: Innovative Solutions for Rapid Detection, Alert, Damage Assessment (R. Bossu – EMSC)

WP 5 – Real time-dependent risk assessment
(K. Pitilakis – AUTH)

- Task 5.1: Prerequisites for real time time-dependent vulnerability and risk assessment (K. Pitilakis – AUTH)
- Task 5.2: Time-dependent fragility functions (H. Modaressi – BRGM)

– Task 5.3: Instrumentation needs and modalities for real-time risk assessment of critical urban structures, infrastructures and facilities (M. Erdik – KOERI)
– Task 5.4: Time-dependent loss estimation (G. Manfredi – AMRA/UNINA)

WP 6 – Strategies and tools for decision making (T. Leguenan – BRGM)

– Task 6.1: Decision-making procedures for operational earthquake forecast (G. Woo – AMRA)
– Task 6.2: Decision-making procedures in time dependent risk assessment framework (G. Woo – AMRA)
– Task 6.3: Participatory Decision Making (T. Leguenan – BRGM)
– Task 6.4: Feasibility of a Decision support system (T. Leguenan – BRGM)

WP 7 – Strategic Applications and Capacity Building (G. Cua – ETHZ)

– Task 7.1: Work plans of the "Feasibility studies and initial EEW implementation efforts" for all the test sites (G. Cua – ETHZ)
– Task 7.2: Feasibility studies and initial EEW implementation efforts in nuclear power plants in Switzerland (S. Wiemer – ETHZ)
– Task 7.3: Feasibility studies on real-time risk mitigation in the SINES Industrial Complex, Portugal (C. Sousa Oliveira – IST)
– Task 7.4: Feasibility studies on EEW application to the Circumvesuviana Napoli railway (B. Montella – AMRA/UNINA) and at schools (A. Emolo – AMRA/UNINA)
– Task 7.5: Feasibility study on the implementation of hybrid EEW approaches on stations of the RAN network (A. Zollo – AMRA/UNINA)
– Task 7.6: Risk assessment and initial implementation efforts for using EEW to protect the IGDAS Natural Gas Network, Istanbul (M. Erdik – KOERI, A. Zollo – AMRA/UNINA)
– Task 7.7: Risk assessment and initial implementation efforts for using EEW to protect the Thessaloniki Port and the AHEPA Hospital, Thessaloniki (K. Pitilakis – AUTH)
– Task 7.8: Near-real-time probabilistic seismic hazard mapping and initial EEW implementation efforts in Iceland (K. Vogfjord – IMO)
– Task 7.9: Feasibility study of a regional EEW system for the Eastern Caribbean Islands (C. Lai – EUCENTRE)
– Task 7.10: Initial implementation efforts for an EEW system to protect the city of Patras, with special focus on the Rion Antirion bridge (E. Sokos – UPAT)
– Task 7.11: Risk assessment and initial implementation efforts for using EEW to monitor structural health of the FSM Suspension Bridge, Istanbul (E. Şafak – KOERI)
– Task 7.12: Report containing the main comments and recommendations of the End-Users Committee (G. Cua – ETHZ)

WP 8 – Dissemination
(S. Laskowski – KIT)

– Task 8.1: Dissemination, processes, products and web portal (S. Laskowski – KIT)
– Task 8.2: European reference reports (guidelines and recommendations) (S. Laskowski – KIT)
– Task 8.3: Development of knowledge base (S. Laskowski – KIT)
– Task 8.4: Developing and maintaining contacts outside the EU (P. Gasparini – AMRA)
– Task 8.5: Training and direct knowledge dissemination (P. Gasparini – AMRA)
– Task 8.6: Raising public awareness and engaging with Citizens through the use of social networks (R. Bossu – EMSC)

PROJECT PARTNERS

1. AMRA – ANALISI E MONITORAGGIO DEL RISCHIO AMBIENTALE – ITALY
2. GFZ – HELMHOLTZ-ZENTRUM POTSDAM DEUTSCHES GEOFORSCHUNGSZENTRUM – GERMANY
3. ETHZ – EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH – SWITZERLAND
4. BRGM – BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES – FRANCE
5. INGV – ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA – ITALY
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7. KIT – KARLSRUHER INSTITUT FUER TECHNOLOGIE – GERMANY
8. EMSC – EURO-MEDITERRANEAN SEISMOLOGICAL CENTRE – FRANCE
9. EUCENTRE – CENTRO EUROPEO DI FORMAZIONE E RICERCA IN INGEGNERIA SISMICA – ITALY
10. IMO – VEDURSTOFA ISLANDS – ICELAND
11. CNRS – CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE – FRANCE
12. UEDIN – SCHOOL OF GEOSCIENCES, UNIVERSITY OF EDINBURGH – UNITED KINGDOM
13. IST – INSTITUTO SUPERIOR TECNICO – PORTUGAL
14. KOERI – BOGAZICI UNIVERSITESI – KANDILLI OBSERVATORY ANDEARTHQUAKE RESEARCH INSTITUTE – TURKEY
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16. ULSTER – UNIVERSITY OF ULSTER – UNITED KINGDOM
17. UPATRAS – UNIVERSITY OF PATRAS – GREECE
18. CCEO – COUNCIL OF CARIBBEAN ENGINEERING ORGANIZATIONS – BARBADOS
19. SCEC – SOUTHERN CALIFORNIA EARTHQUAKE CENTER – USA
20. UWI – UNIVERSITY OF THE WEST INDIES – JAMAICA
21. NTU – NATIONAL TAIWAN UNIVERSITY – TAIWAN
22. JMA – JAPAN METEOROLOGICAL AGENCY – JAPAN
23. NKUA – NATIONAL & KAPODISTRIAN UNIVERSITY OF ATHENS – GREECE

PROJECT MANAGEMENT

INSTRUMENTS
FP7 – ENV-2011

SCIENTIFIC OFFICER
Denis Peter

FUNDING SCHEME
Collaborative Project (Large scale Integrating Project)

START DATE
1st September 2011

DURATION
36 Months

TOTAL COST
10,096,307.79 €

EC CONTRIBUTION
6,972.190.00 €

CONSORTIUM
23 partner from 15 countries

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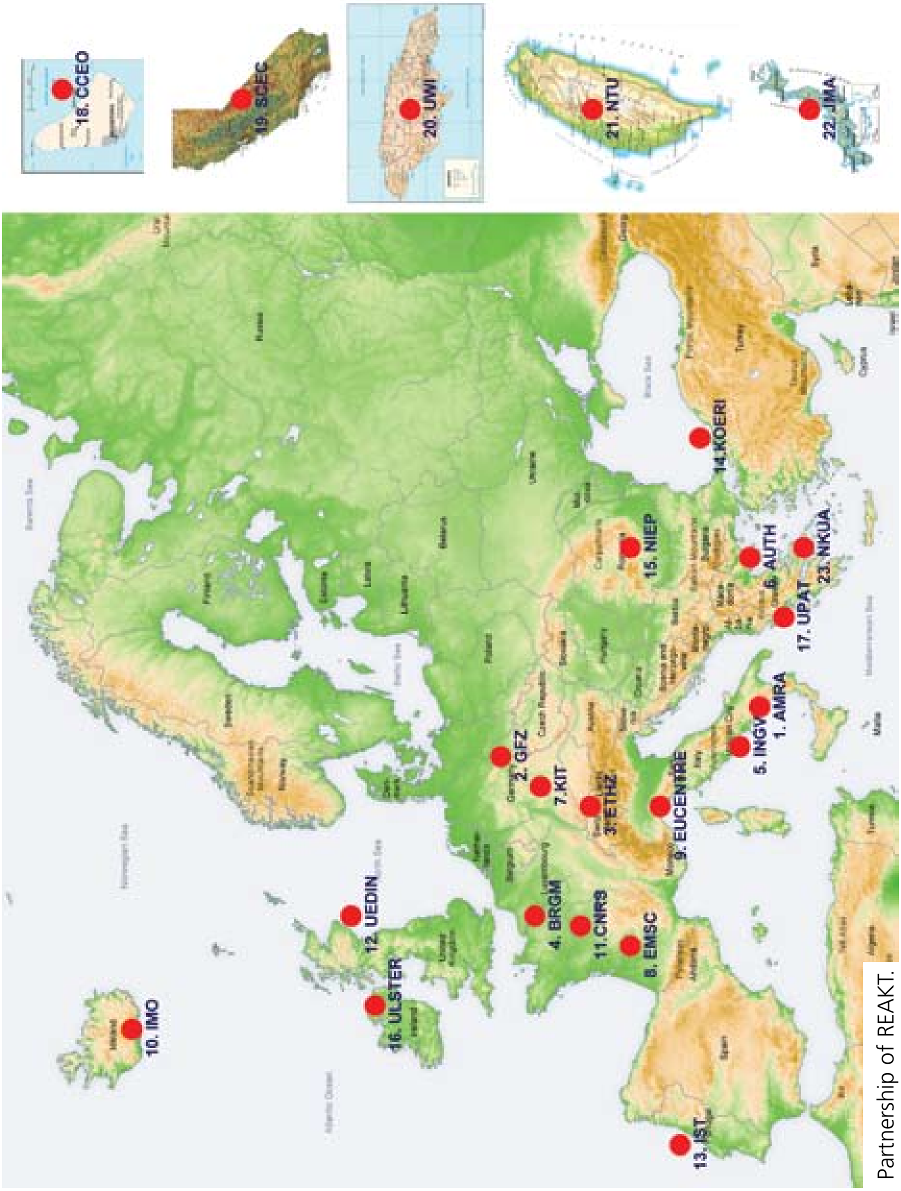
\+ 1 member of the End User Group

KEY WORDS
Earthquake hazard, Vulnerability and risk, Earthquake Early Warning, Earthquake operational forecasting.



Partnership of REAKT.

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