

MATRIX

Title: New Multi-Hazard and Multi-Risks Assessment Methods for Europe

Instrument: FP7, Collaborative project

Total Cost: 4.314.417€

EC Contribution: 3.395.870.60€

Duration: 36 months

Start Date: 1/10/2010

Consortium: 12 partners from 10 countries

Project Coordinator: Helmholtz-Zentrum Potsdam Deutsches GeoForschungszentrum (Germany)

Project Web Site: <http://matrix.gpi.kit.edu>

Key Words: Multi-type hazards and risks, extreme risk comparability, cascade effects, time-dependent vulnerability.

THE CHALLENGE

MANY PARTS OF EUROPE ARE AT RISK FROM A VARIETY OF NATURAL EXTREME EVENTS, SUCH AS EARTHQUAKES, LANDSLIDES, VOLCANIC ERUPTIONS, WILDFIRES, TSUNAMIS, STORMS, AND COASTAL AND INLAND FLOODING. SUCH PHENOMENA ARE USUALLY TREATED INDIVIDUALLY BY SCIENTISTS AND ENGINEERS WHO ADVISE CIVIL PROTECTION AUTHORITIES AND POLICY MAKERS. HOWEVER, THESE EVENTS OFTEN OCCUR IN COMBINATION, HENCE THERE IS A NEED TO CONSIDER THE SPATIAL, TEMPORAL AND CAUSAL RELATIONSHIPS BETWEEN THEM TO ALLOW BETTER PREDICTIONS, MITIGATION, AND RESPONSE PLANS TO BE MADE. MATRIX SETS OUT TO DO THIS, USING NEW MULTI-TYPE RISK AND HAZARD ASSESSMENT METHODS THAT PROPAGATE THE UNCERTAINTIES INHERENT IN EACH PHENOMENA'S ASSESSMENT, WHILE TAKING INTO ACCOUNT TEMPORAL VARIABILITY AND CASCADING EFFECTS.

PROJECT OBJECTIVES

WHILE EXTENSIVE WORK HAS BEEN CARRIED OUT ON INDIVIDUAL EXTREME EVENTS, MATRIX WILL FOCUS ON MULTI-TYPE HAZARD AND RISK ASSESSMENT, SINCE SUCH EVENTS OFTEN OCCUR IN COMBINATION, E.G., HEAVY RAINS MAY LEAD NOT ONLY TO FLOODING, BUT ALSO TO LANDSLIDES. THE CORE OBJECTIVES OF MATRIX ARE THE DEVELOPMENT OF METHODS AND TOOLS TO CONSIDER MULTIPLE NATURAL HAZARDS WITHIN A COMMON FRAMEWORK. THIS WILL ALLOW FUTURE ANALYSTS TO OPTIMISE RISK ASSESSMENT PROCESSES, CONTRIBUTE TO OPTIMISING DATA MANAGEMENT FOR HAZARD AND VULNERABILITY REDUCTION, AND SUPPORT COST-EFFECTIVE DECISIONS WHEN DEFINING MITIGATION AND ADAPTATION MEASURES WITHIN A MULTI-HAZARD CONTEXT.

TO ACHIEVE THIS, FOUR SUB-OBJECTIVES WILL BE PURSUED:

- ◆ DEVELOPMENT OF NEW METHODOLOGIES FOR MULTI-TYPE HAZARD AND RISK ASSESSMENT THAT CONSIDER RISK COMPARABILITY, CASCADE EFFECTS, AND TIME DEPENDENCE OF SOCIAL AND INFRASTRUCTURE VULNERABILITY.
- ◆ COMPARING THESE NEW METHODOLOGIES WITH STATE-OF-THE-ART SINGLE-RISK ANALYSIS.
- ◆ ESTABLISHING AN INFORMATION TECHNOLOGY FRAMEWORK FOR TEST CASE ANALYSIS WITHIN A MULTI-RISK CONTEXT.
- ◆ DISSEMINATION OF RESULTS TO RELEVANT COMMUNITIES AND END USERS (SCIENTIFIC, TECHNICAL, AND POLITICAL).



METHODOLOGY

FIRST, BEST PRACTICES FOR ASSESSING SINGLE- AND MULTI-TYPE HAZARDS OF MOST CONCERN TO EUROPE WILL BE REVIEWED. SINCE EACH SPECIFIC HAZARD INVOLVES DIFFERENT SPATIAL SCALES, RETURN PERIODS AND VASTLY DIFFERENT SOURCES OF UNCERTAINTY, SIGNIFICANT EFFORT WILL BE SPENT ON HARMONIZING THE CURRENT METHODOLOGIES, WHILE ALSO CONSIDERING SOCIETAL RISK AVERSION. IN ADDITION, THE DATA RELEVANT TO THESE RISKS WILL BE GATHERED AND HARMONIZED.

MATRIX WILL EXPLORE THE CONDITIONS WHERE INDIVIDUAL HAZARDS INTERACT, LEADING TO CASCADING OR DOMINO EFFECTS, AGAIN REQUIRING NEW PROBABILISTIC SCHEMES. SIMILARLY, TIME-DEPENDENT VULNERABILITY WILL BE CONSIDERED, PARTICULARLY WHEN EVENTS OCCUR IN RAPID SUCCESSION, WITH LATER EVENTS INFLECTING GREATER DAMAGE ON ALREADY WEAKENED POPULATIONS AND INFRASTRUCTURE.

THE DEVELOPED METHODOLOGIES WILL BE TESTED AT SELECTED SITES (NAPLES IN ITALY, COLOGNE IN GERMANY, AND THE FRENCH WEST INDIES), REPRESENTING CHARACTERISTIC SITUATIONS. A "VIRTUAL CITY" APPROACH WILL ALSO BE EMPLOYED, IN ORDER TO PROVIDE A FLEXIBLE INFORMATION TECHNOLOGY TOOL FOR TESTING CONDITIONS THAT AREN'T MET IN THE CHOSEN TEST SITES.

DISSEMINATION IS A CRUCIAL ASPECT OF THIS PROJECT AND IT WILL BE UNDERTAKEN BY FORMULATING TRAINING PROGRAMS, THE DEVELOPMENT OF A WEB-WIKI PROGRAM FOR DOCUMENTING RELEVANT ISSUES AND PROGRESS, AND THE INVOLVEMENT OF THE EUROPEAN CIVIL PROTECTION PLATFORMS AND OTHER INTERESTED END-USERS AT THE PROJECT'S GENERAL ASSEMBLES.

EXPECTED RESULTS

HARMONIZING SINGLE-TYPE HAZARD AND VULNERABILITY ASSESSMENT MODELS WITHIN A MULTI-RISK CONTEXT WILL SUPPORT THE DEVELOPMENT OF A FRAMEWORK FOR ASSESSING AND COMPARING RISKS ASSOCIATED WITH DIFFERENT NATURAL THREATS IN A CONSISTENT MANNER. SUCH A FRAMEWORK WILL AID RATIONAL ADAPTATION AND RISK MITIGATION IN SOCIETIES THREATENED BY MULTIPLE HAZARDS.

THE NEW DEVELOPMENTS ON RISK COMPARABILITY, CASCADING EVENTS, AND TIME-DEPENDENT VULNERABILITY WILL PROVIDE MORE REALISTIC, CREDIBLE AND LEGITIMATE INFORMATION FOR DECISION MAKERS. THE IMPACT WILL BE INSIGHTS THAT CAN POTENTIALLY REDUCE BEHAVIOURAL AND INSTITUTIONAL BARRIERS TO USING ANALYTICAL APPROACHES, SUCH AS COST-BENEFIT AND MULTI-CRITERIA ANALYSES, IN PUBLIC POLICY DECISIONS FOR MANAGING MULTIPLE HAZARDS.

MATRIX WILL IDENTIFY APPROPRIATE DECISION-ANALYTICAL METHODS FOR RISK MITIGATION AND ADAPTATION TO MULTIPLE HAZARDS AND EVALUATE THE BARRIERS AND BENEFITS OF THIS MULTI-RISK APPROACH COMPARED TO CLASSICAL SINGLE-RISK ONES.

FINALLY, GUIDELINES FOR BEST PRACTICES IN MULTI-RISK ASSESSMENT WILL BE FORMULATED, AND THE PLANNED DISSEMINATION SCHEME WILL ENSURE A LASTING AND WIDESPREAD USE OF **MATRIX** PRODUCTS AFTER THE END OF THE PROJECT. OF PARTICULAR IMPORTANCE WILL BE THE INTERACTION WITH THE EU, WHERE THE RESULTS FROM **MATRIX** ARE EXPECTED TO BE INCORPORATED INTO THE GUIDELINES CURRENTLY BEING FORMULATED FOR HAZARD AND RISK ASSESSMENT WITHIN EUROPE.

PROJECT PARTNERS	
Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum	DE
Analisi e Monitoraggio de Rischio Ambientale AMRA Scarl	IT
Bureau de Recherches Geologiques et Minieres	FR
Stiftelsen Norges Geotekniske Institutt	(Norway) NO
Internationales Institut für Angewandte Systemanalyse	AT
Aspinall William Phillip - Aspinall & Associates	GB
Karlsruher Institut für Technologie	DE
Technische Universiteit Delft	NL
Eidgenössische Technische Hochschule Zürich	(Switzerland) CH
Instituto Superior de Agronomia	PT
Deutsches Komitee Katastrophenvorsorge e.V.	DE
University of British Columbia	(Canada) CA

