



**BRGM**  
—  
THE FRENCH  
GEOLOGICAL  
SURVEY

Contributions to Disaster Risk Reduction

H. Fabriol

Vice-Director of Risks and Prevention Direction

Florent de Martin

Seismic and volcanic risks Unit



Geoscience for a sustainable Earth

**brgm**

## THE FRENCH GEOLOGICAL SURVEY

THE BRGM IS FRANCE'S LEADING PUBLIC INSTITUTION WORKING IN EARTH SCIENCE APPLICATIONS FOR THE MANAGEMENT OF SURFACE AND SUBSURFACE RESOURCES AND RISKS.

## ITS ACTIVITIES ARE GEARED TO

- SCIENTIFIC RESEARCH,
- SUPPORT TO PUBLIC POLICY DEVELOPMENT
- INTERNATIONAL COOPERATION

## UNDERSTANDING

*geological phenomena and associated risks.*

## DEVELOPING

*new methodologies and techniques.*

## PRODUCING

*and disseminating data to support the management of soils, subsoils and their resources.*

## DELIVERING

*the necessary tools for managing soils, subsoils and their resources, preventing risks and pollution and developing climate change policies.*

Over

**1100** staff

*including more than 700 engineers and researchers*

**BUILDING ON GEOLOGY AS ITS CORE COMPETENCE, BRGM DEVELOPS EXPERT KNOWLEDGE IN RESOURCE MANAGEMENT, RISK MANAGEMENT AND INNOVATIVE ECOTECHNOLOGIES.**

**THESE ACTIVITIES ARE ORGANISED INTO 10 MAIN TOPIC AREAS THAT ADDRESS DIFFERENT INDUSTRIAL AND SOCIAL CHALLENGES.**



**GEOLOGY**

14.33 M€  
2013  
turnover



**MINERAL RESOURCES**

7.07 M€  
2013  
turnover



**GEOHERMAL ENERGY**

7.16 M€  
2013  
turnover



**GEOLOGICAL STORAGE OF CO<sub>2</sub>**

4.31 M€  
2013  
turnover



**WATER**

23.52 M€  
2013  
turnover



**ENVIRONMENT AND ECOTECHNOLOGIES**

20.50 M€  
2013  
turnover



**RISKS**

17.29 M€  
2013  
turnover



**POST-MINING**

24.99 M€  
2013  
turnover



**LABORATORIES AND EXPERIMENTATION**

5.36 M€  
2013  
turnover



**INFORMATION SYSTEMS**

8.23 M€  
2013  
turnover



## RISKS

The BRGM implements research programmes , decision-support and diagnostic tools to anticipate, prevent and manage surface and subsurface risks.

- **RISK ASSESSMENTS AND RISK REDUCTION**
- **DESIGNING SURVEILLANCE SYSTEMS AND PREDICTIVE MODELS**
- **VULNERABILITY ASSESSMENTS**
- **DELIVERING DATABASES**
- **MAPPING AND UNDERSTANDING GEOLOGICAL AND COASTAL RISKS**
- **ASSESSING CLIMATE CHANGE IMPACTS**
- **SAFETY ANALYSES OF UNDERGROUND STORAGE AND SUB-SURFACE WORKINGS**
- **POST-MINING EXPERT STUDIES**
- **THIRD-PARTY EXPERT STUDIES ON NATURAL RISKS AND UNDERGROUND STORAGE**

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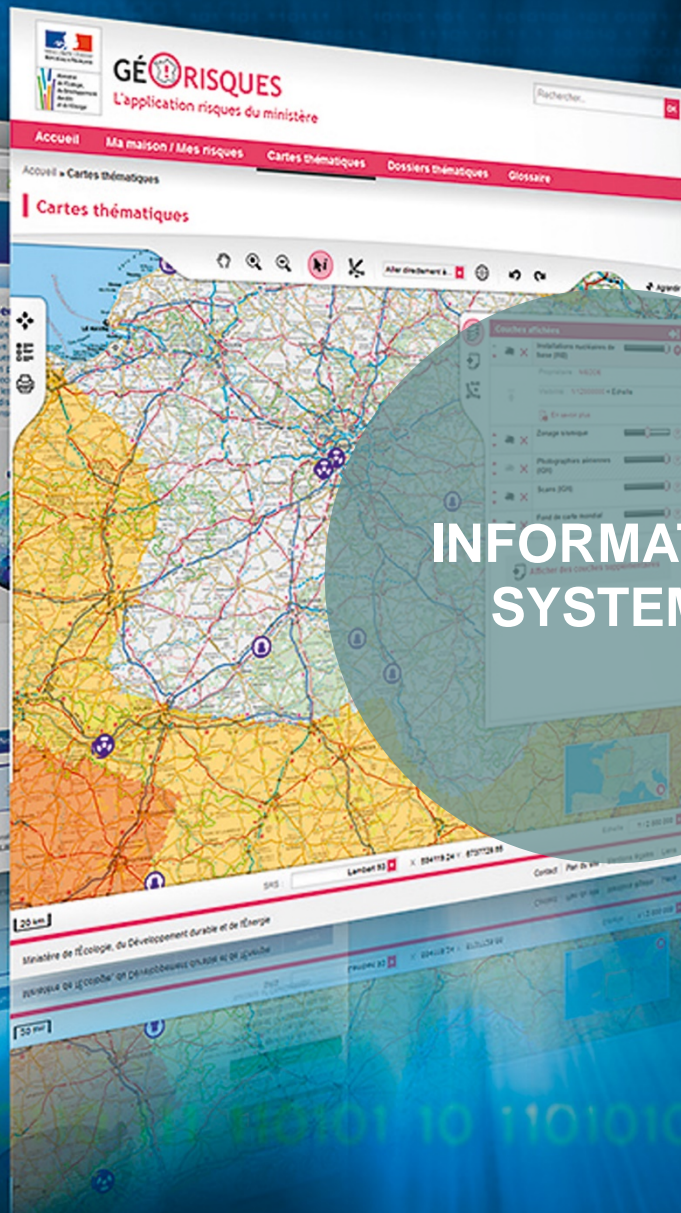
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alogue

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Particip

Particip



# INFORMATION SYSTEMS

The BRGM delivers geological and environmental data via information and communication technologies to provide the public authorities, economic players and the general public with georeferenced data to aid decision-making.

- EARTHQUAKES
- TSUNAMIS
- LANDSLIDES
- FLOODINGS
- SHINKING AND SWELLING OF CLAYS
- UNDERGROUND CAVITIES

# Research implementation for disaster risk reduction



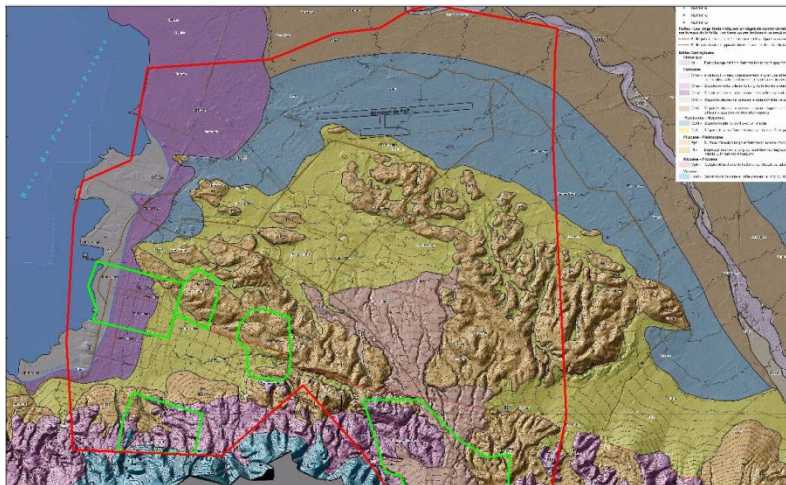
## Haiti National Microzonation program (after the 2010 earthquake)

- Funded by UNDP for the Haitian Ministry of Public Work
- Microzonation of Port au Prince ; then Cap Haitien, Fort-Liberté, Ouanaminthe, Port de Paix

### Objectives:

- **Training of the Haitian team** to perform seismic microzonation
- Producing **microzonation maps**:
  - Site effects maps: soil seismic response and ground motion spectra
  - Induced effects maps: lands instability and liquefaction
  - Recommendations for risk prevention plans

### Vulnerability of the Northern Province



Risks and Prevention Division

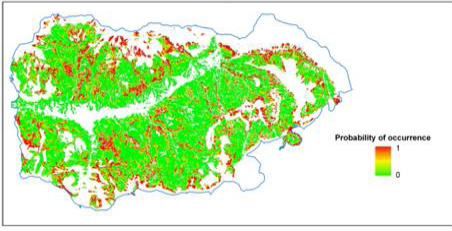
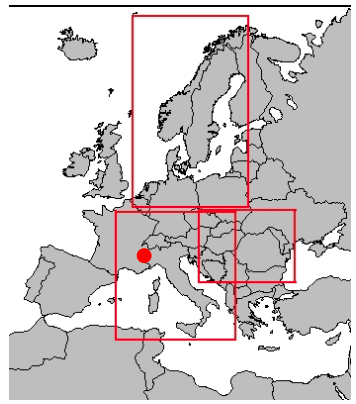
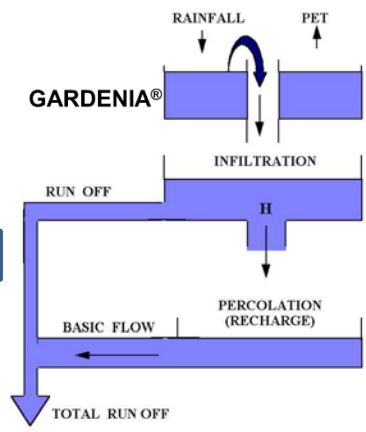
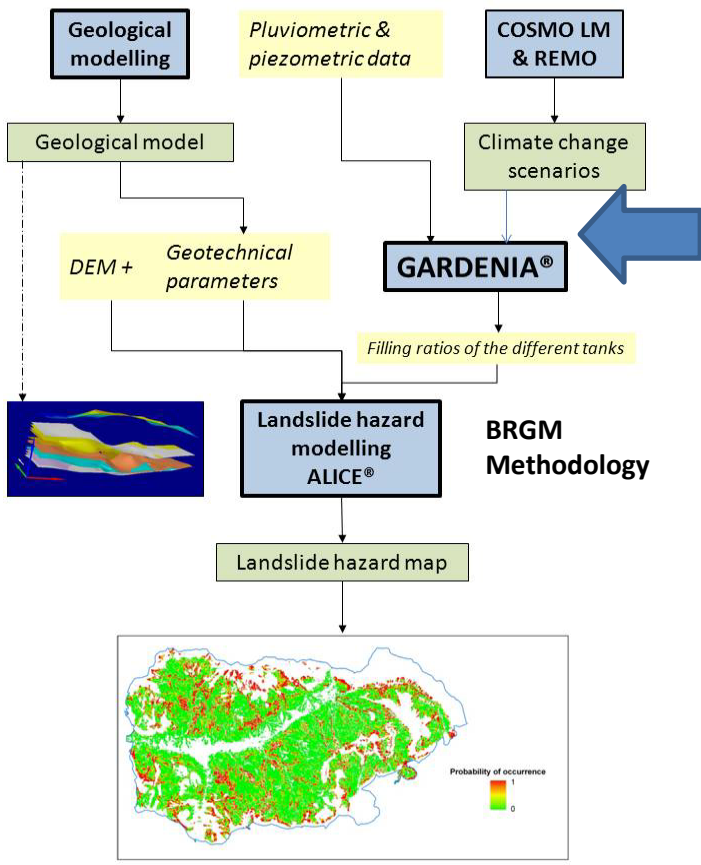
4 Years:  
2011-2015

Collaboration between

- BRGM
- Bureau des Mines et de l'Énergie
- Laboratoire National du Bâtiment et des Travaux Publics



**Integrate global changes scenarios in the assessment of landslide hazard and risk evolution in selected "hotspot" areas in Europe**



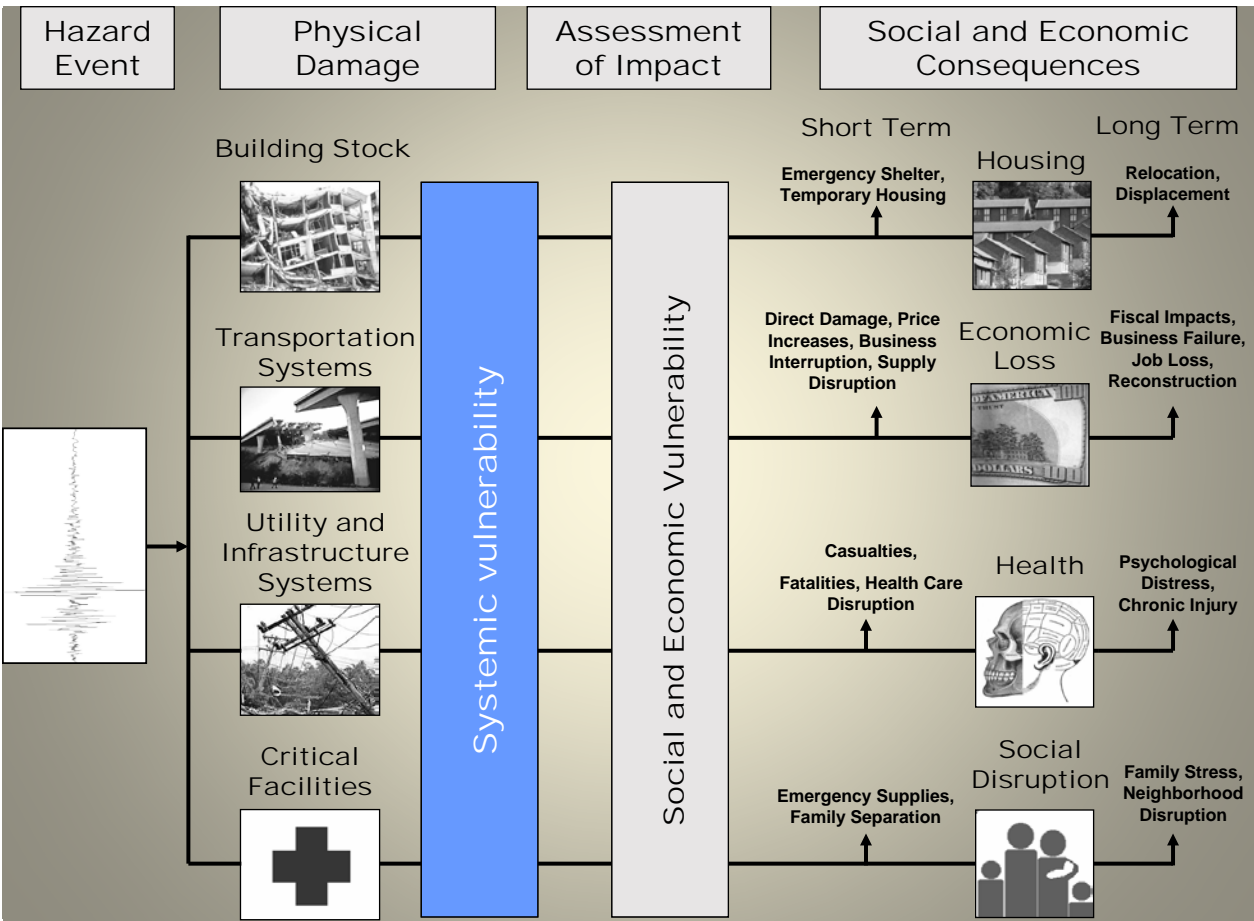
**3** Years: 2009-2012  
<http://www.safeland-fp7.eu>





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- ⇒ **Understanding systemic vulnerability of human-constructed system (city, region, lifeline network, etc.)**
- ⇒ **Proposing appropriate methods and tools to consider intra-systems interdependencies, including socio-economic features**
- ⇒ **Promoting the use of modern resources and tools for seismic risk mitigation**
- ⇒ **Establishing a European reference for seismic societal and physical vulnerability**



4 Years: 2009-2013

<http://www.vce.at/SYNER-G>







Risks and Prevention Division

To develop methods and tools to tackle multiple natural hazards within a common framework.

Focusing on:

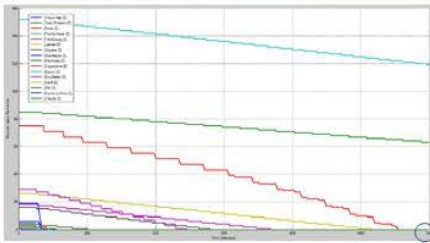
- ⇒ Risk comparability and uncertainties
- ⇒ Cascading hazards and impacts
- ⇒ Time-dependent vulnerability for joint/successive hazards
- ⇒ Helping future analysts to optimize the risk assessment process

3 Years:  
2010-2013

<http://matrix.gpi.kit.edu>

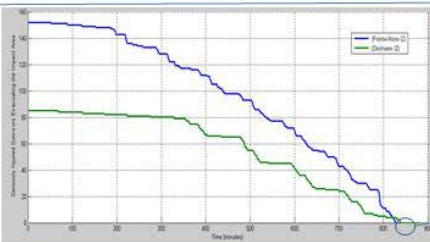
#### Evacuation of severe injured people vs time

#### Treatment of severe injured people vs time



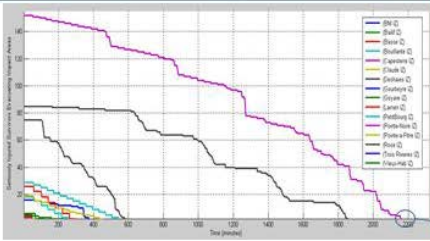
- Without damage to lifelines
- Without optimization policy

1200min



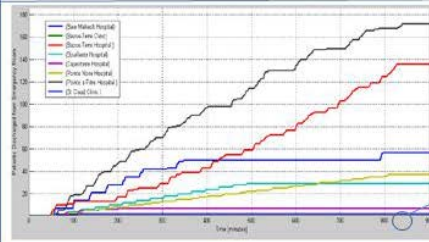
- Without damage to lifelines
- With optimization policy

840min

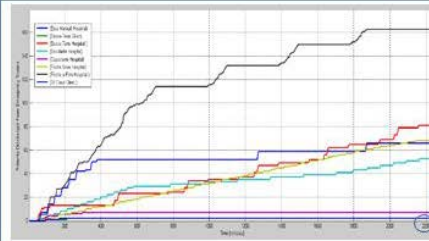


- With damages to lifelines
- With optimization policy

2150 min



880



2180

Coordinated by



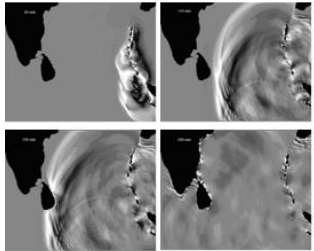
# Research on Tsunamis

## Example on Sumatra 2004

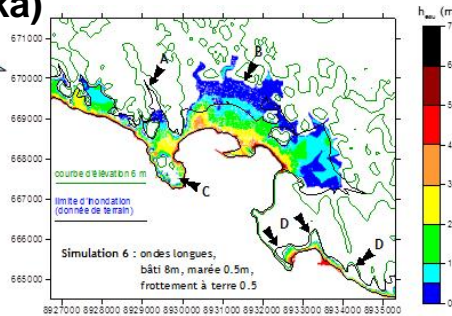
- ⇒ Modeling of generation/propagation/submersion
- ⇒ Hazard mapping
- ⇒ Building typology and Damage scale
- ⇒ Vulnerability curves and Risk mapping



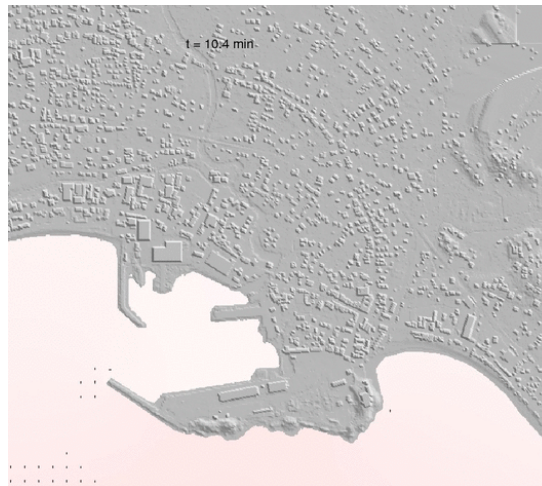
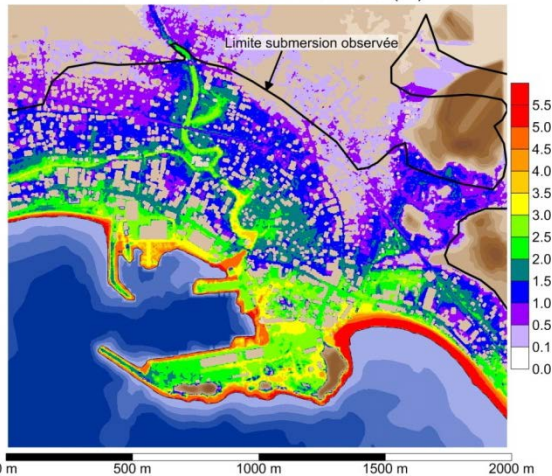
### City of Galle (Sri Lanka)



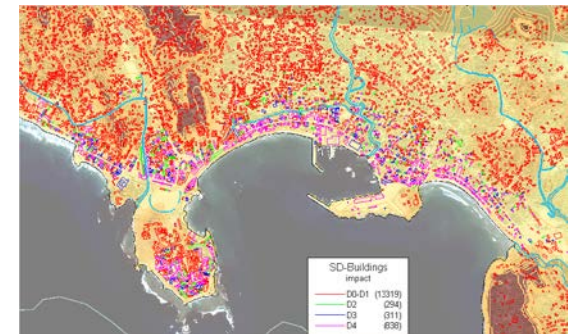
Emboitements jusqu'à  
résolution de 2.5 m, prise  
en compte du bâti et  
ouvrages (données Lidar)



Hauteur de la submersion à terre (m)



9 Rank A publications  
over 2009-2012



# International Charter "Space and Major Disasters"

## The Intervention Cell of technical and scientific expertise (CIEST, since 2005)

To ease:

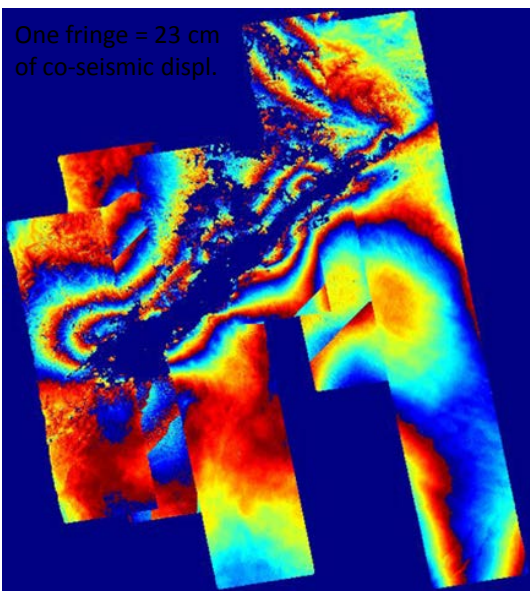
- Collaborative effort of French institutions (CNES, INSU-CNRS, BRGM, CEA, IRD, IPGP)
- Exchanges of information and data between the Charter partners and the space agencies during and after events (earthquakes, volcanic eruptions, landslides, tsunami) triggering the International Charter.



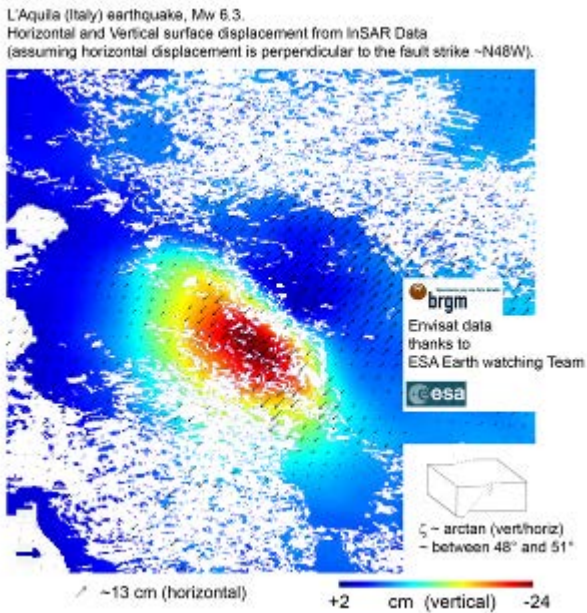
[www.disasterscharter.org](http://www.disasterscharter.org)



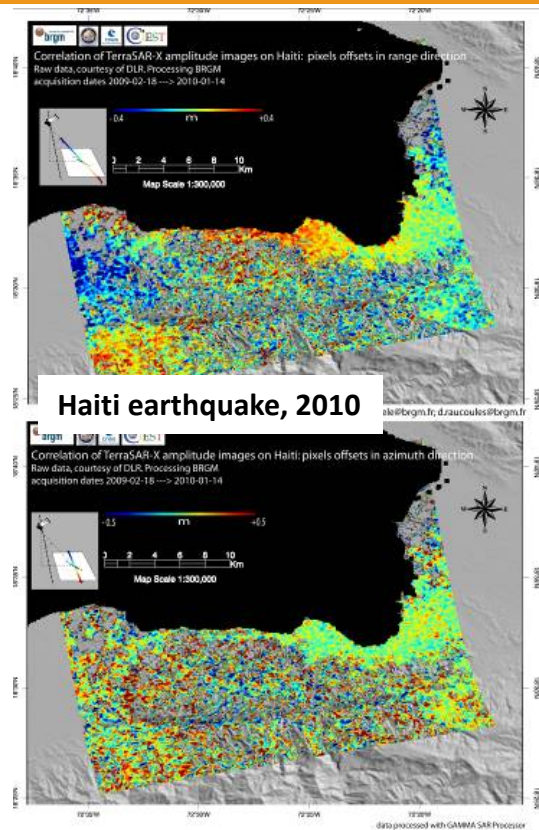
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Sichuan earthquake, 2008 (China): Alos PALSAR L-band interferometry



L'Aquila earthquake, 2009 (Italy)



Cellule d'Intervention et d'Expertise Scientifique et Technique

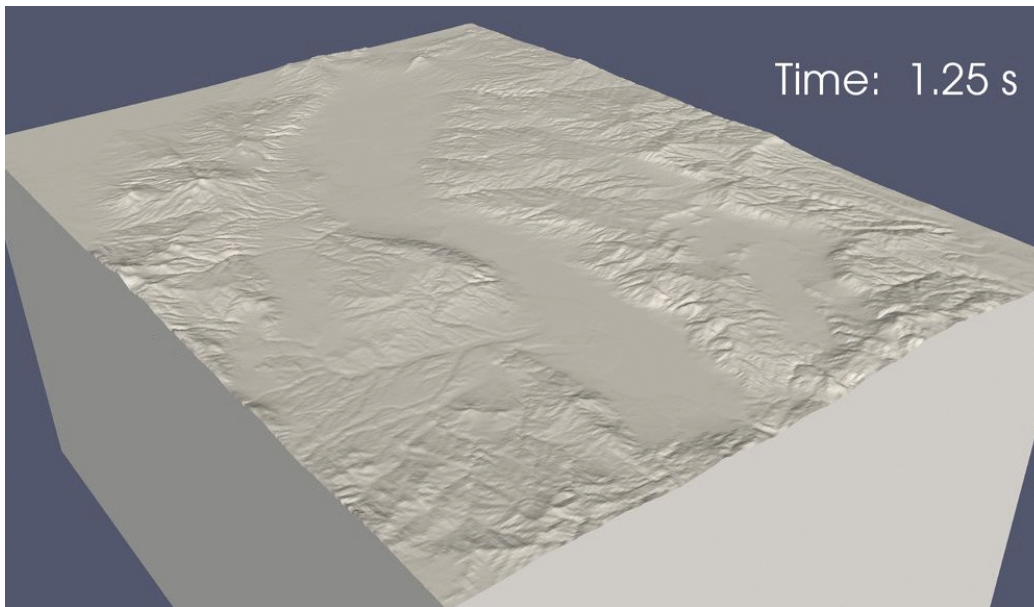




Risks and Prevention  
Division

***Sending and receiving young scientists at the forefront of recent knowledge enables BRGM to renew and strengthen its creativity on original scientific issues***

Toward more realistic simulations for seismic hazard assessment  
→ past exchanges with DPRI led to improve understanding of waves propagation in complex geological medium



Seismic waves propagation in the Mygdonian basin (Greece)  
computed by EFISPEC3D<sup>©BRGM</sup> (Project Euroseistest Verification and Validation)

[HTTP://EFISPEC.FREE.FR](http://EFISPEC.FREE.FR)

8 EXCHANGES  
DPRI-BRGM

*5 stays of BRGM's researchers  
at DPRI*

*3 stays of DPRI's researchers  
at BRGM*

= 32 months  
of exchanges

Supported by



# Strategy and Perspectives

## From Geo-hazards expertise to integrated risks management in the context of global change

- ***Improve and disseminate the knowledge about geological hazards***
  - Integrate global change in their assessment
  
- ***Develop multi-hazard and multi-risk approaches***
  - Including uncertainty management
  - Supporting decision-makers for an informed multi-risk management of land-use in the aim of a sustainable use of urban and rural territories
  
- ***Assess urban systems vulnerability***
  - Reduce communities vulnerability
  
- ***Develop mitigation and adaptation strategies***
  - Improve resilience to geological and climatic risks
  - Elaborate adaptation strategies to climate change-induced hazards
  
- ***Strengthen early warning and crisis management preparedness***

# Strategy and Perspectives

- ***Take up more and more complex challenges arising to human communities***
  - Develop transverse approaches to man-made subsurface risks
  
- ***Keep heading towards leading-edge research in Geosciences***
  - New demand for geosciences to support the development of “green” industries
  - Strengthen innovation and industrial competitiveness
  - Foster national and international collaborations and exchanges
  
- ***Guide and advise public-policies to find answers to emergent questioning***
  - Accompanying the evolution of the roles of the State at all levels
  
- ***Inform actors and raise awareness of the public***
  - Educate and communicate in the field of geoscience

# Strategy and Perspectives : Major challenges

- *Understanding and quantifying the impacts on natural hazards of climate change and increased human pressure on the environment, in order to derive appropriate adaptation strategies*
- *Expanding vulnerability assessment methods and their geographical coverage, including vulnerability assessment of urban / peri-urban systems*
- *Improving our capacity to support public authorities and private stakeholders in the management of crises due to natural hazards*
- *Improving the reliability of computations/simulations (e.g. to better reflect the complexity of phenomena or heterogeneity of the geological medium) and quantifying their uncertainties,*
  - strengthening the capacity to appropriately assess and manage low-probability-high-consequences events
- *Coping with numerous data and computationally intensive models: use High Performance Computing, distributed sensors and/or crowdsourcing, Bigdata ...*

# Suggestions for Disaster Reduction Roadmap

- ***Multidisciplinary approaches to natural disaster.***
  - Evaluate the populations' perception of risk, land use planning policies, mitigation and adaptation strategies;
  - Assess potential costs of natural risks, to support decision-maker in securing appropriate credits.
- ***Collaborate with the economics scientific community, including insurance companies***
- ***Contribute to populations resilience during the crisis and post-crisis phases, through:***
  - Developing alert systems, support to emergency aid during crisis and feedback of experiences;
  - Designing tools for systemic risks analysis and predictive modelling
- ***Translate the scientific progresses and achievements (in terms of data, tools and methods) to the benefit of concrete disaster risk reduction policies***
- ***Develop the capacity to educate populations for an appropriation of risk mitigation actions***
- ***Responsibility of Research Institutes to knowledge transfer in less developed countries, to help building local competencies***





1st announcement

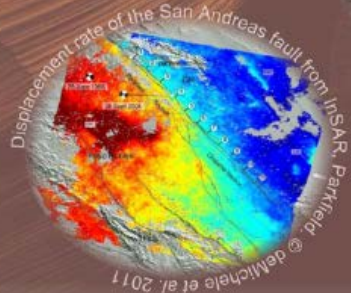


# French-Japanese Symposium on Earthquakes & Triggered Hazards



BRGM-Orléans <sup>1hr from Paris</sup>  
France

Wed. 16 - Fri. 18  
September 2015



**Organising Committee**  
BRGM and DPRI, Kyoto University



# THANK YOU FOR YOUR ATTENTION