The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
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IAEA
International Atomic Energy Agency

2053-39

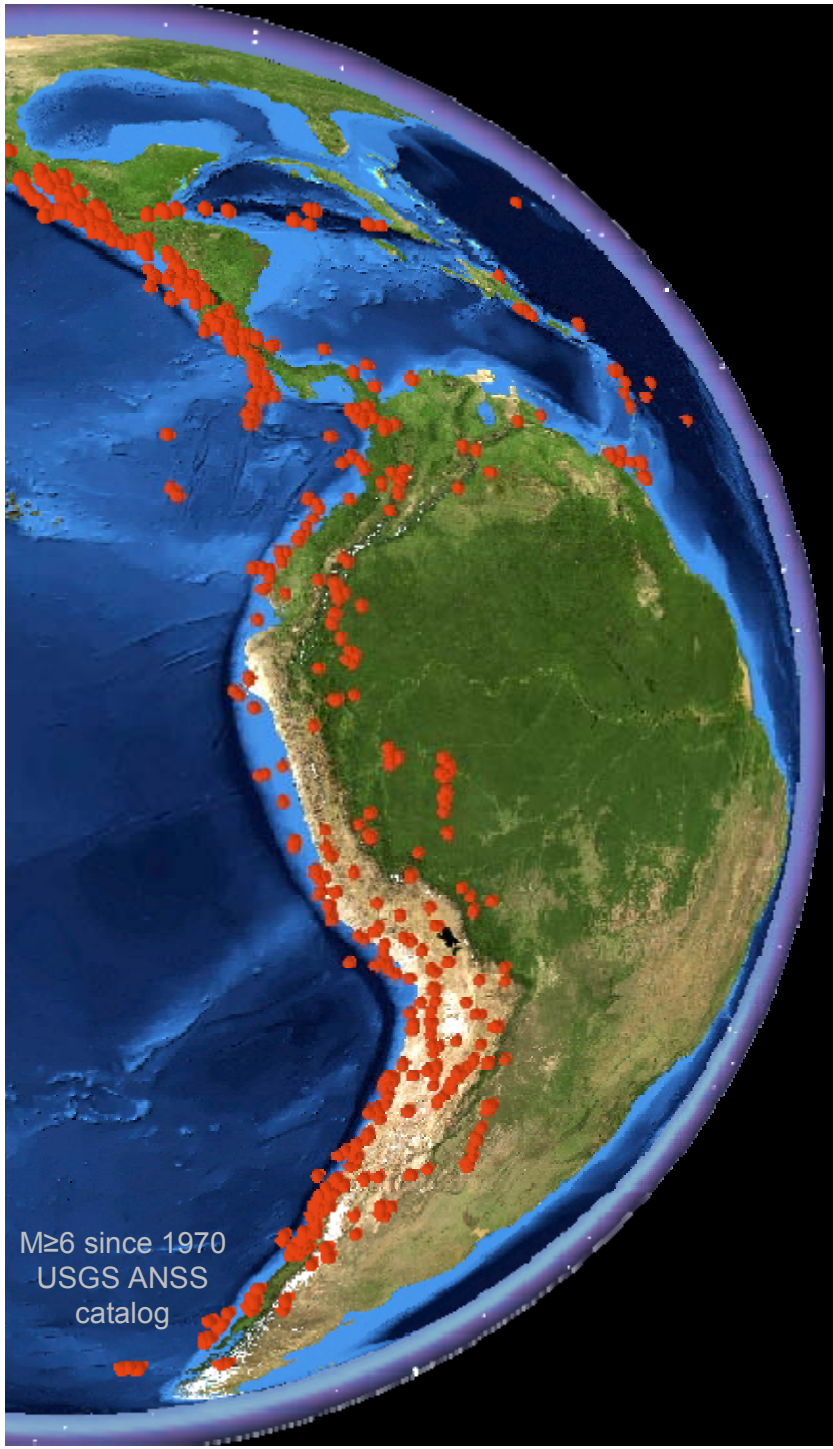
Advanced Workshop on Evaluating, Monitoring and Communicating Volcanic and Seismic Hazards in East Africa

17 - 28 August 2009

The Global Earthquake Model initiative and Africa; presentation and open discussion

Ross Stein
US Geological Survey, Menlo Park
USA

Strada Costiera 11, 34151 Trieste, Italy - Tel.+39 040 2240 111; Fax +39 040 224 163 - sci_info@ictp.it



GEM

Access to lucid seismic risk information should be a human right

Building and testing the model should be our professional responsibility

This can be accomplished only through international public-private partnership

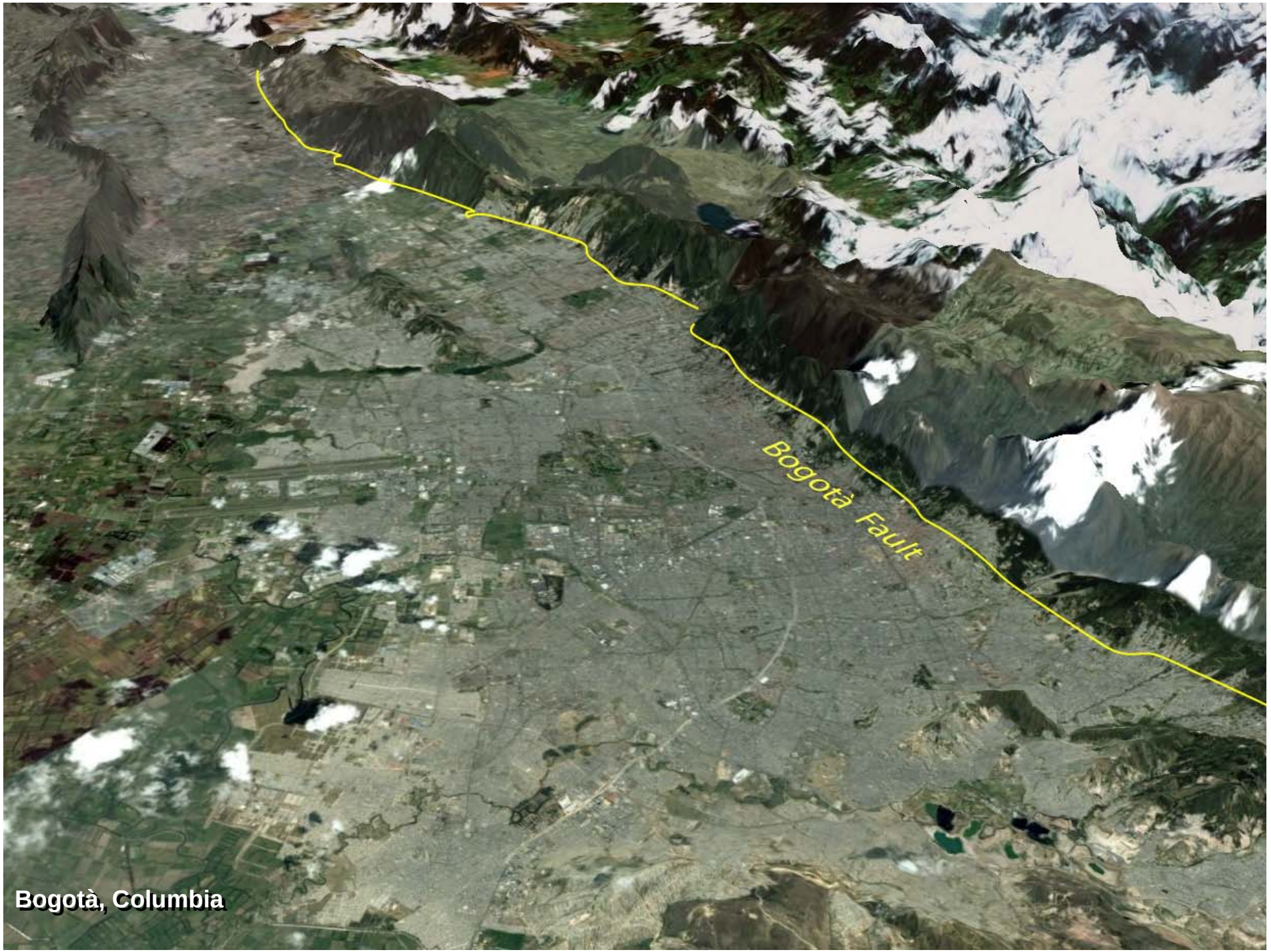
Megacity growth in regions such as Latin America guarantees a rising quake toll

Population (megacities of Lima, Santiago, Quito, Bogatà, Mexico City, Guatemala City)

Magnitude>6 quakes (*L'Aquila sized events*) since 1970

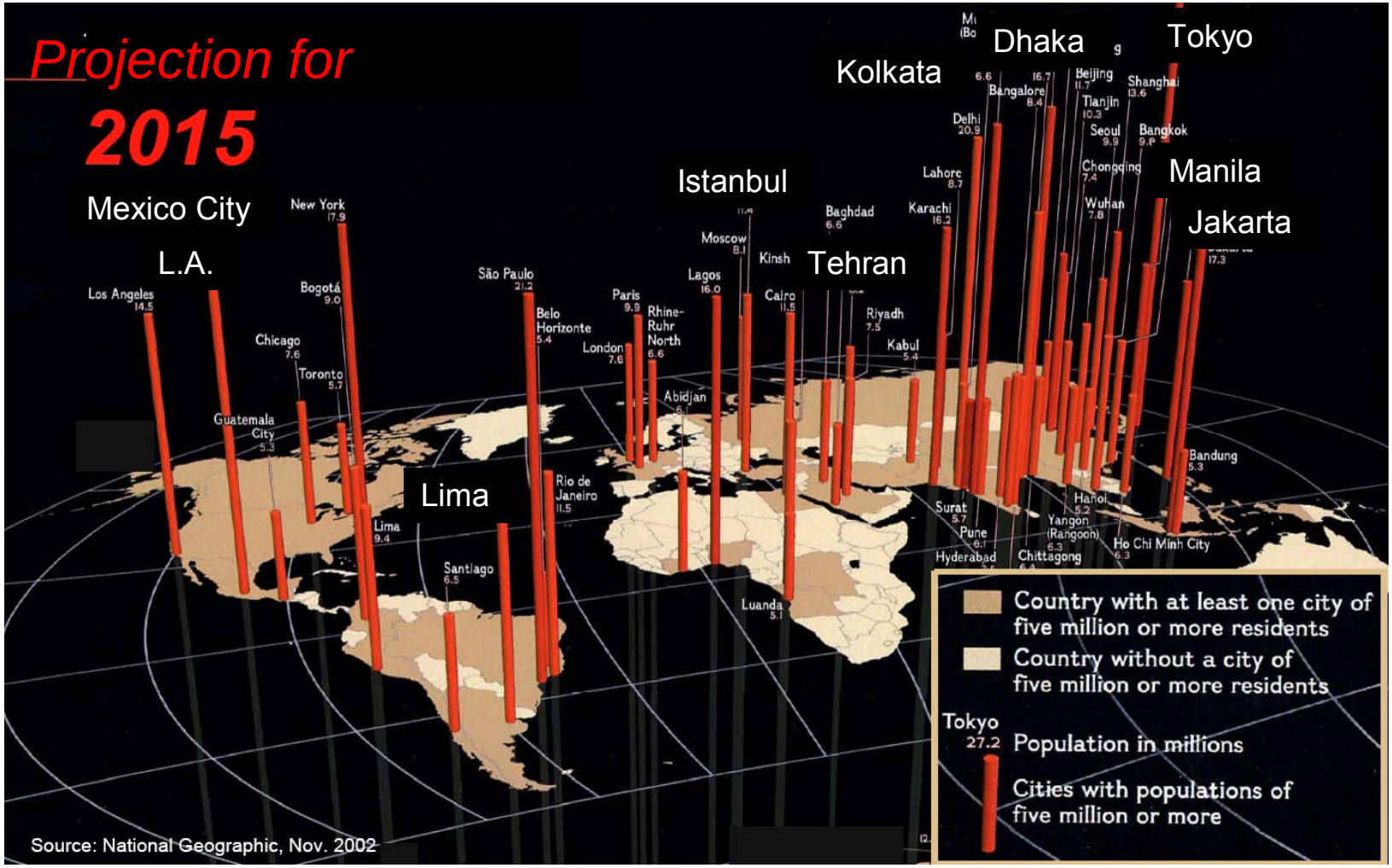

Fault
Quito
Quito, Ecuador


El Avila Fault
Caracas, Venezuela

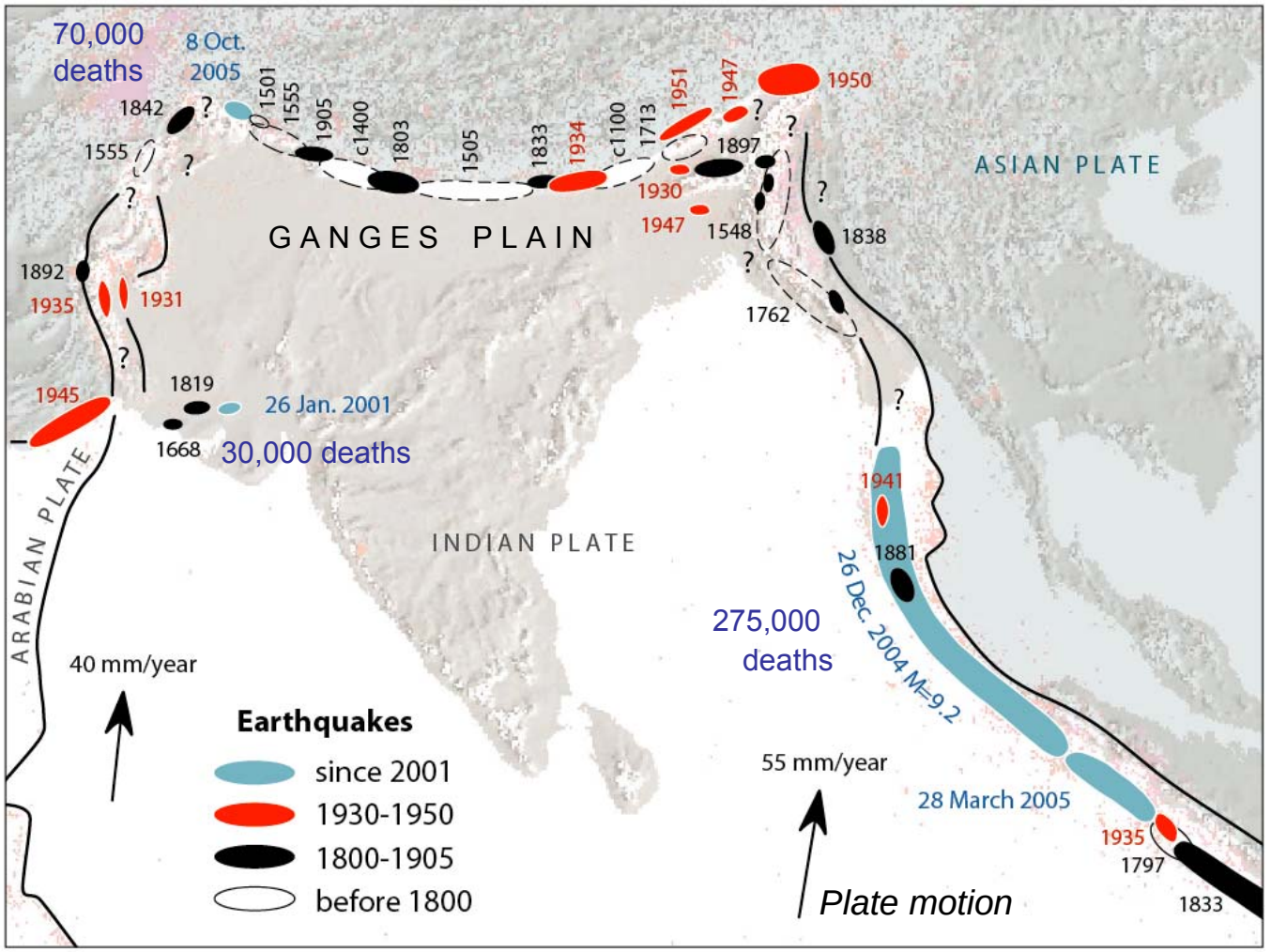

Bogotà Fault
Bogotà, Columbia

Urban Explosion

Population is growing in hazardous regions



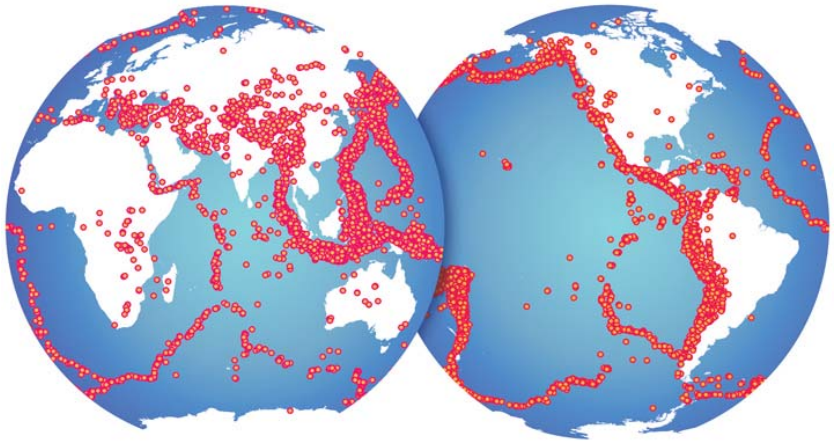
Earthquakes—*notmaps*—raise risk awareness, but quakes provide key moments to inform



Ganges Pain—one of the most populated and vulnerable areas of the world—has not suffered a great quake in a generation

from Roger Bilham, *Science* 2006

GEM: THE GLOBAL EARTHQUAKE MODEL



A PUBLIC–PRIVATE PARTNERSHIP

An independent standard to estimate and convey earthquake risk, raise risk awareness, and promote mitigation, insurance use, and risk transfer

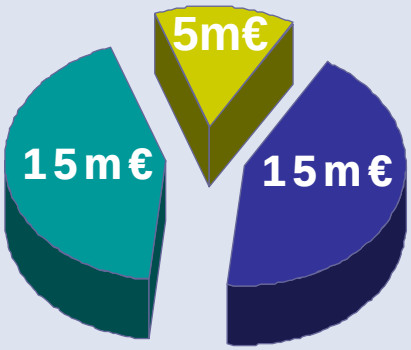
Zurich, June 2008: 72 scientists from 26 countries • Munich, June 2009: 130 scientists from 40 countries

How do we build the model?

- **Open source software with new standards and common formats, taught around the world**
- **New global datasets and model testing, without which we will never improve the quality of risk forecasts**
- **Regional centers and initiatives allied with GEM but funded by other institutions and governments**

GEM Public-PrivateFunding

- Ambitious 5-yr program: €22M pledged; €35M needed
- Annual maintenance and operation: €2M/yr



Foundingsponsor, *Munich Re*

Other private sponsors&foundations

Publicsponsors

GEM: A Public-Private Partnership

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- Singapore
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- Belgium

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- Zurich Financial Services
- AIR Worldwide
- Willis Holdings Group
- EUCENTRE

Inter-Governmental Organizations

- OECD
- World Bank

International ScientificSocieties

- Int'lAssoc. Earthqu. Engineers
- Int'lAssoc. Seismol. (IAESPEI)

Goals of GEM1

- GEM1 strives to bring GEM on its feet
- Pilot project to generate GEM's first products and develop GEM's IT infrastructure
- A worldwide inventory of existing hazard and risk software and databases

GEM1 in numbers

- Budget 2.2M€
- Jan 2009 –March 2010
- 14 positions of full time staff, plus senior staff

Schweizerischer Erdbebendienst
Swiss Seismological Service

USGS
science for a changing world

EUCENTRE™
European Centre for Training and Research in Earthquake Engineering

GFZ
Helmholtz Centre
POTSDAM

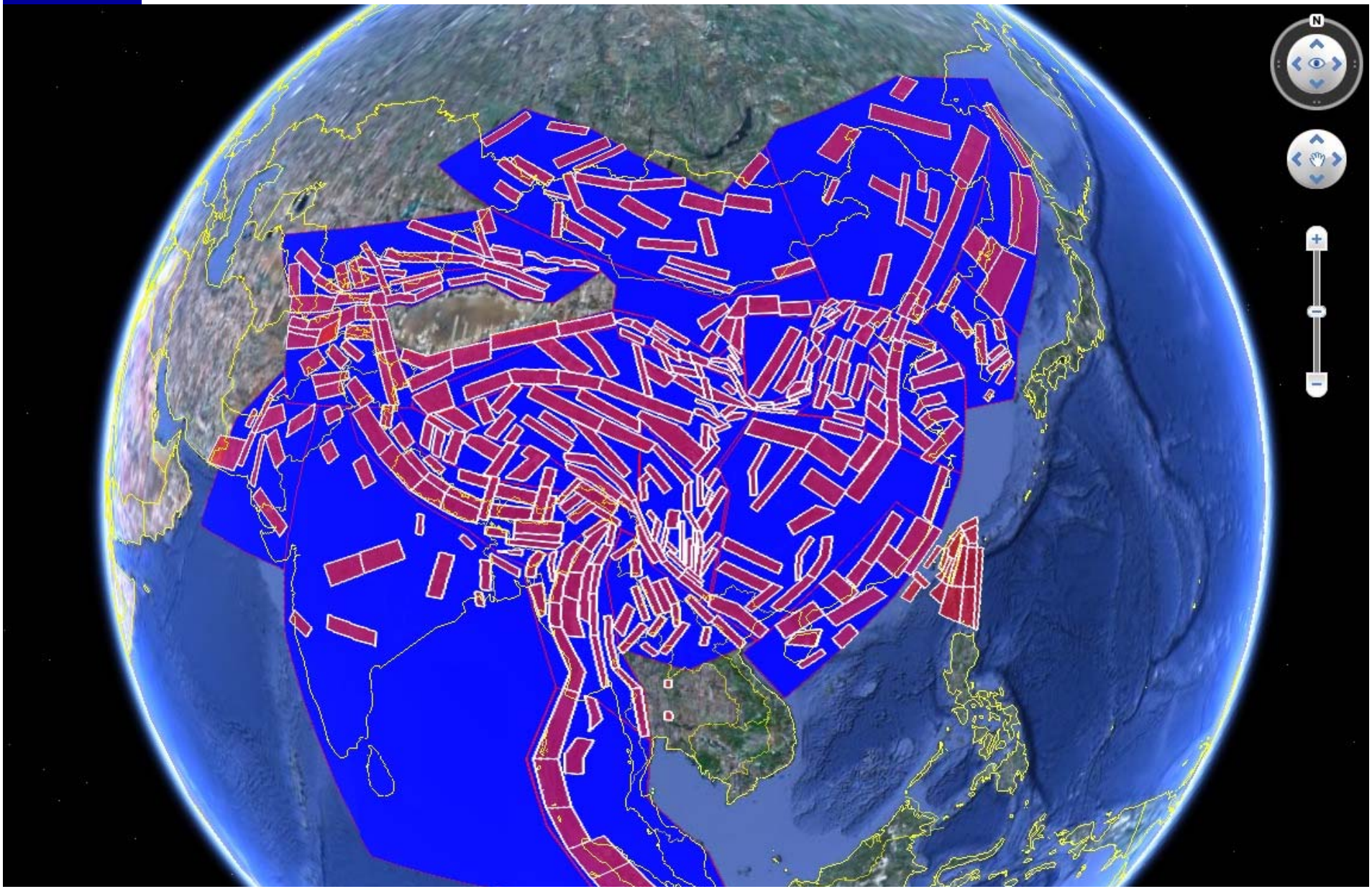
NORSAR

Inter-comparison of non-proprietary codes
Establishment of new standards & formats

Codes:

UNAM- Ordaz
OpenSHA- Field
NSHMP- Frankel
GNS NZ- Stirling
GSHAP- Giardini
RESIS II- Lindholm
SHARE- Woessner
Geoscience Australia- Schneider

GSHAP test model: *Asia*



GEM's 2M€ budget for Hazards Global Component Datasets

- 450K€ Instrumental seismic catalog
- 400K€ Historical seismic catalog
- 400K€ Active fault & seismic source database
- 400K€ Ground motion prediction equations
- 250K€ GPS strain rate database

Ten proposals for these two-year projects are now in review

GEM 1 Risk Software Inter-Comparison

EQRM (T. Allen)

SELENA (C. Lindholm)

QLARM (M. Wyss)

ELER (M. Erdik)

CAPRA (S. Gill/O. Cardona)

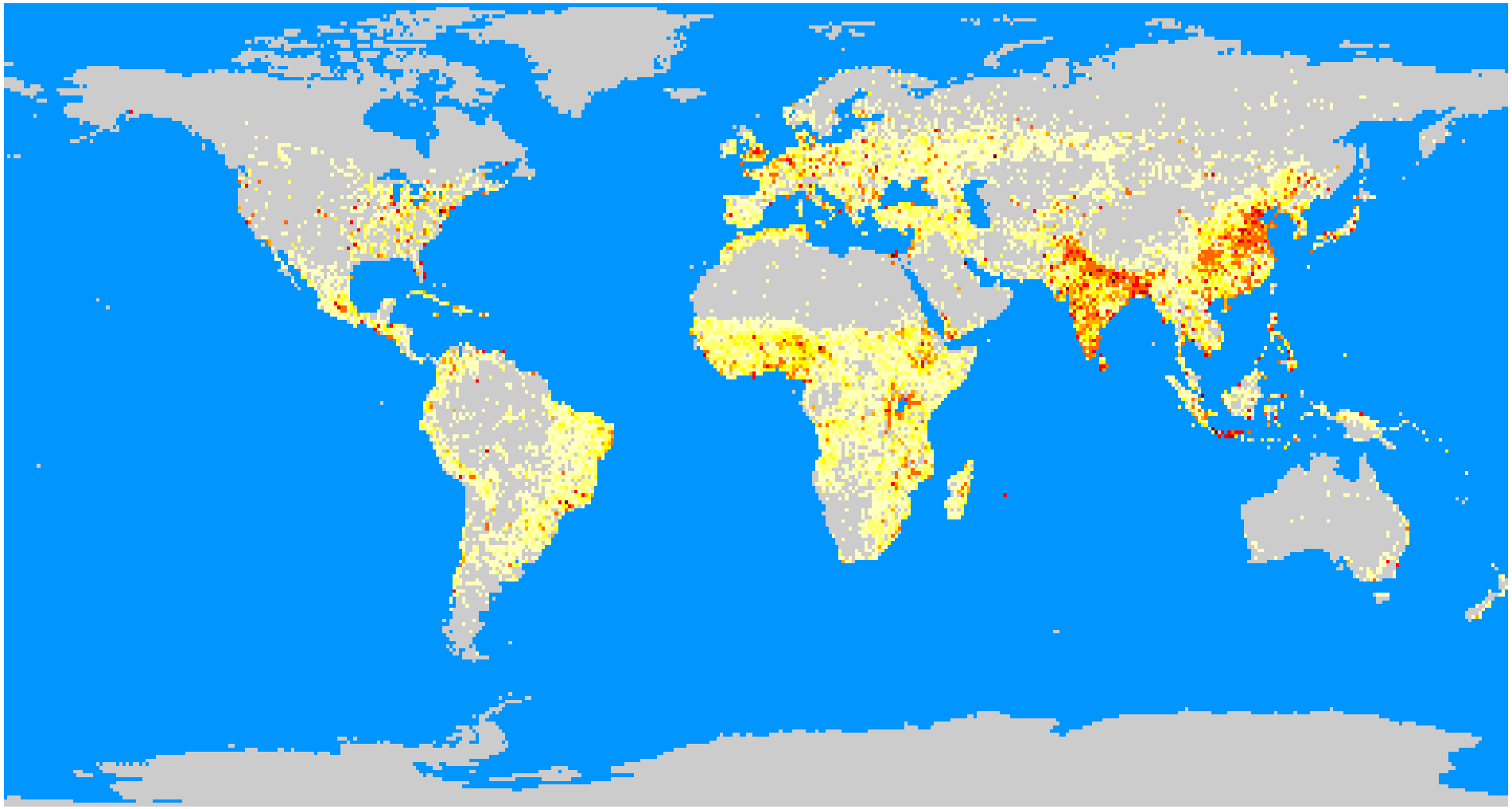
LNECLoss (A. Campos-Costa)

RiskScape (A. King)

OpenRisk (K. Porter)

CEDIM (L. Stempniewski/T. Liesch)

Global Population Inventory(Landscan 2006)



UNIVERSITY OF CAMBRIDGE

Cambridge University Earthquake Damage Database

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Reducing the impact of earthquake catastrophes requires a good understanding of the destruction they cause and the vulnerability of different types of buildings.

Damage survey data from destructive earthquakes is compiled here as a reference resource for use in vulnerability assessment and seismic risk analysis.

Data has been contributed by many institutions, gratefully acknowledged. Several initial surveys were carried out by researchers of the Martin Centre, Department of Architecture, University of Cambridge. We welcome further contributions of earthquake damage survey data.

Usage is free, but please credit the Cambridge University Earthquake Damage Database.




Key: Earthquakes

China	2008
Indonesia	2006
Pakistan	2005
Japan	2005
Indonesia	2004
Japan	2004
Iran	2003
Greece	2003
Japan	2003
Algeria	2003
Japan	2001
India	2001
Japan	2000
Taiwan	1999
Greece	1999
Turkey	1999
Columbia	1999
Italy	1997
Greece	1995
Japan	1995
Japan	1994
USA	1994
Japan	1993
Japan	1993
The Netherlands and Germany	1992
Turkey	1992
Philippines	1990
Iran	1990
Romania	1990
Australia	1989
Algeria	1989
Armenia	1988
Greece	1986
Mexico	1985
Italy	1980
Japan	1978
Japan	1964
Japan	1948

GEM


GEM will
be lucid
© 2007 Europa Technologies
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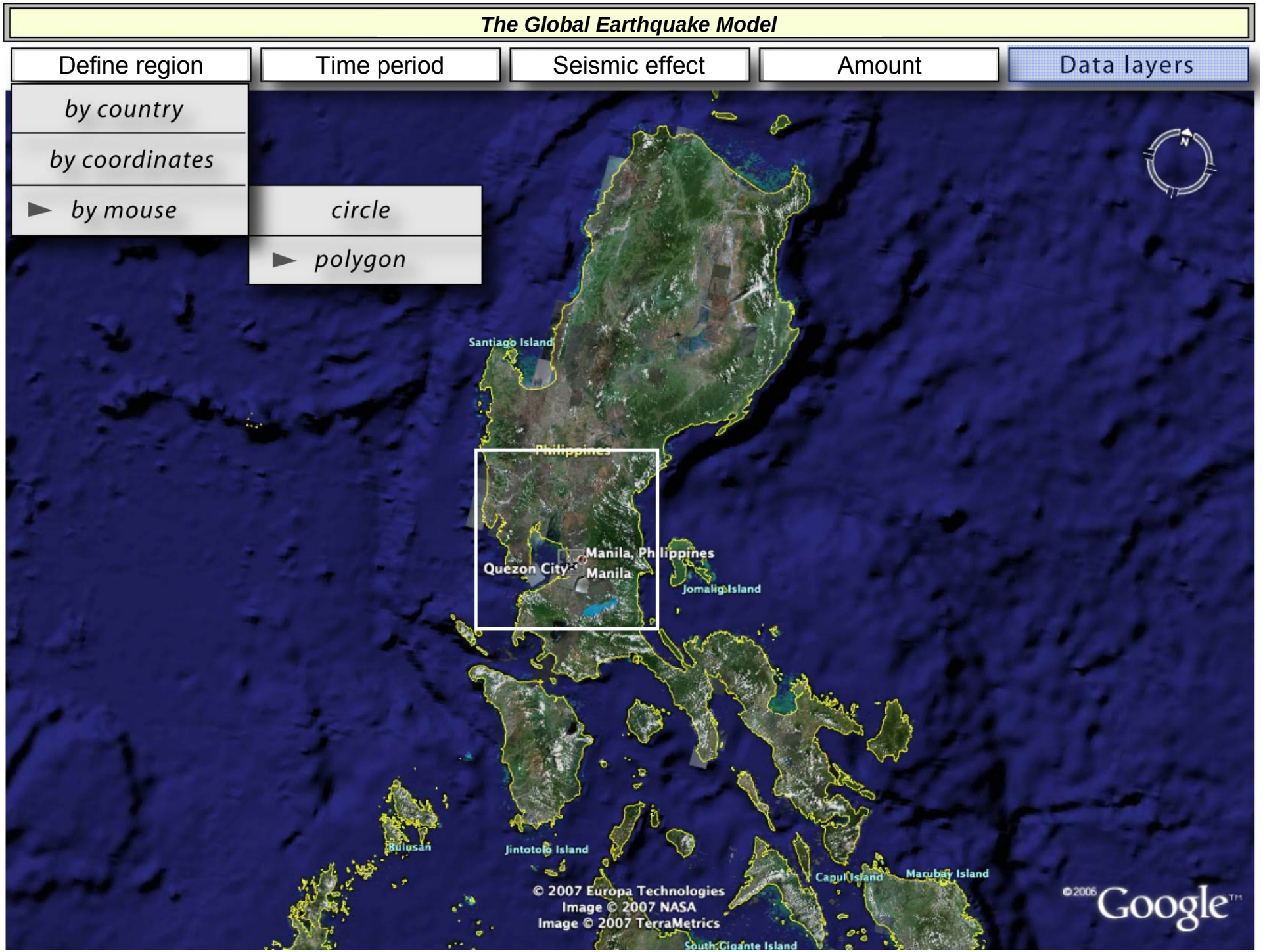
Streaming 100%
Eye alt 9799.11 km


The Global Earthquake Model
Define region
Time period
Seismic effect
Amount
Data layers
by country
by coordinates
by mouse
circle
polygon
Santiago Island
Philippines
Manila, Philippines
Quezon City
Manila
Jomalig Island
Bulusan
Jintotolo Island
Capul Island
Marubay Island
South Gigante Island
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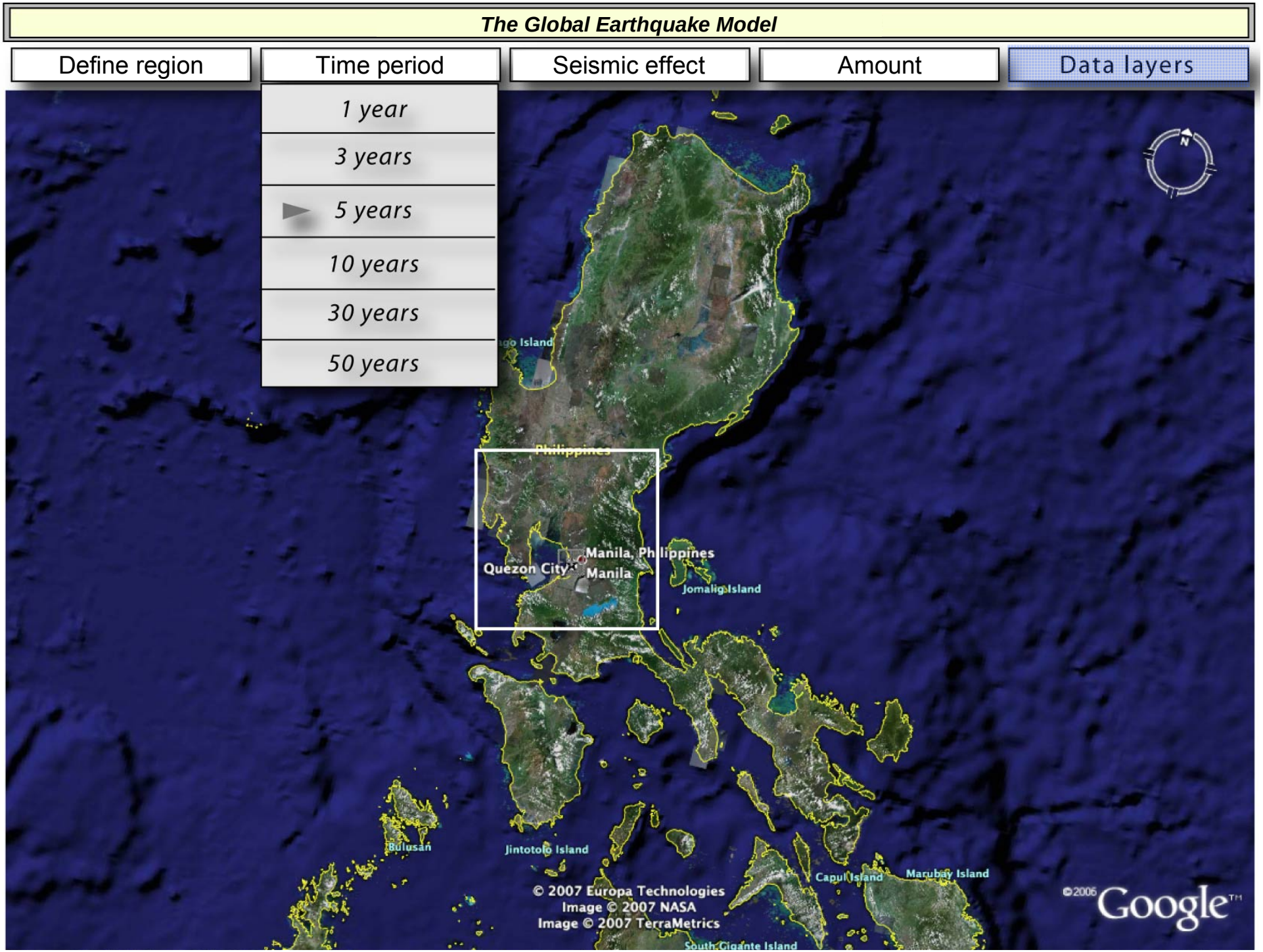
The Global Earthquake Model
Define region
Time period
Seismic effect
Amount
Data layers
1 year
3 years
5 years
10 years
30 years
50 years
Philippines
Manila, Philippines
Quezon City
Manila
Jomalig Island
Bulusan
Jintotolo Island
Capul Island
Marubay Island
South Gigante Island
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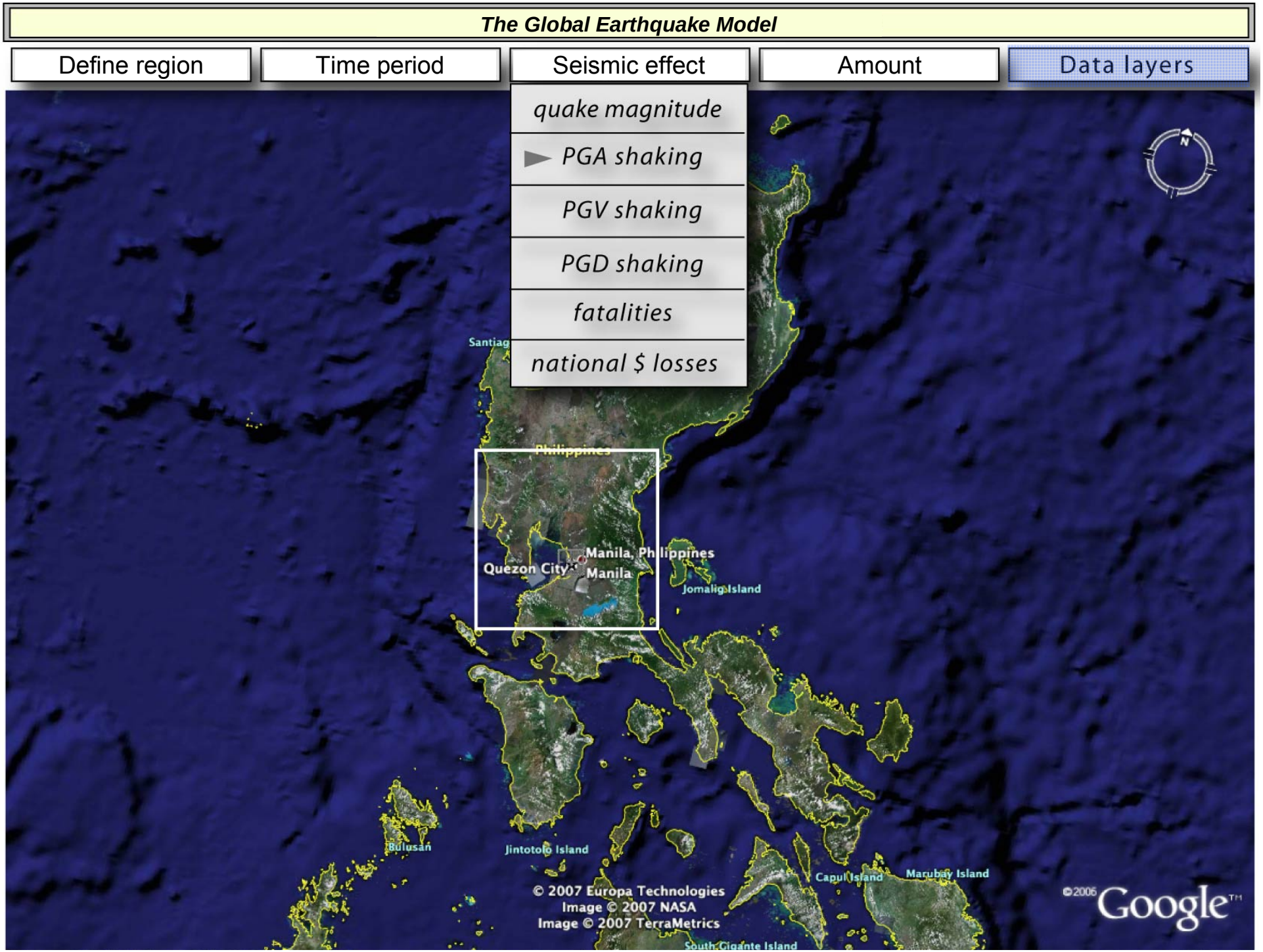
The Global Earthquake Model
Define region
Time period
Seismic effect
Amount
Data layers
quake magnitude
PGA shaking
PGV shaking
PGD shaking
fatalities
national $ losses
Santiag
Philippines
Manila, Philippines
Quezon City
Manila
Jomalig Island
Bulusan
Jintotolo Island
Capul Island
Marubay Island
South Gigante Island
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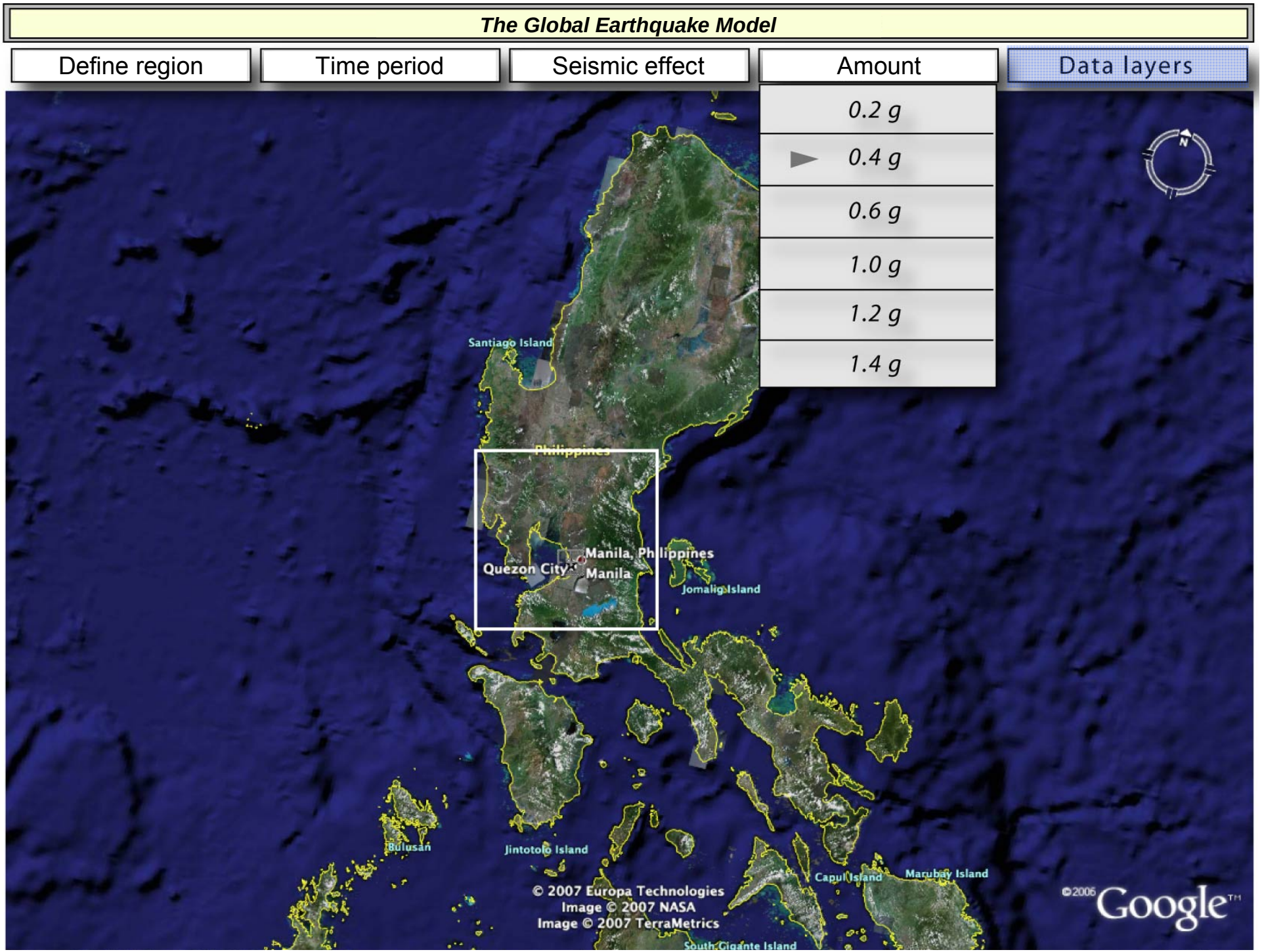
The Global Earthquake Model
Define region
Time period
Seismic effect
Amount
Data layers
0.2 g
0.4 g
0.6 g
1.0 g
1.2 g
1.4 g
Santiago Island
Philippines
Manila, Philippines
Quezon City
Manila
Jomalig Island
Bulusan
Jintotolo Island
Capul Island
Marubay Island
South Gigante Island
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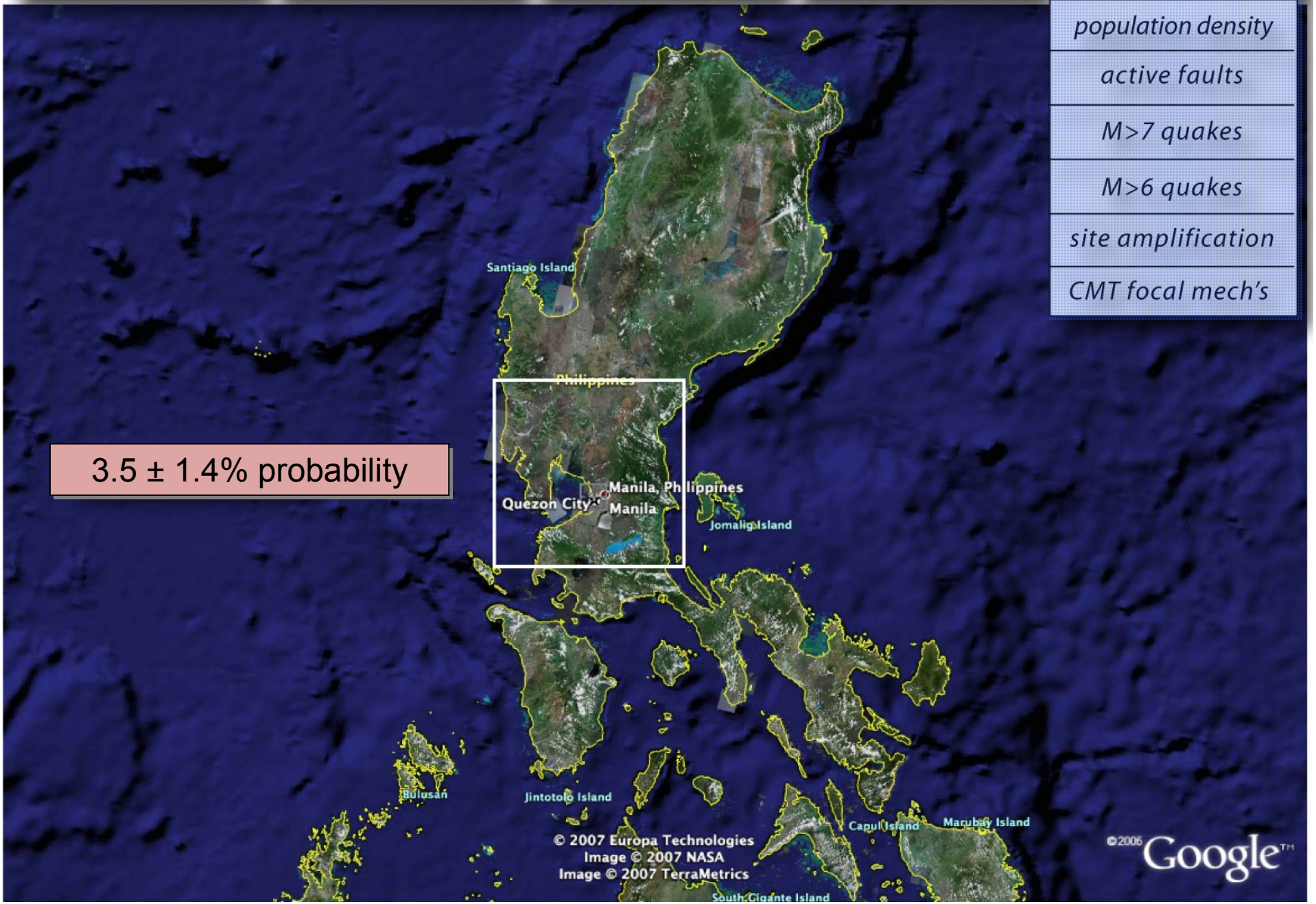
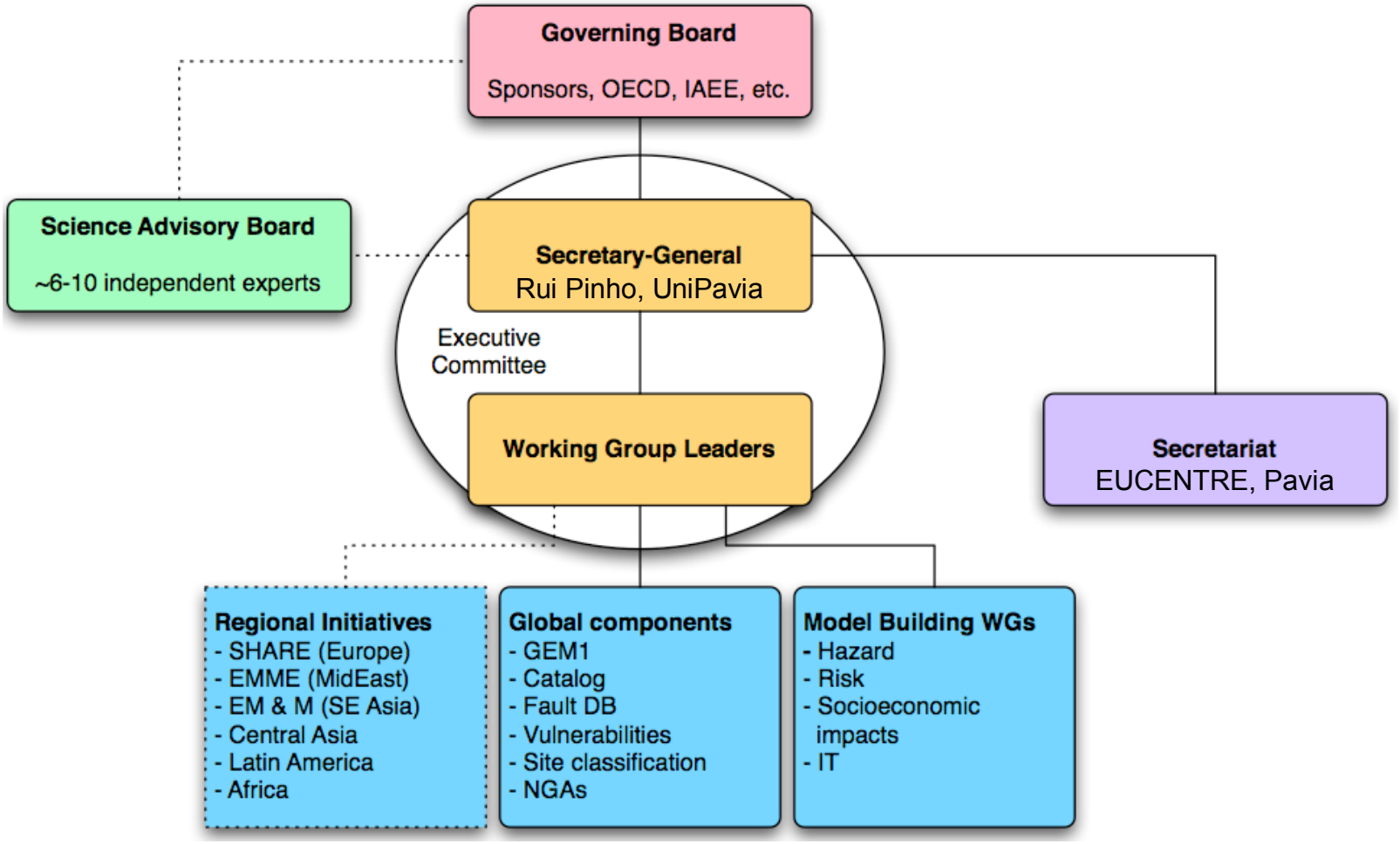
The Global Earthquake Model

Define region	Time period	Seismic effect	Amount	Data layers



Organizational Structure of GEM



A Global Earthquake Model | www.globalquakemodel.org

http://www.globalquakemodel.org/

Google

GEM

GLOBAL EARTHQUAKE MODEL

A uniform, independent standard to calculate and communicate earthquake risk worldwide.

General

- **Home page**
- About GEM
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- Governance
- Participants
- Scientific Modules
- Regional Initiatives
- Outreach
- Contribute
- GEM1

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A Global Earthquake Model

GEM is a public/private partnership initiated and approved by the Global Science Forum of the Organisation for Economic Co-operation and Development (OECD-GSF). GEM aims to be the uniform, independent standard to calculate and communicate earthquake risk worldwide. With committed backing from academia, governments, and industry, GEM will contribute to achieving profound, lasting reductions in earthquake risk worldwide.

GEM will be the critical instrument to support decisions and actions that reduce earthquake losses worldwide. All who face risk, from homeowners to governments, need accurate and transparent risk information before they will take mitigating action. By providing the information in a manner that is understandable to all users, GEM aims to raise awareness, lead to adoption and enforcement of building codes, promote seismic mitigation, and stimulate insurance use.

GEM will be the first global, open source model for seismic risk assessment at a national and regional scale, and aims to achieve broad scientific participation and independence. It will be conducted in three integrated modules: Hazard, Risk, and Socio-Economic Impact.

GEM press release

New GEM press release: "Global Earthquake Model to become key instrument for earthquake risk estimation worldwide".

Read the full press release.

GEM Outreach Meeting a success

The GEM Outreach Meeting, held 8-10 June 2009 in Schloss Hohenkammer (Germany) brought together 130 key stakeholders (both public and private) and distinguished experts from over 40 countries. For more information, the detailed programme and presentations, click under Events or go directly to the page of the GEM Outreach Meeting 2009.

more »

Hazard Requests for Proposals Released

May 14, 2009

GEM has released five requests for proposals for the hazard global components of GEM. The deadline for submitting a proposal is 15th July 2009. Click here for more information.

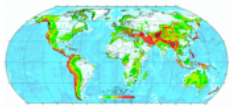
search...

Highlight

Request for proposals

Five Requests for Proposals for hazard global components have been released. Deadline **15th July**.

Click **here** for more information.



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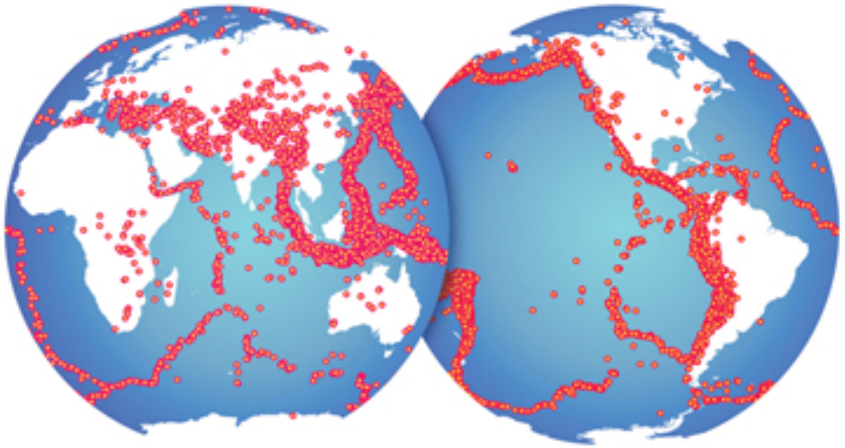
EDITORIAL

nature geoscience

Vol.1 No.12 December 2008 www.nature.com/naturegeoscience

Globalizing quake information

Destruction from earthquakes continues to threaten poor and wealthy nations alike. The Global Earthquake Model is a potentially important step towards providing risk information on a worldwide basis, using a unified standard.

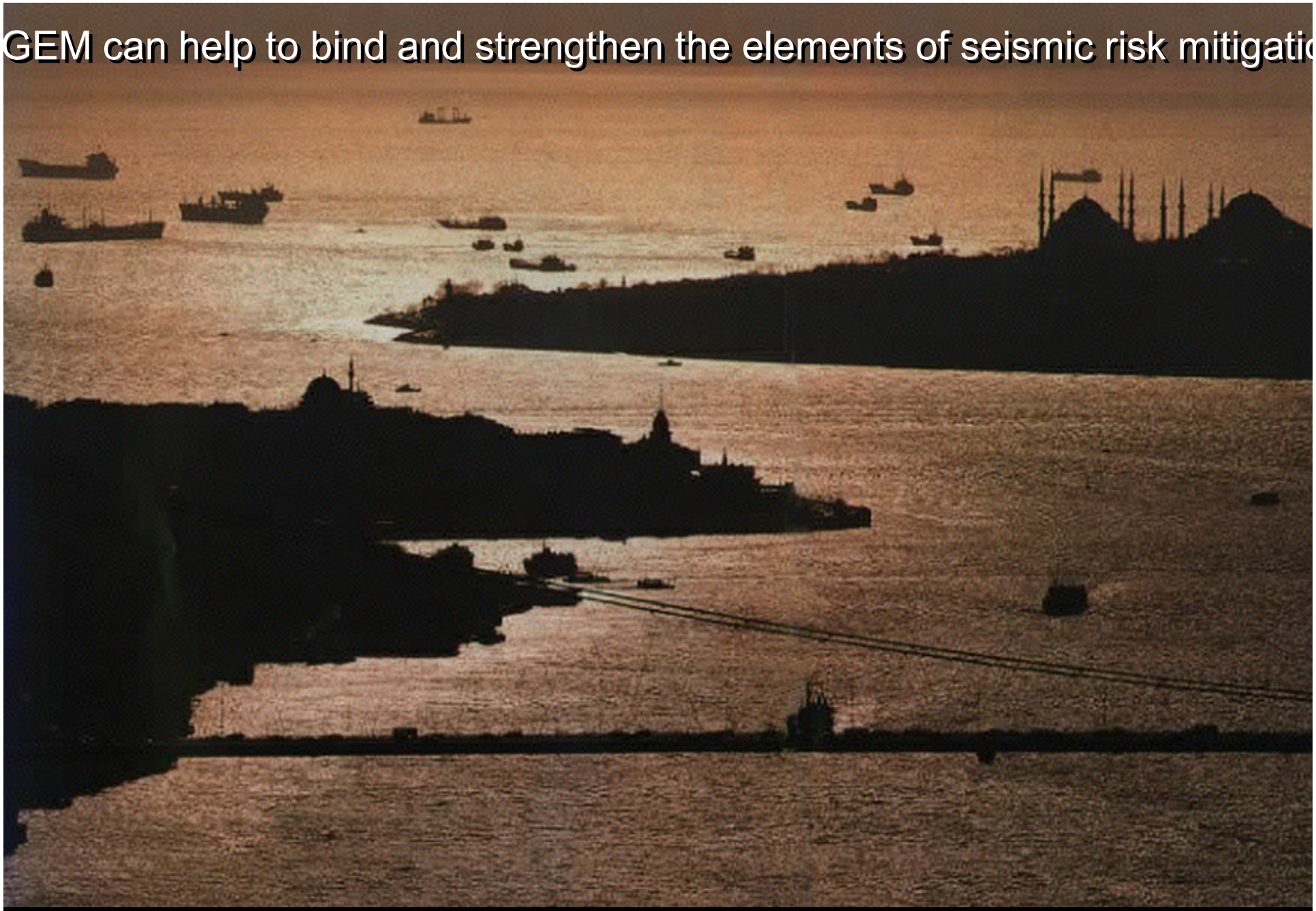


GEM Secretariat: EUCENTREin Pavia, Italy

European Centre for Research & Teaching in Earthquake Engineering

The 1999 Izmit quake left
20,000 dead and 20,000 destroyed buildings

GEM can help to bind and strengthen the elements of seismic risk mitigatio



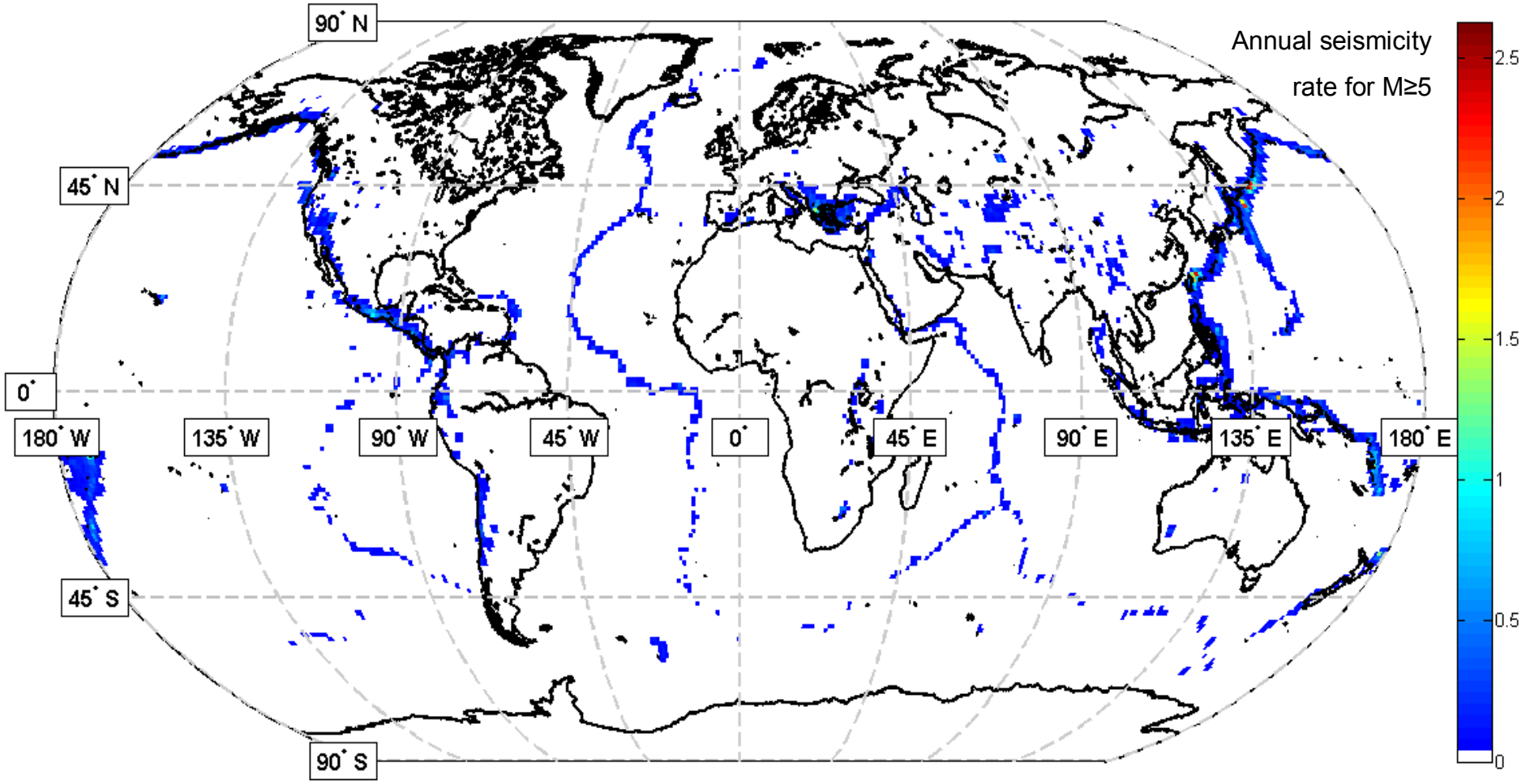
Istanbul, strongly shaken 12 times in 15 centuries

GEM Milestones

- Mar 08: OECD Global Science Forum endorsement
- Jun 08: Zurich Strategic planning mtg for 72 people
- Sep 08: 60% funding goal reached
- Nov 08: Secretariat established in Pavia, Italy
- Dec 08: Endorsed by Nature Geoscience& IAESPEI
- Feb 09: Incorporated as non-profit GEM Foundation
- Mar 09: GEM 1 commenced at Australia workshop
- Apr 09: RuiPinho appointed Secretary General
- Jun 09: GEM outreach meeting in Munich for 130

Smoothed seismicity as a control standard

ISC catalogue (1964-1999); triple-S algorithm of Zechar& Jordan (2009)

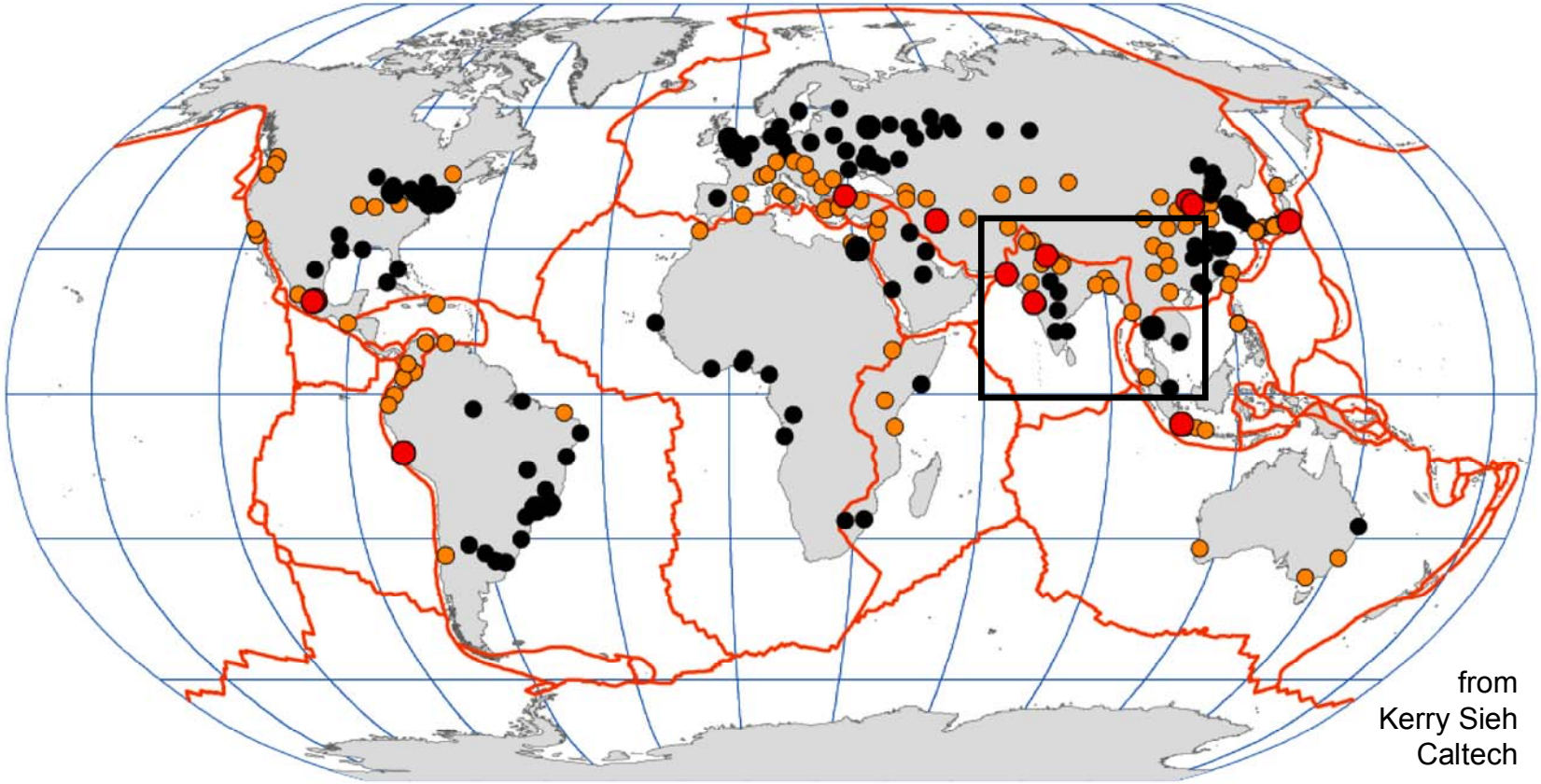


6 April 2009 M_w=6.3 L'Aquila, Italy

NY Times photo

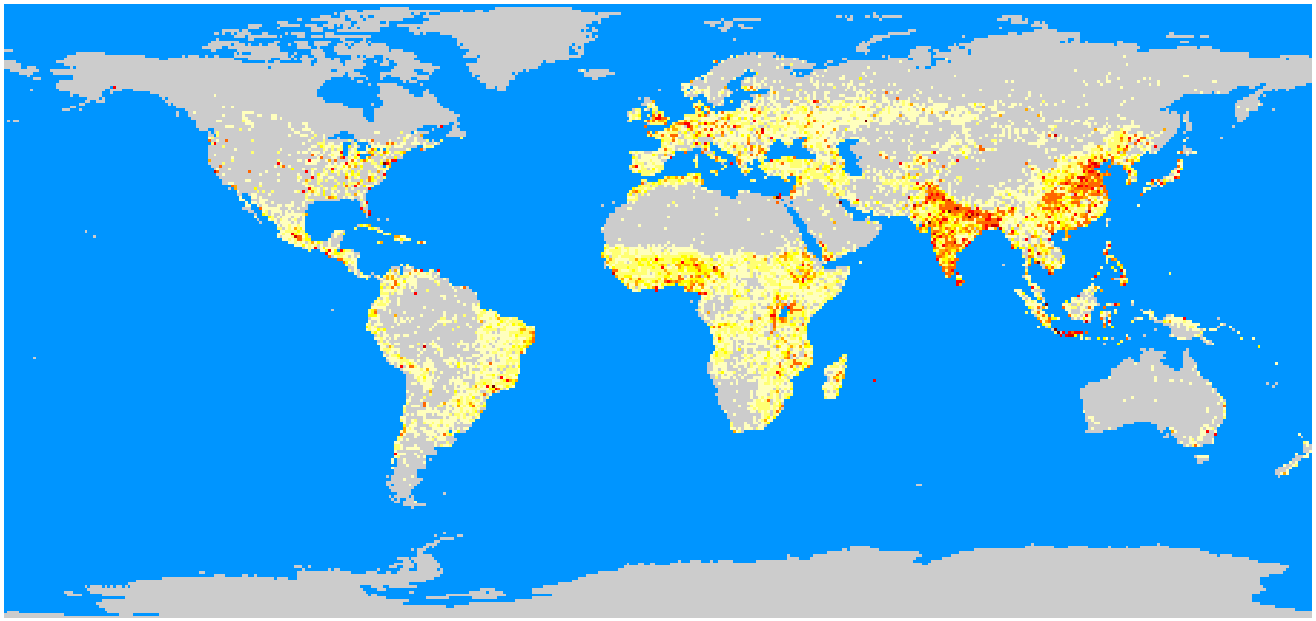
Major cities near plate tectonic boundaries

Risk is concentrating in hazardous regions

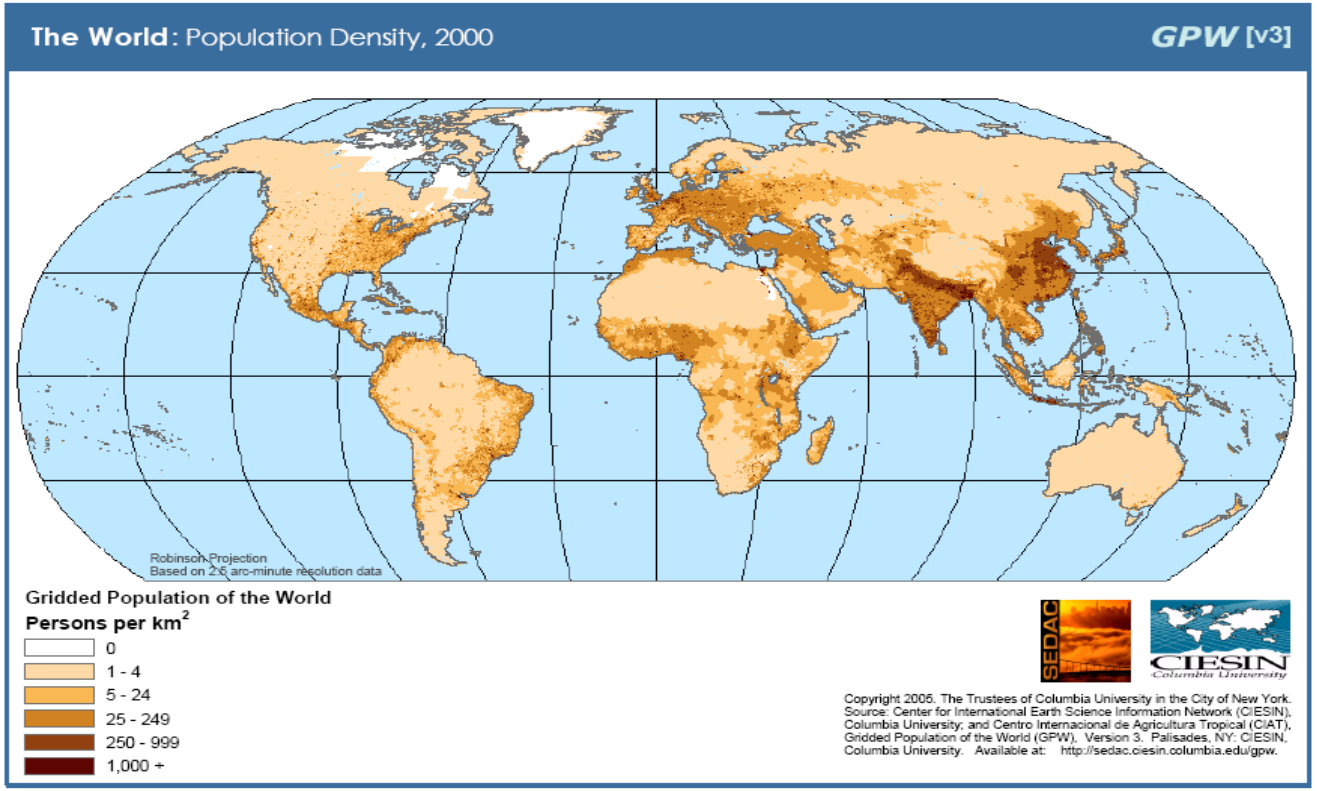


from
Kerry Sieh
Caltech

Plate boundaries Cities at seismic risk Cities without seismic risk



Global Population InventoryData Landscan2006



Global Rural-Urban Mapping Project (gridded popula-tion of the world)

A closer look at the model components

Hazard

- Active faults
- Instrumental quake catalogs
- Historical quake catalog
- Geodetic strain
- Ground motion prediction eqns
- Soil amplification

Risk

- Exposure
  - Population
  - Buildings
  - Remote sensing
- Vulnerability
  - Damage data
  - Damage functions
  - Risk maps

Economics

- Decision tools
- Case studies
- Urban scenarios
- Risk transfer tools


PALAZZO DEL GOVERNO

6 April 2009 M_w=6.3 L'Aquila, Italy

NY Times photo

Peak ground acceleration for Asia
(10% probability of exceedance in 50 years)