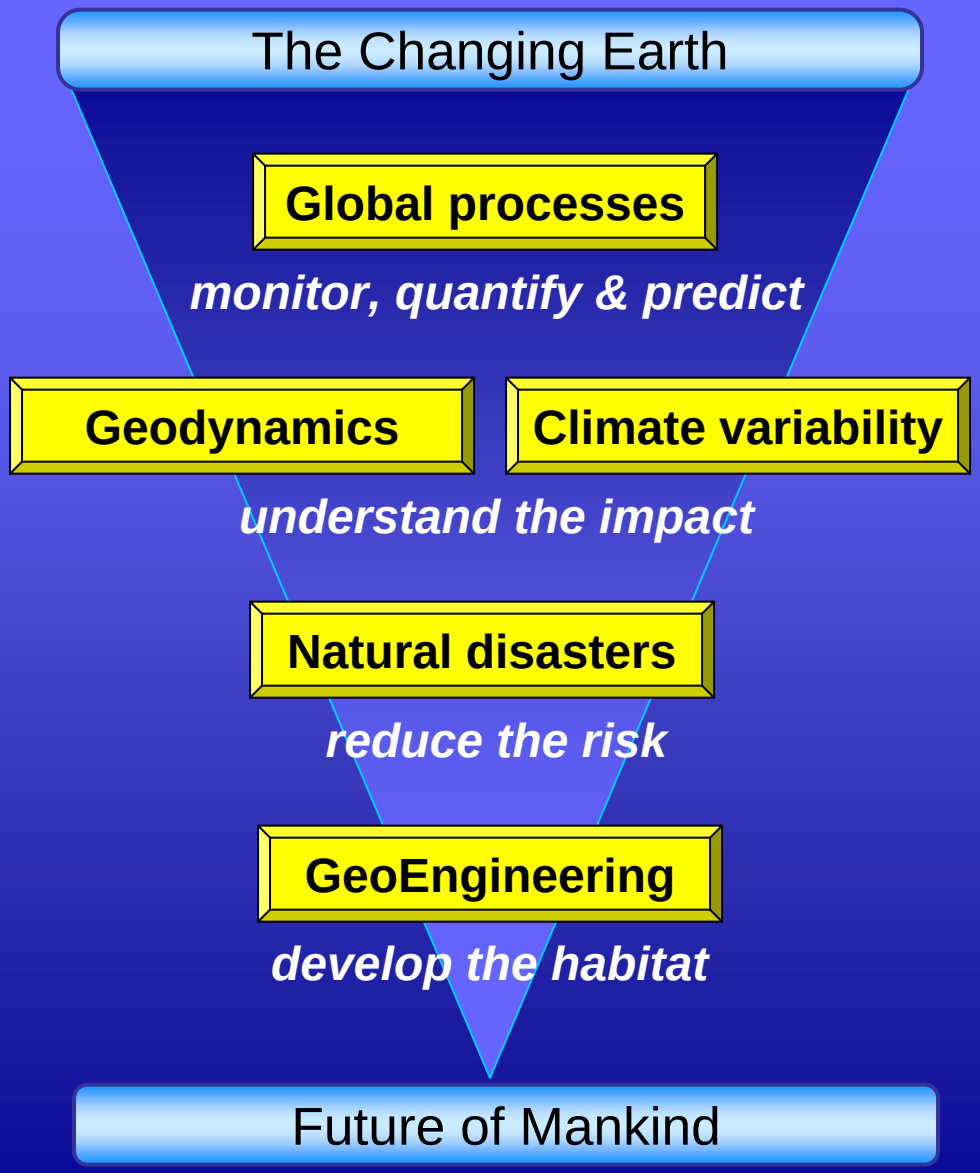
GFZ German Research Centre for Geosciences,

National Lab for Geosciences, Potsdam, Germany

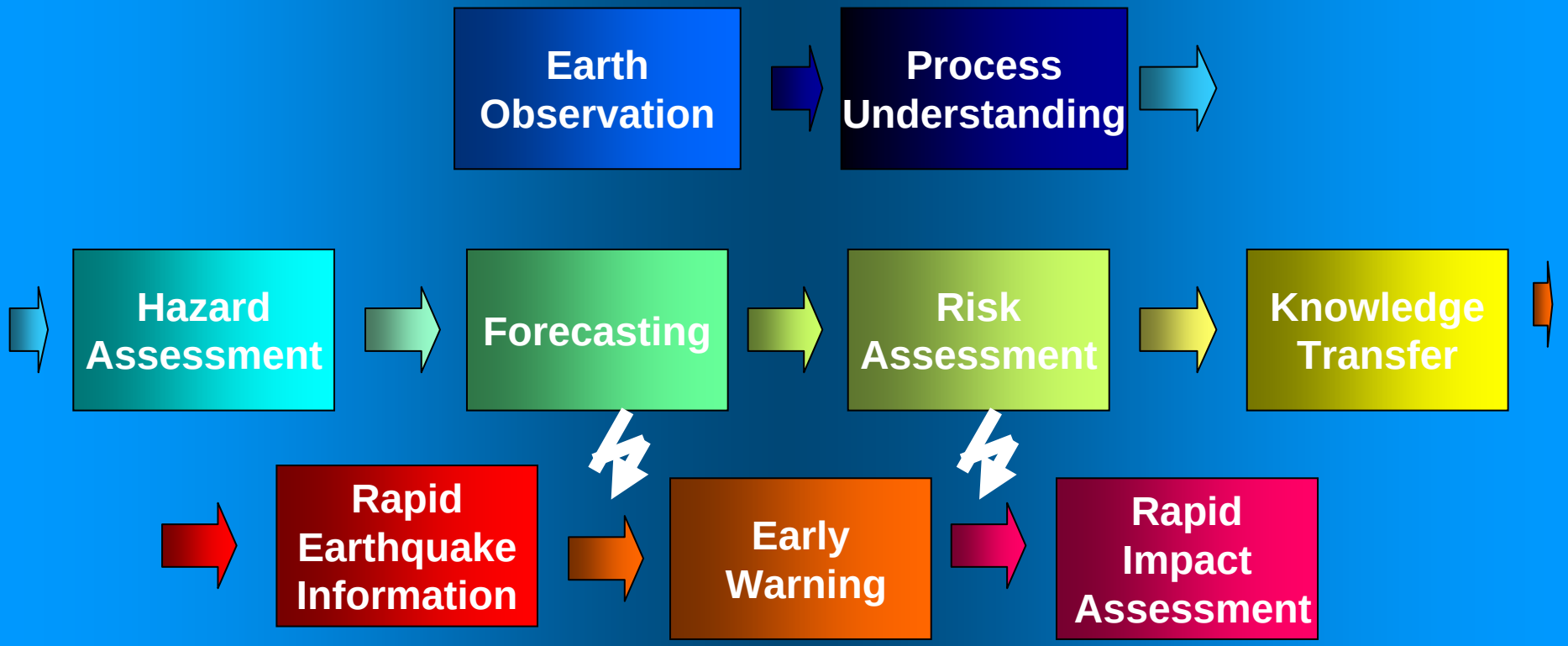
Staff: >1100 of which more than 50% are scientists

Jochen Zschau, Head of Section „Earthquake Risk and Early Warning“
Professor at University of Potsdam

GFZ-Focus: Earth System Dynamics



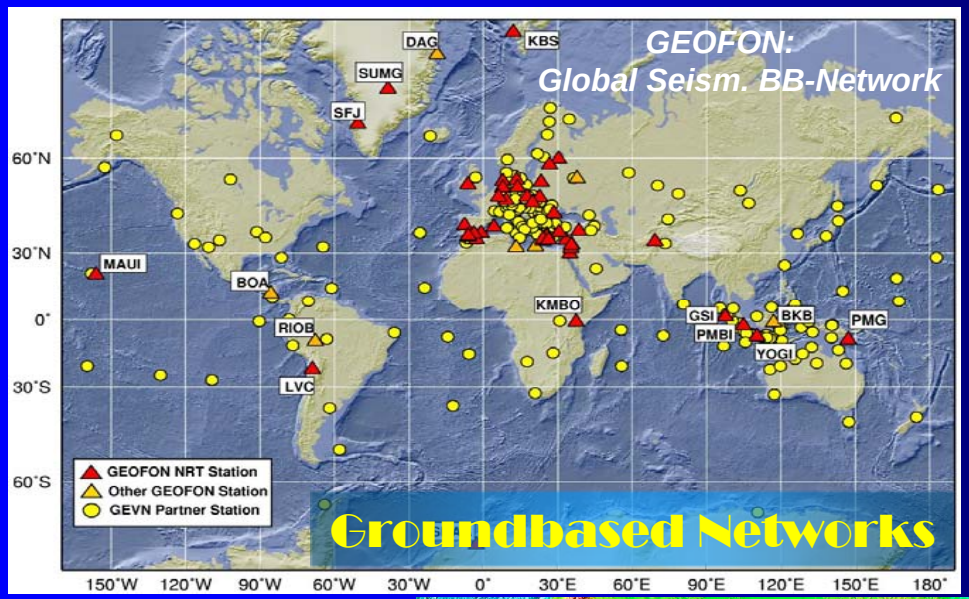
GFZ Involvement in the Earthquake Risk Reduction Chain

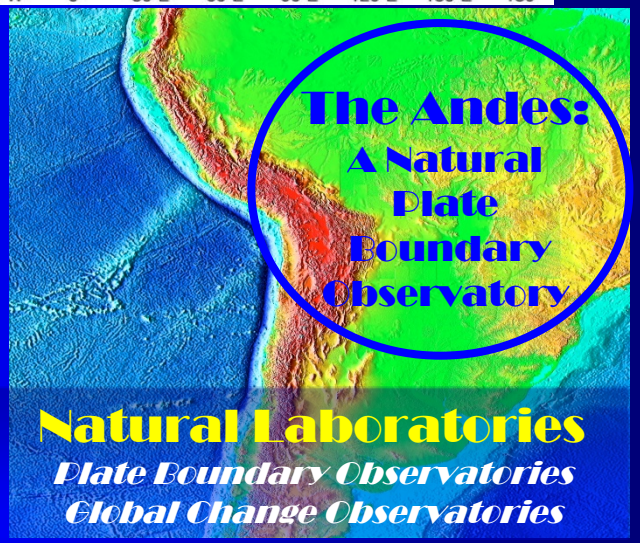


Integrated Earth Observation

A Cornerstone of GFZ´sEarth System Analysis

Satellites





SAFER

Seismic EArly Warning For EuRope

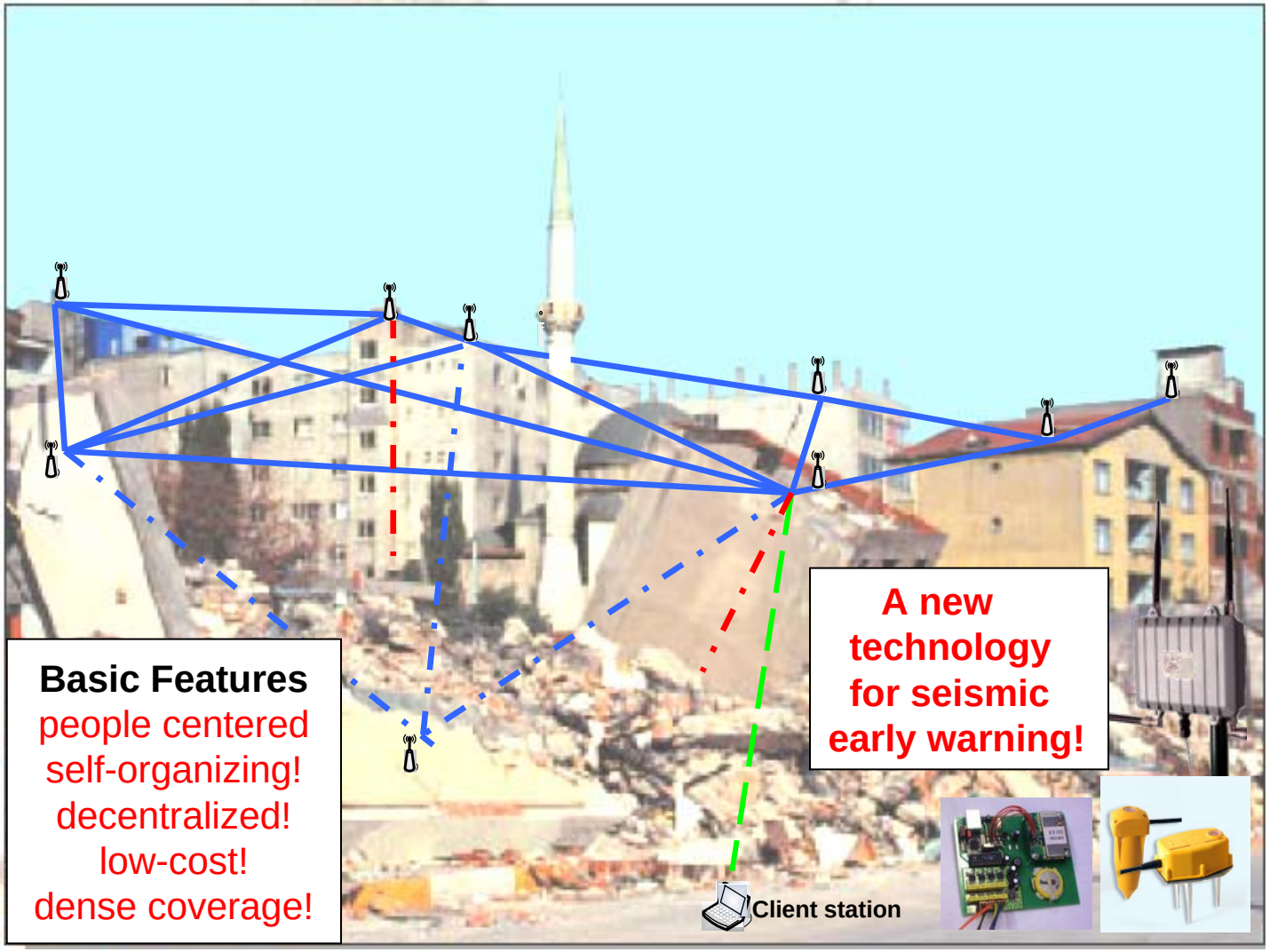
EU-FP6-Project
Duration 36 months
starting date 1/06/2006
Coordinator GFZ German Research Centre for Geosciences

The Objectives

A. **Develop tools for effective early warning to be used for disaster management in Europe's densely populated cities.**

B. **Application to selected European test cities.**

SOSEWIN: Towards a People Centered Mobile Early Warning System



A conceptual representation of the SOSEWIN people centered early warning system

MATRIX

New Multi-HAzard and MulTi-RIsK Assessment MethodS For Europe

Start: 1.10.2010 **End: 31.9.2013**

Coordinator GFZ German Research Centre for Geosciences

Develop and apply
a common theoretical framework
for tackling multiple natural hazards and risks!
(compatible with the new EU-guidelines)

MATRIX
Objective

Compare with single-type hazard and risk methodology!

Interactions Between Hazards

Cascading/domino hazards:

Those triggered or amplified by an earlier event

earthquake → tsunami
earthquake → landslide
main shock → aftershocks
storm → coastal floods
.
.

Combined hazards:

Those acting independently, but at about the same time, on the same vulnerable system

earthquake followed by a flood
forest fire followed by a storm
.
.

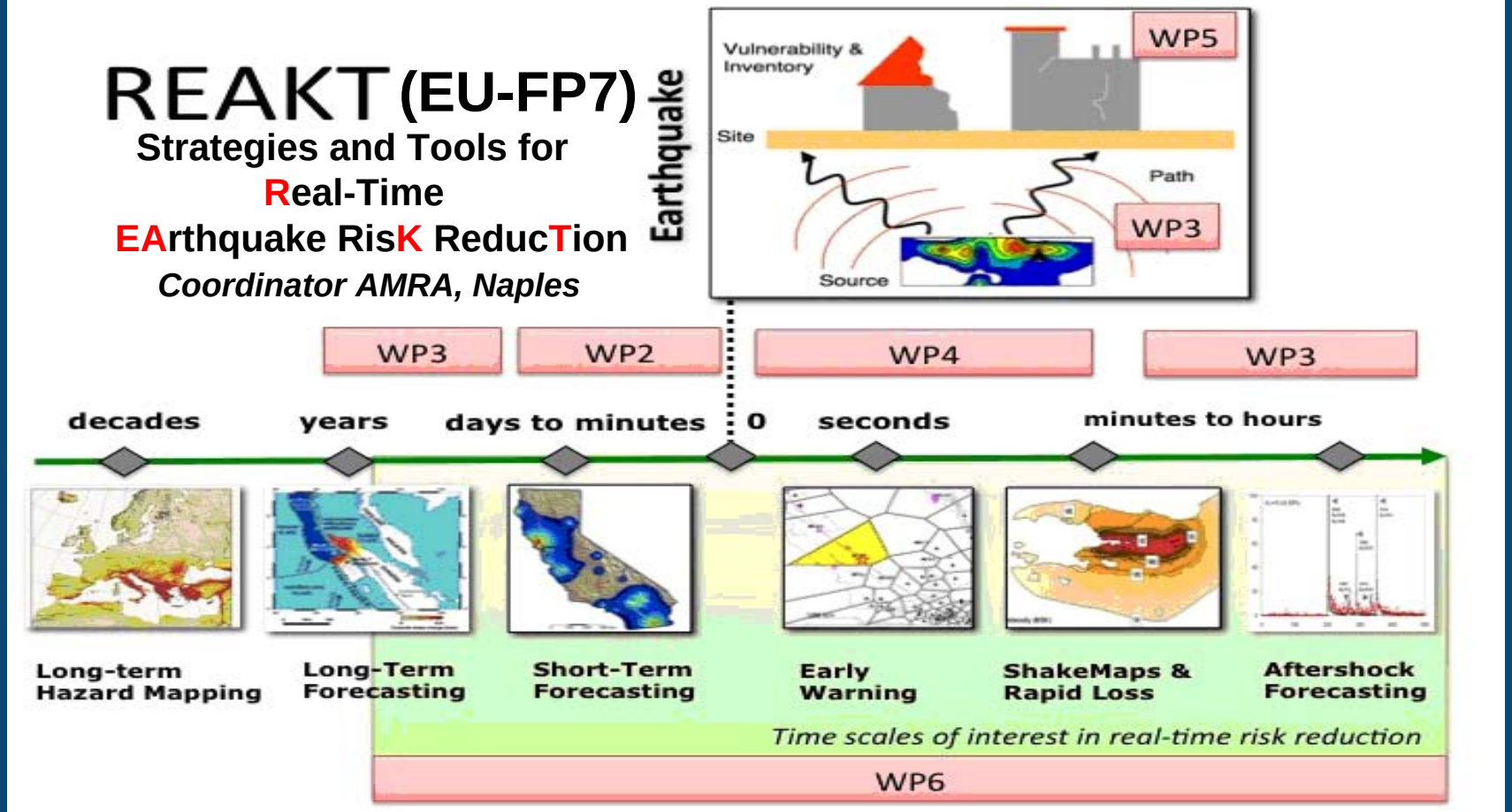
Conditional probabilities
Time-dependent vulnerability

Interactions between hazards make the multi-hazard approach more than the simple sum of individual single hazards!

REAKT (EU-FP7)

Strategies and Tools for
Real-Time
EArthquake RisK ReducTion

Coordinator AMRA, Naples



GITEWS

Coordinated by GFZ German Research Centre for Geosciences

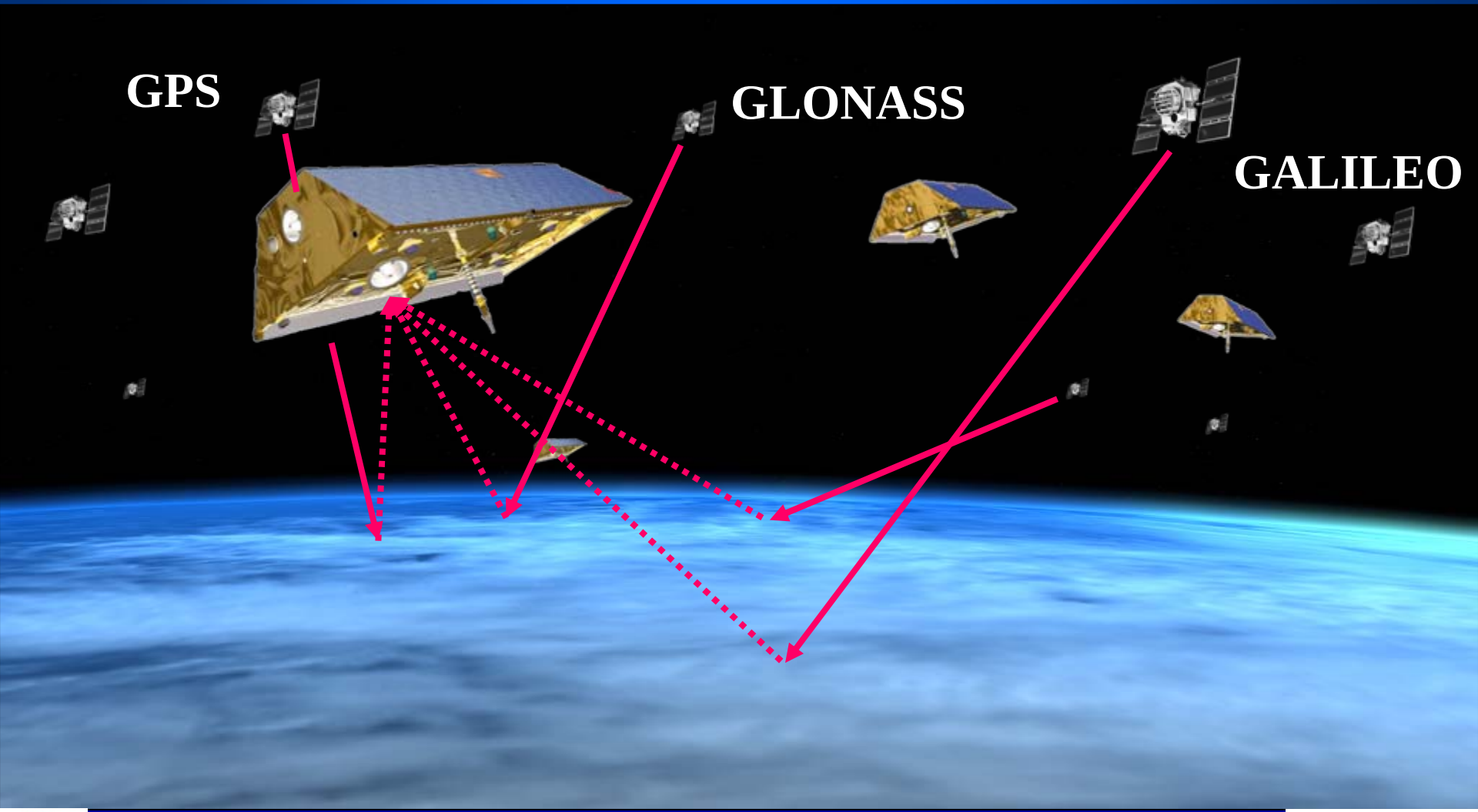
The German-Indonesian Initiative towards a Tsunami Early Warning System for the Indian Ocean

Model: A. Babeykov (Univ. Frankfurt/M)
S. Sobolev (GFZ Potsdam)

The GITEWS Components

They cover the complete tsunami early warning chain!

GNNS-Reflectometry:
Monitoring the Ocean Surface with GPS?



GEM

The Global Earthquake Model

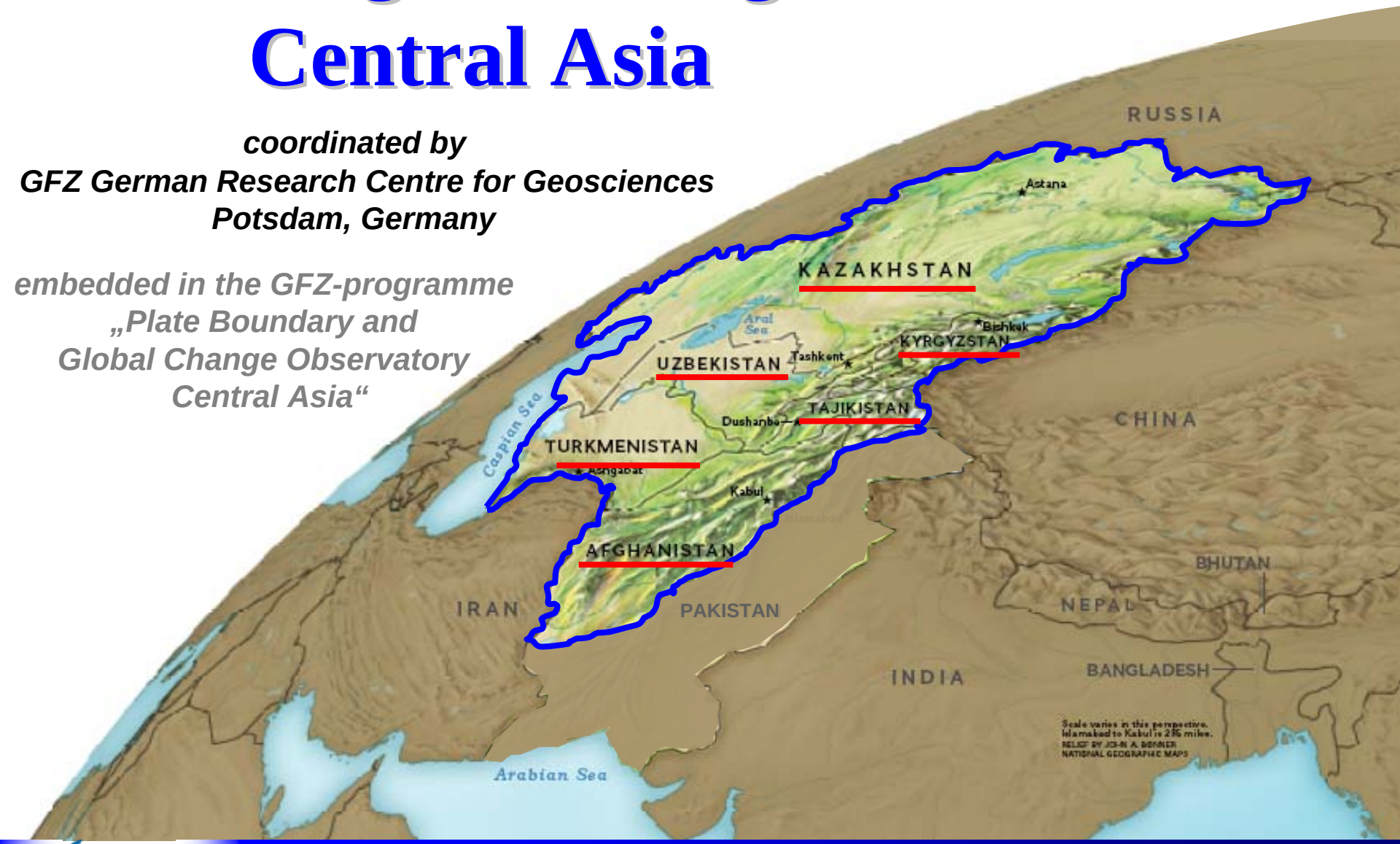
A public/private partnership
for mapping and communicating
complex earthquake risk globally

GFZ Helmholtz Centre Potsdam
Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences

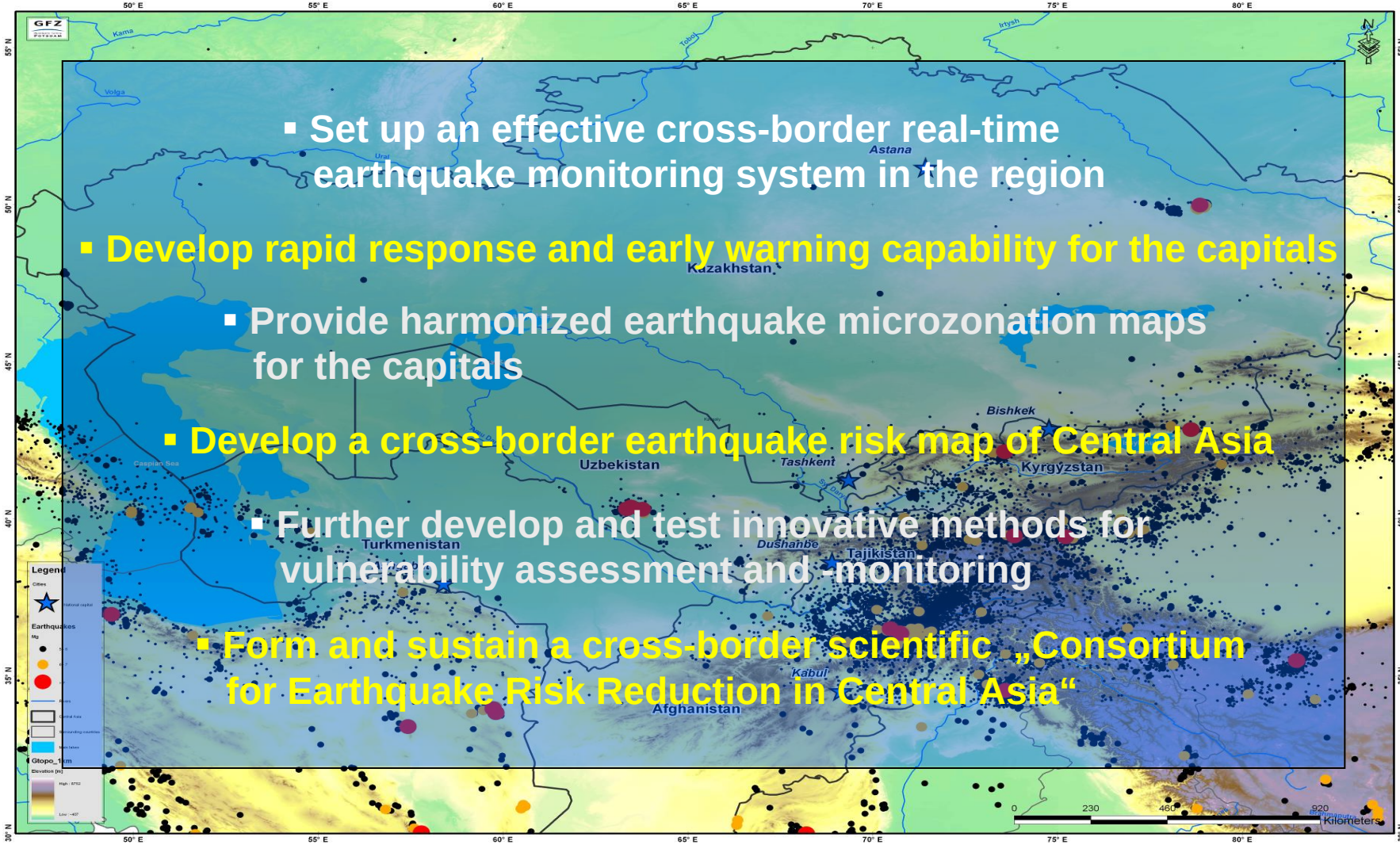
GEM Regional Programme Central Asia

coordinated by
GFZ German Research Centre for Geosciences
Potsdam, Germany

embedded in the GFZ-programme „Plate Boundary and Global Change Observatory Central Asia“



Science for Earthquake Risk Reduction in Central Asia



- Set up an effective cross-border real-time earthquake monitoring system in the region
- Develop rapid response and early warning capability for the capitals
- Provide harmonized earthquake microzonation maps for the capitals
- Develop a cross-border earthquake risk map of Central Asia
- Further develop and test innovative methods for vulnerability assessment and -monitoring
- Form and sustain a cross-border scientific „Consortium for Earthquake Risk Reduction in Central Asia“

Earthquake Hazard and Risk Modelling Testing and Evaluation Centre

Currently being set up at GFZ in Potsdam

„Monitoring“ Vulnerability and Risk

GFZ-activity in the frame of GEM!

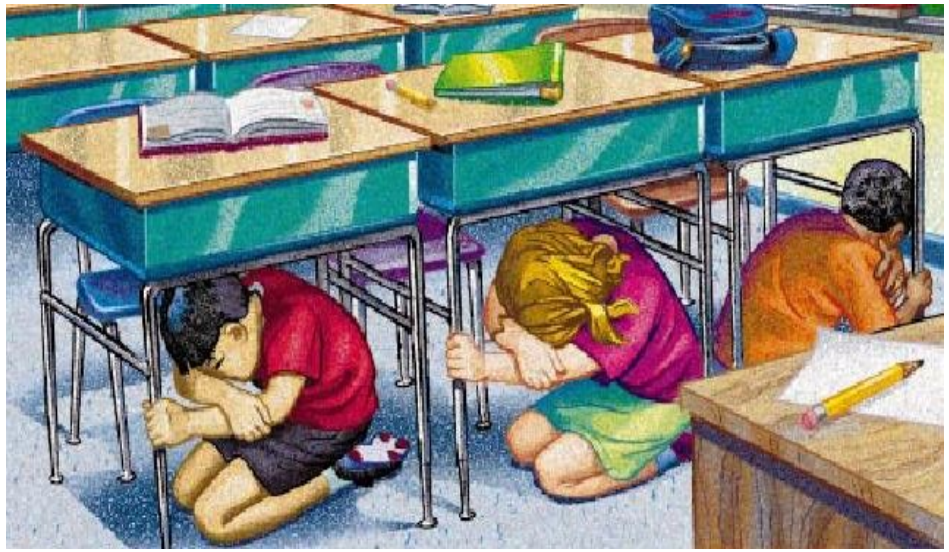
New Tools are needed!

satellite remote sensing

Ground based panoramic street view with mobile 3D-camera

Thank you!

Meeting the Challenges of Earthquake Risk Dynamics and -Globalisation



Tohoku 2011

16.000 fatalities! 6.000 injured! 4.000 missing!	125.000 buildings damaged! 300 billion US$ overall cost

Earthquake risk is dynamically increasing!

Most expensive natural disaster on record!

Earthquake risk is globalizing!

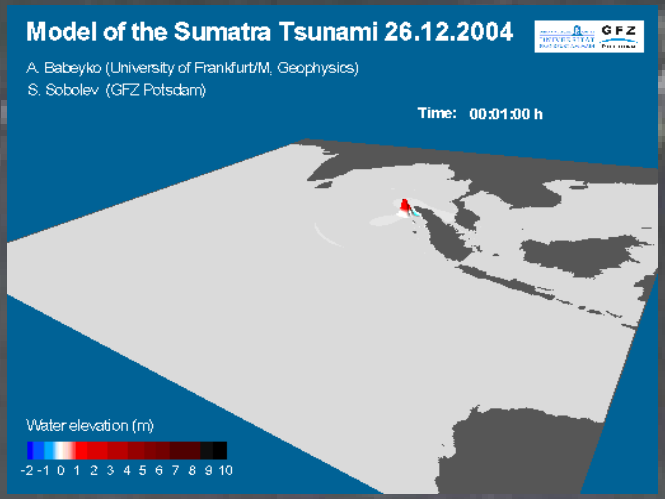
Nuclear accidents with global consequences!

11. March 2011, Magnitude 9.1

Photo US Navy ID 110312-N- 0000-X- 003

Sumatra, 26.12.2004

230000 Fatalities!



Earthquake risk
is dynamically increasing!
The deadliest
tsunami catastrophe
the world has ever seen!

Earthquake risk is globalising!
552 Germans among the fatalities,
more than
in any natural disaster
within Germany!

Drivers of Risk Dynamics and -Globalisation

In the developing world:

decreasing resilience due to poverty and the urban explosion!

Everywhere: Poorly developed cross-sectorial component of risk management!

In the industrialized world:

critical infrastructures and growing networking!

US$ 180,000,000

San Francisco 1906

US$ 260,000,000,000?

San Francisco 20??

US$ 2,800,000,000

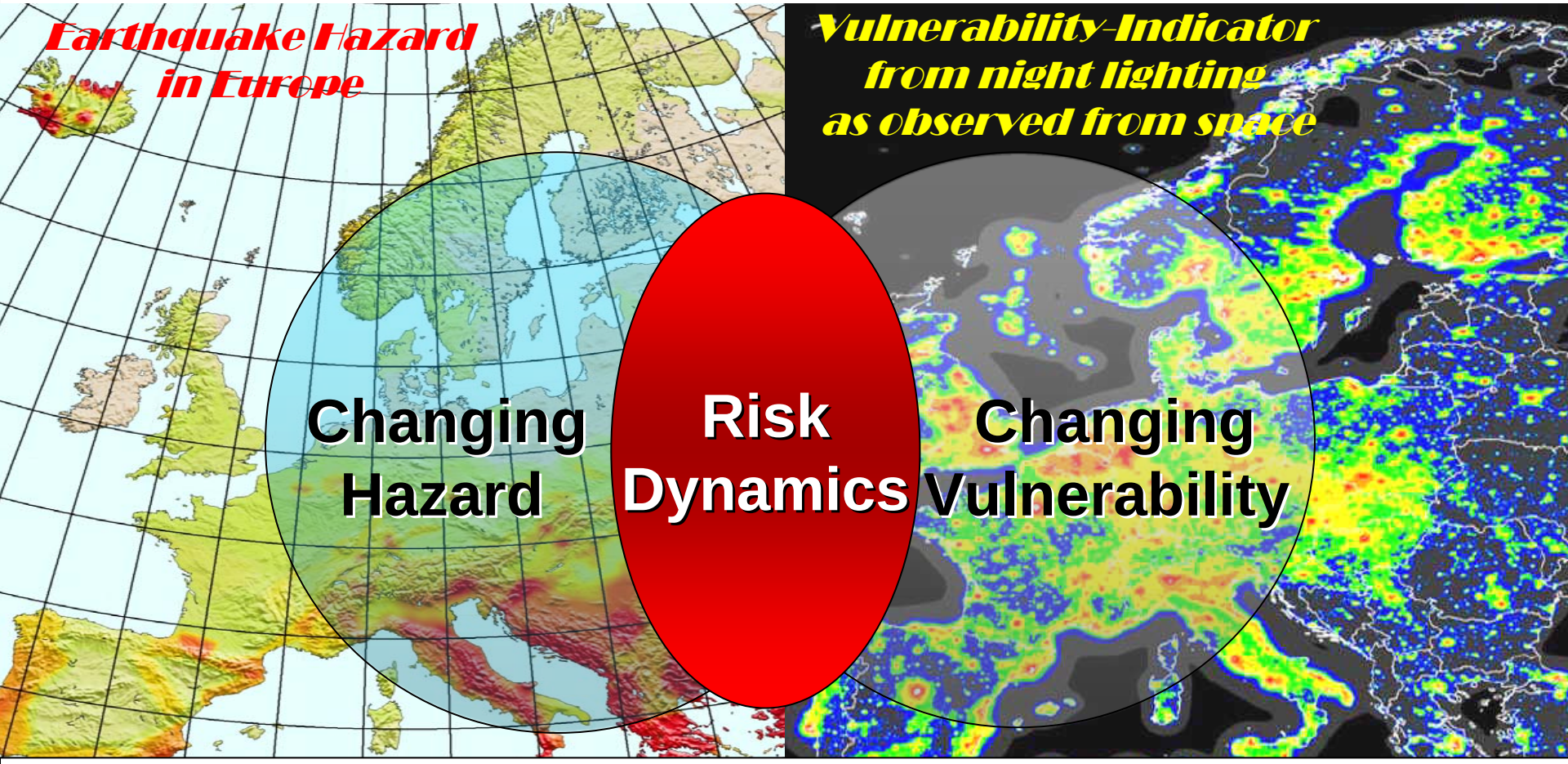
Tokyo 1923

US$ 2,000,000,000,000?

Tokyo 20??

Risk Dynamics and Global Change

They occur at the contact between man and nature!



Risk dynamics is determined to a great extent by vulnerability changes!
But:Time-dependence of hazard is more important than usually accepted!

Intensity to be exceeded with X% probability over the next Y decades

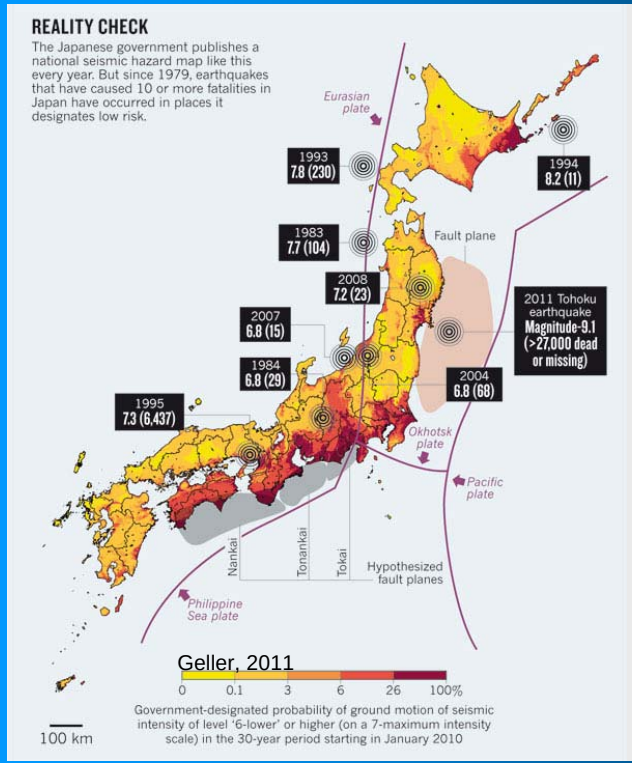
Seismic Hazard Maps

Hazard Assessment

How good are they?

State of the Art

Probability that a given intensity X is exceeded within the next Y decades)



Earthquakes in Japan that caused 10 or more fatalities

They have occurred in places it designates low hazard!

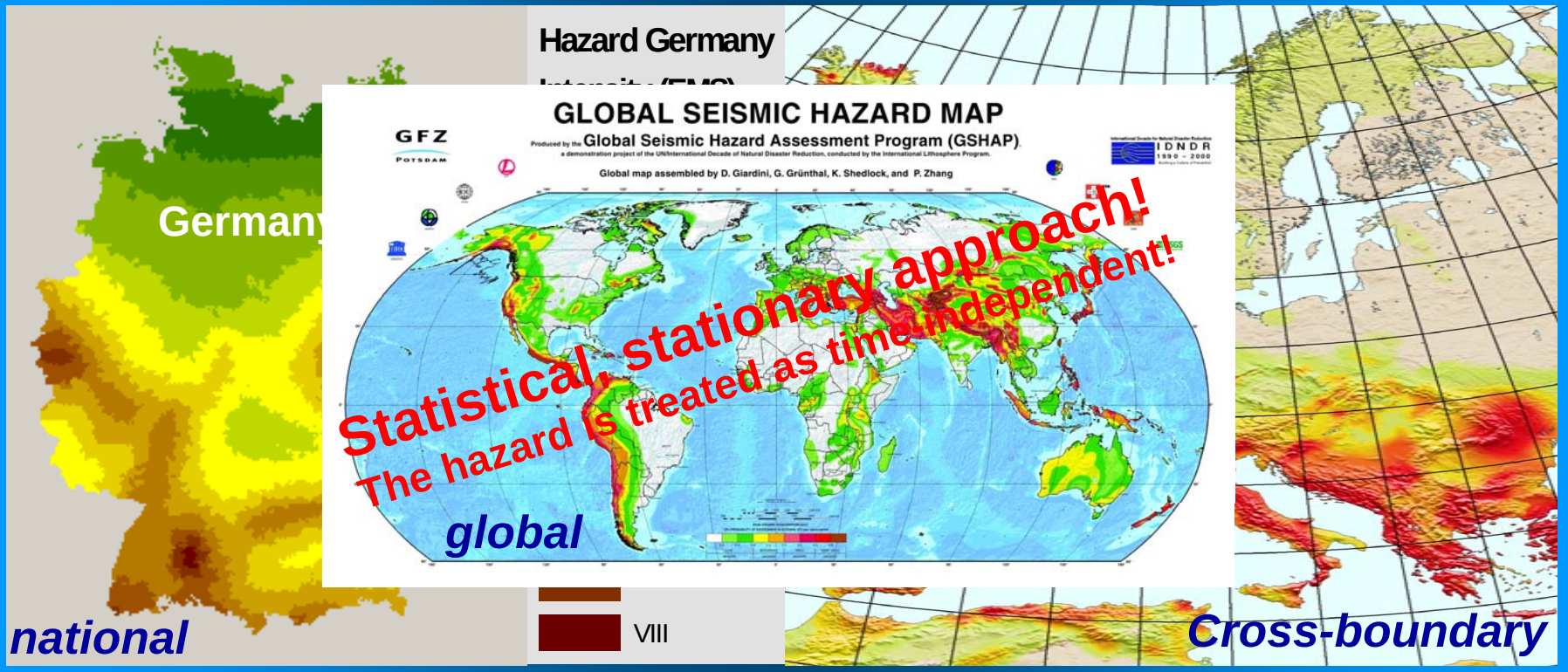
Many other examples worldwide: Wenchuan 2008, Haiti 2010,…

Intensity to be exceeded with X% probability over the next Y decades

Seismic Hazard Assessment

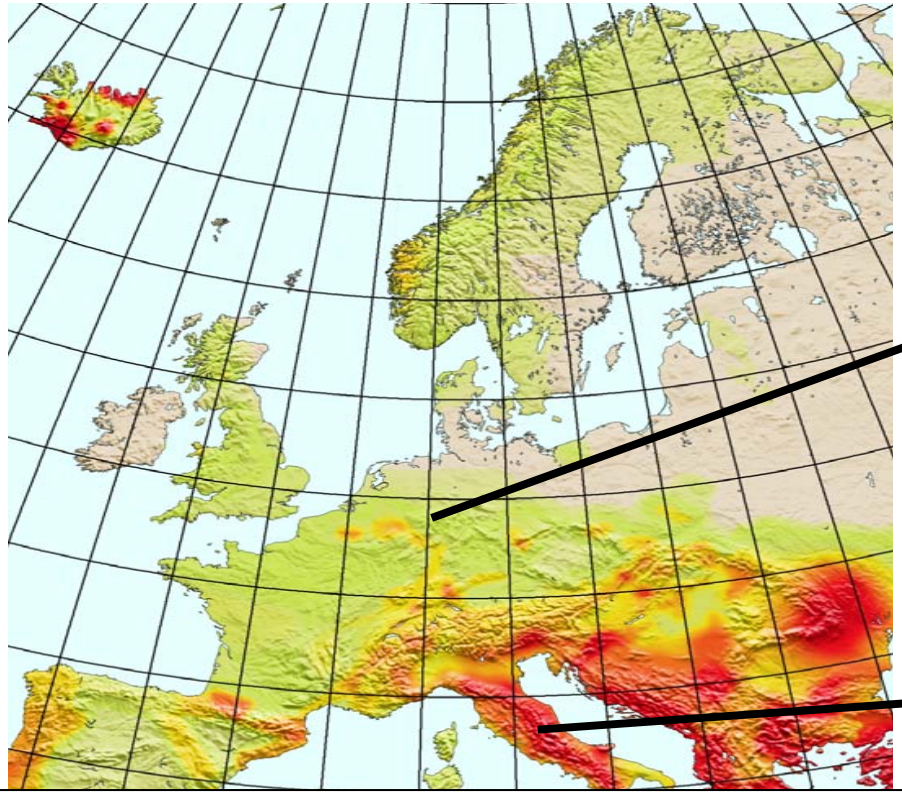
State of the Art

Probability that a given intensity X is exceeded within the next Y decades)

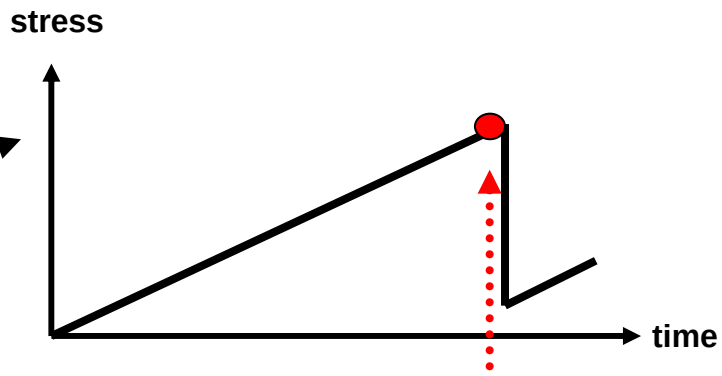


Classical Earthquake Hazard Maps

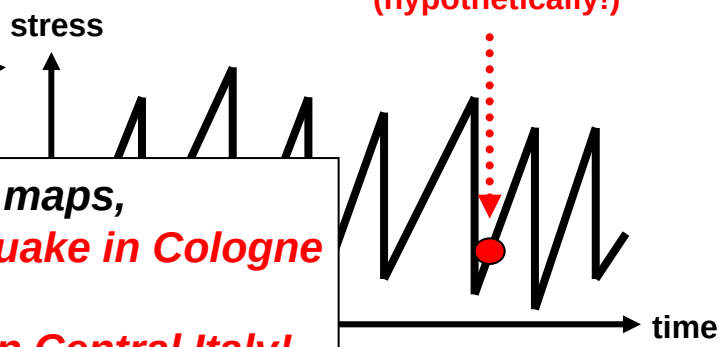
Low earthquake probabilities in low seismicity areas,
and high earthquake probabilities in high seismicity areas
at any time!



They neglect
the earthquake cycle!



Present
(hypothetically!)



In contradiction to the current hazard maps,
the present probability of having a large earthquake in Cologne
could be much higher than
the present probability of a large earthquake in Central Italy!

The Specific Challenge

"Time Dependent" Hazard Assessment

- **including physical process understanding, in particular for low probability earthquakes (based on seismology, paleoseismology, geodesy, modelling)**
  - ***earthquake cycle***
  - ***earthquake interaction***

- **accounting for earthquake "clustering" in time**

„Monitoring“ Vulnerability and Risk

GFZ-activity in the frame of GEM!

New Tools are needed!

satellite remote sensing

Ground based panoramic street view with mobile 3D-camera

We need to develop

a new quality of multi-disciplinary / cross-sectoral cooperation

in the management of natural risks and risk dynamics!

The Many Facettes of Vulnerability

Natural risk management can not be assessed by one discipline alone!