

Enhancement of Earthquake and Tsunami Disaster Mitigation Technology in Peru

Summary Report on SATREPS Peru Project



August 13, 2014



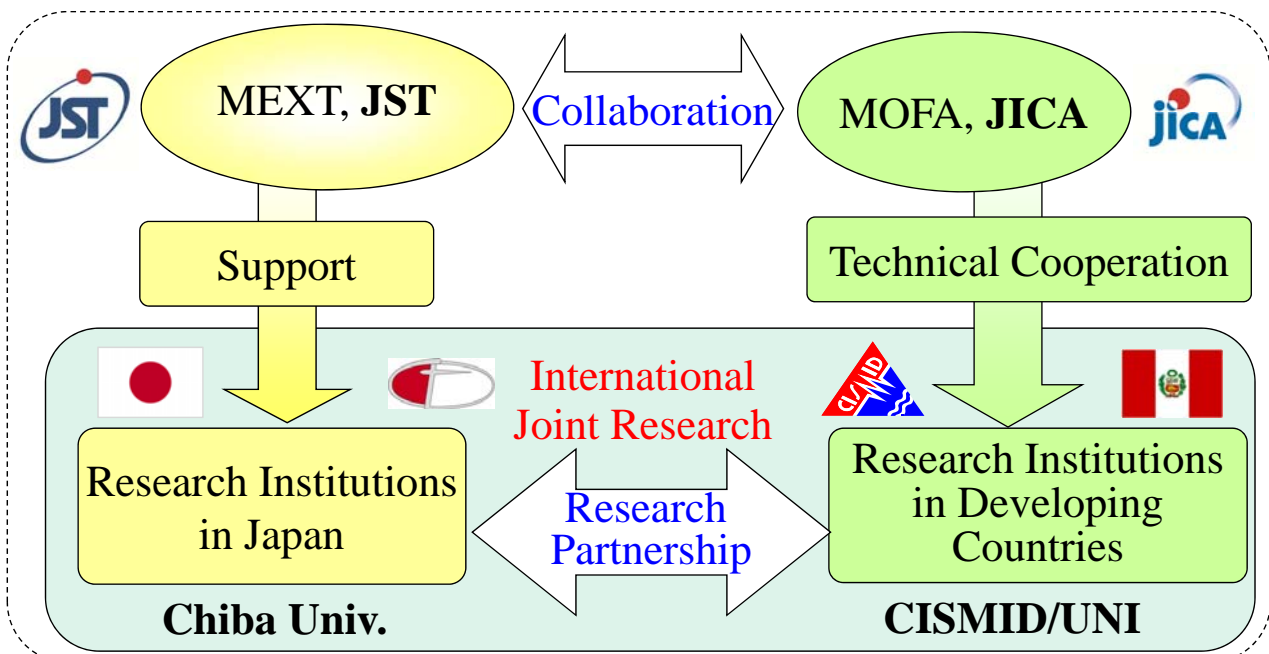
Fumio YAMAZAKI
Professor, Chiba University, Japan.
Doctor Honoris Causa, UNI, Peru.



Science and Technology Research Partnership for Sustainable Development : SATREPS

- 1) Environment and Energy
- 2) Bioresources
- 3) Natural Disaster Prevention
- 4) Infectious Diseases Control

JST: Japan Science and Technology Agency
JICA: Japan International Cooperation Agency



Significance of joint research between Peru and Japan

Both countries are located in a similar seismic environment, frequently hit by damaging earthquakes & tsunamis.

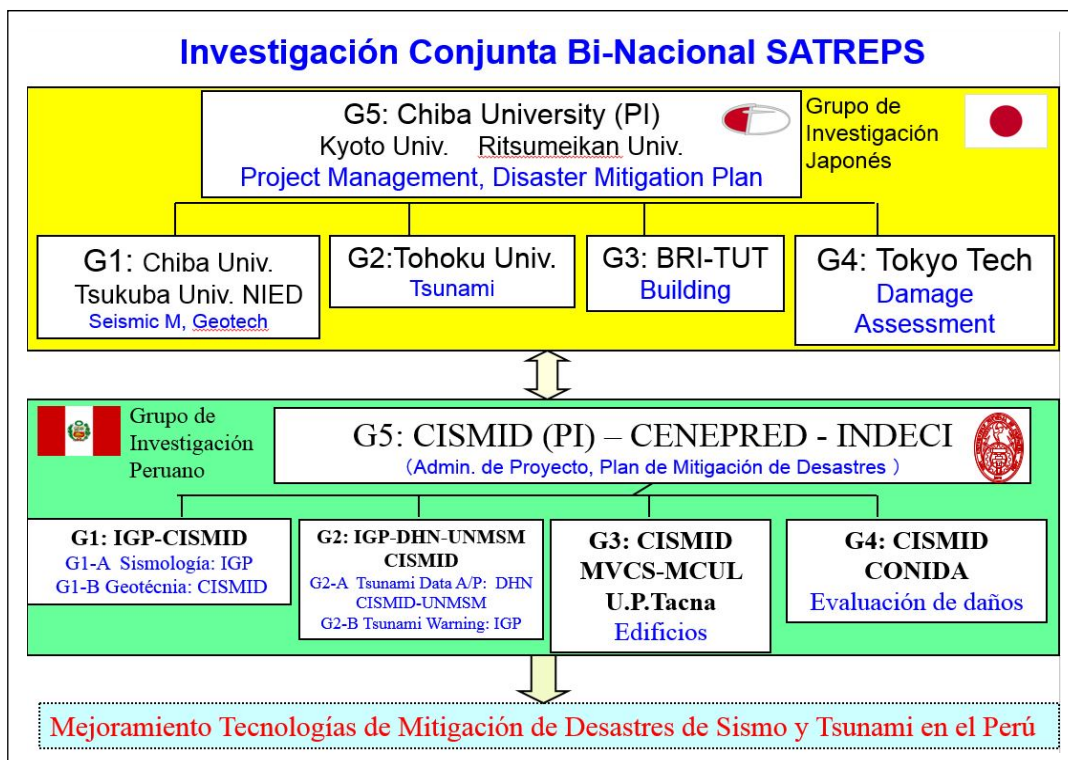


- Japanese experiences can **contribute** to disaster mitigation in Peru
- Merits to Japanese **geoscience** since subduction-zone EQs are **rare events**
- **Tsunamis** caused by earthquakes in **South America** hit **Japan** (1960, 2010 Chile EQs) and vice versa (2011 Tohoku EQ). Thus the joint-research contributes to **tele-tsunami study** in the world.
- Promotion of **disaster mitigation** and **capacity building** through **sharing the knowledge** from the international joint research



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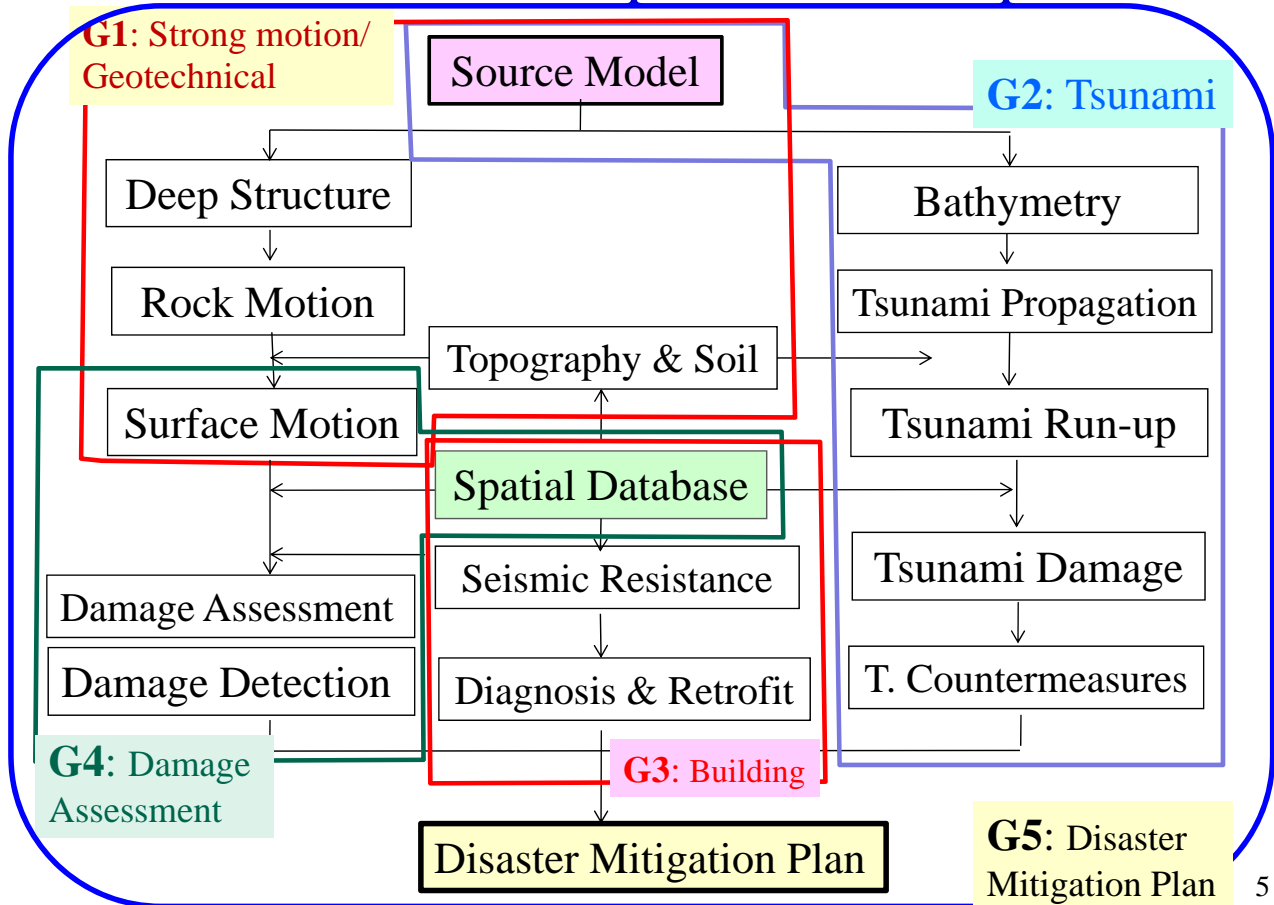
Esquema de Cooperación



G1: Sismología y Geotecnia, G2: Tsunami, G3: Edificaciones, G4: Evaluación de daños, G5: Planificación.

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Research Topics and Groups



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Overview of the Program

Project Management and Coordination

PI: F. Yamazaki (Chiba U), C. Zavala (CISMID/UNI)

- Project Management, International & domestic coordination
- Public relations, Information dissemination
- International workshops, symposia <http://ares.tu.chiba-u.jp/peru/>

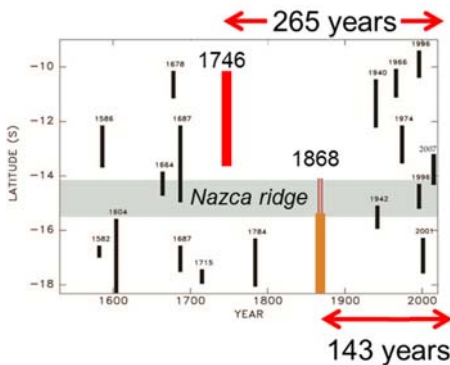


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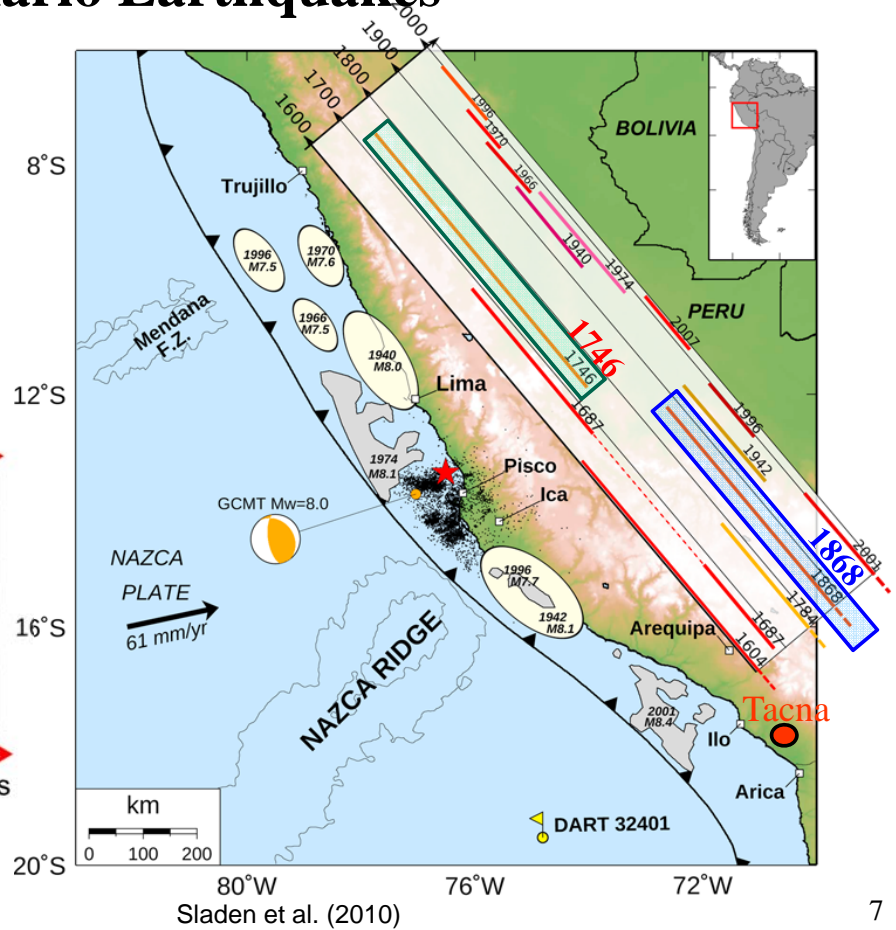
Selection of Scenario Earthquakes

Consultation by IGP

- 1746 ($M_w=8.6$)
- 1868 ($M_w=8.8$)



Adapted from Okal et al. (2006)

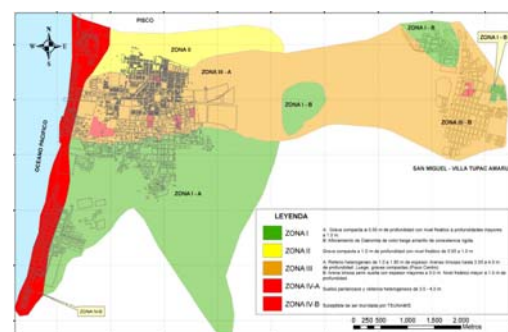
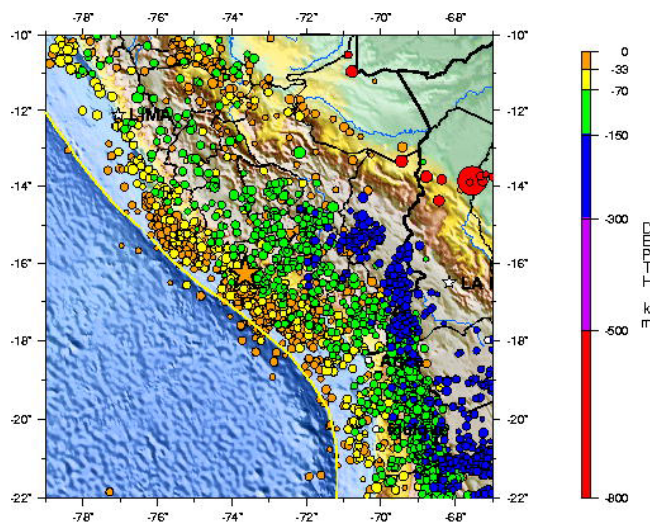


Sladen et al. (2010)

G1: Seismic Motion and Geotechnical Issues

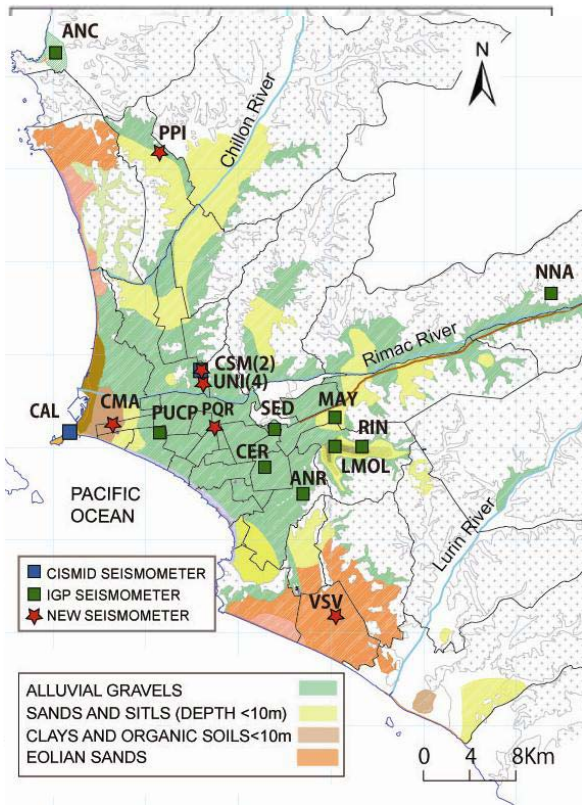
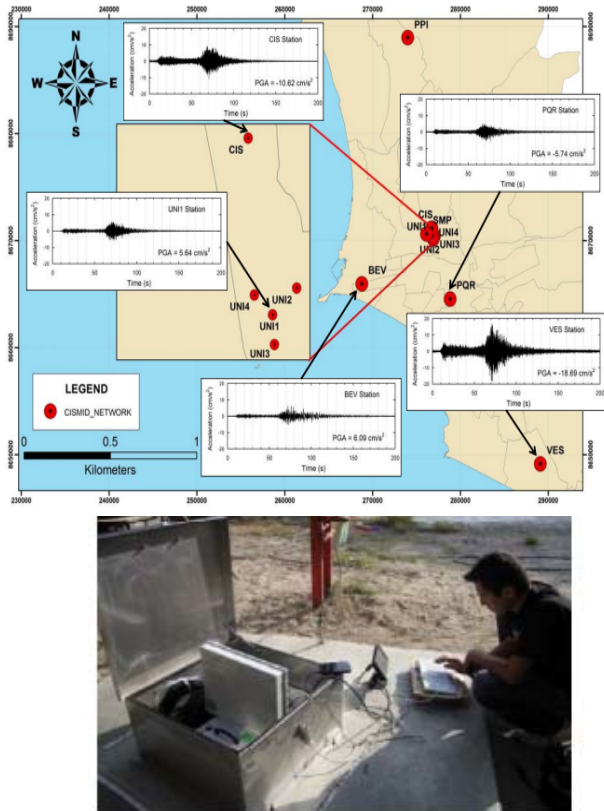
GL: S. Nakai (Chiba U), Z. Aguilar (UNI) & H. Tavera (IGP)

- Source Modeling and Simulation of Seismic Motion
- Microzonation based on EQ and MT observations
- Risk Assessment of Slope Failures

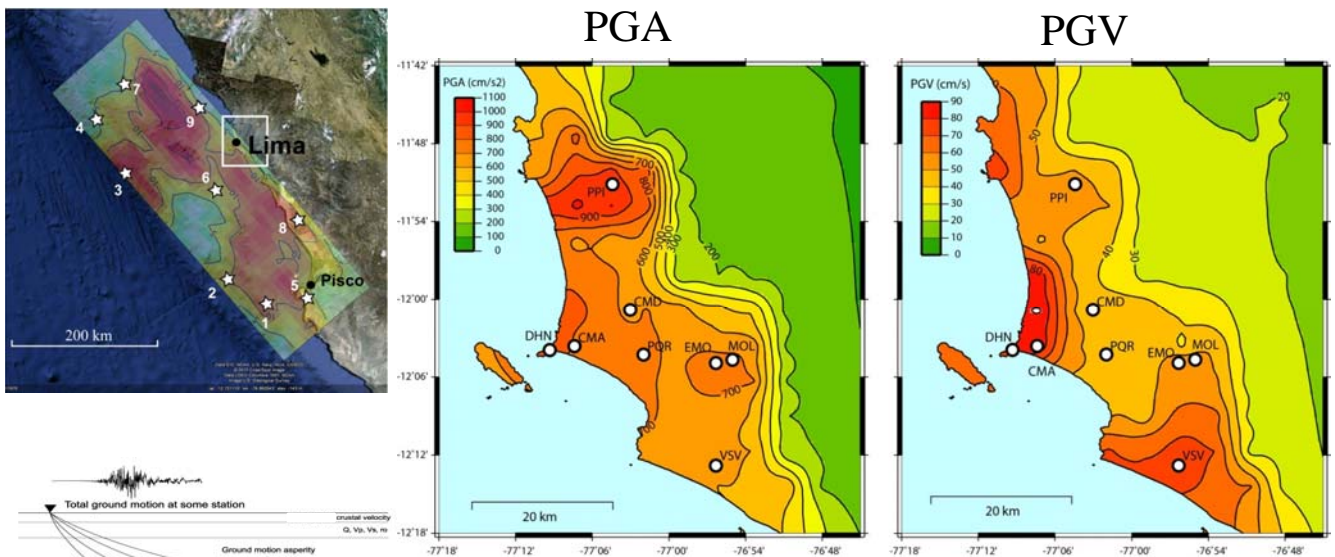


Installation of New Accelerometers in Lima and Data Release on the Web

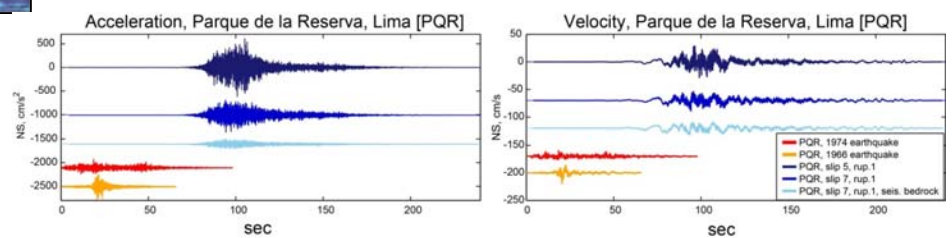
Contamán Earthquake (August 24, 2011)



Simulation of seismic ground motion in Lima



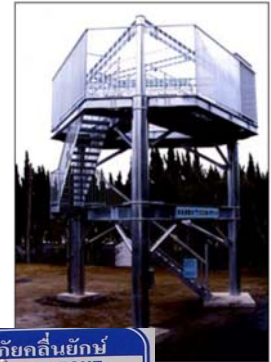
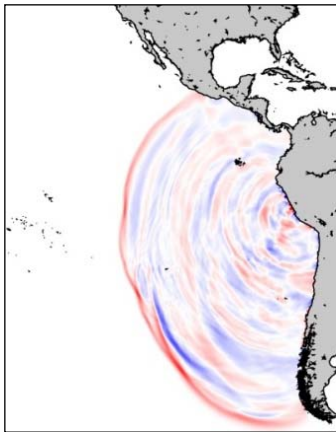
Average values for slip No.5 and all rupture starts



G2: Tsunami Simulation and Damage Mitigation

GL : S. Koshimura (Tohoku U), DHN, IGP, CISMID

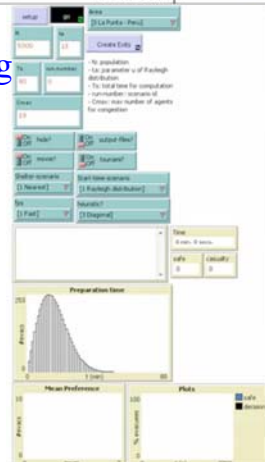
- Tsunami Source, Propagation and Impacts
- Tsunami Hazard and Impacts Mapping
- Implementation of Tsunami Disaster Mitigation Technology



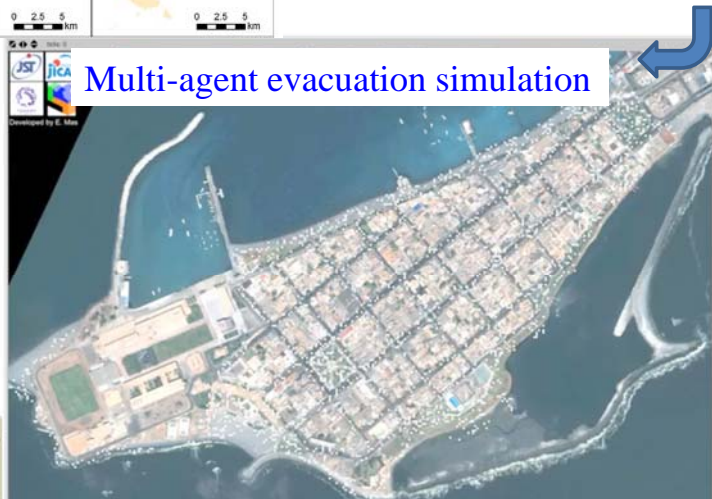
Data Collection, Hazard Mapping, and Evacuation Planning



Evacuation building



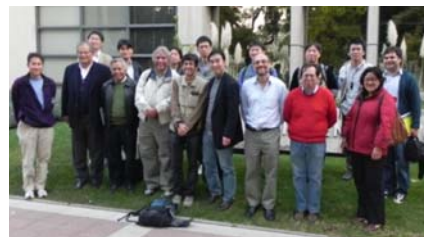
Multi-agent evacuation simulation



G3: Seismic Resistance of Buildings

GL: T. Saito (BRI, Toyohashi UT), C. Zavala (UNI)

- Develop Database of Structural Tests for Masonry Buildings
- Develop Seismic Diagnosis and Retrofit Technologies
- Assessment and Retrofit of Historical Buildings



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Equipment introduced to Peru

Structural testing

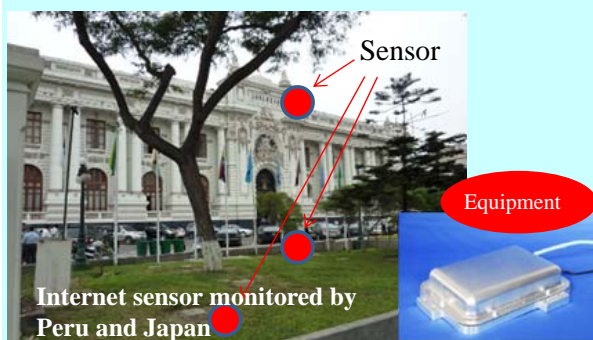


Material testing

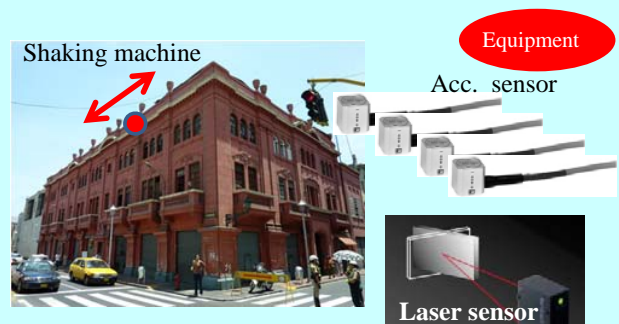
Renewal of old CISMID machine



Building monitoring



Dynamic behavior monitoring & test

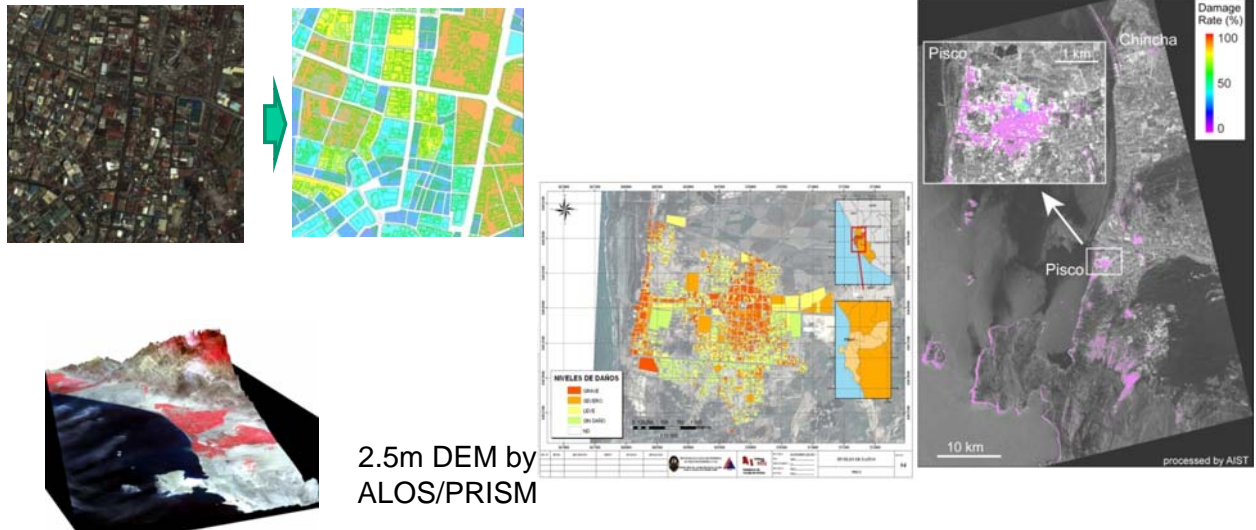


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G4: Geo-spatial Database and Damage Assessment

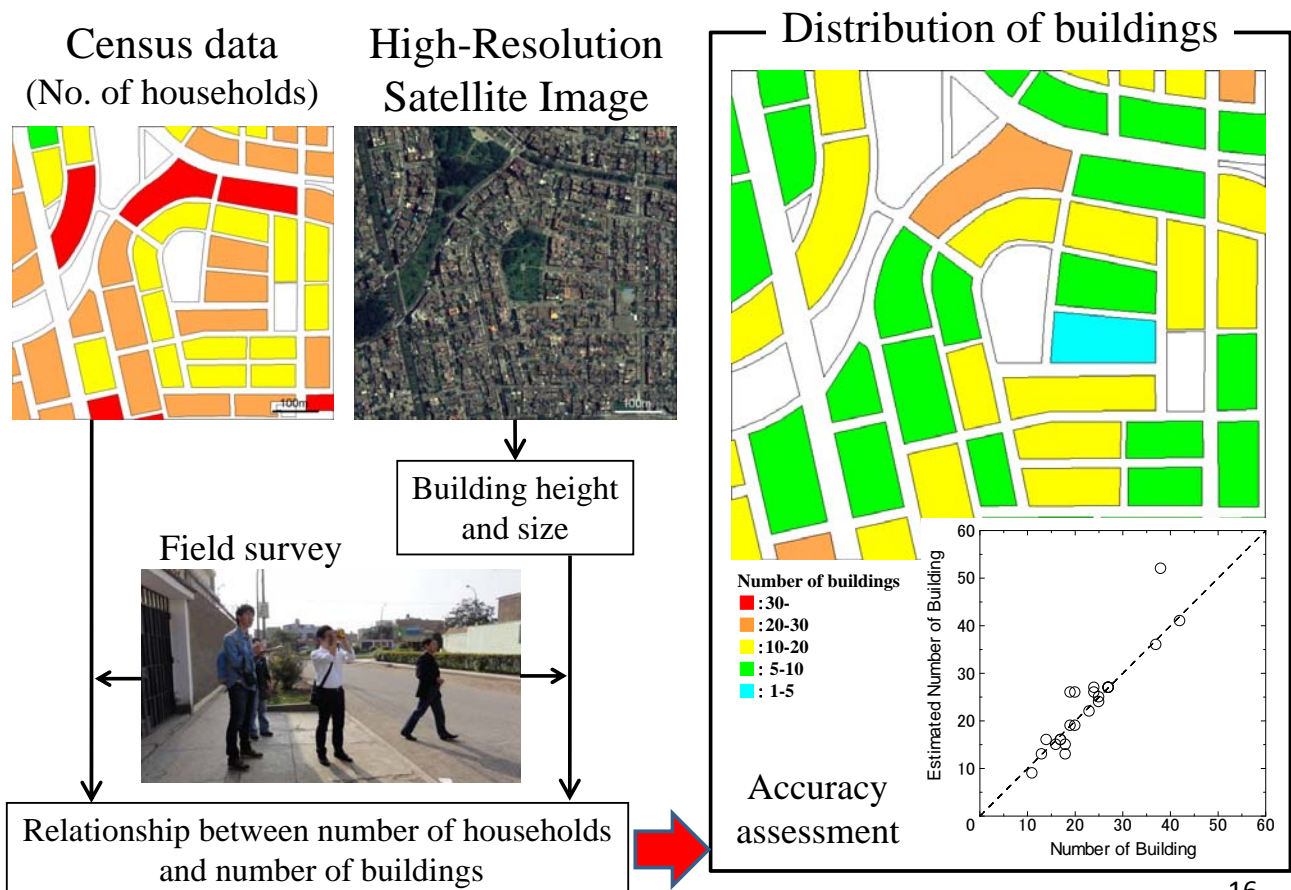
GL: S. Midorikawa (Tokyo Tech), M. Estrada (UNI)

- Development of **Geo-spatial Database**
- **Damage Detection** using Satellite Images
- **Damage Assessment** for Scenario Earthquakes



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G4: Development of Building Inventory Data in Lima

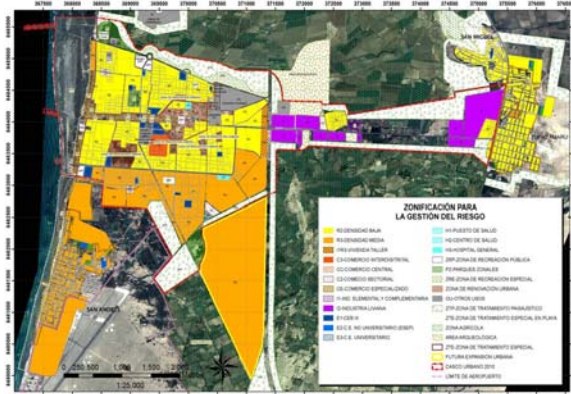


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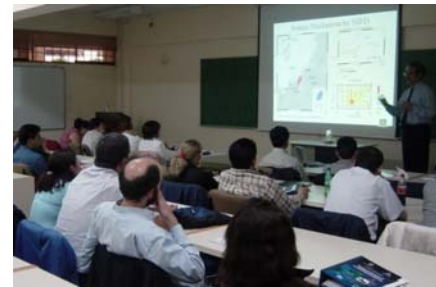
G5: Development of Disaster Mitigation Plan

GL: F. Yamazaki (Chiba U), A. Bisbal (INDECI→PCM)

- Formulate **Land-use Policies** for Disaster Mitigation
- Develop **Local Disaster Mitigation Plans** for the **Study Areas**
- **Awareness Raising and Dissemination Activities**



Land-use plan after the 2007Pisco EQ (CISMID)



Technical seminar (JICA-Peru, 2004)

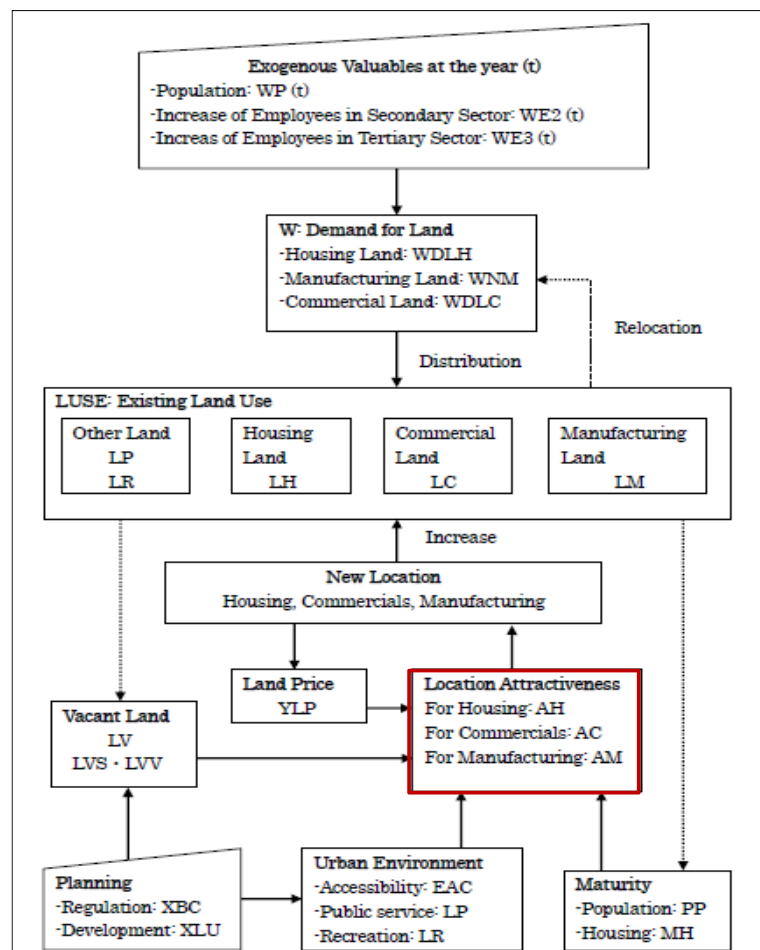
Structure of the Model: LIMA-UVEQ

A Simulation Model for Forecasting

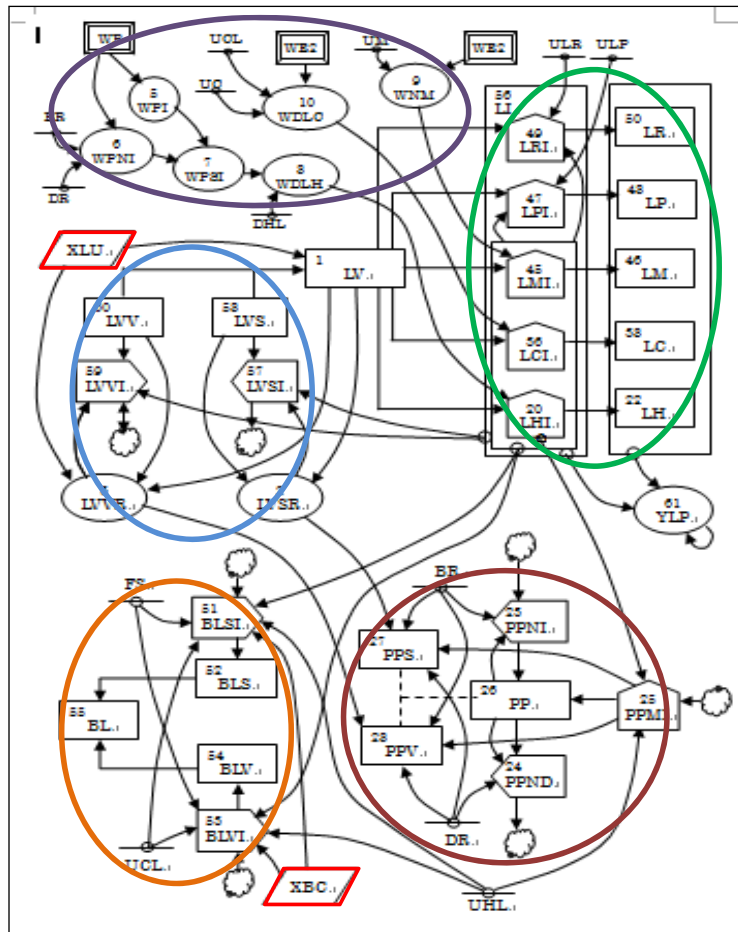
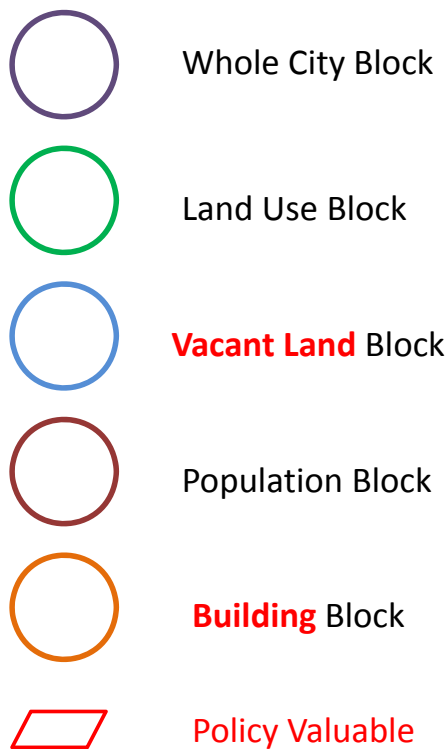
Urban Vulnerability to Earthquake Disaster in Lima, Peru


Attractiveness Index for Location:


- Vacant Land
- Accessibility
- Maturity
- Land Price
- Public Services




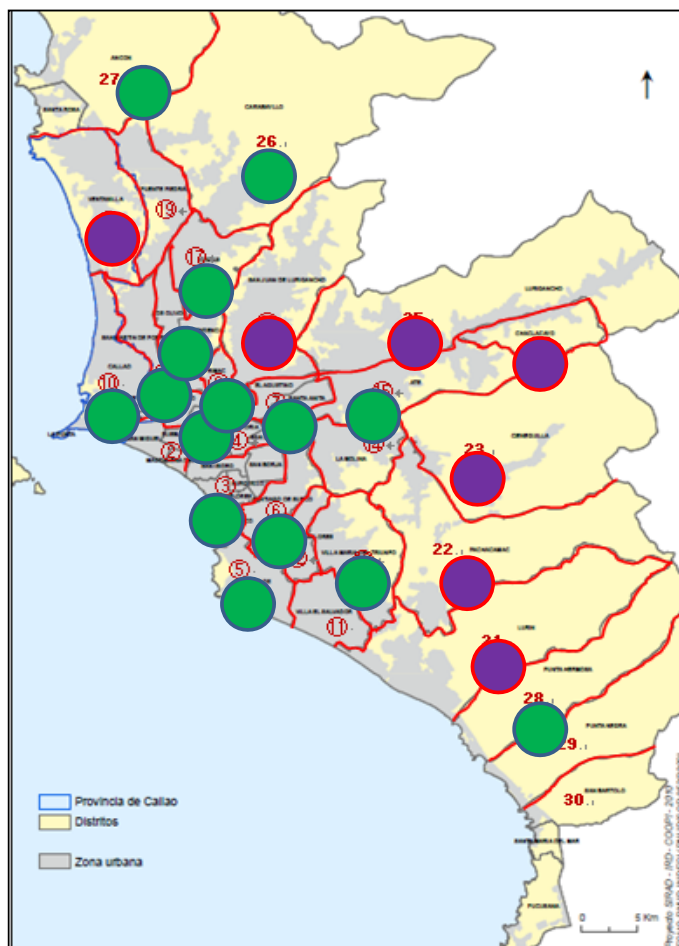
Flow Diagram of LIMA-UVEQ



 P6-P1>5,000 persons
Population with strict land use regulation is less than that without the regulation.

 P6-P1<0
Population with strict land use regulation is more than that without the regulation.
⇒ Strict land use regulation restrain population growth in central parts and disperse it to the suburban areas.

 Earthquake decreases population of the central part and generates new urban areas in the eastern and northern districts.



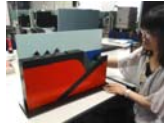
Equipment for Public Awareness Centers

- CISMID Awareness Center in Lima
- INDECI Arequipa Public Awareness Center



CISMID/UNI

1. Elementary Public Awareness Models (2 sets)
 - Plate tectonics model
 - Tsunami generation model
 - Small shaking table



INDECI Arequipa

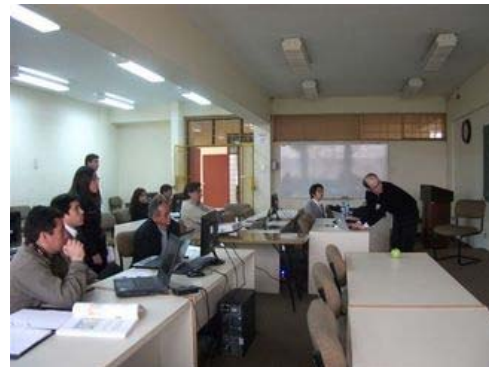
2. Portable 1D Shaking Table (2 sets)
3. Hand-move Shaking Test Kit (1 set)
- ~~4. Earthquake Experience Car (1 set)~~



Human Resources Development



Trainees from CISMID to Chiba U.



Tsunami Training Course at CISMID



Attending a practice class at Chiba U.



C. Jemenez in Onagawa

Activities in 2010-2014

Meetings and field survey

Field survey at Tacna coast



Meeting at Tacna Private Univ.



Visit INDECI Arequipa



Public Relations

Seminar at Peruvian Congress



2010 Lima

Press conference



2012 Tacna

Press conference



2013 Lima

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Special Issues on *Journal of Disaster Research*

<http://www.fujipress.jp/JDR/>

Special issues on the Peru project

#1 published: JDR Vol. 8 No. 2 Mar. 2013

#2 in preparation: JDR Vol. 9 No. 6 Dec. 2014



Thank you very much!
Muchas Gracias!
ご清聴ありがとうございます。