Summary Report on SATREPS Peru Project

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Science and Technology Research Partnership for Sustainable Development (SATREPS)

Enhancement of Earthquake and Tsunami Disaster Mitigation Technology in Peru

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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

Chiba Univ. CISMID/UNI

International Joint Research
MOFA, JICA

Technical Cooperation

Research Institutions in Japan
Research Institutions in Developing Countries

MEXT, JST

Support

Collaboration

MOFA, JICA

Research Partnership

Chiba Univ.

CISMID/UNI
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

Esquema de Cooperación

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/

Peru-Japan WS, 2010 March, @UNI
Selection of Scenario Earthquakes

Consultation by IGP

- 1746 (Mw=8.6)
- 1868 (Mw=8.8)

Adapted from Okal et al. (2006)

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

Simulation of seismic ground motion in Lima

PGA

PGV

Average values for slip No.5 and all rupture starts
G2: Tsunami Simulation and Damage Mitigation

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

Data Collection, Hazard Mapping, and Evacuation Planning

- Bathymetry
- Topography
- Landuse
- Street & Evacuation zone

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**
- Self supporting loading system
- 4-jack jacks with Control system

**Material testing**
- Renewal of old CISMID machine
- 50ton Universal
- 300ton Compression

**Building monitoring**
- Internet sensor monitored by Peru and Japan

**Dynamic behavior monitoring & test**
- Shaking machine
- Acc. sensor
- Laser sensor
**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

2.5m DEM by ALOS/PRISM

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**G4: Development of Building Inventory Data in Lima**

Census data (No. of households)  
High-Resolution Satellite Image  
Building height and size  
Relationship between number of households and number of buildings  
Accuracy assessment
**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 2007 Pisco EQ (CISMID)](image)

**Technical seminar (JICA-Peru, 2004)**

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**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

- Whole City Block
- Land Use Block
- Vacant Land Block
- Population Block
- Building Block
- Policy Valuable

- 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.
  $\Rightarrow$ 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

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

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  Press conference  Press conference

2010 Lima  2012 Tacna  2013 Lima

Special Issues on *Journal of Disaster Research*

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

Special issues on the Peru project

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#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した．