

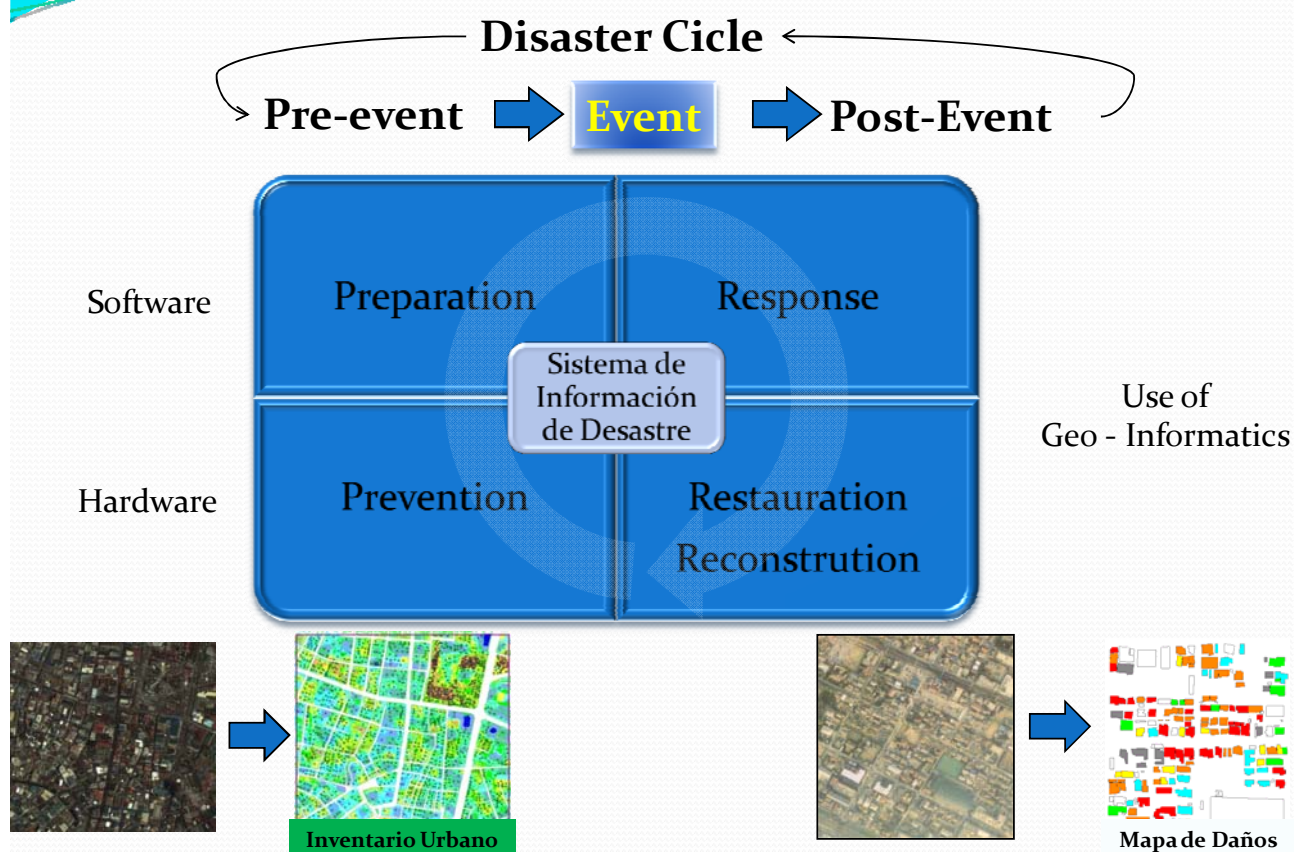
# The 1st Japan-Peru Workshop on Enhancement of Earthquake and Tsunami Disaster Mitigation Technology

## Group 4: Damage Assessment

Miguel Estrada - Hiroyuki Miura  
(CISMID-FIC-UNI) – (Tokyo Institute of Technology)

15 – 16 March, 2010

## Disaster Management





# Objectives of Group 04

- Research Topics
  - Building Inventory
  - Geo-Spatial Database
  - Data Integration (Geotechnical, Structure, Tsunami)
  - Damage Simulations (Earthquake and Tsunami)
  - Earthquake Scenario of Seismic Risk Assessment
  - Damage Assessments Methodologies
  - Internet Based System for data dissemination

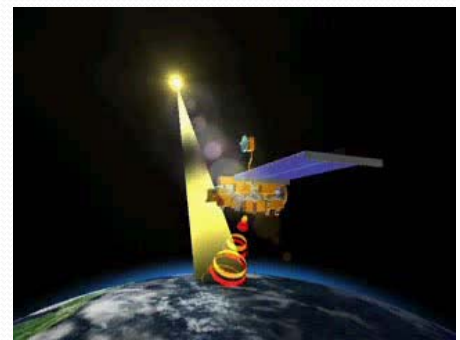


# Institutions

- **From Japan**
  - Chiba University
  - Tokyo Institute of Technology
  - National Institute of Advanced Industrial Science and Technology (AIST)
- **From Peru**
  - CISMID – FIC – UNI
  - CONIDA
  - ONGEI – PCM

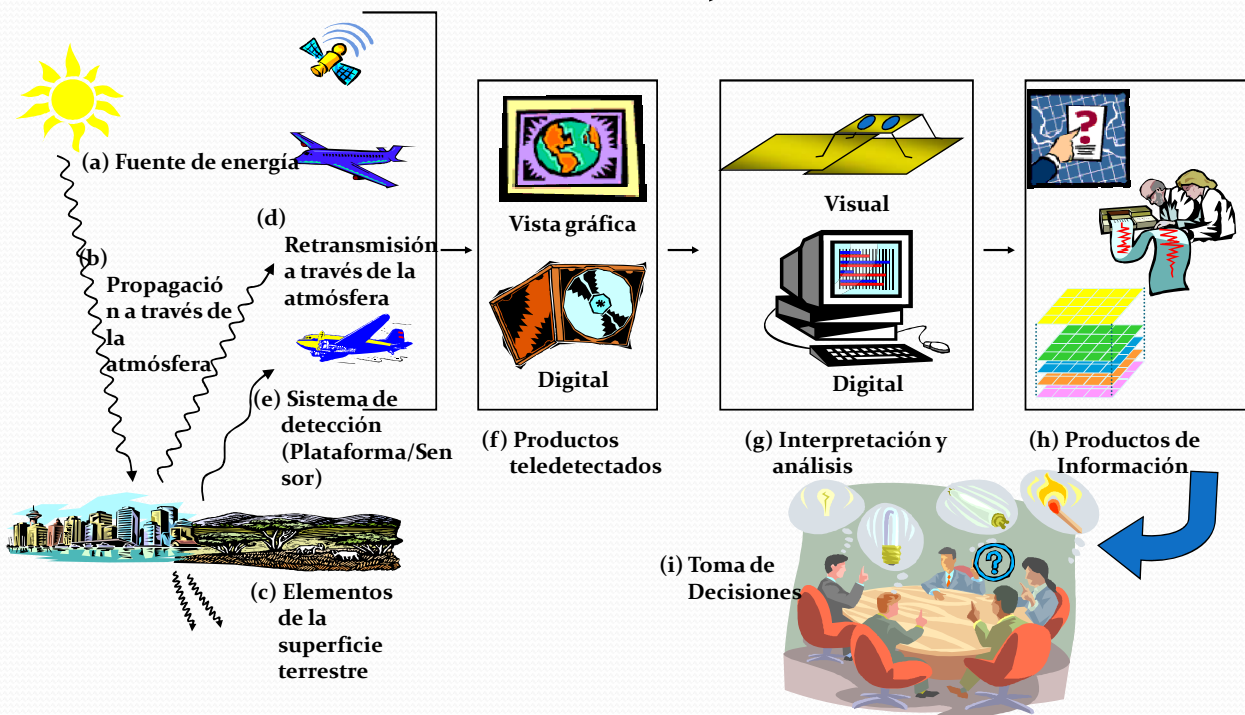
# La Información Satelital

- Cover extensive land area
- There exists historical satellite images (Pre-event data)
- Periodical acquisition (fourth dimension)
- Spectral information (Fifth dimension)
- Many satellites are orbiting (Optical, SAR, Lidar)

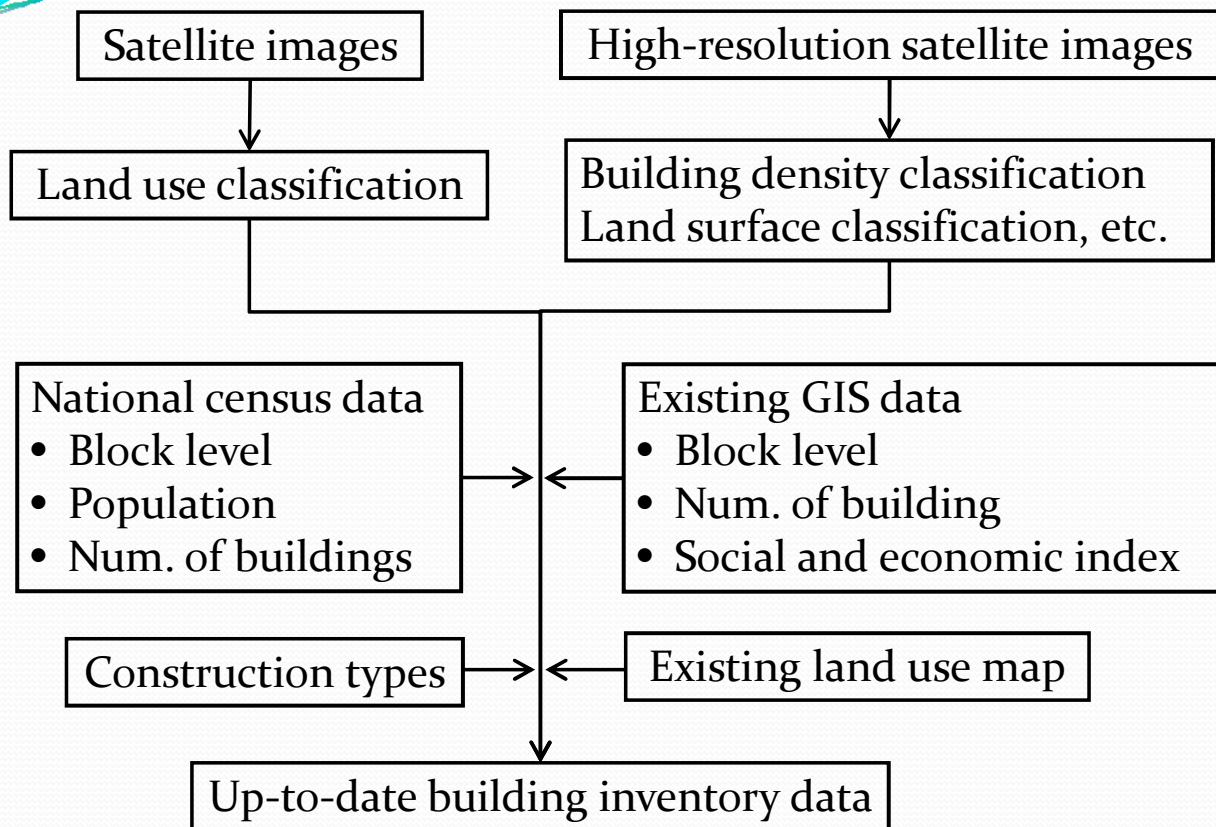


# Surface Remote Sensing

Adquisición de Datos  Análisis de Datos

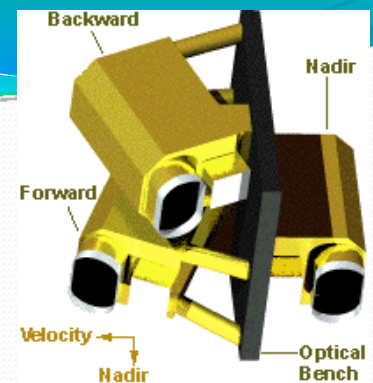


# Development of Building Inventory Data

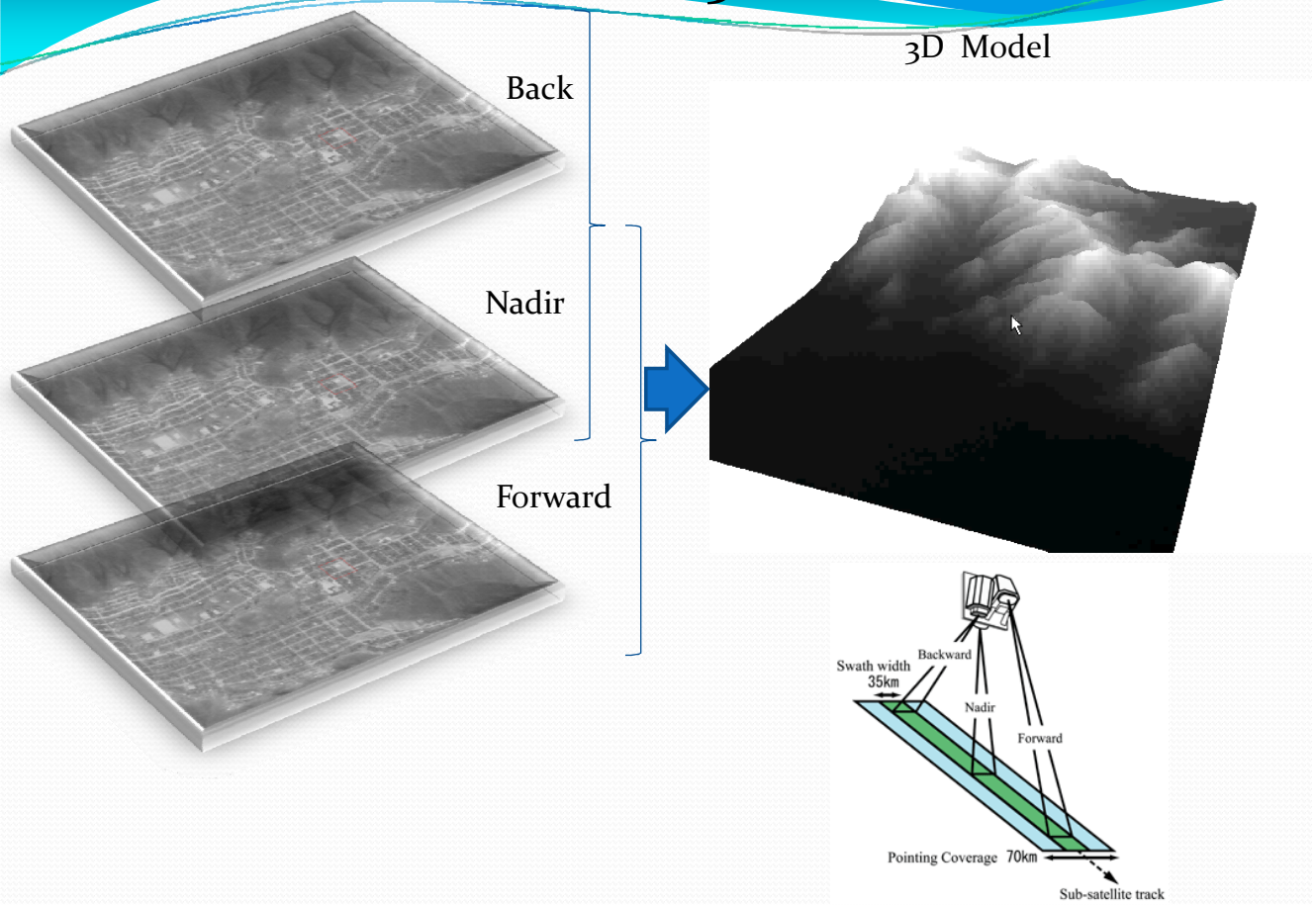


## Sensor PRISM

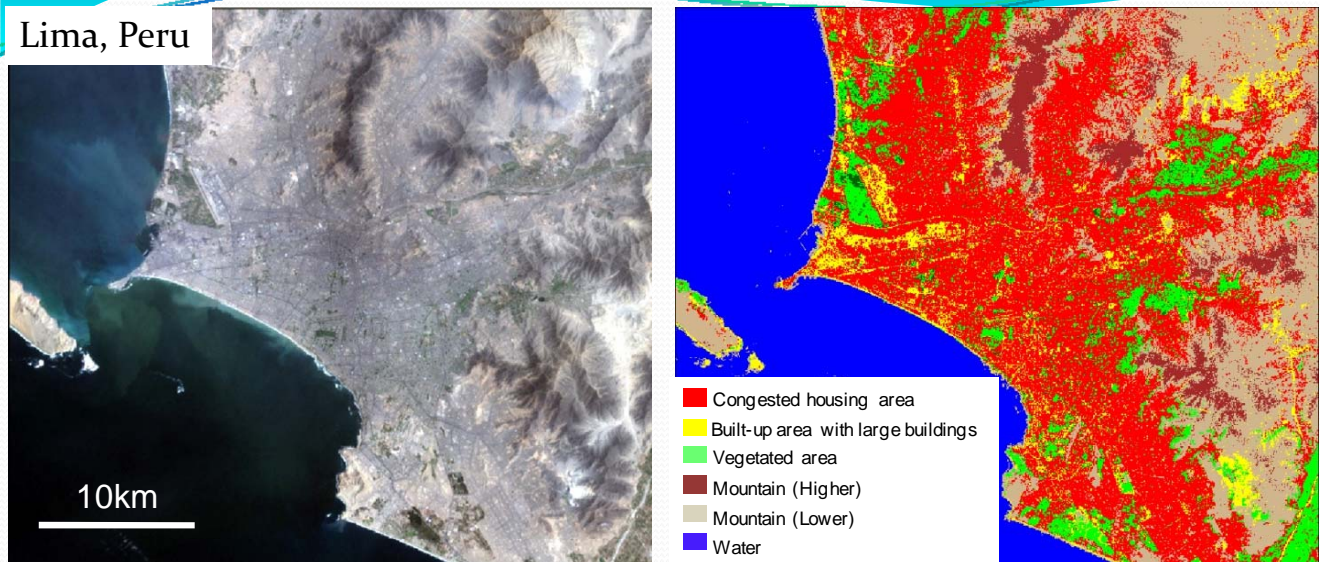
- PRISM: Panchromatic Remote-sensing Instrument for Stereo Mapping (Instrumento de Teledetección Pancromático para Mapeo Estéreo)
- Radiómetro pancromático de 2.5 metros de resolución espacial.
- El procesamiento de sus datos provee modelos de superficie digital (DSM o DEM) de alta precisión.
- Tiene tres sistemas ópticos independientes que trabajan en tándem.



## 3D Model Generation



## Land Use Estimated from Satellite Optical Image



Landsat Image (15m-resolution)  
Observed in 2002/1/17

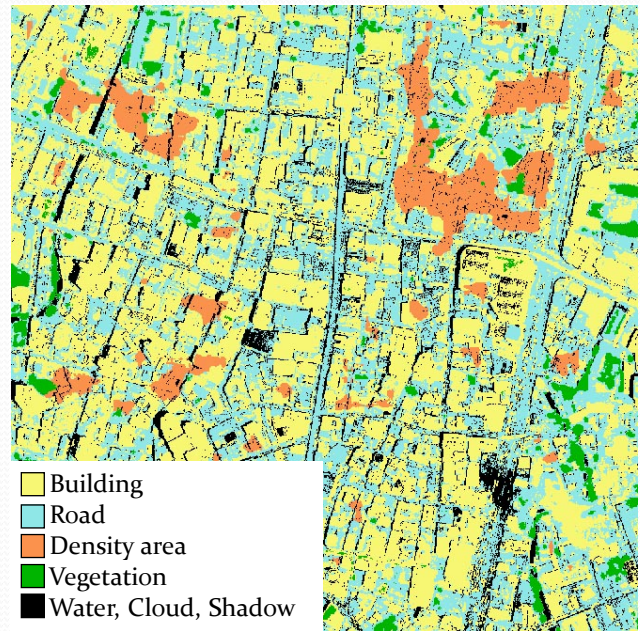
Land Use Map Estimated by  
Supervised Classification of Image

Classification accuracy should be improved by using appropriate supervised data and digital elevation model (DEM).  
From time-series analysis of Landsat images, sprawl of urbanized area would be evaluated.

# Micro-scale Urban Classification Using High-resolution Satellite Images



High-resolution Satellite Image  
in Urban Area



Building Density Classification  
Land Surface Classification

## Satellite Data + GIS (Geo-Spatial DataBase)

Multimedia Informaton  
Linked to database

The screenshot displays the ArcMap interface with a satellite image of an urban area. Red bounding boxes are overlaid on the image, indicating specific features of interest. The Identify window is open, showing the following metadata for the selected feature:

Field	Value
EnConst	0
N_Pisos	2
Material	M
Uso	Abandonado
Observacio	Municipalidad Distrital de Tambo de Mora
MaterialAS	M
N_PisosAS	2
UsoASismo	Institucional
Daño	3
Foto1	.\FOTOSCAMPO\FOTOSD2\BRUNO\DSC05249.JPG
Foto2	.\FOTOSCAMPO\FOTOSD2\BRUNO\DSC05249.JPG

The IrfanView window shows a zoomed-in photo of a building, identified as the Municipalidad Distrital de Tambo de Mora. The photo is labeled with the file name DSC05249.JPG and shows a two-story building with a sign that reads "MUNICIPALIDAD DISTRITAL DE TAMBO DE MORA".

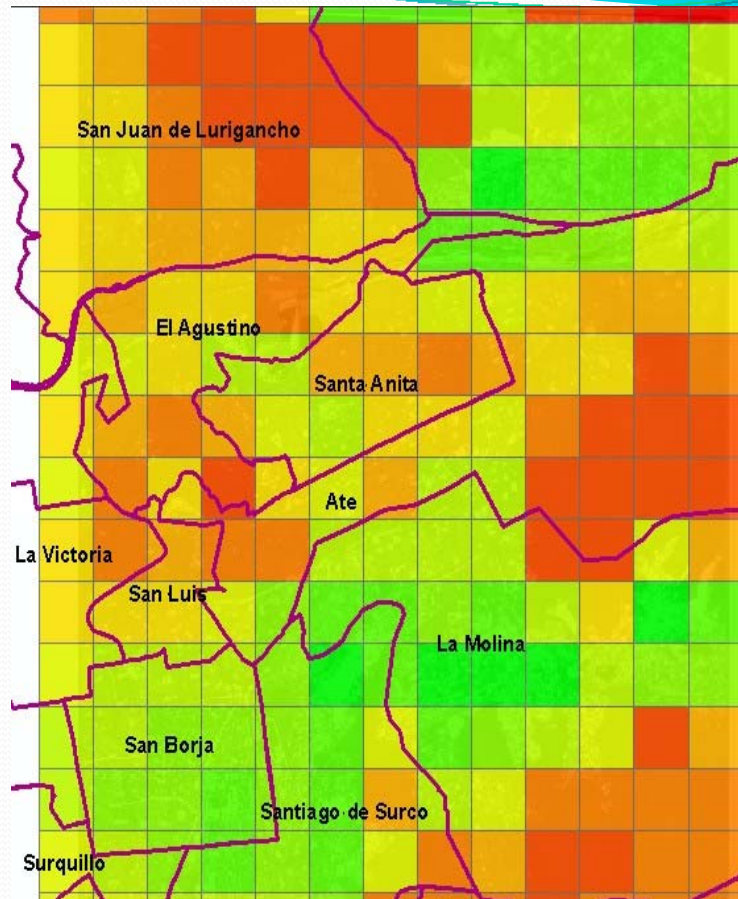
# Urban Growth 1958 - 2008



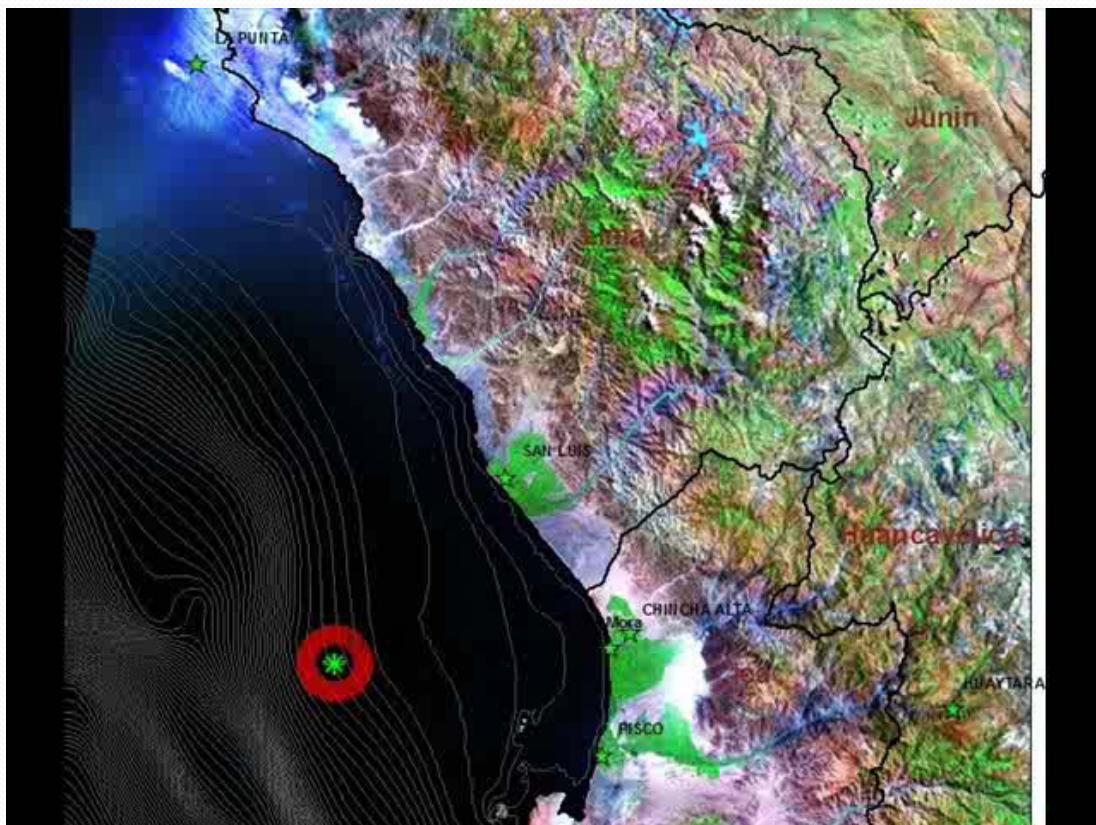
**Imagen satelital sobre el modelo digital de terreno. En borde rojo AH 12 de Agosto, en borde magenta AH Nuevo Amanecer y en borde azul AH 1ro de Julio**



# Spectral Analysis Cluster Analysis



# Earthquake Affected Area





# Comparación Imagen Satelital vs. Fotografía Aérea



# Zonas de Refugio



## Zonas de Refugio



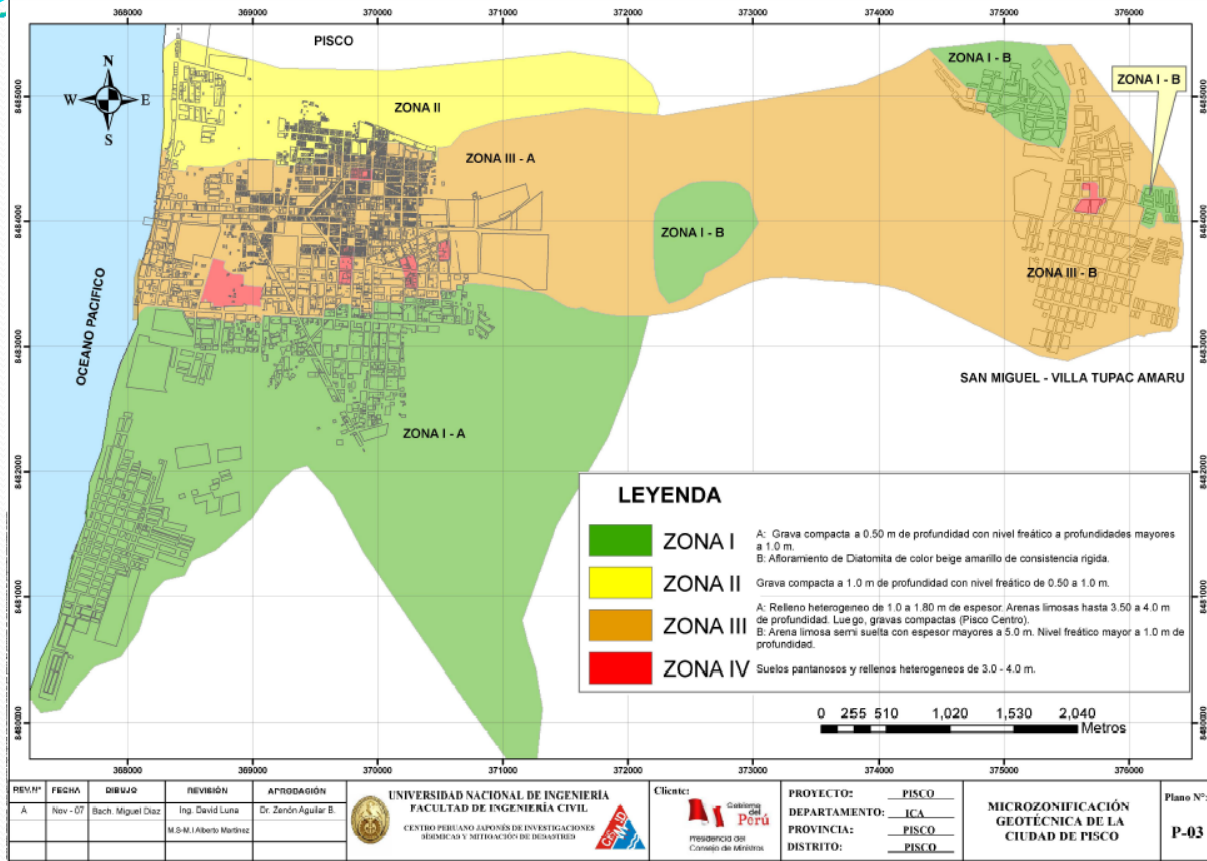
## High Resolution Images: Visual Damage Assessment



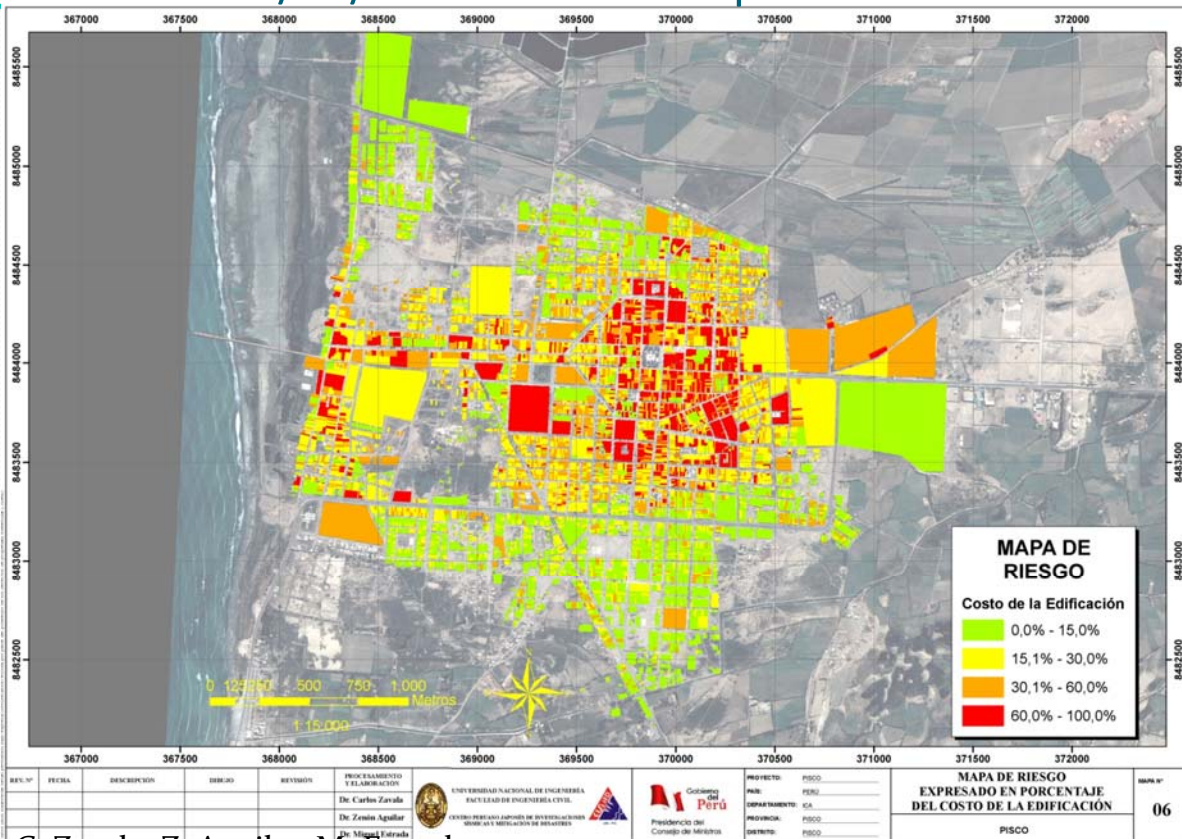
CISMID - FIC - UNI - Para la Presidencia del Consejo de Ministros



# Seismic Geotechnical Microzonation

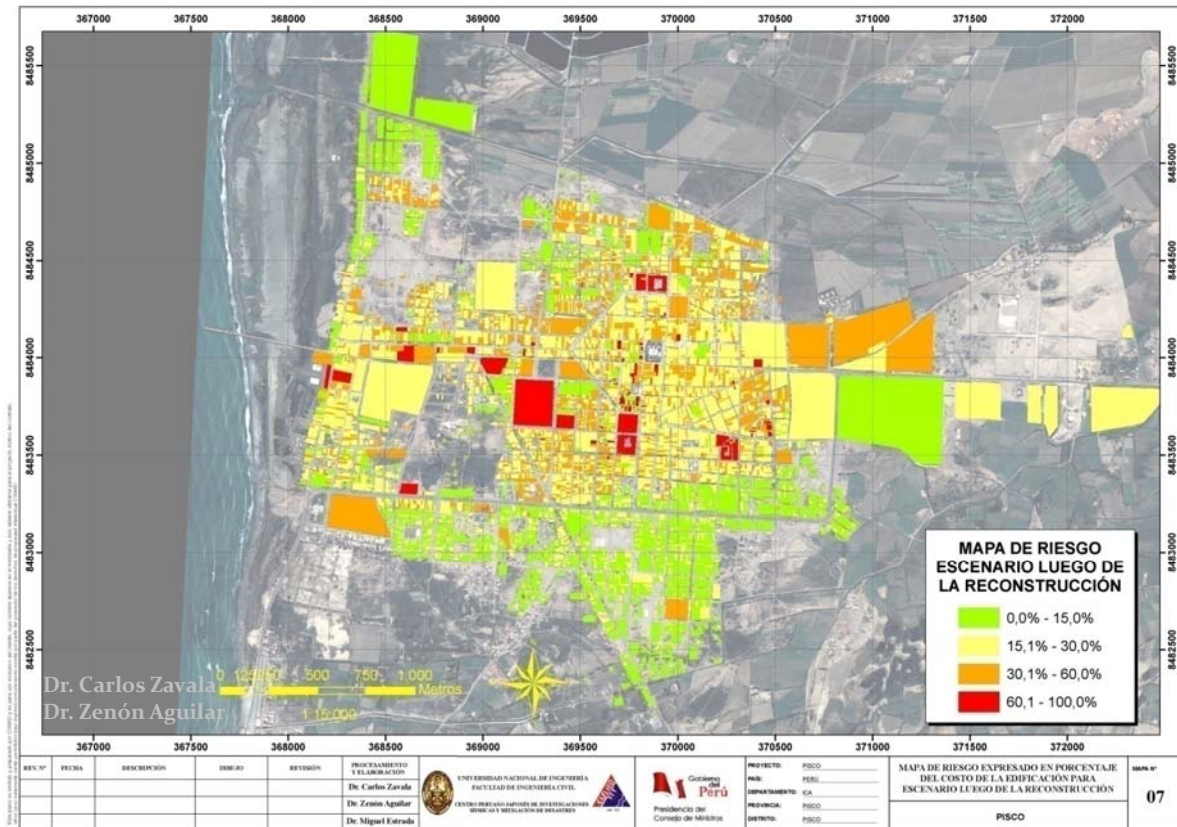


# Seismic Risk Map Scenario: 15/08/2007 Pisco Earthquake

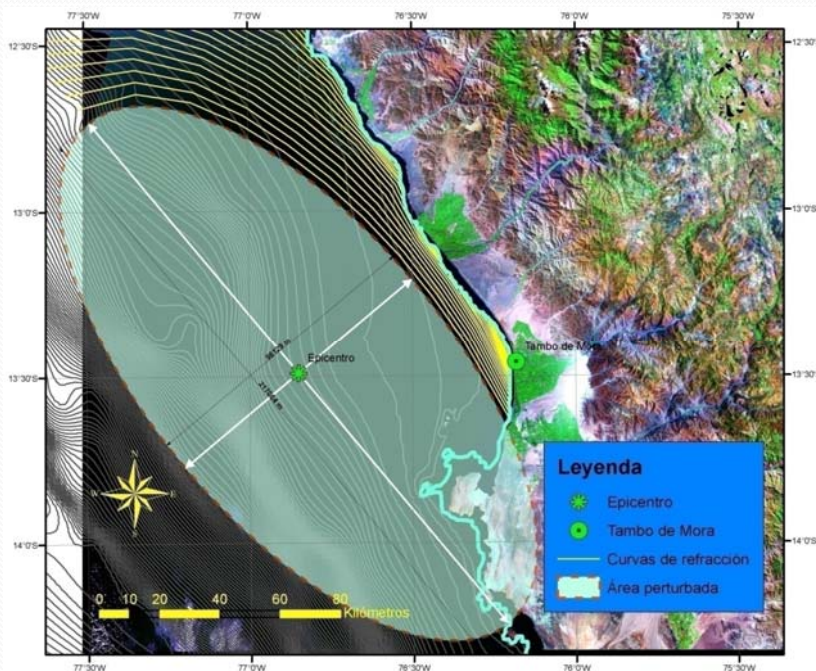


Dr. C. Zavala, Z. Aguilar, M. Estrada

# Seismic Risk Map Pisco Earthquake Scenario



# Preliminary Work for Tsunami Hazard Assessment



Basic Equations:

$$\log(S) = \frac{2}{3}M - 2.93$$

$$b = (3.77 - 0.42M)S$$

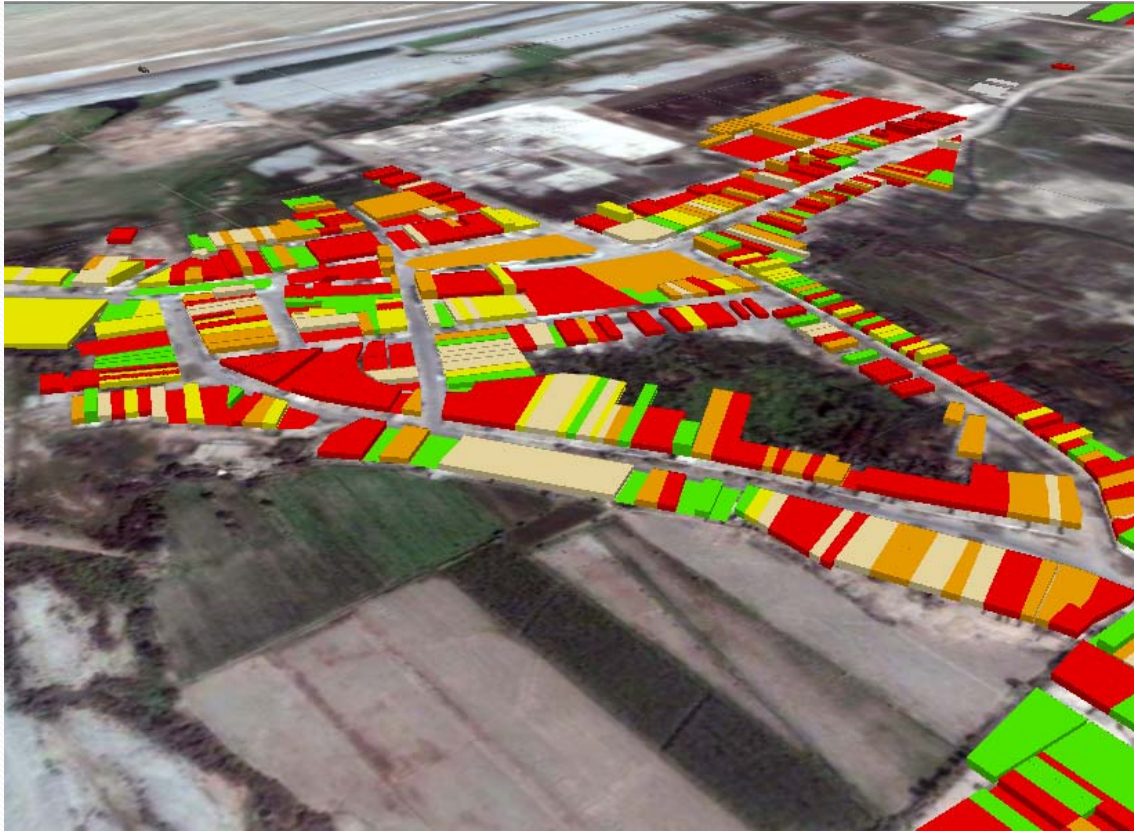
Where:

S : Major axes (217 km)

b : Minor axes (98 km)

M : Magnitude

## Simulación Inundación: Altura de Ola 6 m



## Group 04: Outputs

- Construction of Base Map Data
  - Land use map by satellite and existing data
  - Building inventory data by using high resolution satellite images
  - Digital Elevation Model (DEM)
- Development of Damage Detection Techniques
  - Elaborate methodology for fast damage detection by optical and SAR satellite data
- Building Damage Estimation for Earthquake Scenario based on Group 01, Group 02 and Group 03
- Internet based platform to disseminate the results.