RESEARCH PROJECT ON ENHANCEMENT OF TECHNOLOGY TO DEVELOP TSUNAMI-RESILIENT COMMUNITY

SATREPS For the Earth, For the Next Generation

Associate Institutions / Japan

- Japan International Cooperation Agency (JICA)
- Japan Science and Technology Agency (JST)
- Port and Airport Research Institute (PARI)
- Ministry of Land, Infraestructure, Transport and Tourism (MLIT)
- Japan Meteorological Agency (JMA)
- Meteorological Research Institute (MRI)
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- Kansai University
- Yamaguchi University

Associate Institutions / Chile

•Ministerio de Obras Públicas / Dirección Nacional de Obras Portuarias

•Instituto Nacional de Hidráulica (INH)

•Oficina Nacional de Emergencia del Ministerio del Interior (ONEMI)

•Servicio Hidrográfico y Oceanográfico de la Armada (SHOA)

•Pontificia Universidad Católica de Chile

•Universidad de Chile / Servicio Sismológico Nacional

•Universidad Técnica Federico Santa María

•Universidad de Valparaíso

•Pontificia Universidad Católica de Valparaíso

•Universidad Católica de la Santísima Concepción

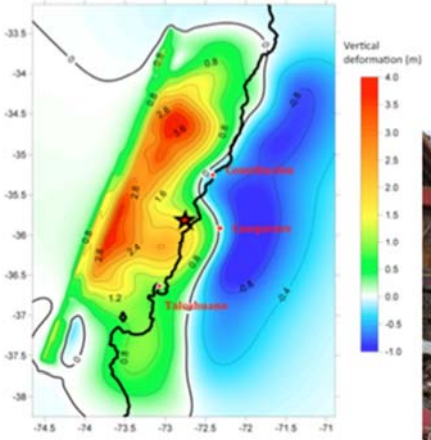
•Universidad Católica del Norte

MOTIVATION

- **8.8Mw 2010 Great Maule Earthquake & Tsunami**

- Chile was prepared against earthquakes

- Many difficulties when facing the tsunami disaster (emergency alert and response, public understanding, scientific knowledge)



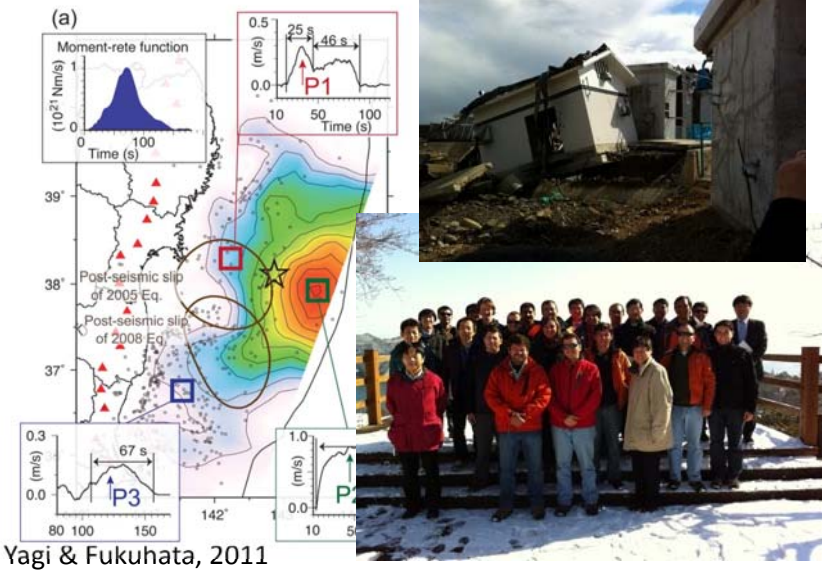
NEIC's fault model

MOTIVATION

- **9.0Mw 2011 Great Tohoku Earthquake & Tsunami**

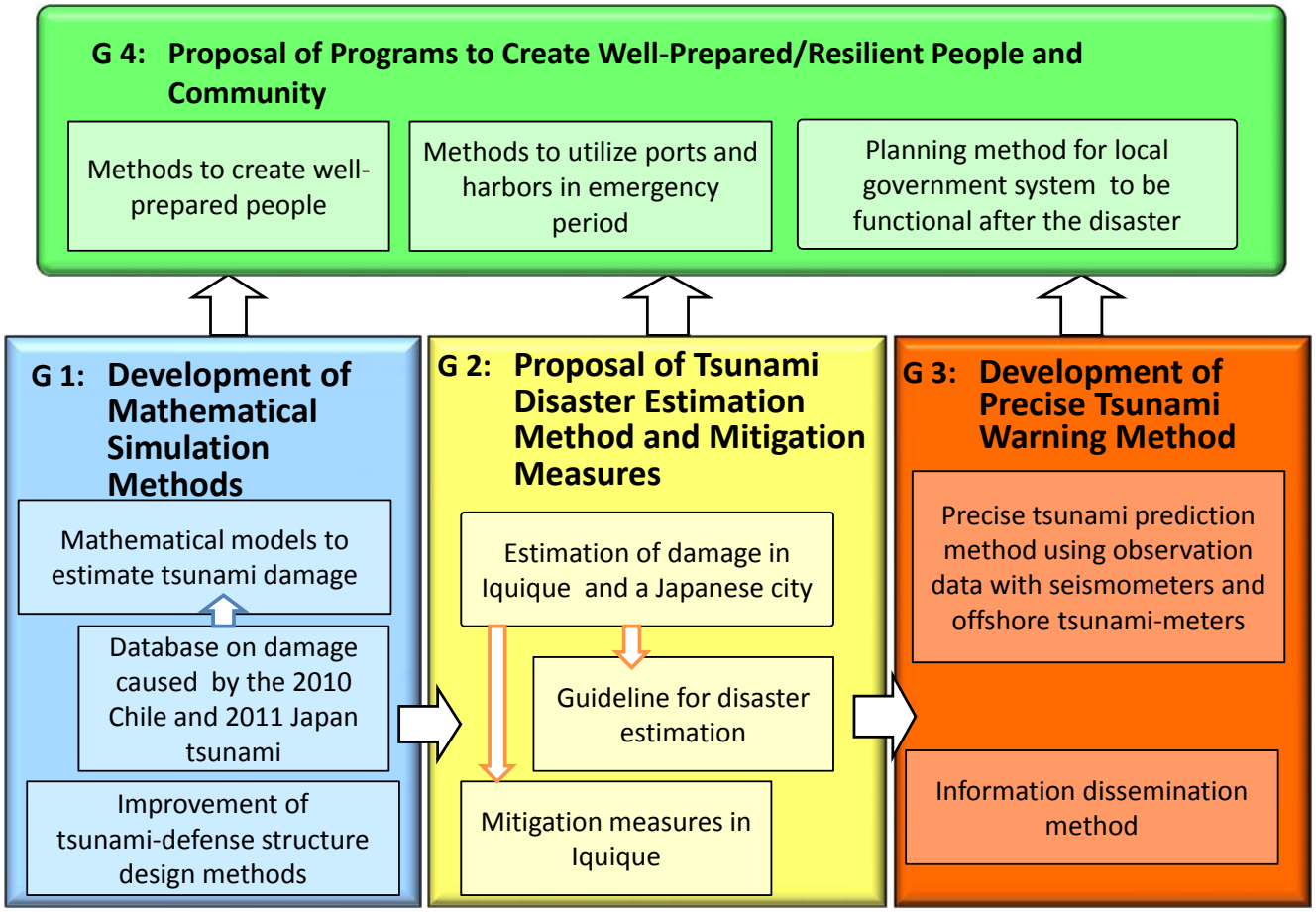
- Much bigger than the Chilean event

- Important knowledge to share and many lessons to learn



Yagi & Fukuhata, 2011

MOTIVATION



WG1 : Implementation and Validation of Mathematical Simulation Models to Estimate Tsunami Damage

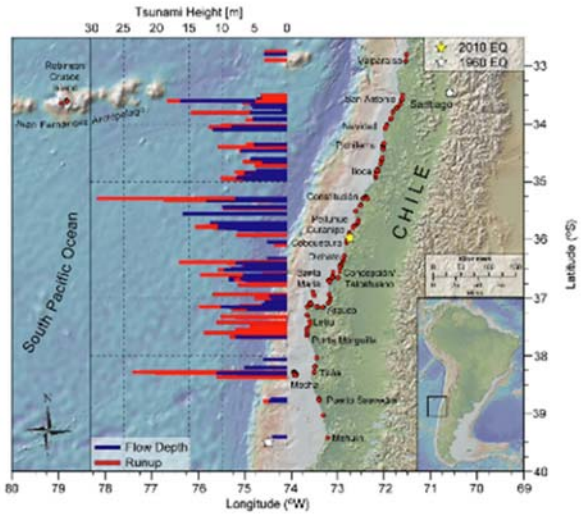
WORKGROUP 1 : Activities

A1 : Tsunami disaster database

From ITIC Survey
Fritz et al., 2011

- ***Bathymetric and topographic (improvements at specific locations using Lidar data)***

- ***Hydrodynamic information related with the 27F tsunami (inundated areas, run-up, flow depth, arrival times, etc.).***



- ***Tsunami impact in terms of damage (port facilities, infrastructure, buildings and houses) and casualties.***

WORKGROUP 1 : Activities

A2 : Mathematical simluation model on tsunami damage

Assessing and improving the capabilities of tsunami models at several scales:

- ***Regional scale***

- ***Inundation, run-up, breaking, fission, propagation on river/estuaries***

- ***Damage estimation (including tsunami debris, scouring…)***

The recents tsunamis of Chile and Japan offers unique opportunities to test and improve models

WORKGROUP 1 : Activities

A3 : Evaluation methods of tsunami impacts (Talcahuano port)

Validation and improvement of tsunami damage models in view of the impact of tsunamis focusing on ports and urban areas heavily affected

- *External forces induced by tsunamis*
- *Debris/containers impact*
- *Scour – flow/soil/structure interaction*
- *Performance of different types of constructions*
- *Methods to estimate tsunami-induced economical losses*

WG2: Tsunami Disaster Estimation Methods and Mitigation Measures

WORKGROUP 2 : Activities

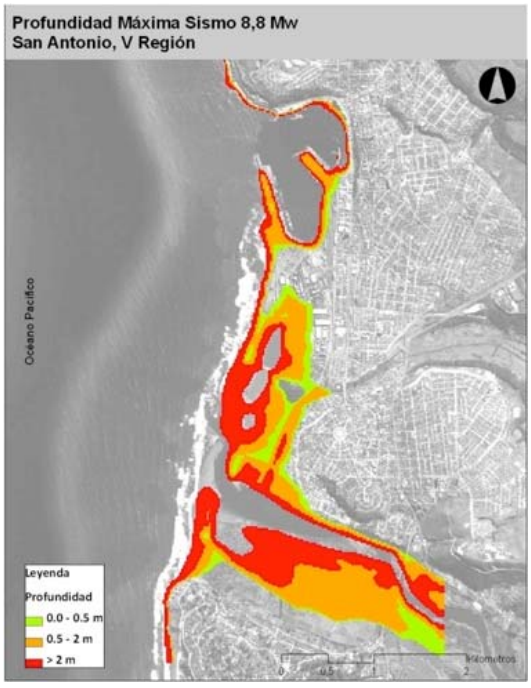
A1 : Estimation of tsunami damage in pilot sites for future tsunamis generated off the coast of Chile

Relevant information is gathered to define possible tsunami sources in the future and propagate tsunami waves. Inundation areas, flow depths, and velocities are computed for the evaluation of the impact of tsunamis in the studied areas

WORKGROUP 2 : Activities

A2 : Guideline for elaboration of tsunami disaster estimation

- ***How to assume the earthquake model***
- ***How to estimate the tsunami source model***
- ***How to set up bathymetry and topography***
- ***What governing equations to be applicable for tsunami propagation and run-up***
- ***How to evaluate human and building damages***



WORKGROUP 2 : Activities

A3 : Tsunami damage estimation in Japan

- *Assuming possible earthquakes off the coast in Chile in the future*
- *Estimation of tsunami sources by using the assumed earthquakes*
- *Simulation of far field tsunami propagation from the source to the coast area in Japan*
- *Estimation of tsunami height, velocity and arrival time in the coastal area in Japan*
- *Evaluation of human and building damages in the coastal area in Japan*


Photo by Kahoku Shimpo


Photo by K. Mochida

WORKGROUP 2 : Activities

A4 : Tsunami disaster mitigation measures


Photo: The International Federation of Red Cross and Red Crescent Societies

- *Research on human and building damages in Japan by the 2011 Japan Tsunami*
- *Study of hard and soft measures in tsunami disaster mitigation based on the damages*
- *Simulation of far field tsunami propagation from the source to the coast area in Japan*
- *Research on background, environment and condition of tsunami disaster mitigation in Chile*
- *Study on adaptability of the hard and soft measures studied in Japan to Chile*
- *Proposal of the measures appropriate for Chile*

WG3: Improvement of Early Tsunami Warning System

WORKGROUP 3 : Activities

A1 : To develop a precise real-time forecasting tsunami method and early tsunami warning system

A comprehensive data base for pre-modeled seismic scenarios is developed based on the Japanese experience

- ***Definition and validation of methodologies for tsunami forecasting based on unit seismic sources along the Chilean trench***
- ***Elaboration of pre-modeled databases and their integration on the early tsunami warning system***
- ***Improvement of tsunami detection capabilities by proposing a suitable arrangement of instruments in the pilot sites***

WORKGROUP 3 : Activities

A2 : To implement a precise method to alert the communities and disseminate the information

Improve the coordination and communication between SHOA and ONEMI in order to reduce the time response and uncertainities. Implement an efficient strategy to disseminate the alert and reach the community.

- ***Enhance a fast and accurate communication of tsunami alerts and warning based on forecasting/assimilation models***
- ***Propose an effective method to disseminate tsunami information***

WG4: Design of a Program to Create Well Prepared and resilient communities

WG4a: Education and training

WG4b: Use of ports in rescue and rapid recovery phase

WORKGROUP 4a : Activities

A1 : A community outreach program to improve preparedness against tsunami is elaborated

This program is aimed at neighbourhood watch, community focus groups and public institutions (police, fire) who carry out emergency response.

WORKGROUP 4a : Activities

A2 : Improvement of evacuation procedures and the coordination of different institutions during the disaster

The experiences from the Chilean and Japanese recent disasters will be studied. Recommendations of measures to be taken in pilot sites to avoid human losses and maintain the functionality of municipalities after the disaster are elaborated.

WORKGROUP 4b : Activities

A3 : Damage and performance of ports during the 2010 earthquake and tsunami

Information regarding the impact of the earthquake and tsunami on the Chilean port infrastructure will be compiled. Lessons learned from Chilean and Japanese experiences will be formalized.



WORKGROUP 4b : Activities

A4 : A method to utilize ports and harbors in a rescue phase after a tsunami disaster is developed

Taking into account the particular Chilean legal body, methods for business continuity plans will be proposed for the pilot sites. The coordination between municipalities, public institutions and the private sector will be investigated in order to foster a fast and efficient recovery after a tsunami disaster.


Schedule of the Project