



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

Activities Considered in the Chilean Research Groups

International Symposium on Earthquake & Tsunami Disaster Reduction
March 14-15, 2012

SATREPS For the Earth, For the Next Generation

WORKING GROUPS

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

WG2: Tsunami Disaster Estimation Methods and Mitigation Measures

WG3: Improvement of Early Tsunami Warning System



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 1 : Activities

A1 : Digital database for the 2010 Chilean tsunami

We aim at producing digital GIS-based maps with different layers of information, namely:

- Bathymetric and topographic information at regional level for the whole country, and locally for the specific sites where tsunami inundation and damage will be investigated.
- 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.

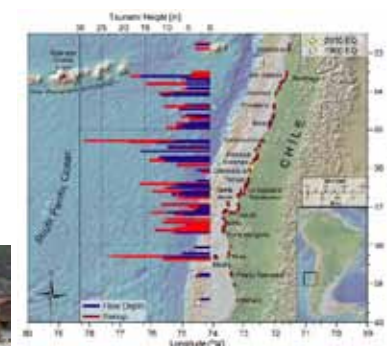
WORKGROUP 1 : Activities

A1 : Digital database for the 2010 Chilean tsunami

Data from the 2010 Chilean tsunami is gathered and organized to develop a digital map in GIS format integrating different levels of information.



Photo courtesy of P. Winckler



From Fritz et al., 2011

WORKGROUP 1 : Activities

A2 : Implementation and validation of numerical models

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

- Regional scale
- Inundation, run-up, propagation on river/estuaries
- Damage estimation

The recent tsunamis of Chile and Japan offers unique opportunities to test and improve models since important information is available

WORKGROUP 1 : Activities

A2 : Implementation and validation of numerical models

Research questions

- Wave interaction with bathymetry / sensitivity to seismic sources
- Refractively trapped edge waves, late arrivals
- Local amplification at embayments/ports
- Nonlinear processes under breaking and run-up
- Is frequency dispersion important in tsunami inundation models?
- Tsunami propagation in rivers/estuaries



Guerra et al., 2011

WORKGROUP 1 : Activities

A3 : Analysis and validation of numerical models for damage estimation

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

- External forces induced by tsunamis
- Debris/containers impact
- Scour – flow/soil/structure interaction
- Performance of different type of constructions



WORKGROUP 1 : Time schedule

	1st year	2nd year	3rd year	4th year
Digital Database	→			
Implementation and validation of tsunami models		→		
Improvement of numerical models for damage estimation		→		

WORKGROUP 1 : Chilean Members

Name	Organization	Role
Rodrigo CIENFUEGOS	PUC	Group leader
Patricio CATALAN	UTFSM	Field data / modeling
Ariel GRANDON	MOP	Tsunami damage in ports and harbors
Marcelo LAGOS	PUC	Tsunami hazard maps
Cristian ESCAURIAZA	PUC	Flow-sediments-scour modeling
Esteban SAEZ	PUC	Structural damage
Rafael ARANGUIZ	UCSC	Tsunami modeling / tsunami impact
Roberto RIQUELME	UDEC	Tsunami modeling
Elias OVALLE	UDEC	Tsunami modeling

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 to the pilot sites. Inundation areas, flow depths, and velocities are computed for the evaluation of the impact of tsunamis on the studied areas

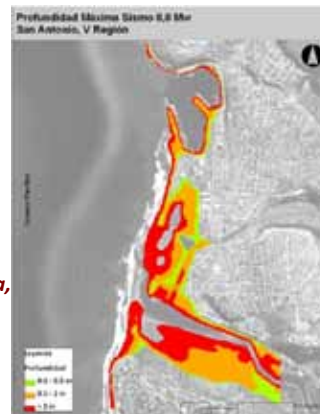


WORKGROUP 2 : Activities

A2 : Guideline for elaboration of tsunami hazard maps and disaster estimation

A guideline for tsunami disaster estimation in Chile is handed out to the organizations which are responsible for tsunami disaster estimation by the end of the 3rd year

- Standardized practices for the elaboration of tsunami hazard maps
- Requirements for topo-bathymetric data, seismic scenarios, grid resolution, etc



WORKGROUP 2 : Activities

A3 : Design and building codes are developed for infrastructure and mitigation measures

To assess performance of state-of-the-art codes and formulae, and refine and develop building codes for coastal infrastructure and edifications



- Definition of guidelines for design of buildings and counter measures
- Development of PTHA and performance based design
- Recommend specific measures in pilot sites for tsunami mitigation

WORKGROUP 2 : Time schedule

	1st year	2nd year	3rd year	4th year
Estimation of tsunami damage in pilot sites	→			
Guideline for elaboration of tsunami hazard maps		→		
Design and building codes		→		

WORKGROUP 2 : Chilean Members

Name	Organization	Role
Patricio CATALAN	UTFSM	Group leader
Rodrigo CIENFUEGOS	PUC	Tsunami inundation modeling
Rodrigo PHILIPPI	MOP	Tsunami hazard map and damage estimation
Mauricio REYES	UV	Tsunami damage and countermeasures
Juan GONZALEZ	SHOA	PTHA, Tsunami hazard maps
Cristian LEDEZMA	PUC	Structural damage
Rafael ARANGUIZ	UCSC	Tsunami modeling and mitigation measures
Gabriel GONZALEZ	UCN	Seismic sources
Luis ZAMORANO	INH	Design codes and countemeasures

WORKGROUP 3 : Activities

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

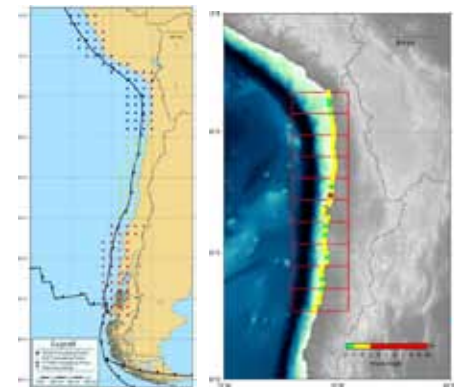
A comprehensive data base for pre-modeled seismic scenarios is developed based on the Japanese experience

- *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

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

- *Development of a pre-modeled tsunami database*



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 uncertainties. 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*

WORKGROUP 3 : Time schedule

	1st year	2nd year	3rd year	4th year
Implementation of a real-time tsunami forecast method	→			
Development of a method to disseminate tsunami information		→		

WORKGROUP 3 : Chilean Members

Name	Organization	Role
Cecilia ZELAYA	SHOA	Group leader
Juan GONZALEZ	SHOA	Tsunami forecasting modeling
Cristian TORRES	ONEMI	Tsunami information dissemination
Sergio BARRIENTOS	SSN	Seismic monitoring
Jaime CAMPOS	UCH	Seismic sources
Patricio CATALAN	UTFSM	Tsunami forecasting modeling

WORKGROUP 4a : Activities

A1 : Training of scientists, professionals and community leaders

A capacity building plan will be developed promoting interchange between personnel of Chile and Japan. Workshops and summer schools are to be organized.



WORKGROUP 4a : Activities

A2 : An education program in tsunami disaster prevention aimed at school students is developed

Educational material will be made freely available and a mobile scientific laboratory is under consideration.



WORKGROUP 4a : Activities

A3 : 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

A4 : 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 4a : Time schedule

	1st year	2nd year	3rd year	4th year
Training of scientists, professionals and community leaders	→			
Education program in tsunami disaster		→		
Program to improve preparedness against tsunami and disseminate tsunami information		→		
Improvement of evacuation procedures	→			

WORKGROUP 4a : Chilean Members

Name	Organization	Role
Ignacia CALISTO	UDEC	Group leader
Matt MILLER	UDEC	Coordination
Samuel HORMAZABAL	PUCV	Coordination
Cristian TORRES	ONEMI	Educational material and program
Oscar CIFUENTES	UDEC	School education program
Eduardo VEGA	UDEC/CICAT	Tsunami demonstration material
Daniel BOURDON	UDEC	Digital education material
Arturo BELMONTE	UDEC	Chilean tsunami revision
Jorge QUEZADA	UDEC	Chilean tsunami revision

WORKGROUP 4b : Activities

A1 : 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

A2 : A method to utilize ports and harbors in a recue phase after a tsunami disaster is developed

Taking into account the particular Chilean legal body, methods for buisness 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.



WORKGROUP 4b : Chilean Members

Name	Organization	Role
Ariel GRANDON	MOP	Group leader
Matt MILLER	UDEC	Coordination
Rodrigo PHILIPPI	MOP	Port and harbors
Cristian TORRES	ONEMI	Coordination
Mauricio REYES	UV	Port and harbors
Rafael ARANGUIZ	UCSC	Port and harbors
Arturo BELMONTE	UDEC	Chilean tsunami revision

