COLOMBIAN TSUNAMI WARNING SYSTEM

LESSONS LEARNED

DRILL EXERCISE (2004) vs PERUVIAN EARTHQUAKE ALERT (15/08/07) AND GORGONA ISLAND SEISMIC EVENT (09/09/07)
AGENDA

SISTEMA NACIONAL PREVENCIÓN Y ATENCIÓN DE DESATRES – COLOMBIA

COMITÉ TECNICO NACIONAL DE TSUNAMI
FLUJO DE INFORMACION
CLOPAD – COMITES TECNICO y EDUCATIVO

SIMULACRO A ESCALA REAL 2005


SISMO DEL 9 DE SEPTIEMBRE DE 2007

CONCLUSIONES
## Prevention and Disaster Local Component - CLOPAD

<table>
<thead>
<tr>
<th>Committee</th>
<th>Members</th>
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</thead>
<tbody>
<tr>
<td>Educational Committee</td>
<td>RED CROSS – CCCP (OCEANOGRAFIC CENTER) – SECRETARY OF EDUCATION (LOCAL)</td>
</tr>
<tr>
<td>Technical Committee</td>
<td>CCCP (OCEANOGRAFIC CENTER) – COLOMBIAN SEISMIC AUTHORITY (INGEOMINAS) – EL VALLE UNIVERSITY (OSSO) - ENVIRONMENTAL OFFICE -</td>
</tr>
<tr>
<td>SAR and Security Committee</td>
<td>NAVY – ARMY – POLICE – RED CROSS</td>
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<tr>
<td>Infrastructure and Services Committee</td>
<td>SECRETARY OF PUBLIC INFRASTRUCTURE</td>
</tr>
<tr>
<td>Social Comissio</td>
<td>ICBF – FAMILY COLOMBIAN INSTITUTE - HEALTH CENTERS</td>
</tr>
<tr>
<td>Health Committee</td>
<td>HOSPITALS – HEALTH CENTERS</td>
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</tbody>
</table>
HOW THE EVACUATION STARTS


CLOSE ORIGIN TSUNAMI

THERE IS NO A POSSIBILITY FOR EARLY WARNING SYSTEM BASED ON BUOYS OR TIDE GAGES (FIRST WAVE: 25 MINUTES AFTER THE EVENT)

PERSONAL ALARM : GO TO ONE OF THE SEVEN EVACUATION ZONES

WHEN?

• MERCALLI SCALE : 7
• TSUNAMI IS ARRIVING IN 45 MINUTES (INFORMED BY AN AUTHORITY)
• SEA BOTTOM SEISMIC EVENT HIGHER THAN 6.5 (INFORMED BY AN AUTHORITY)
TECHNICAL COMMITTEE

NATIONAL TSUNAMI WARNING CENTER
RESEARCH
LOCAL EMERGENCY PLAN
### Basic Components of the Colombian NTWC

#### Information
- **On-Line**
  - Earthworm
  - Tide Tool
  - Enwin
  - Cisn
  - NDBC (Dart)
  - Ptwc

- **Messages**
  - Ptwc
  - Usgs
  - OssO
  - Rsnc
  - NTWC (Equador – Peru – Chile)

- **Monitoring Network**
  - Ideam – Tide Gages
  - Dimar – Tide Gage Net
  - Dimar Triaxy

#### Tools
- **Modelling**
  - Time
  - Most

- **Data Base**
  - Precomputed Scenarios
  - Inundation Maps
  - Ptwc (Data Base)
  - Contacts List (national – international)

- **Marine Weather Forecast**
  - Sea State
  - Weather Forecast
  - Tides

#### Communications
- **UHF - ARC**
- **HF**
- **VHF - Local**
- **Satelital**
- **Tel / fax**
- **Internet**

#### Principles
- **Redundance**
- **24 / 7**
- **Automatic Alarms**
- **Training**
- **Research**
- **Automatization**
- **Interinstitutional Cooperation**

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**Technical Committee**

**Educational Committee**
<table>
<thead>
<tr>
<th>Mw</th>
<th>LOCAL</th>
<th>CERCANO</th>
<th>LEJANO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hc &lt; 100m</td>
<td>Hc &gt; 100m</td>
<td>Hc &lt; 100m</td>
</tr>
<tr>
<td>5.0 - 6.4</td>
<td>Poca posibilidad BOLETIN</td>
<td>Poca posibilidad BOLETIN</td>
<td>IMPROBABLE</td>
</tr>
<tr>
<td>6.5 - 6.9</td>
<td>Posible ALERTA</td>
<td>Poca posibilidad BOLETIN</td>
<td>Poca posibilidad BOLETIN</td>
</tr>
<tr>
<td>7.0 - 7.7</td>
<td>Posible ALERTA</td>
<td>Posible ALERTA</td>
<td>Poca posibilidad BOLETIN</td>
</tr>
<tr>
<td>&gt; 7.8</td>
<td>Muy posible ALARMA</td>
<td>Muy posible ALARMA</td>
<td>Posible ALERTA</td>
</tr>
</tbody>
</table>

**CENTRO DE ALERTA DE TSUNAMI - DIMAR/CCCP**

**MAPA DE PROCESO Y CRITERIOS**

**EPICENTRO DEL SISMO**

- **LOCAL**
  - Hc < 100m: Poca posibilidad BOLETIN
  - Hc > 100m: Poca posibilidad BOLETIN

- **CERCANO**
  - Hc < 100m: Poca posibilidad BOLETIN
  - Hc > 100m: IMPROBABLE

- **LEJANO**
  - Hc < 100m: IMPROBABLE
  - Hc > 100m: IMPROBABLE

**FASE DE EJECUCION**

- **RECOLECCION DE INFORMACION**
- **EVALUACION**
- **DIFUSION**

**FASE DE REGISTRO**

- **CHECK**
  - TSUNAMI: ALARMA / ACTUALIZACION PARAMETROS

**REPORTES:**
- ADMINISTRATIVO
- OPERATIVO
- CIENTIFICO

**Centro Control Contaminación del Pacífico. San Andrés de Tumaco. Colombia**
RECEPCIÓN DE INFORMACIÓN SÍSMICA Y DE NIVEL DEL MAR (INGEOMINAS - CISN – USGS – PTWC – NTWC)

VERIFICACIÓN DE PARÁMETROS SÍSMICOS

¿CUMPLE CON CRITERIOS SÍSMICOS PARA ENVÍO DE MENSAJE?

SI

EMISIÓN DEL MENSAJE

NO

VERIFICACIÓN SEÑAL TSUNAMI (DART – MAREOGRAFOS)

¿CUMPLE CON CRITERIOS PARA AUMENTAR NIVEL DE ALERTA?

SI

ALMACENAR DATOS

NO

INFORME PRELIMINAR

ACTUALIZACIÓN NIVEL ALERTA

REPORTE FINAL

CENTRO DE ALERTA DE TSU
EMERGENCY MANAGERS WEATHER INFORMATION NETWORK
(EMWIN)

RADIO (VHF – UHF) – INTERNET – SATELITE (GOES)

Pacific Tsunami Warning Center products

Pacific
Advisory/Watch/Warning Information Bulletin

Hawaii
Advisory/Watch/Warning Information Statement
Public Tsunami Message Seismic Information Statement

Caribbean
(See also Puerto Rico,
Virgin Is. below)
Advisory/Watch Information Statement

Indian Ocean
Advisory/Watch Information Bulletin

NATIONAL WEATHER SERVICE

U.S. DEPARTMENT OF THE INTERIOR
GEOSCIENCE SURVEY
NEIC QUICK EPICENTER DETERMINATIONS

UTC TIME HRMNSEC LAT LONG DEP GS MAGS MB MSZ SD STA REGION--COMMENTS

May 15
000929.6 31.873N 104.500E 10G 4.3 0.7 35 E SICHUAN, CHINA
004915.7 7.871N 36.367W 10G 4.7 1.0 49 CENTRAL MID-ATLANTIC RIDGE
015448.2 2.893S 78.345W 35G 4.5 1.0 25 ECUADOR
052748.2 31.986N 104.440E 10G 4.9 0.8 51 E SICHUAN, CHINA
094640.4 36.516N 70.569E 194 4.8 0.9 48 HINDU KUSH REGION, AFGHANISTAN
134448.6 39.447N 119.705W 5G 1.4 13 NEV. ML 2.9 (GS)
140615.5 20.801S 174.094G 35G 5.1 0.8 66 TONGA
142329.8 57.922S 25.624G 35G 0.9 46 SOUTH SANDWICH ISLANDS REGION. MW 5.9 (UCMT), 5.9 (GCMT), 5.8 (GS), 5.9
Latest Earthquakes in the World - Past 7 days

Worldwide earthquakes with M4.0+ located by USGS and Contributing Agencies. (Earthquakes with M2.5+ within the United States and adjacent areas.)

Mon May 19 17:09:39 UTC 2008

253 earthquakes on this map

Instructions

- Hold your mouse over an earthquake to see its

Earthquake Lists

- M2 5/4+ Earthquake list
== PRELIMINARY EARTHQUAKE REPORT ==

Region: OFFSHORE COQUIMBO, CHILE
Geographic coordinates: 30.968S, 71.815W
Magnitude: 5.0 Mb
Depth: 35 km
Universal Time (UTC): 18 May 2008 17:14:49
Time near the Epicenter: 18 May 2008 13:14:49
Local standard time in your area: 18 May 2008 12:14:49

Location with respect to nearby cities:
123 km (76 miles) SSW (203 degrees) of Coquimbo, Chile
236 km (146 miles) N (357 degrees) of Valparaiso, Chile
302 km (187 miles) NNW (339 degrees) of SANTIAGO, Chile

ADDITIONAL EARTHQUAKE PARAMETERS

event ID: US 2008sebc

This event has been reviewed by a seismologist at NTFC for subsequent updates, maps, and
**BOLETÍN PRELIMINAR**

**2008-05-19 8:58:5 P.M. Hora Local**

**EVENTO SÍSMICO MAGNITUD (ML) 4.3**

**SUCRE-SUCRE**

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**INGEOMINAS - COLOMBIAN SEISMIC INSTITUTE**

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**INGEOMINAS**

*Red Sismológica Nacional de Colombia*

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**BOLETÍN DE EVENTO SÍSMICO**

INGEOMINAS INFORMA:


LA LOCALIZACIÓN DE LA RSNC ES:

LATITUD = 8.72 GRADOS NORTE
LONGITUD = -74.70 GRADOS OESTE
PROFUNDIDAD = SUPERFICIAL (MENOR DE 30 KILOMÉTROS)
MAGNITUD = 4.3 EN LA ESCALA DE RICHTER
CAPITAL MÁS CERCANA=SINCELEJO a 103.3 km OBSERVACIONES
Tabla. Altura máxima de ola registrada (H) y tiempo de arribo del tren de olas (t) para un sismo localizado en la zona de subducción colombo-ecuatoriana.

<table>
<thead>
<tr>
<th>Marea</th>
<th>Mw=7.5</th>
<th>Mw=7.8</th>
<th>Mw=8.0</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>H (m)</td>
<td>t (min)</td>
<td>H (m)</td>
</tr>
<tr>
<td>Alta</td>
<td>0.64</td>
<td>22</td>
<td>1.6</td>
</tr>
<tr>
<td>Media</td>
<td>0.58</td>
<td>21</td>
<td>1.4</td>
</tr>
</tbody>
</table>

TSUNAMI MODELLING

Sismo 7.5 Mₘ
Sismo 7.8 Mₘ
Sismo 8.0 Mₘ
TSUNAMI INUNDATION MAP FOR TUMACO - COLOMBIA

Centro Control Contaminación del Pacífico. San Andrés de Tumaco. Colombia
HIGH RESOLUTION MULTIBEAM BATHIMETRIC SURVEY
HIGH RESOLUTION TOPOGRAPHIC AERIAL SURVEY
LIDAR – LIGHT DETECTION AND RANGING

Centro Control Contaminación del Pacífico. San Andrés de Tumaco. Colombia
SOCIALIZACION DEL PLEC

Charlas a colegios
Información en programas de radio
Información en canales TV Locales
Distribución de un video educativo
Distribución de folletos
Distribución multimedia

Centro Control Contaminación del Pacífico. San Andrés de Tumaco. Colombia
Material didáctico

Apoyo Institucional

Colegio Nuestra Señora de las Lajas
Colegio Naval Tumaco
Colegio Santa Teresita
Escuela Luís Irizar

Divulgación
Eventos técnicos y científicos

Centro Control Contaminación del Pacífico. San Andrés de Tumaco. Colombia
REAL SCALE TSUNAMI DRILL (19/04/08)

STEPS

1. LOCAL COMMITTEE FOR EMERGENCIES AND DISASTER COMFORMATION
2. RESEARCH
3. TSUNAMI DISASTER PLAN IMPLEMENTATION
4. TSUNAMI EVACUATION PLANS FOR SCHOOLS
5. EDUCATION FOR SCHOOLS – COMPANIES – INSTITUTIONS
6. EVACUATION EXERCISE GUIDE
7. COLOMBIAN VICEPRESIDENT INVOLMENT

RESULTS:

VHF LOCAL COMM – OK
AUTHORITIES COORDINATION – OK
EVACUATION SIGNS ON PLACE – OK
COMMUNITY KNOWLEDGE – (Good: Mainly school students)
SAFE ZONES DETERMINED

12,000 inhabitants in 25 minutes were evacuated to seven safe zones - walking
PERUVIAN EARTHQUAKE (15/08/07)
PERUVIAN EARTHQUAKE (15/08/07)

BAD

No emergency authority was consulted (as far as I know)
No NTWC exists (just a contact between OSSO - Seismological observatory with PTWC)
The PTWC warning was the only source of information
No communication between NTWC – (Ecuador - Peru – Chile)
The local and regional media made an important roll given information about the event (panic)
Not every one move walking
The emergency local committee did not meet because the Emergency Operation Center was close
The man in charge of the security of the airport did not aloud the entrance of the people (The airport is one of the safe zones)
The VHF handies of the coordinators were not configured with the CLOPAD frequencies
The telephone network collapsed
No confirmation of the tsunami event were confirmed
GOOD

The people knew what to do and where to go
The evacuation order was given directly by the Colombian president
Most of population made the evacuation to the safe zones previously defined
75% of the people move to the safe zones
15% undetermined (stay in homes or move out of the city)

The previously modelling and inundations maps gave us the information needed to know (if there were a tsunami no damage were done because the tide level at the arrival time of the wave)

The Navy knew what to do – They sent immediate help by ship
The people were calm
No damage or robbery was reported
The communication system to the public works (TV – Radio)
The hospital emergency plan were applied
INMEDIATE MESURES ADOPTED

- The VHF radios were reconfigured (including airport)
- A list of requirements were sent to the national authority
- The Colombian NTWC is in the implementation phase
- Tsunami technical information was given to the media
- The National Technical Tsunami Committee made a meeting in order to change the actual system, given the NTWC responsibility to the maritime authority.
- More connections were done with the Regional NTWC.
- A protocol for tsunami warnings and alerts is in the implementation phase having into account the Chilean, Ecuadorian and Peruvian protocols.
- Hospital relocated
<table>
<thead>
<tr>
<th>IMPLEMENTED</th>
<th>ON GOING</th>
<th>STAND BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTALATIONS</td>
<td>INUNDATION MAP (BVTURA)</td>
<td>TIDE GAGE NETWORK</td>
</tr>
<tr>
<td>TIME – MOST</td>
<td>PROTOCOLS</td>
<td>TRAINING</td>
</tr>
<tr>
<td>@MAIL – (USGS – PTWC – INGEOMINAS – JIMCA)</td>
<td>REGIONAL LINK</td>
<td>LINK TO SEISMIC OFFICE</td>
</tr>
<tr>
<td>TRIAXYS</td>
<td>PRECOMPUTED SCENARIOS</td>
<td>EMWIN</td>
</tr>
<tr>
<td>INUNDATION MAP (TUM)</td>
<td>INTERNET BACKUP</td>
<td>INUNDATION MAPS PAC - CARIBBEAN</td>
</tr>
<tr>
<td>TIDE TOOL – TSUNAMI TRAVEL TIME – BUOYS DART</td>
<td>UHF – SATELITE - HF</td>
<td>INTERINSTITUTIONAL COORDINATION</td>
</tr>
<tr>
<td>VHF (LOCAL) – TELEFONOS - INTERNET</td>
<td>INTERNET BACKUP</td>
<td>AUX EQUIPMENT</td>
</tr>
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<td>ELECTRIC BACKUP</td>
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<tr>
<td>COMPUTATIONAL CAPACITY - CLUSTER</td>
<td></td>
<td></td>
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<tr>
<td>INTERNAL SOUND SYSTEM</td>
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</table>
6.2 EARTHQUAKE GORGONA ISLAND (09/11/08)

The radios of the emergency coordinators worked.
The coordinators meet at the Emergency Operation Center.
The media was well informed by the technical committee.
Even though the media gave information about the event, it was mainly given by the Mayor based on technical.
The population did not evacuate but they were expecting for information, ready to evacuate.
There was very good communication with the regional and national authorities using cell phones.
Again, the people did why they had to do.
RECOMMENDATIONS

NTWC’s are needed
The real scale drills must be done with the presence of a higher political level than the mayor of the city.

The regional coordination and communication is critical
Drills and periodic meetings have to be done by the local emergency committee.

Redundant communication systems are needed to the authorities
Periodic communication systems checking is needed

Technical information have to be given to the media by the authority with the support of the technical authority, not the other way around.

The technical capacities of the system have to be given to the higher level.

The information chain have to be respected
The information have to be given as soon as possible to the national and local media.

At the safe zone the people in charge must have what to do

The system have to be prepared to work with the most complicated scenario (night – darkness – the head of local system out of the city – basic communication systems out – heavy rain. –MURPHY’S LAW