Reducing Tsunami Risk through Early Warning System, Preparedness and Awareness Information Workshop on NEAMTWS

Economic Loss Assessment in Spain due to Tsunami Impact
(A forthcoming IGME-CCS agreement)

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Escuela Nacional de Protección Civil
Rivas (Madrid) Spain
25-26 September 2017
Summary

General framework
- The insurance sector and the NH
- Solvency II Directive
- The Spanish Insurance Compensation Consortium

Risk assessment
- Assessing chances
- Modelling initial conditions
- Modelling propagation
- Modelling floods
- Vulnerability approach
- Valuable assets
- Risk assessment
The circle of risk management

EVENT

Warning

Correcting

Preventing

Monitoring and issuing early warnings
scientific support & information
building/reinforcing defences
 evacuation
...

life saving actions (rescue, evacuation)
reinforcing property defences
scientific support during event
monitoring & information
insurance (compensations)
other financial tools
...

Pre-event

Post-event

Planning, policy making and implementation (including insurance)
knowledge development & public awareness, mapping hazards and risks

The bigger prevention the better
Losses in recent disasters and insurance

- Earthquake (25.4) Nepal
- Taifun Mujigae (1-5.10) China, Philippinen
- Winter storm (16-25.2) United States, Canada
- Taifun Soudelor (2-13.8) China, Taiwan
- Severe storms (23-28.5) United States

2016 Munich Re, Geo Risks Research, NatCatSERVICE
Disasters and insurance trends

2016 Munich Re, Geo Risks Research, NatCatSERVICE
Solvency II directive


One of the strong pillars deals with the amount of capital that EU insurance companies must hold in order to comply with solvency buffers regulated.

It's aiming at a minimum of 99.5% a year success for a 100 year return period (solvency)
The Consorcio de Compensación de Seguros
(Insurance Compensation Consortium)

The CCS is a public business institution active since 1954 (63 years)

CCS manages a public-private partnership insurance solution covering extraordinary risks (natural catastrophes and terrorism) by means of policies issued by private insurers (property accidents life)

Natural catastrophes considered include:
- earthquakes
- tempest
- tsunamis
- meteorites
- floods
- volcanoes
An advanced version of UNISDIR (2009) and ANEX III Inspire on NRZ
Assessing chances

Joint effort of the most relevant actors of the Scientific Community
Tsunamigenic sources

Workshop 6-7 November 2017 in University Malaga

Modelling initial conditions of the tsunami triggering event
Will include modelling uncertainty
Will include modelling wave propagation
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Modelling propagation and inundation

Tsunami-HySEA (EDANYA research group) → NLSWE:

\[
\begin{aligned}
\frac{\partial h}{\partial t} + \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} &= 0, \\
\frac{\partial q_x}{\partial t} + \frac{\partial}{\partial x} \left( \frac{q_x^2}{h} + \frac{g}{2} h^2 \right) + \frac{\partial}{\partial y} \left( \frac{q_x q_y}{h} \right) &= gh \frac{\partial H}{\partial x} - S_x, \\
\frac{\partial q_y}{\partial t} + \frac{\partial}{\partial x} \left( \frac{q_x q_y}{h} \right) + \frac{\partial}{\partial y} \left( \frac{q_y^2}{h} + \frac{g}{2} h^2 \right) &= gh \frac{\partial H}{\partial y} - S_y.
\end{aligned}
\]

\( \rho \) density; \( g \) gravity;

\( H(x) \) bathymetry; \( h(x, t) \), water layer thickness;

\( (u_x(x, t), u_y(x, t)) \) flow velocity;

\( q_x(x, t) = u_x(x, t)h(x, t), \quad q_y(x, t) = u_y(x, t)h(x, t) \) fluxes;

\( S_f = (S_x, S_y) \) bottom friction effects.
Exposure

Statistical data: total number of vehicles/people per municipality

Generalizing the cadastre (flattening alphanumeric and cartographic info)

Using the cadastral value to distribute vehicles and people
**Vulnerability assessment**
Papathoma Tsunami Vulnerability Assessment (D’all Osso et al, 2009; PTVA-3 (Relative vulnerability index))

\[
RVI = \left(\frac{2}{3}\right) * (Sv) + \left(\frac{1}{3}\right) * (Wv)
\]

- \(RVI\) is the relative vulnerability index.
- \(Sv\) is the standardized structural vulnerability.
- \(Wv\) is the water intrusion vulnerability.

\[
Sv^{ns} = Bv * Ex * Prot
\]

- \(Bv\) is the standardized building vulnerability.
- \(Ex\) is the standardized water depth.
- \(Prot\) is the standardized level of protection.

\[
Bv^{ns} = \left(\frac{1}{423}\right) * (100S + 80M + 63G + 60F + 51Mo + 46So + 23Pc)
\]

\[
Prot^{ns} = \left(\frac{1}{301}\right) (100ProtBR + 73ProtNB + 73ProtSW + 55ProtW)
\]

- \(S\) is a scoring parameter given the number of stages.
- \(M\) is a scoring parameter addressing (spa) the construction materials.
- \(G\) and \(So\) are spa the floor hydrodynamics.
- \(F\) is spa foundation depth.
- \(Mo\) is spa movable objects.
- \(Pc\) is spa preservation conditions.
- \(Ex\) is spa flood depth.
- \(ProtBR\) is spa building relative location (vs coastline).
- \(ProtNB\) is spa existing natural barriers.
- \(ProtSW\) is spa seawall defences.
- \(ProtW\) is spa other defences.
Max Flow depth
Max Flow velocity \((u, v)\)
Specific flow
Vector maps
Buoy graphs
The IGME-CCS agreement scope

*Purpose:* maximum-most-likely monetary impact (€@2016)

we take no responsibility of any other use of data

*Scenario* based analysis

actual past or future events: out of scope

aiming at relevant monetary impact

Exposure is purely monetary.

No such thing as property or life → only €

It has to be statistically fit

Vulnerability is purely damage (recovery expenses)

**Schedule:** 36 months
Thank you for your attention

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