Public Coastal Evacuation:
Alerting and moving people, Inundation modeling and maps, Evacuation routes and signage, safe return evacuation planning

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1. Identify scenarios – historical, possible, credible, considered
2. Model scenarios
3. Combine results – envelope of all solutions
4. Inundation Map (all scenarios)
5. Evacuation Map (DMO – community input)
Tsunami Modeling – Why?

• Historical tsunamis allow scientists to understand how tsunamis behave
• Tsunamis are high impact, but infrequent
• Therefore, modeling scenarios essential
  – Simulate:
    • When and how tsunami will hit coast?
    • Where highest? How far floods inland?
    • Where strong currents are?

① Science Result: Inundation map - credible scenarios
② Public Safety Result: Evacuation maps by community
Modeling of Near-field Tsunami

- Wave Resonance Studies provide information on near-shore interactions
- Depends on near-shore morphology – coastline shapes (island, shelf, bays...), water depth
- Gives details on
  - Prolonged wave activity (extended time of dangerous waves)
  - height amplification (due to summation of waves at different periods)
The 2010 Maule Earthquake Tsunami

Resonance Study for Near-field Tsunami
1946 Alaska Tsunami at Hawaii
Propagation, Near-Shore Interactions, Inundation
1946 Alaska Tsunami at Hawaii
Illustration of Regional Resonance

Period = 42 minutes

Period = 34 minutes

Period = 27 minutes

Resonance 24-42 min

Bathymetry

Kwok Fai Cheung, Univ. of Hawaii
Similar sources different impacts
Modeling to Inundation Map

Max Inundation + Currents $\rightarrow$ Inundation map

Long Beach, Washington (NOAA, WA EMD)

Multiple scenarios/events used in Inundation map
Evacuation Map

Inundation map
(First wave arrival time)

Community input

Geologic evidence

Local infrastructure

Oral history
Tsunami Evacuation Plan
(next slides are taken from Asian Disaster Reduction Center-ADRC)

- Inundation Area
- Tsunami Arrival Time
- Town Watching
- Shelter & Evacuation Route
- Evacuation Map
- Evacuation Drill
Workshop & Town Watching: Government & Community partnership

1st Workshop: Study about Tsunami

Town Watching: Find out the Dangerous Points in the Community

2nd Workshop: Make the Evacuation Map

3rd Workshop: Find out the Future Tasks
1st Workshop

- What is Tsunami?
- Where is inundation area?
- How long will it take after the Earthquake?
Town Watching

Let’s find out the Dangerous & Safe Points in the Community
Let’s make a map.

- Where we should evacuate?

- Which road is good as the evacuation route?
- We should improve the evacuate route for children and elderly people.
- We should put the sign for the shelter.
Evacuation Map Sample
Evacuation Plans need Evacuation Drill

Check an evacuation route

A drill for revival
Good OR not good practices?
Signage

• Decide on sign locations as part of the evacuation mapping process

• It is difficult to locate signs without first laying out the evacuation zones and routes on the map
New Zealand examples of signage

In case of strong earthquake shaking, unusual ocean behaviour or noise, move to high ground and/or inland following evacuation routes where present.

Wait for official all-clear.

Tsunami Safe Zone above third floor.

After earthquake or warning move above third floor.
Examples of signage

Education campaign must accompany signage
Evacuation zone boundaries can be determined using a variety of hazard models.

Zones ideally need to represent an envelope around all possible inundations from all known tsunami sources.

The high degree of uncertainty in tsunami source models, and the very time consuming and resource intensive nature of modeling make this comprehensive approach to tsunami risk assessment unlikely in many countries.

The recommended approach to developing tsunami evacuation zones is to map now, and progressively refine the accuracy of boundaries as capacity improves over time.

Credible scenarios

Expected Arrival Time

Worst case/Probabilistic approach

OPTIONS

Level one:
Rule-of-Thumb (best judgement) => Yamaguchi

Level two:
Propagation to off-shore, =>TUNAMI, ComMIT, etc

Level three:
Inundation on-shore (finite difference models) => TUNAMI-N2, COMCOT, NEOWAVE, etc
Thank You

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