JST/JICA Science and Technology Research Partnership for Sustainable Development (SATREPS)

Developing Tsunami Damage Estimation and Mitigation Technologies towards Tsunami-Resilient Community

G2: Tsunami

Tsunami Propagation, Damage Assessment and Countermeasures

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G2: Tsunami

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Objectives and Goals

- To assess the **potential tsunami disaster** and its impact to the Peruvian coast.
- To develop **practical technologies** to mitigate tsunami risks in Peru.
- Implementation to the **strategic plans** for disaster mitigation of Peruvian government.
- Contributions to **Pacific** tsunami disaster mitigation strategies.

Activities

1. Transfer of tsunami numerical modeling technique
2. Post-tsunami field survey in Chile (2010 event)
3. Tsunami field survey in Camana, Peru (2001 event)
4. Verification of tsunami numerical model and tsunami source study
5. Tsunami risk assessment along the Peruvian coast
6. Tsunami source study (Historical Tsunami of 1746)
7. Tsunami source study (Future Potential scenario)
8. Updating tsunami inundation map
9. Tsunami refuge building demand during evacuation
10. Tsunami damage assessment (La Punta, Callao)
11. Evacuation drill in 2013 (La Punta, Callao)
12. Bathymetric survey & Updating simulation

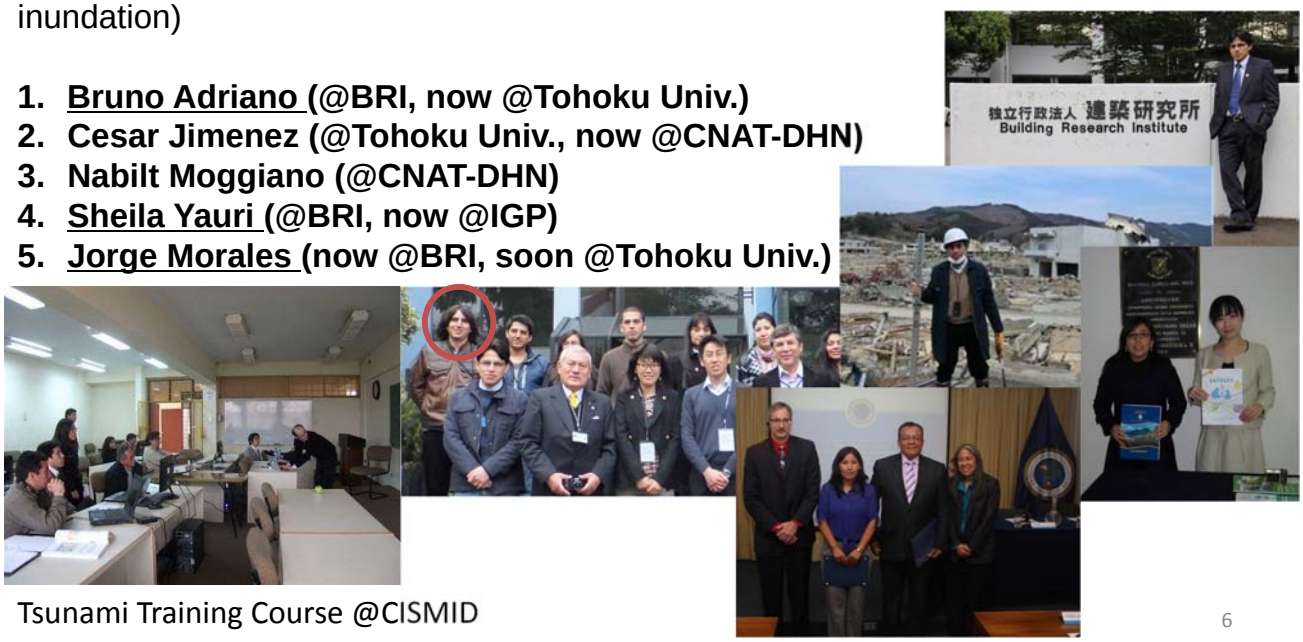
Equipment donated by JICA

Year	Items
2010	Desktop workstation for tsunami modeling
2010	Mobile workstation for survey and analysis
2010	Software for data analysis (Arc GIS and extensions)
2010	High-resolution satellite image data
2014	Fuel for bathymetric survey along Lima coast

1. Transfer of tsunami numerical modeling technique

Tsunami Modeling techniques were transferred to Peruvian researchers (TUNAMI-code to simulate tsunami generation, off-shore/near-shore propagation and coastal inundation)

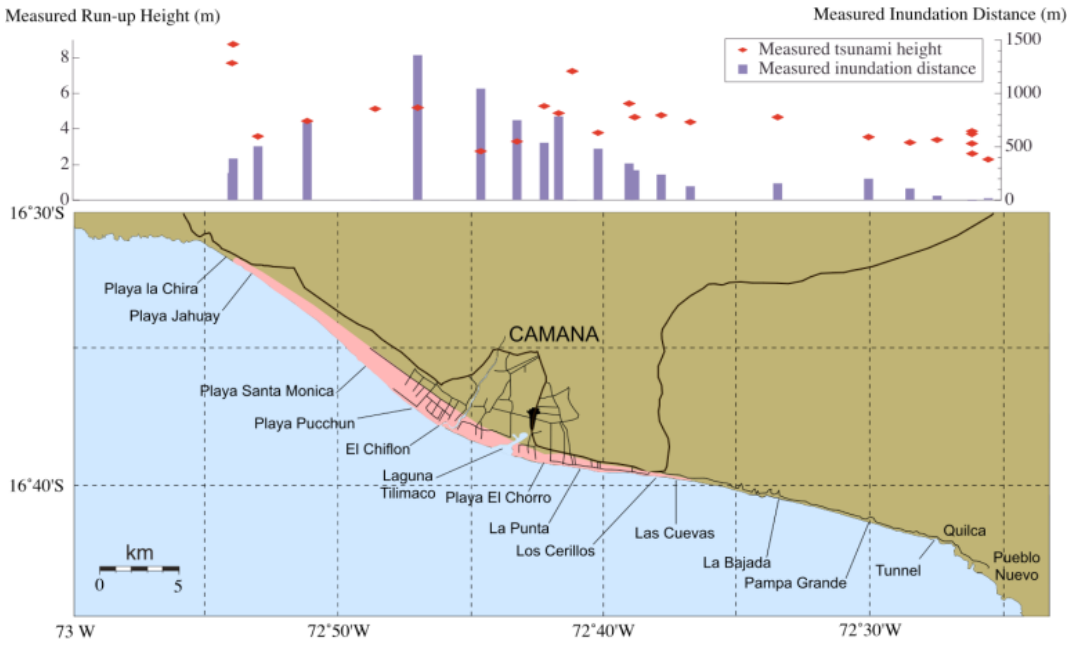
1. **Bruno Adriano (@BRI, now @Tohoku Univ.)**
2. **Cesar Jimenez (@Tohoku Univ., now @CNAT-DHN)**
3. **Nabilt Moggiano (@CNAT-DHN)**
4. **Sheila Yauri (@BRI, now @IGP)**
5. **Jorge Morales (now @BRI, soon @Tohoku Univ.)**



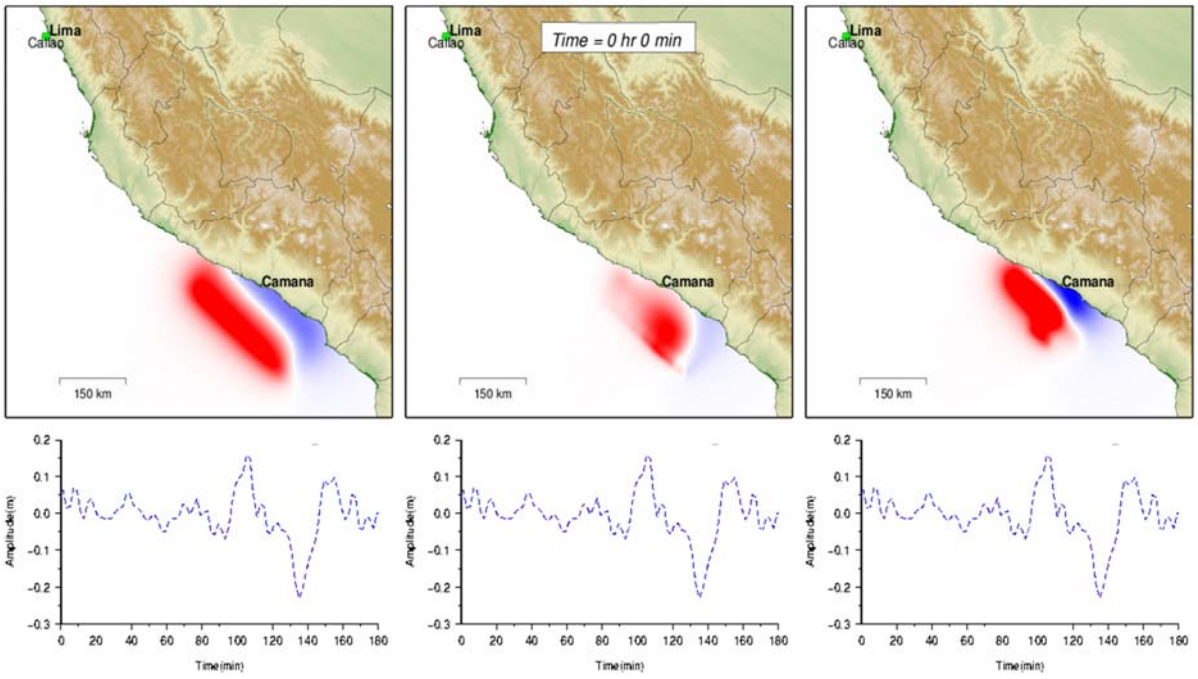
Tsunami Training Course @CISMID

2. Post tsunami field survey in Chile (2010 event)

3. Tsunami field survey in Camana, Peru (2001 event)

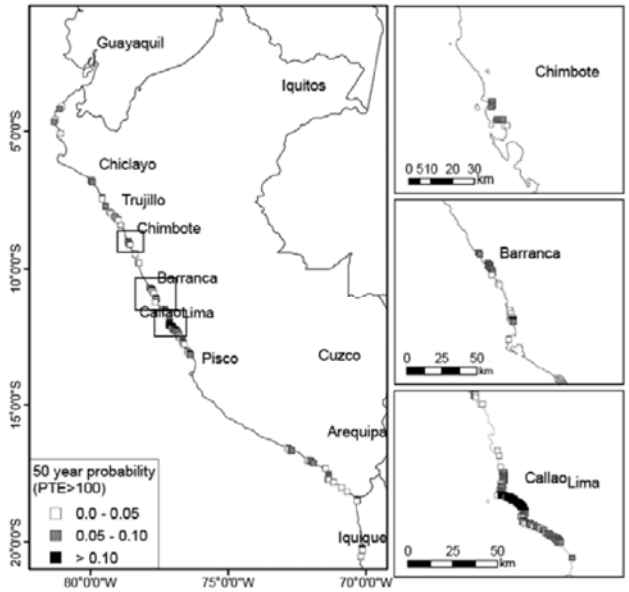


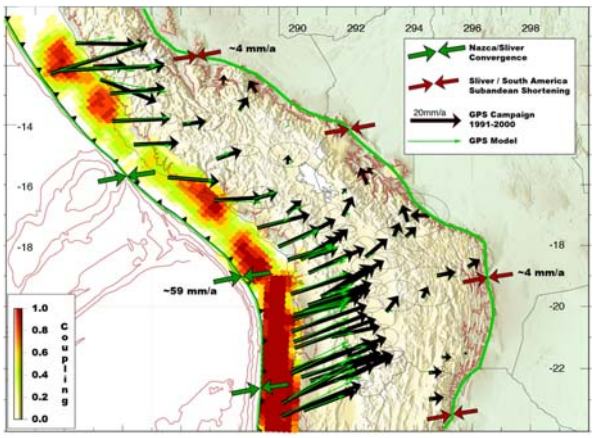
4. Verification of tsunami numerical model and tsunami source study



5. Tsunami Risk Assessment along the Peruvian coast

$$\lambda = \sum_{m=1}^{n} \frac{N[PTE \geq a]}{N_m} \times \frac{1}{n} \times \frac{1}{T}$$



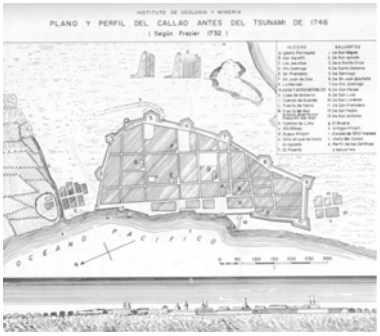


To decide study area:

- Seismic Hazard
- Tsunami Exposure

6. Historical Tsunami of 1746

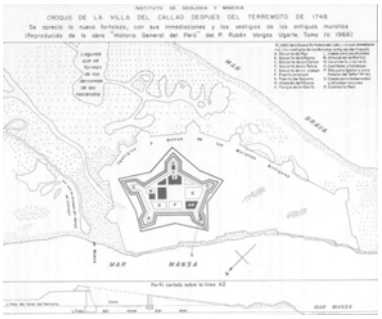
Callao Before

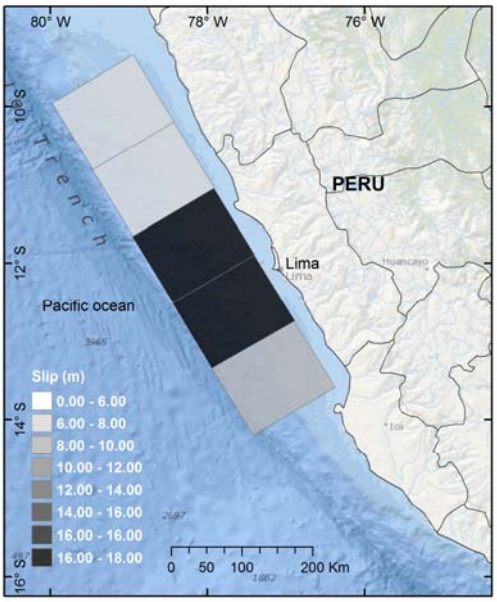


Lozano S. J., P. (1746)

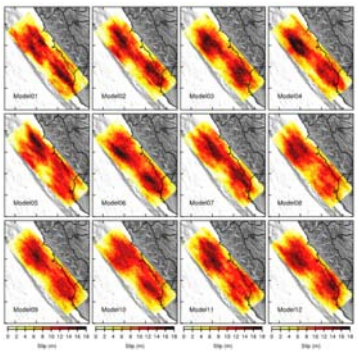
Arrus, D. (1904)

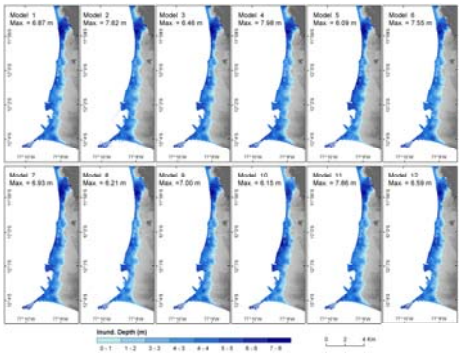
Callao After

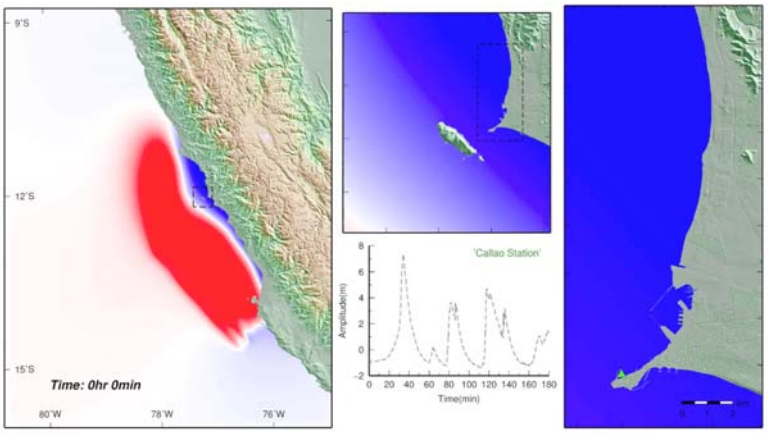


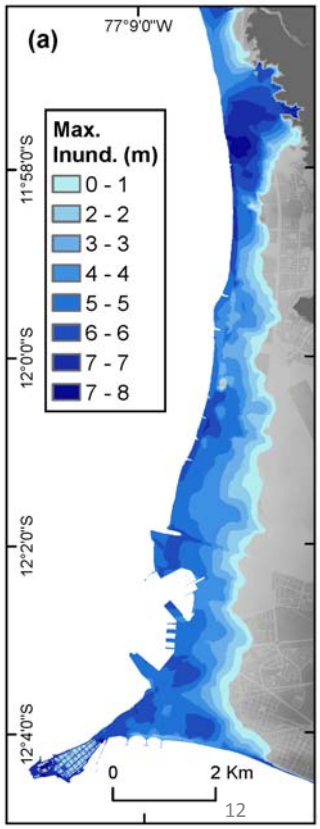


7. Tsunami source study (Future Potential scenario)





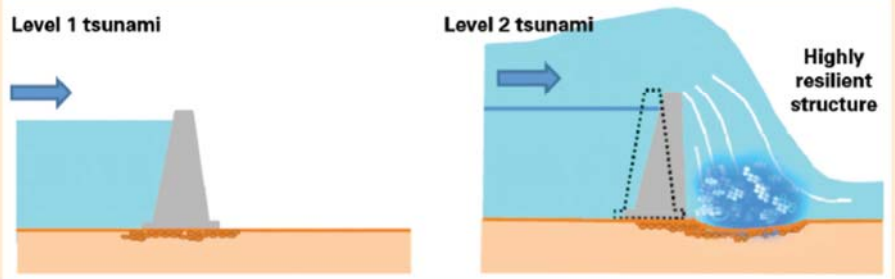




8. Updating the Tsunami Inundation Map (from Jan. 2015)

Level 1 → Future Potential Tsunami scenario (Seismologic)
Level 2 → Extreme event from historical scenario (1746)

	Tsunami to be considered	*Required performance*
Level 1 tsunami	Largest in recent history (return period of approx. 100 yrs.)	Disaster prevention • Protect human lives • Protect properties/economic activities
Level 2 tsunami	Maximum level (return period of approx. 1000 yrs)	Disaster reduction • Protect human lives • Mitigate economic loss • Prevent major secondary disasters • Enable early recovery



Source: MLIT.

Structural measures should be designed to prevent damage to human lives and properties caused by level 1 events and to mitigate damage from level 2 events.

HORIZONTAL

VERTICAL

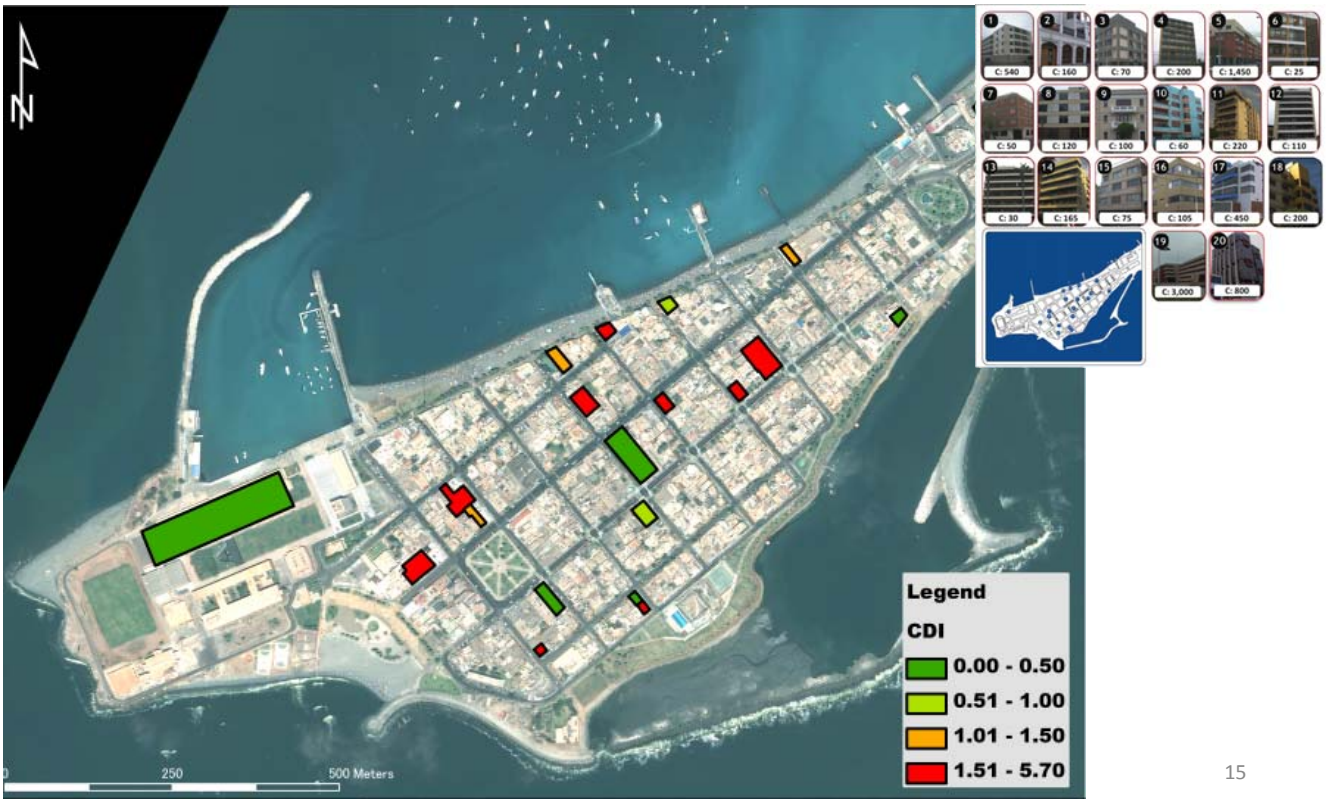
HORIZONTAL & VERTICAL

Casualty Estimation Results

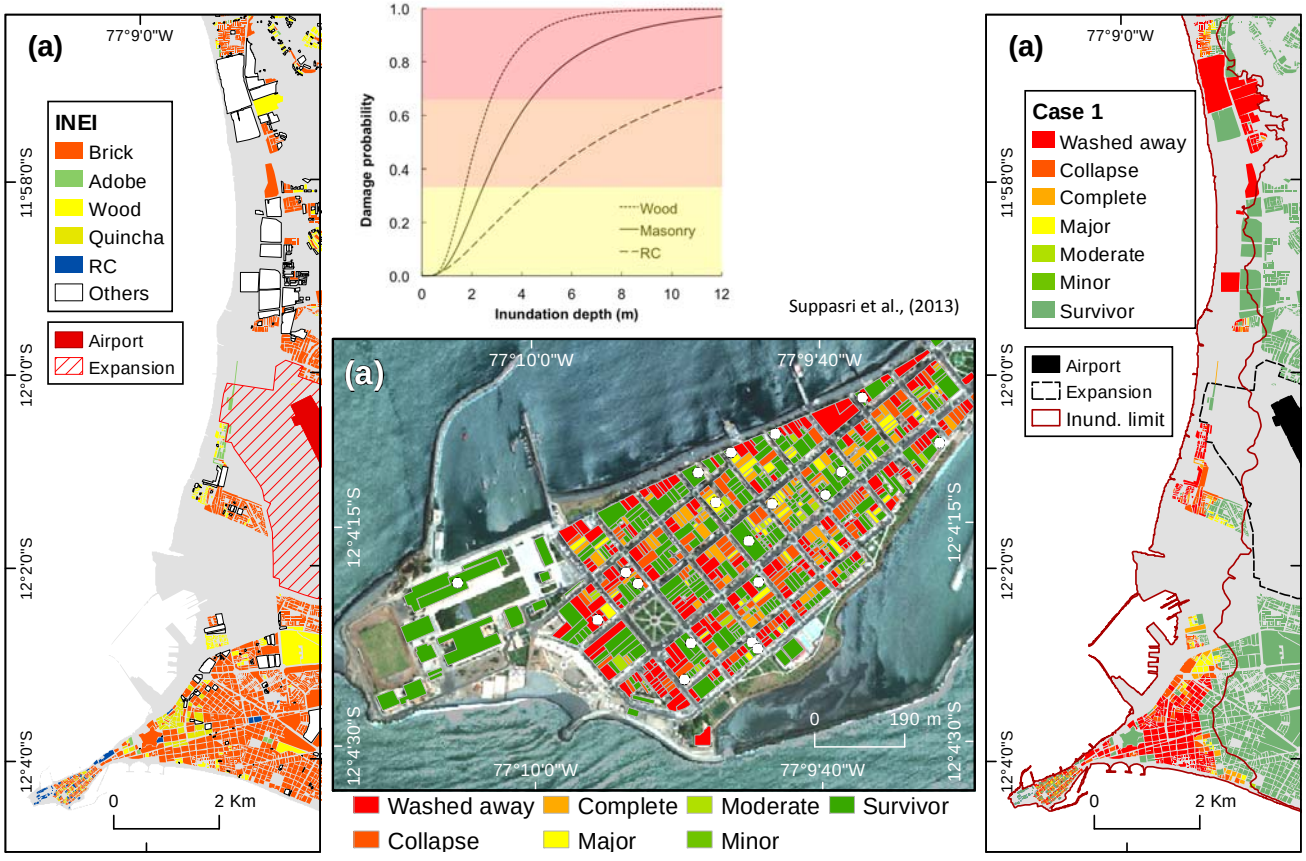
HORIZONTAL > HORIZONTAL+VERTICAL >> VERTICAL

When using vertical evacuation the number of casualties can be reduced from 40% up to 90% compared to the case of only horizontal evacuation, provided building resistant and capacity is assured.

9. Tsunami refuge building demand during evacuation



10. Tsunami damage assessment



11. Evacuation drill in 2013 (La Punta, Callao)

RTV CIP Lima – Peru Society of Engineers

NO.	CAPACITY	SHELTERED
1	540	173
2	160	84
3	70	1
4	200	3
5	1450	305
6	25	8
7	50	18
8	120	0
9	100	17
10	60	0
11	220	79
12	110	17
13	30	4
14	165	2
15	75	8
16	105	1
17	450	16
18	200	20
19	3000	~1000
20	800	270
Total	7,930	2,026

40% of total population

Muchas gracias
ありがとうございます
Thank you