Expert Dialogue on technologies for averting, minimizing and addressing loss and damage in coastal zones

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Session 4: Technologies for recovery and rehabilitation in coastal zones

Recovery and rehabilitation in Sendai from the 2011 Great East Japan Earthquake and Tsunami

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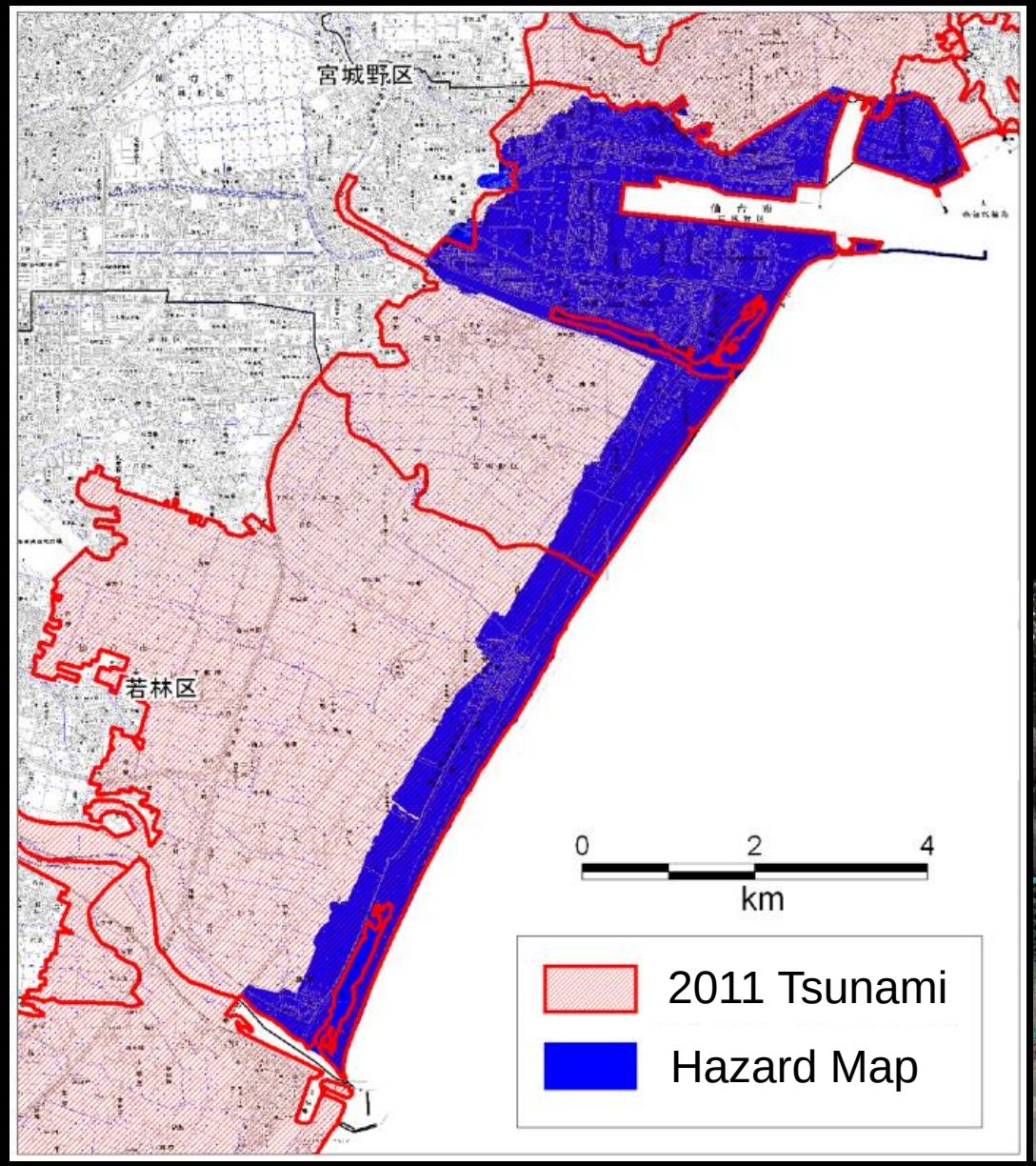
- Build Back Better
- Resiliency and Sustainability
- Multi-hazard system (not only tsunami but also storm surges caused by mid-latitude and tropical cyclones)
- Cascading disasters taken into consideration
- Improved early warning systems and evacuation plans
- Structural (Hard), non-structural (Soft), and psychological (Heart) measures for recovery, reconstruction, and rehabilitation
- Vulnerability: The fatality data indicated that more elderly, more women, and more disabled people were disproportionally killed (2-3 times higher for the disabled).
- In 1896, roughly 20,000 people were killed by tsunami (roughly the same number in 2011). The death ratio in the tsunami inundated area was 40% in 1896 while it was 3% in 2011. Tsunami early warning system, tsunami risk and hazard maps, sea walls, education and public awareness, etc. were introduced in addition to some indigenous knowledge.
- What new were cascading disasters: Fukushima nuclear power plants, numerous fires, supply-chain damages, etc.

Arahama Elementary School, Sendai, Japan (March 11, 2011)

521 people evacuated and survived in this building while 755 people were killed in the area

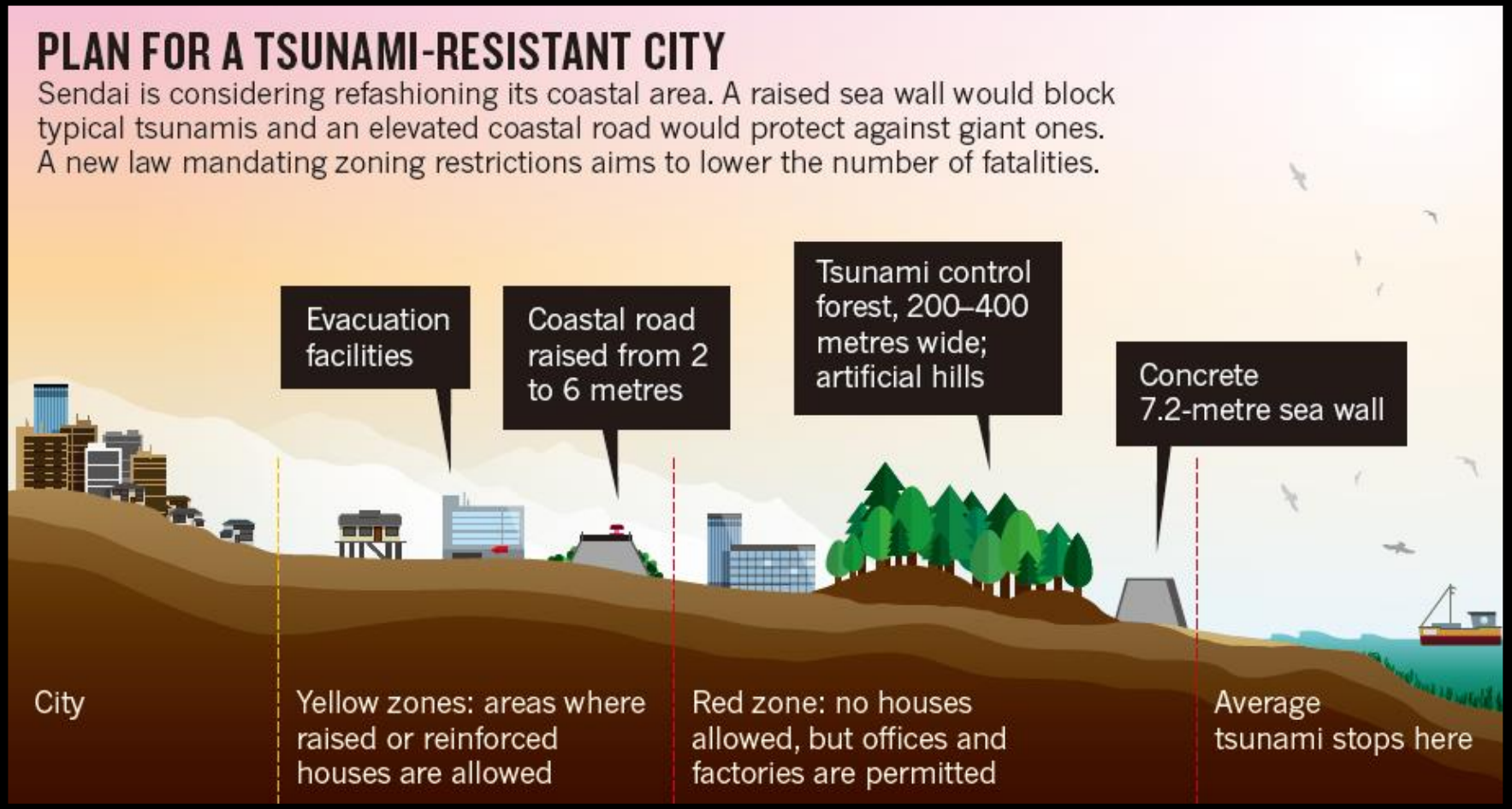
The tsunami was far more extensive than expected



Sendai
Fatality : 755

The 2011 Tsunami in Sendai

Sendai city's reconstruction plan
Multiple protection to minimize losses



How the multiple protection works …

Social Needs

How much losses are ?

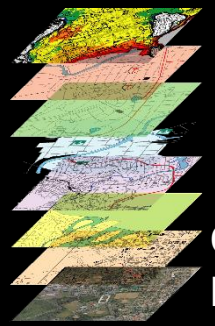
How extensive disaster relief activities should be deployed ?

How many structures/infrastructures are damaged ?

How many people are exposed, killed, and injured ?

How extensive the tsunami penetrates ?

How we prepare to minimize losses ?



Geospatial Information Platform

Mapping products

Real time simulation

Air-borne remote sensing

Space-borne remote sensing

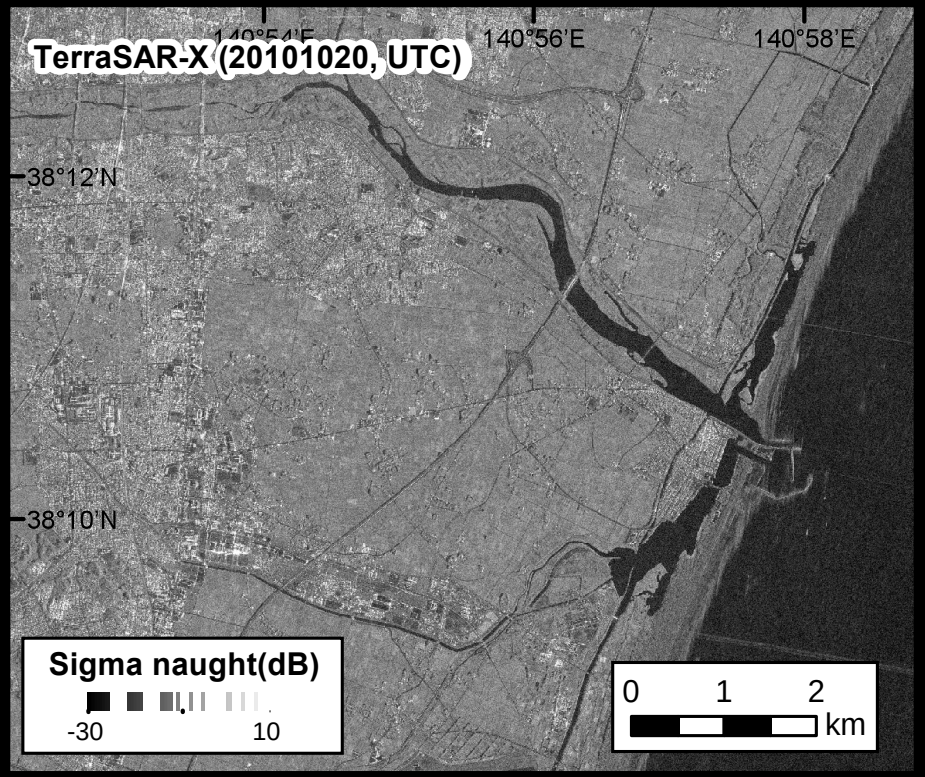
Real time Seismic & GNSS Network

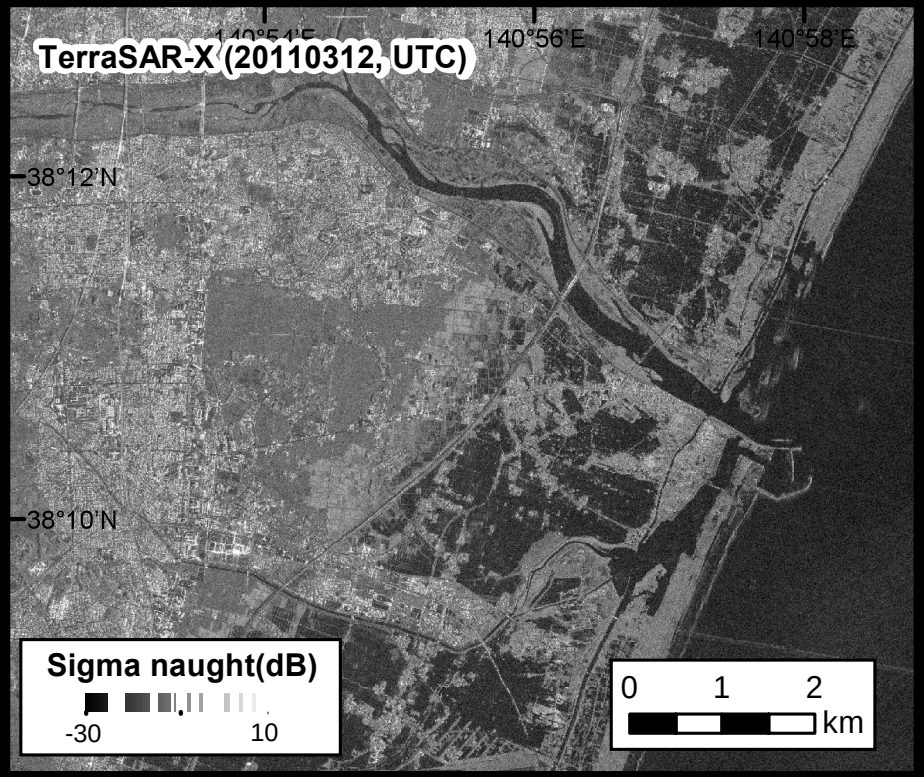
Social sensing

Offshore tsunami monitoring

~minutes ~hours ~days ~weeks

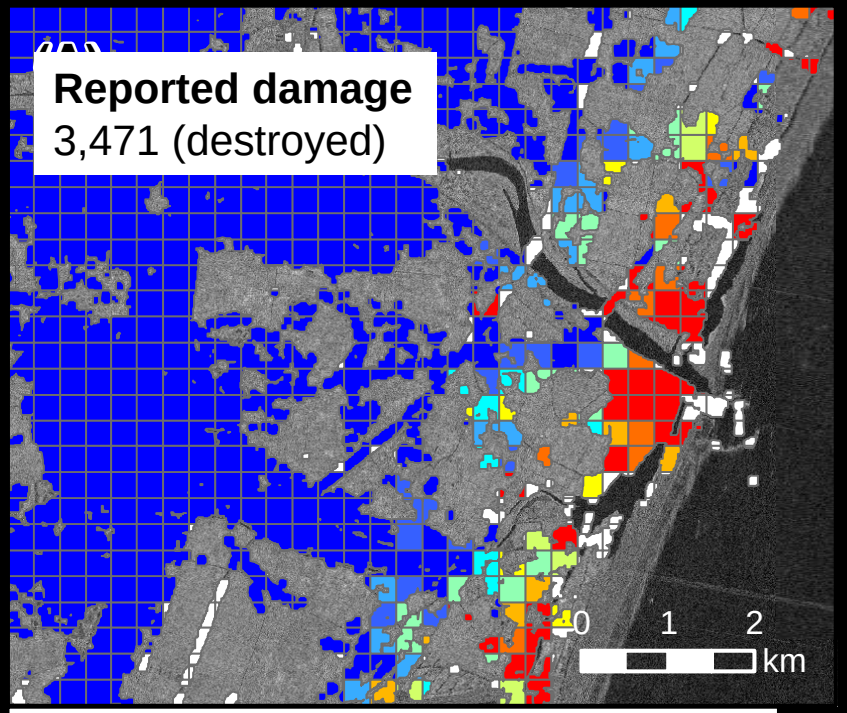
Application of Radar Remote Sensing
Collaboration with German Aerospace Center (DLR)
TerraSAR-X data

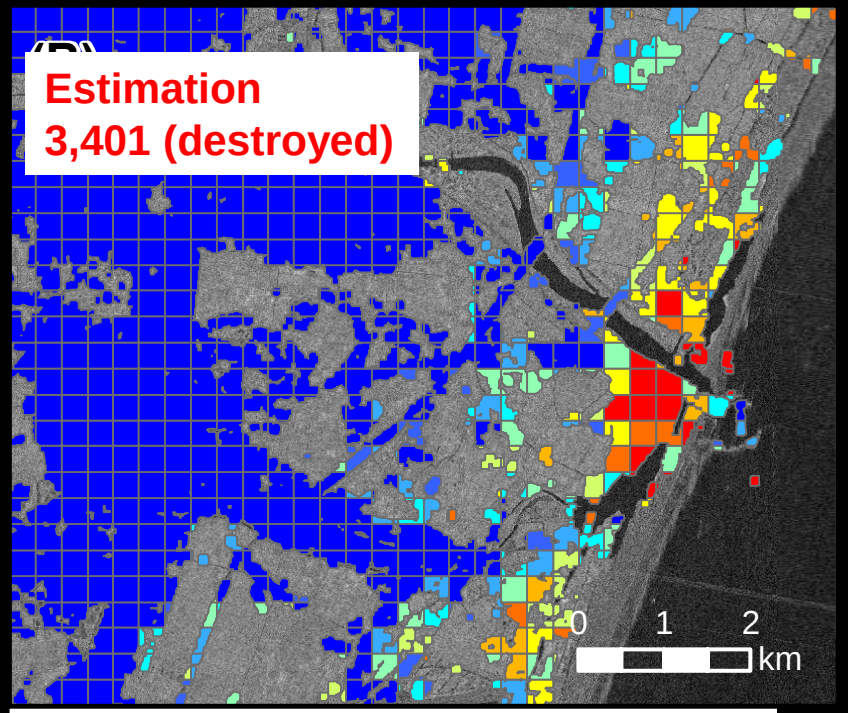




Towards Quantitative Estimation of Structural Damage using SAR data

- Pre and post event satellite data (TSX, CSK, RS-2, PALSAR-2, …)
- Digital elevation models (ASTER GDEM, SRTM)
- Building footprints





Gokon et al. (2014)

Structural damage interpretation using aerial photos GSI (Geospatial Information Authority of Japan)

Gokon et al. (2012)

Tsunami Fragility Curve
Koshimura et al. (2014)