Advances of Remote Sensing for Mapping Disaster Impact

"Advances of Simulation, Remote Sensing, and Geo-informatics in Mapping Disaster Impact"

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Sendai Framework for Disaster Risk Reduction
[Understanding disaster risk]

- National and local levels

Promote real-time access to reliable data, make use of space and in situ information, including geographic information systems (GIS), and use information and communications technology innovations to enhance measurement tools and the collection, analysis and dissemination of data.

Sendai Framework for Disaster Risk Reduction
[Understanding disaster risk]

- Global and regional levels

Promote and enhance, through international cooperation, including technology transfer, access to and the sharing and use of non-sensitive data, information, as appropriate, communications and geospatial and space-based technologies and related services.

Maintain and strengthen in situ and remotely- sensed earth and climate observations. Strengthen the utilization of media, including social media, traditional media, big data and mobile phone networks to support national measures for successful disaster risk communication, as appropriate and in accordance with national laws.

Critical questions in the aftermath

~minutes

~hours

~days

~weeks

- How extensive the tsunami penetrates ?
- How many people are exposed, killed, and injured ?
- How many structures/infrastructures are damaged ?
- How extensive disaster relief activities should be deployed ?
- How much amount of debris need to be removed ?
- How much losses are ?

Solving critical problems

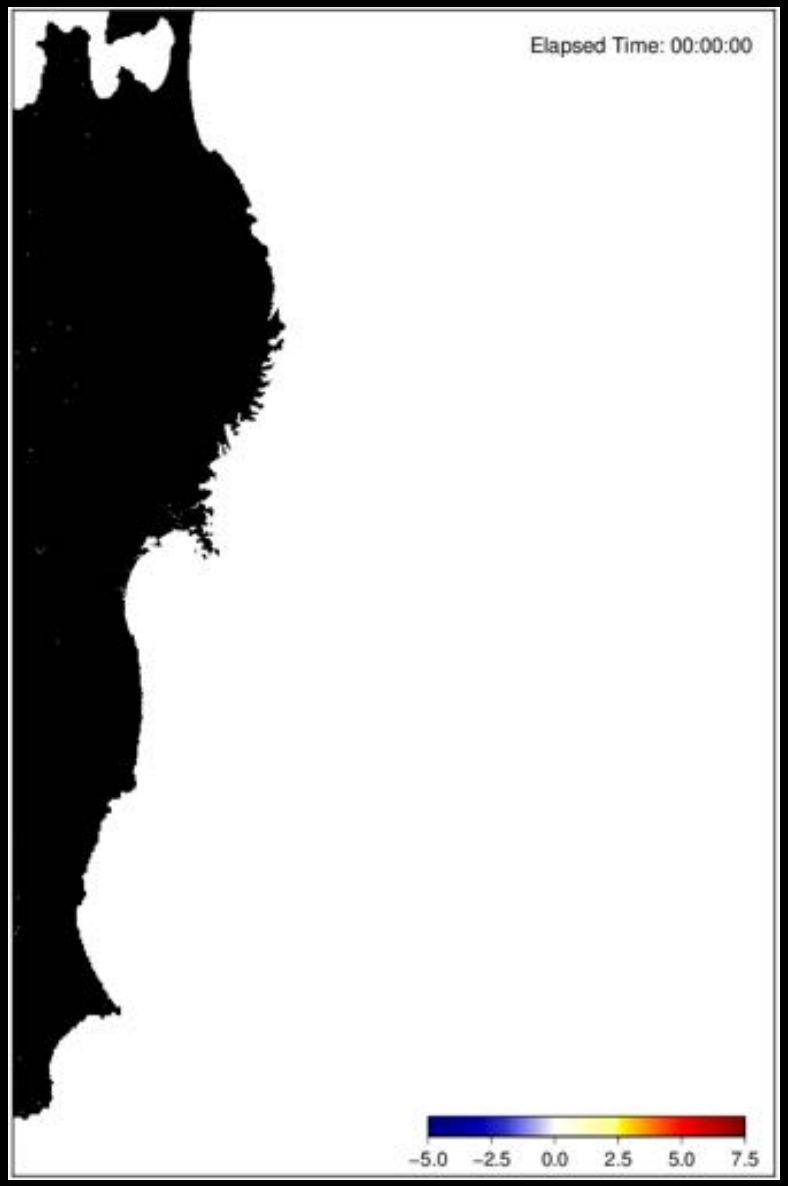
Fusion of three key technologies

Simulation

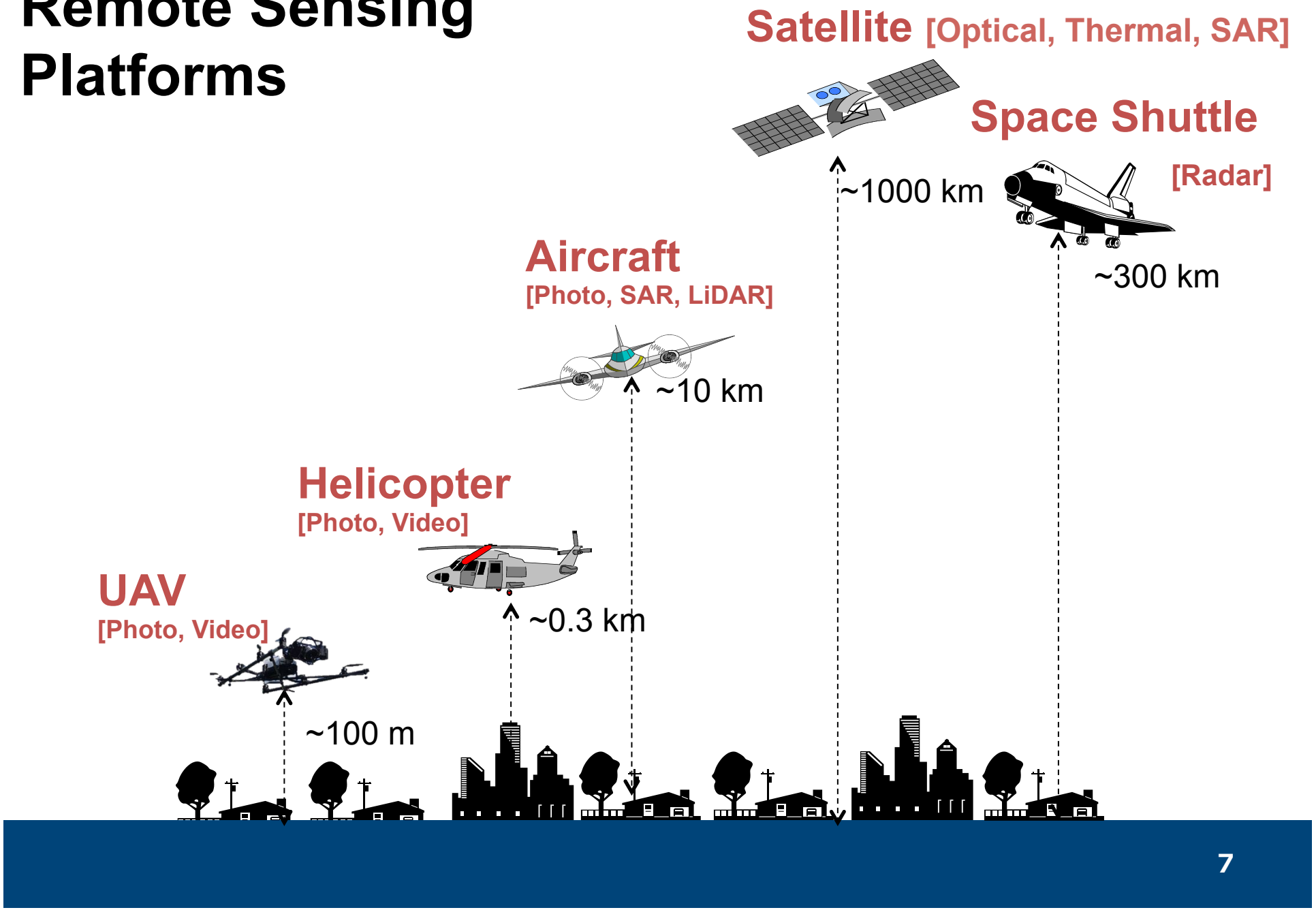
(Remote) Sensing

Spatial Information Science

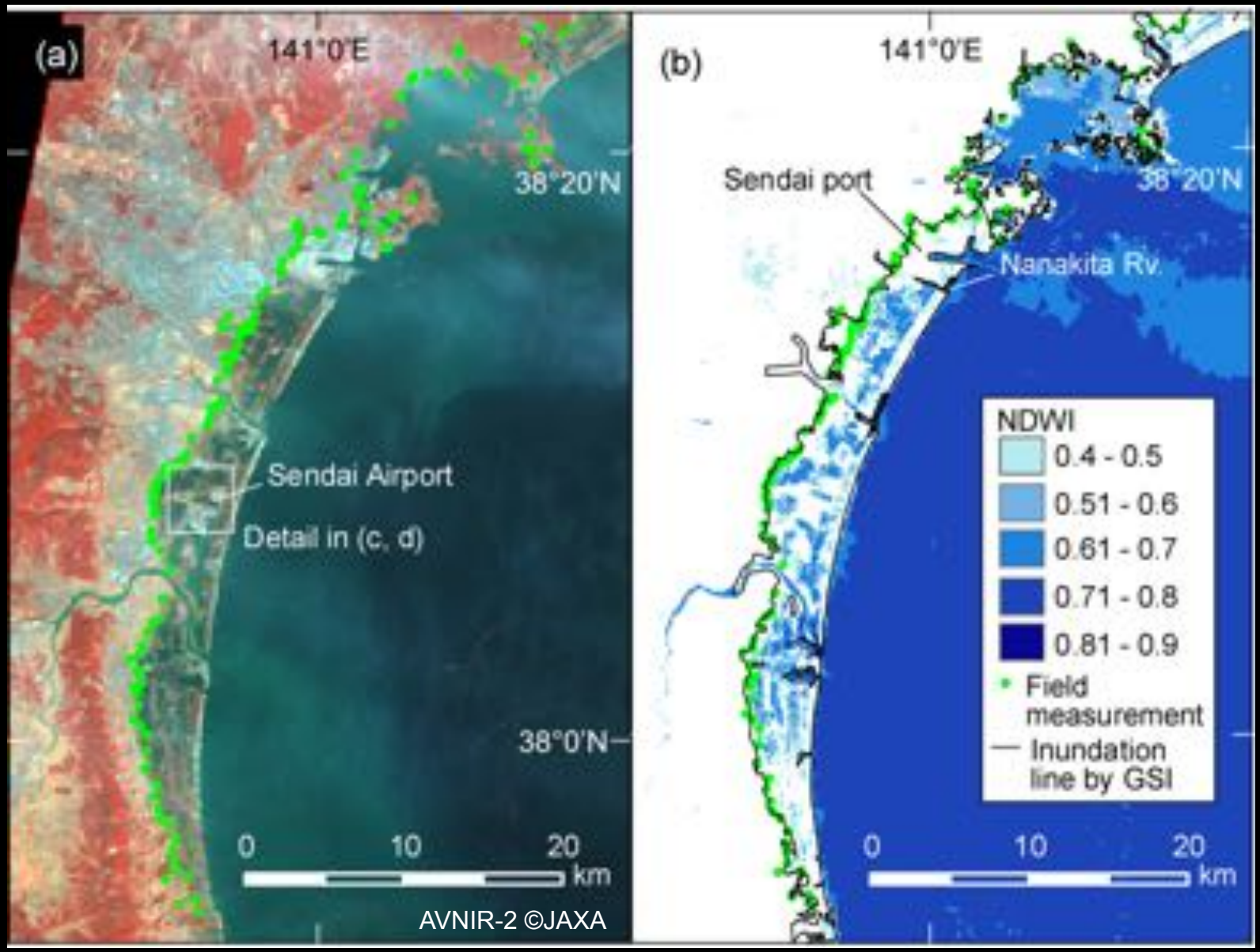
Tsunami Modeling



Remote Sensing Platforms



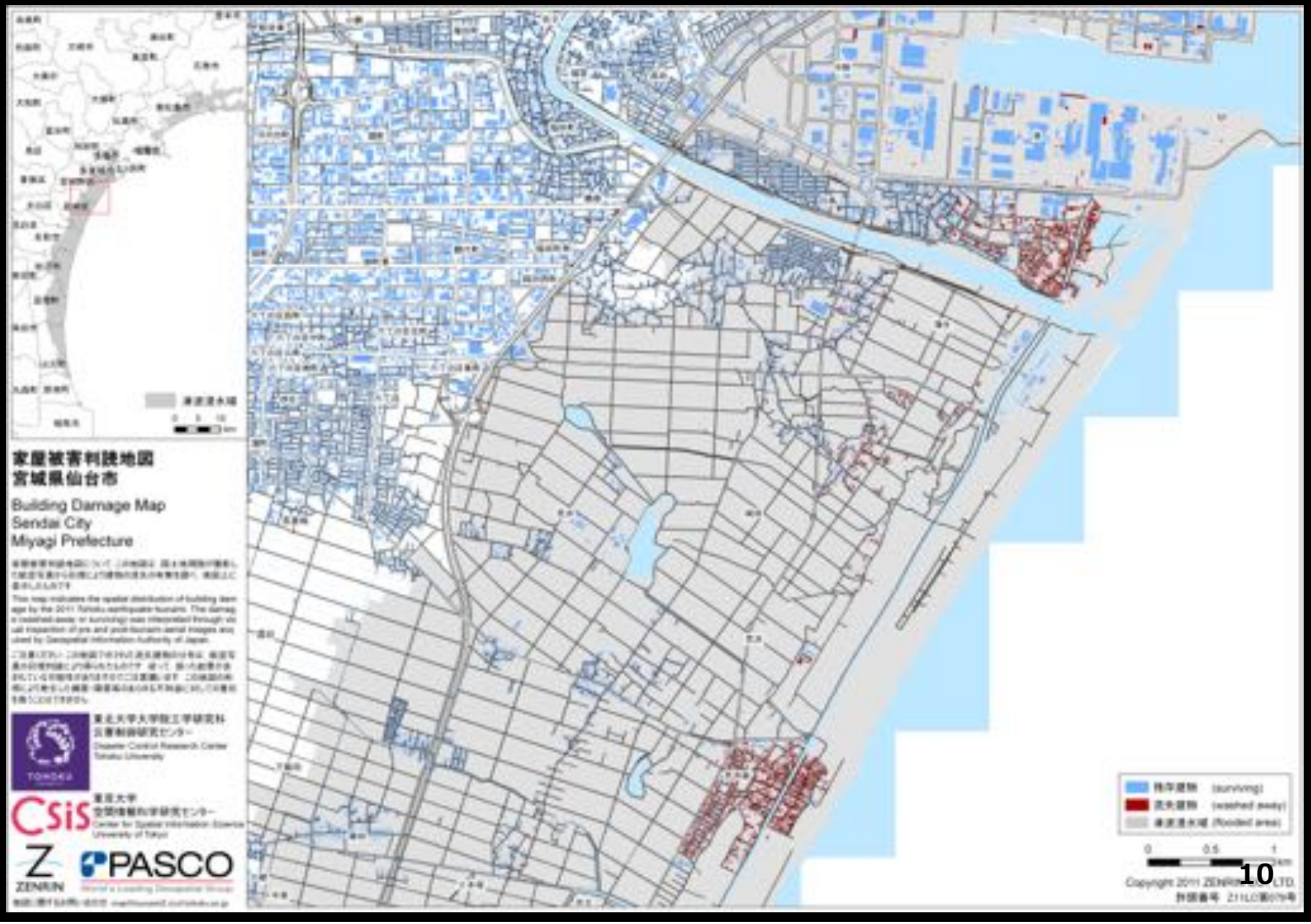
How extensive the tsunami penetrates ?
Optical satellite remote sensing (JAXA ALOS/AVNIR-2)



AVNIR-2 ©JAXA

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

Mapping of structural damage



Application of Radar Remote Sensing
Collaboration with German Aerospace Center (DLR)

Application of Radar Remote Sensing
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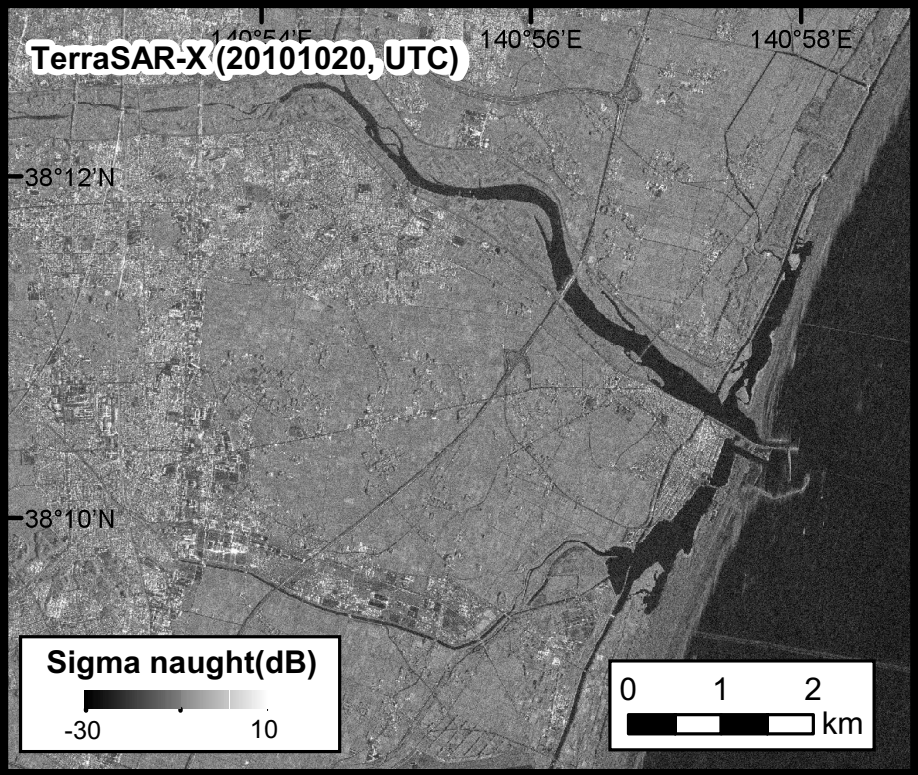
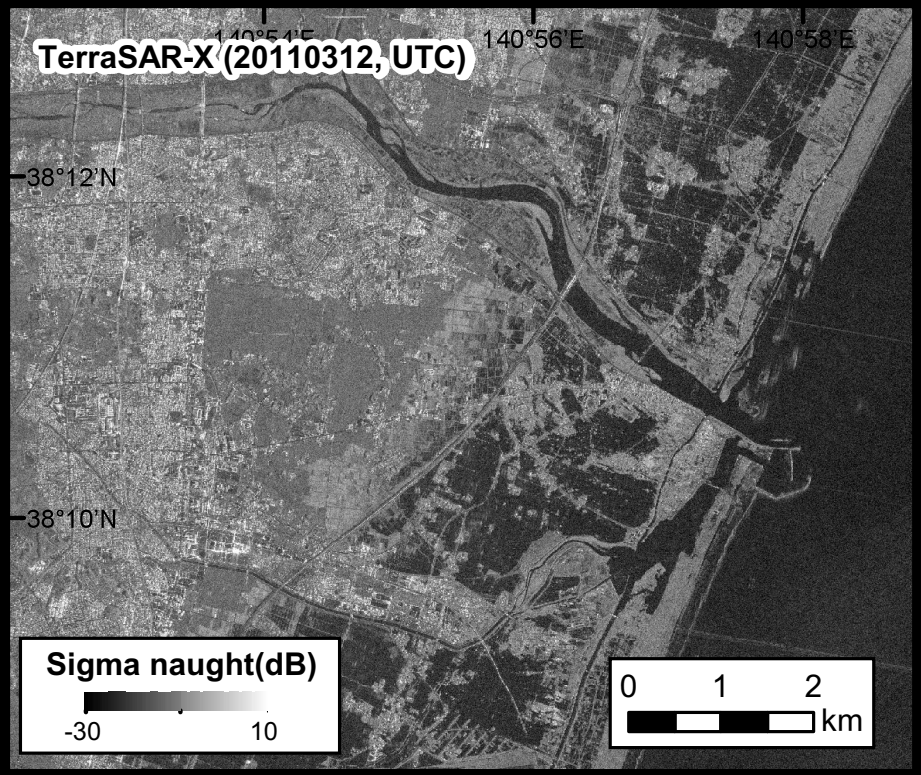
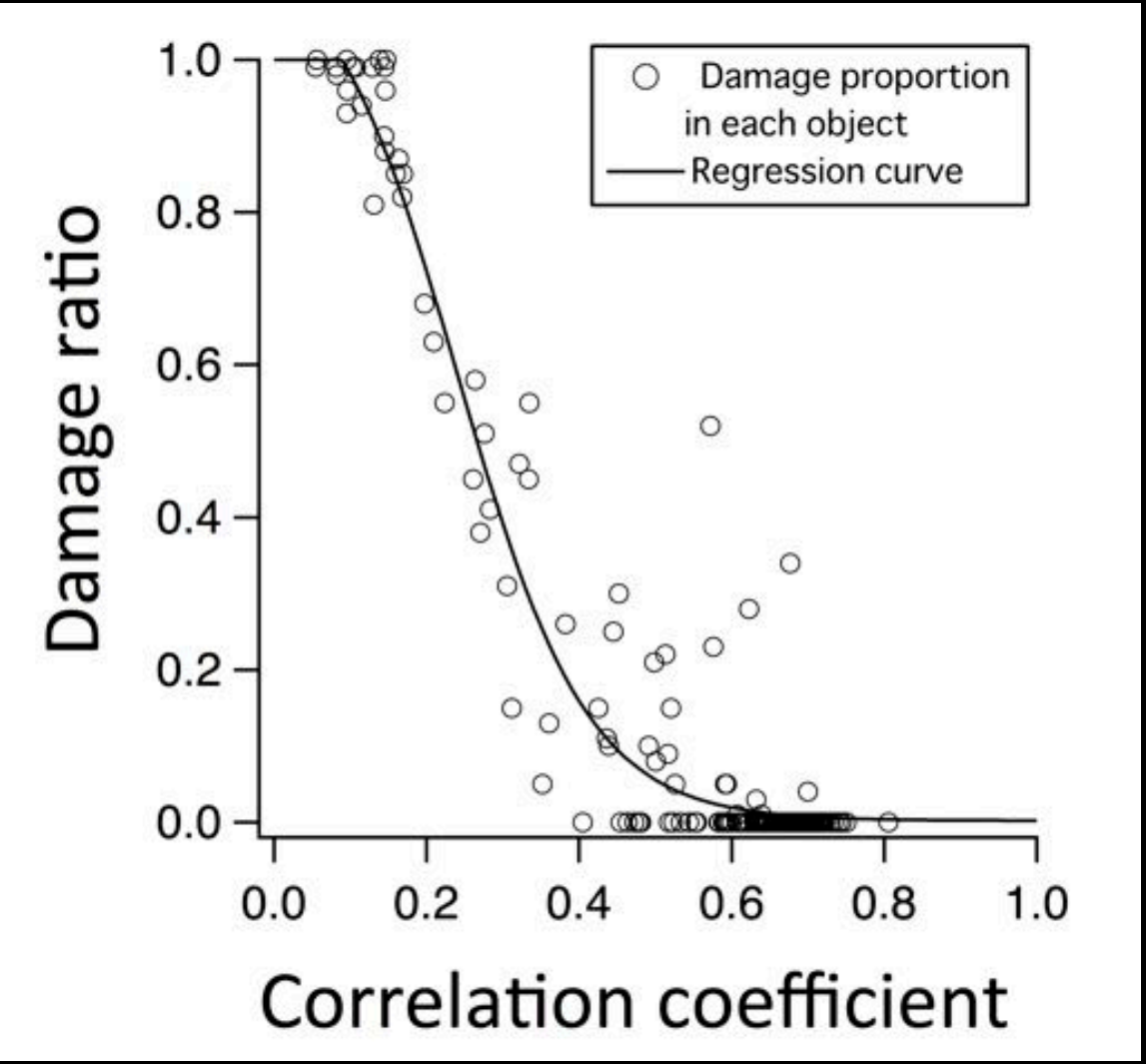
TerraSAR-X data





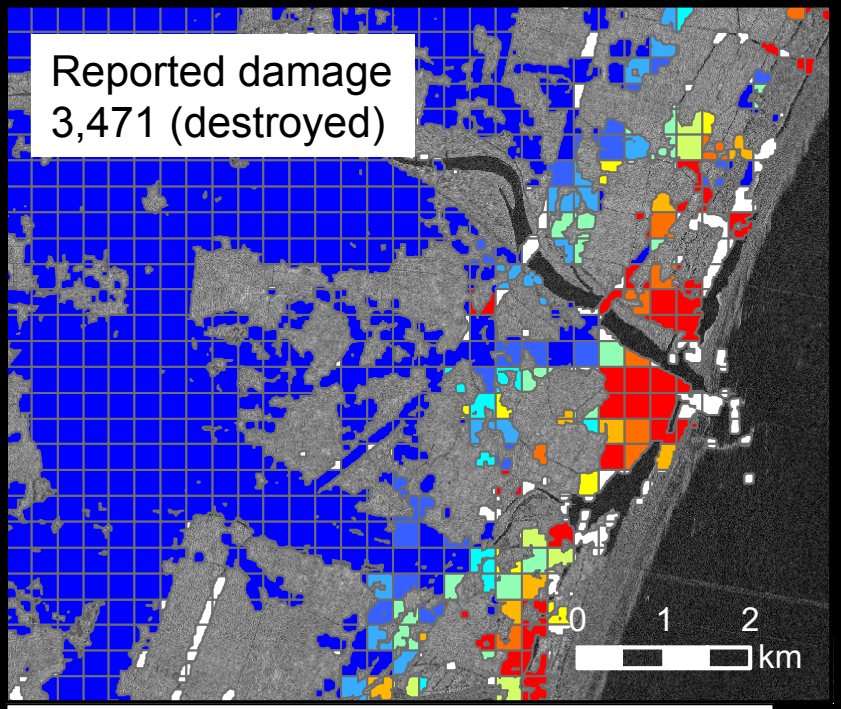
Change of Backscattering and Structural Damage combined with in-situ data

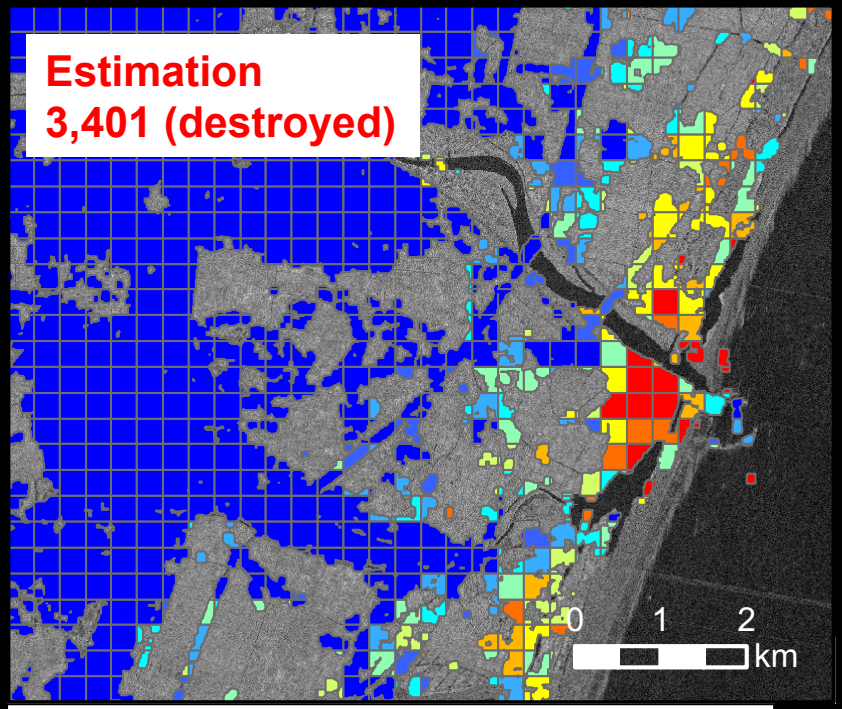


Gokon et al. (2014)

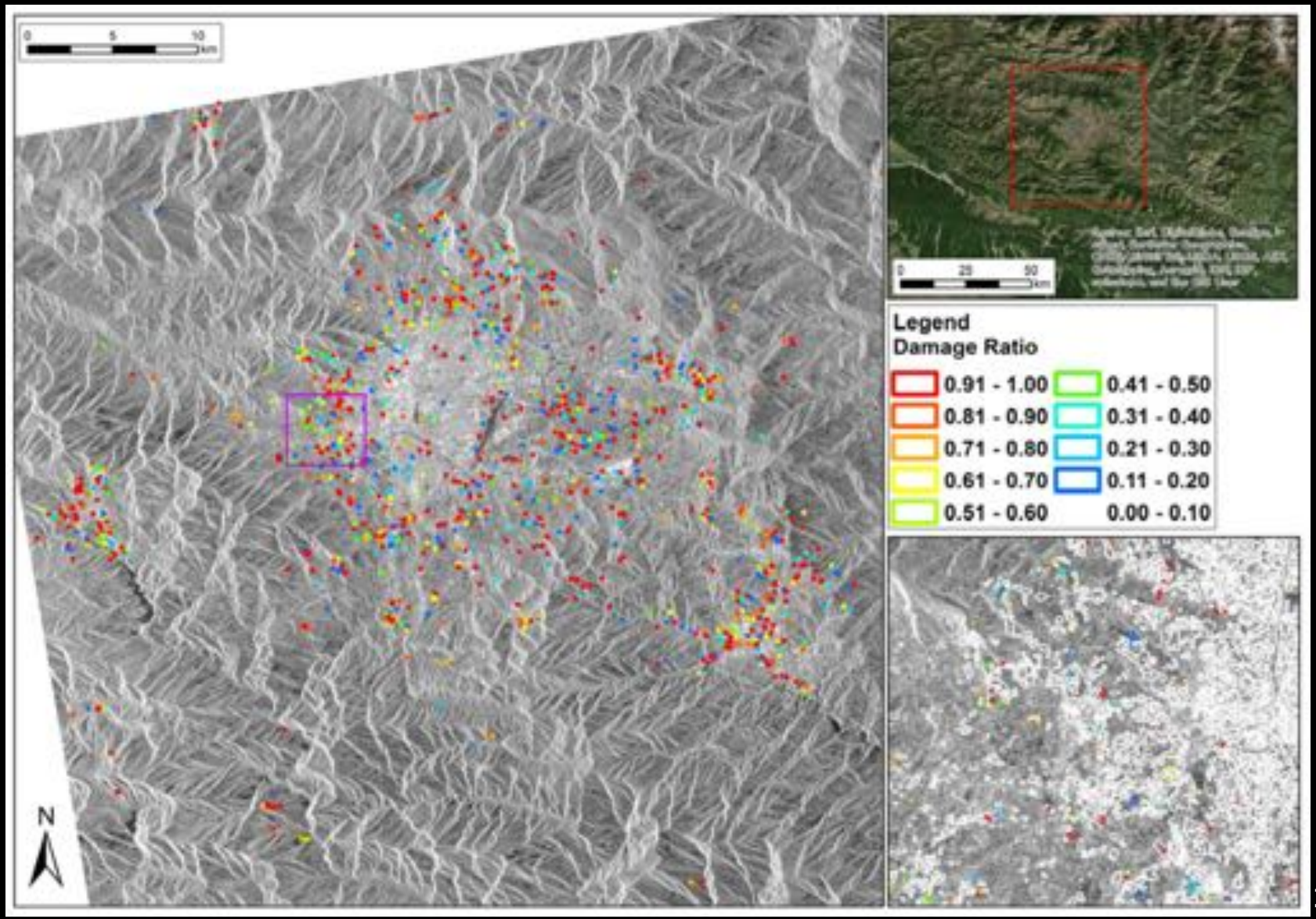
Towards Quantitative Estimation of Structural Damage using SAR data

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





The 25 April Earthquake in Nepal Damage Assessment using PALSAR-2 data



Procedure of damage estimation

Pre- and post-event ALOS-2 PALSAR-2 data

Pre-processing

Registration

Calibration

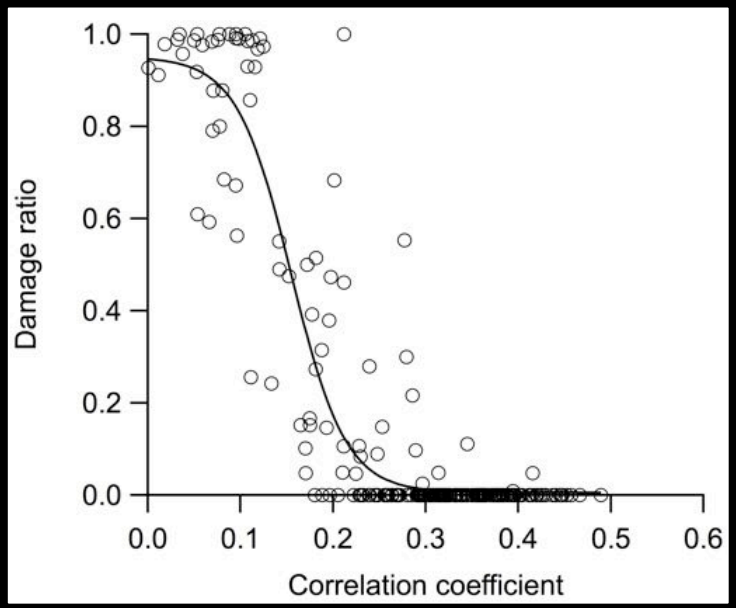
Speckle noise filtering

Change detection (Calculating correlation coefficient with the window size of 5 * 5)

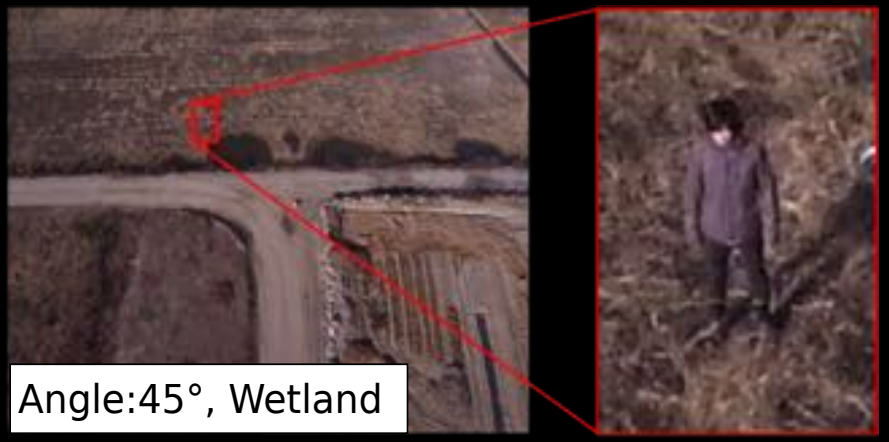
Extracting built-up areas using OSM (Open Street Map) data (with 10-m buffer)

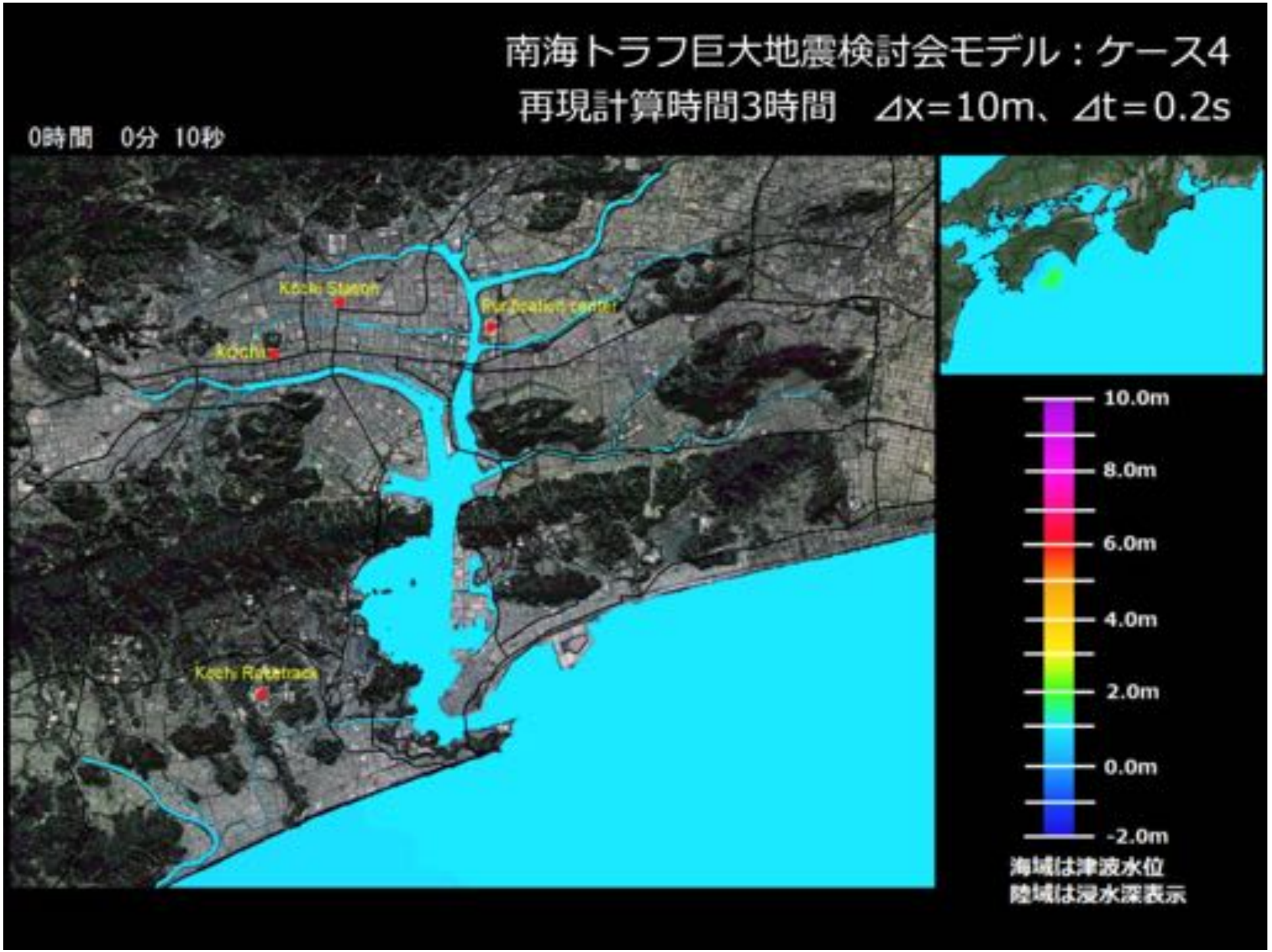
Classifying into objects by the region growing method

Estimating damage ratio by the damage function which was created for L-band data

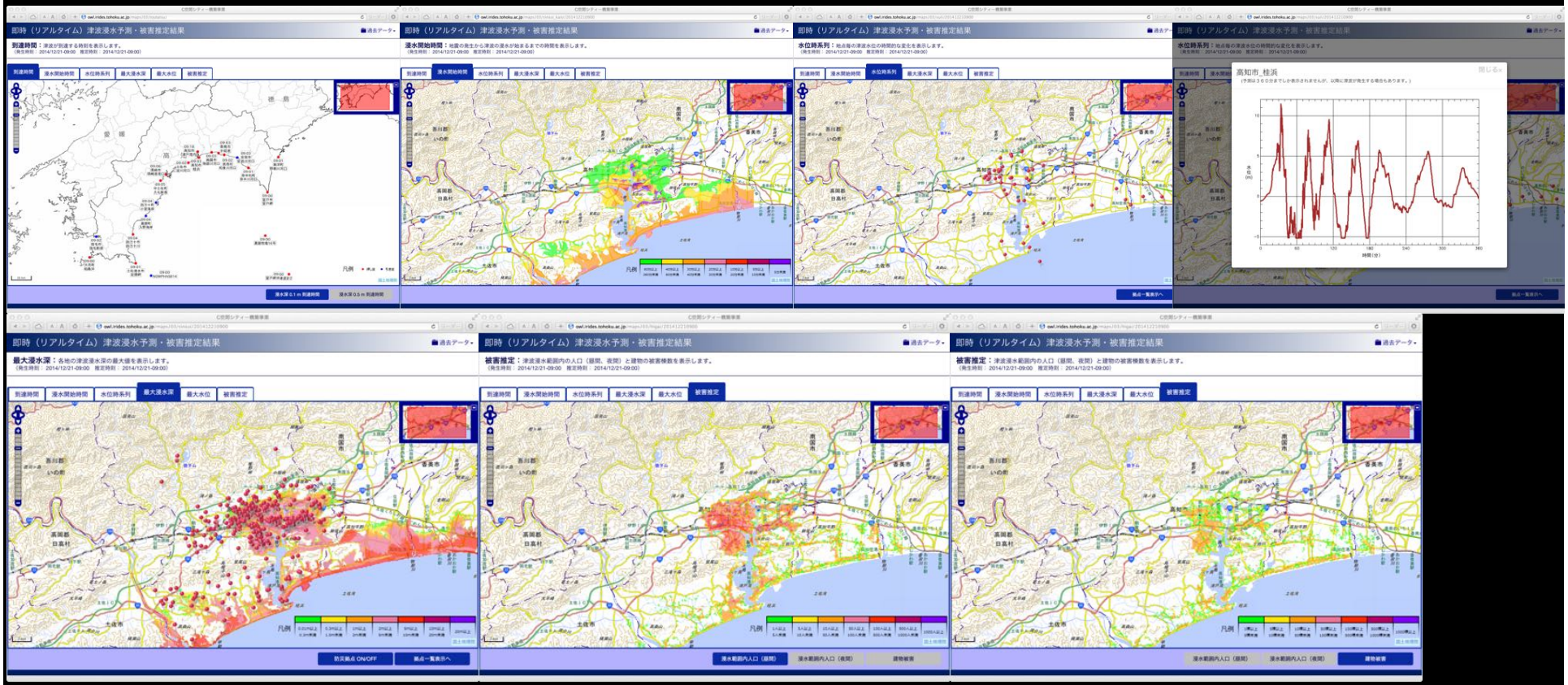


Searching with UAV




南海トラフ巨大地震検討会モデル：ケース4
再現計算時間3時間　⊿x=10m、⊿t=0.2s
0時間　0分　10秒
Kochi Station
Kochi
Kochi Prefectural Office
10.0m
8.0m
6.0m
4.0m
2.0m
0.0m
-2.0m
海域は津波水位
陸域は浸水深表示

Mapping and database system



- Tsunami travel time
- Waveforms
- Inundation depths and heights
- Exposed population
- Structural damage

We need map products

with quantitative information
with adequate timing

~minutes

~hours

~days

~weeks

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Science and Technology for Saving Lives