Damage Survey from the 2024 Noto Peninsula Earthquake

ver.01 (2024/02/01)

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Survey schedule

January 28th – 29th , 2024

Uchinada → Nanao

Wajima → Anamizu → Wajima Monzen

3 seismic tests: ISK009 (1 station), Uchinada (1 station), and ISK003 (microtremor array)

Research members

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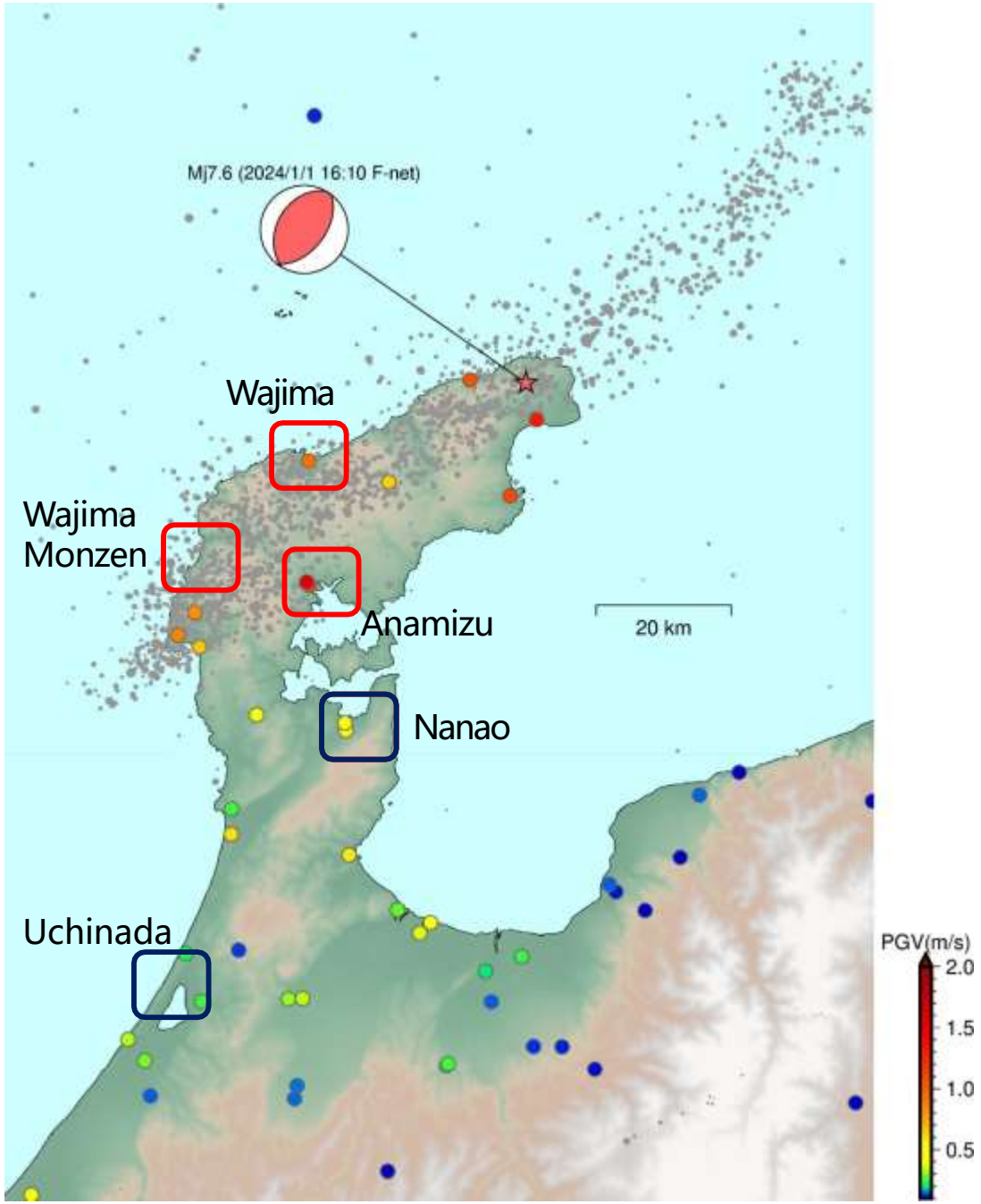
Purpose

<u>Understanding geotechnical failure and ground motions</u>

This report partially covers damage due to ground failure with a focus on liquefaction and some damage to buildings. (This is not at extensive report of all damages in the area)



Uchinada

- Liquefaction-induced damage:
  - Lateral spreading (about 2.7 Ha)
  - Ground upheave
  - Ground settlement
  - Sand ejecta

Google Earth

Uchinada

1. Sinking of Traffic Light and upheave of side walk

Before

Street View,
Google Maps

After

Uchinada

2. Lateral displacement (NW to SE) and vertical relative settlement

Street View, Google Maps

Before

After

Uchinada

3. Tensile cracks, settlement and lateral spreading

Before

Street View, Google Maps

After

Uchinada

4. Sand ejecta, utility pole rotation and structures' settlement

Before

Street View, Google Maps

After

Uchinada

5. Sand ejecta, utility pole sinking and ground upheave

Before

Street View,
Google Maps

Uchinada

6. Sand ejecta, relative settlement and ground upheave

Street View, Google Maps

Uchinada

7. Sand ejecta, horizontal displacement and ground upheave

Before

Street View, Google Maps

After

Uchinada

8. Sand ejecta, rotation, and ground upheave

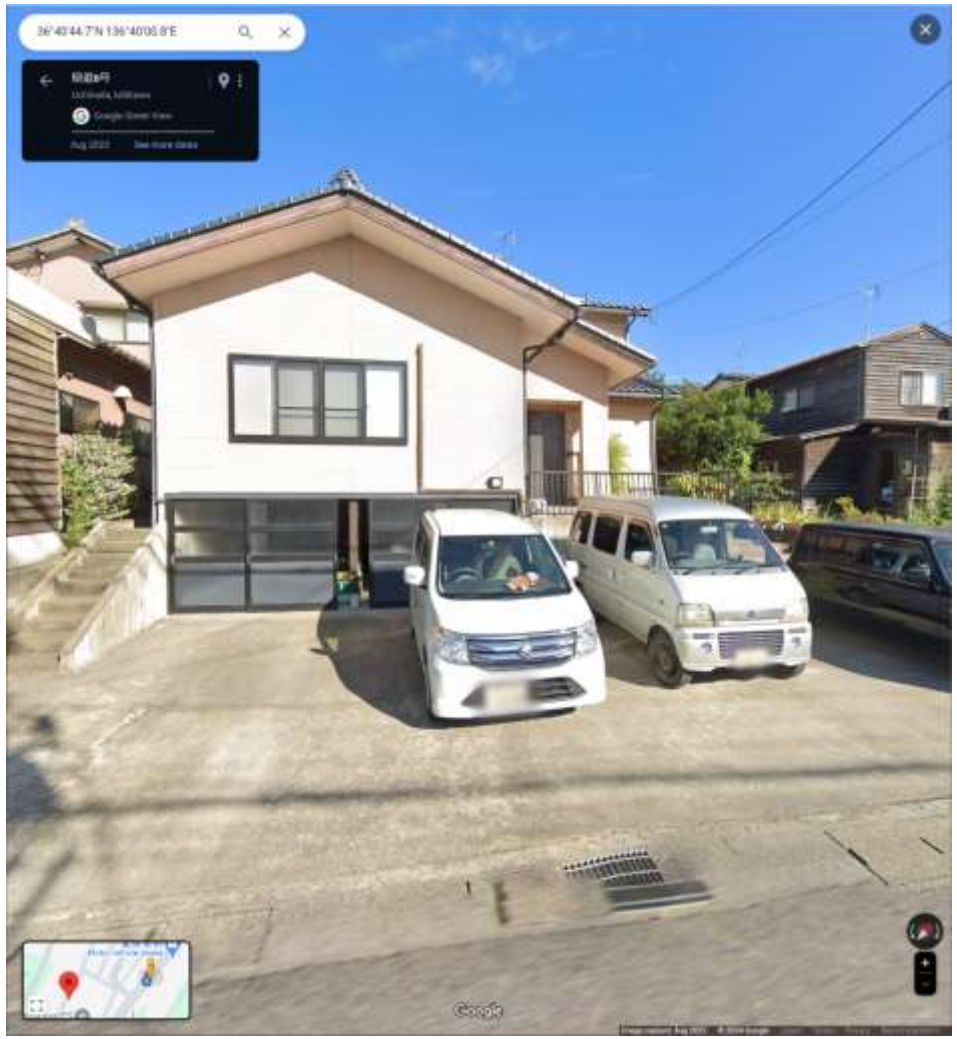
Before

Street View, Google Maps

After

Uchinada

9. Vertical settlement



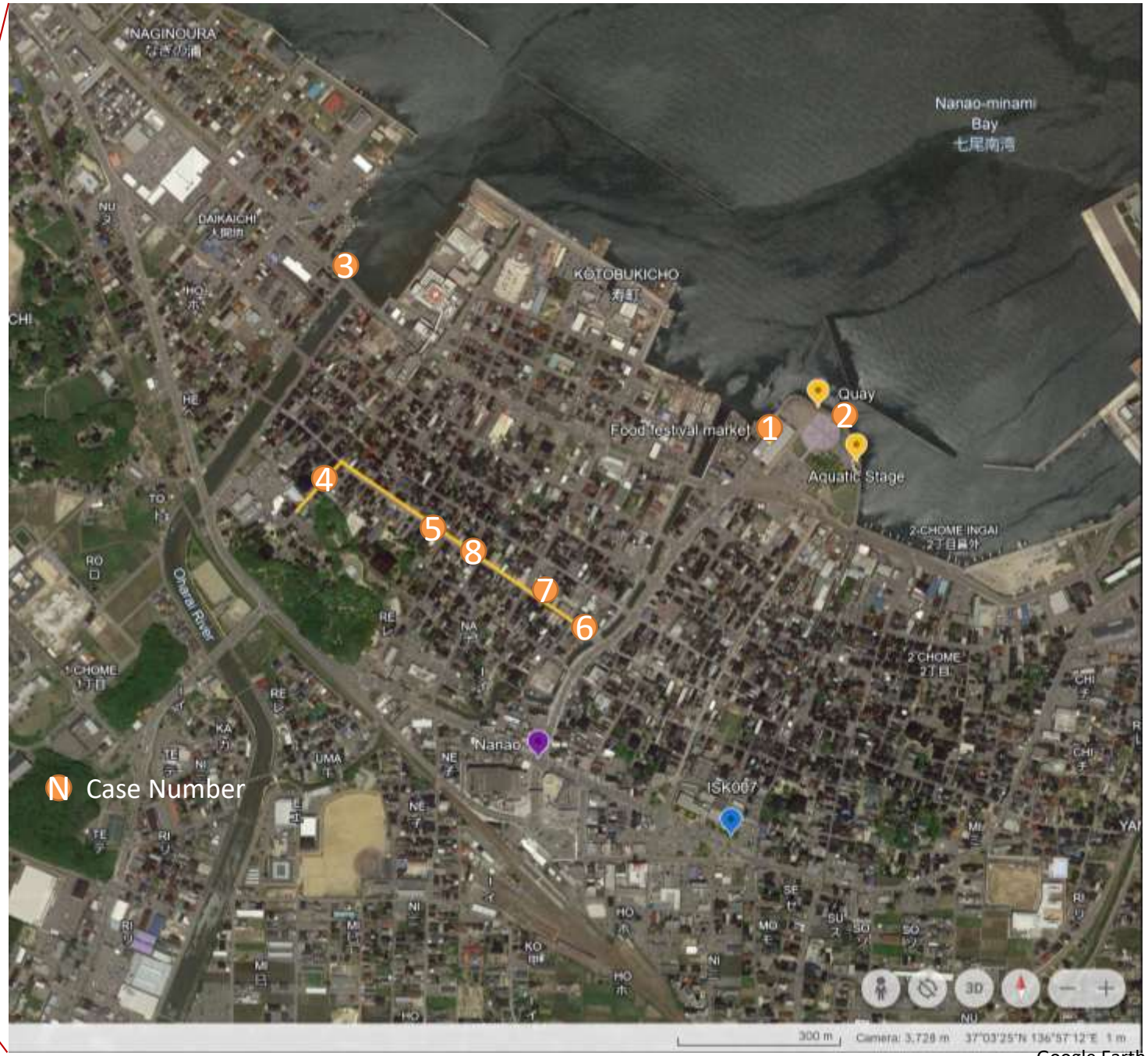
Before

Street View, Google Maps

After

Nanao

- Liquefaction-induced damages (1-3, 8):
  - Manholes upheave
  - Sand ejecta
  - Ground settlement
- Damage to structures:
  - Collapsed traditional wood house (4)
  - Collapsed temple entrance gate (5)
  - Collapsed first floor (6)
  - Fallen facade of steel structure (7)



Nanao

1. Liquefaction-induced Damage surrounding the “ Food Festival Market”

Manholes and pipeline uplift

Relative settlement

Ground subsidence

Nanao

1. Liquefaction-induced Damage surrounding the “ Food Festival Market”

Ground subsidence and sand ejecta

Ground subsidence

Ground subsidence

Nanao

2. Liquefaction-induced Damage at the Quay and the aquatic stage

Tilted quay, sand ejecta and ground subsidence

Sand ejecta and ground subsidence

Ground subsidence

Subsidence and curved quay

Nanao

3. Ground subsidence around bridge

Ramp built to access bridge

Cracks in bridge stairs

Ground subsidence

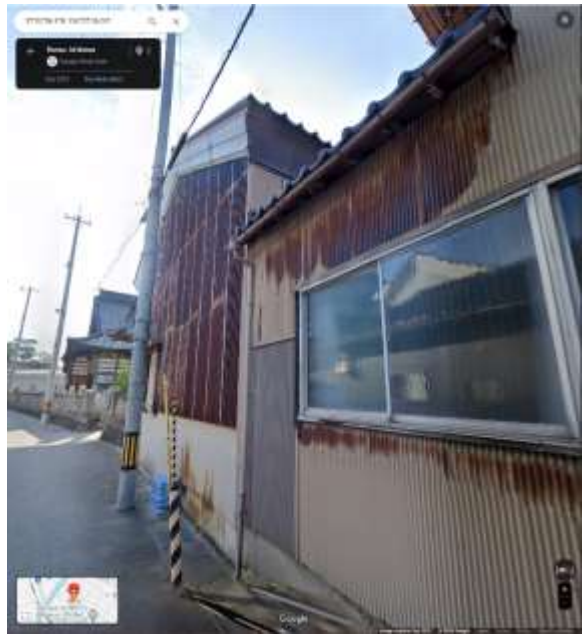
Cracks and ground subsidence at parking lot near bridge

Nanao

4. Collapsed traditional wood house

Timber structure and earthen plaster

https://www.tutikabe.net/en/



Before

Street View, Google Maps

After

Nanao

5. Collapsed entrance gate

Before

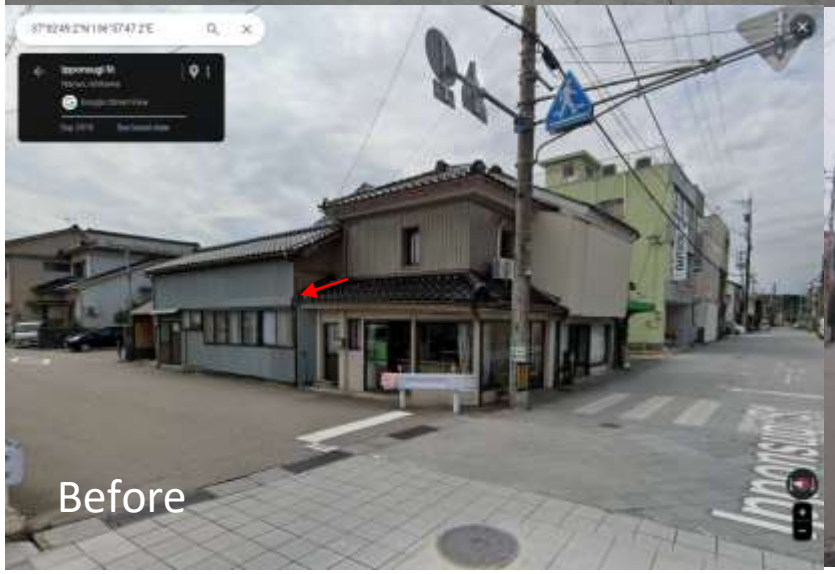
Street View, Google Maps

After

Nanao

6. Collapsed of first floor of wood house

Vertical and horizontal asymmetry

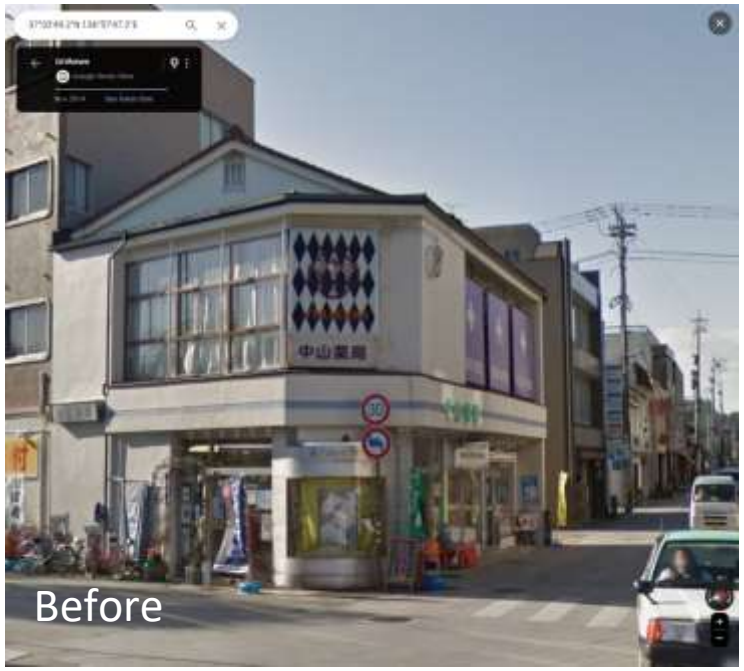


Street View, Google Maps

Nanao

6. Collapsed of first floor of wood house

First “Weak floor”



Street View, Google Maps

Nanao

7. Fallen facade of steel structure

Before

Street View, Google Maps

After

Nanao

RC buildings with no visible damage

Nanao

8. Liquefaction evidence near damaged and collapsed houses

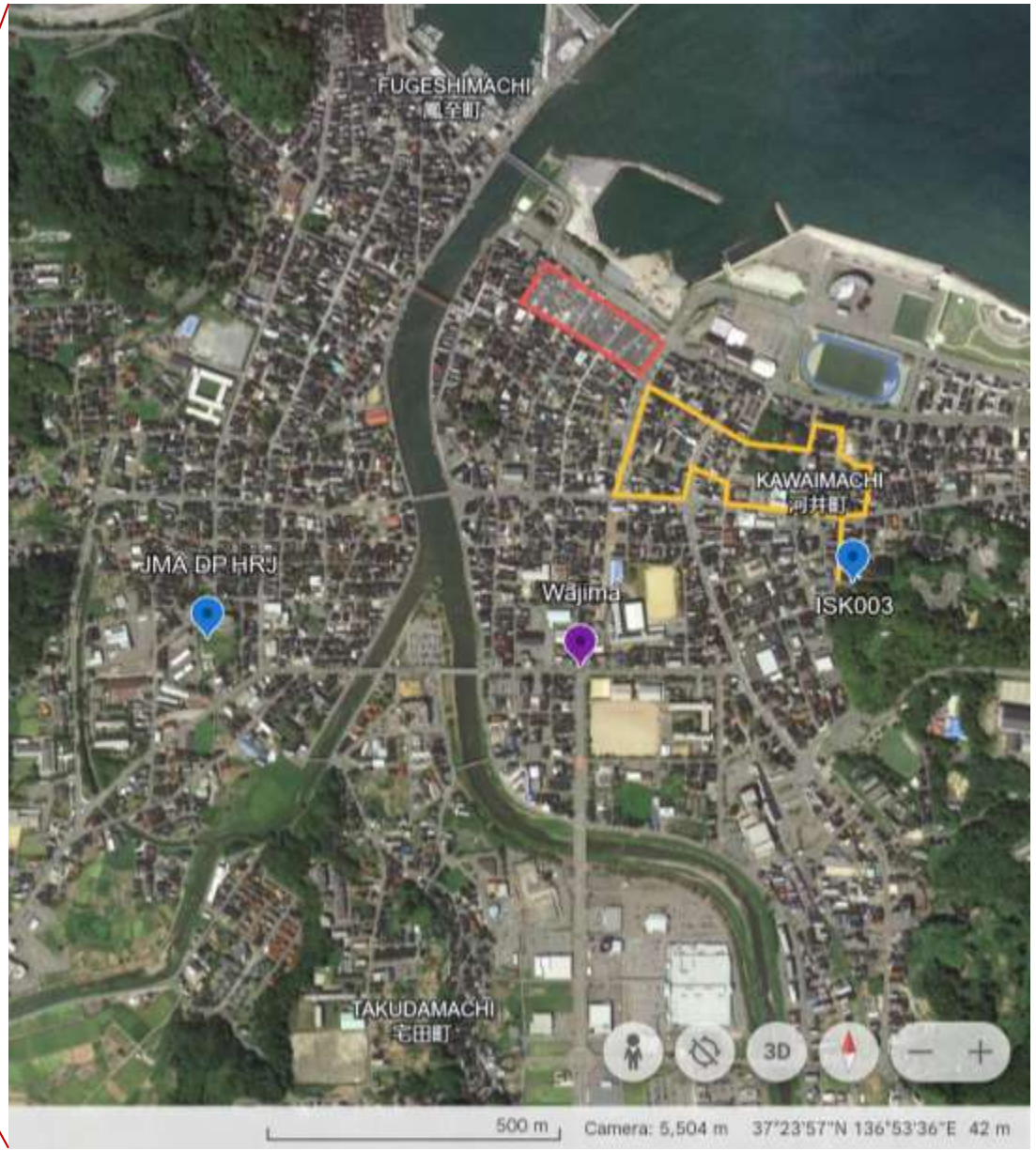
Pole settlement and sand ejecta

Sand ejecta

Wajima City Center

- Many buildings were damaged or collapsed in Kawai-cho, Wajima City (path in yellow).
  - Ground deformation with compression and cracks in road in N-S and E-W direction.
  - Liquefaction evidence only in parks, parking lots, and uplift of buried pipe and manholes.
  - No evidence of liquefaction-induced failure on structures.
- A fire extended in a large area of Morning market - about 200 buildings destroyed and approx. 1.7 Ha

High compressive stresses



Google Earth

Wajima

1. First floor collapsed

Street View, Google Maps

Before

After

Wajima

2. First floor tilted or collapsed

Before

Street View,
Google Maps

After

Wajima

3. First floor collapsed

Before

Street View, Google Maps

After

Wajima

4. First floor collapsed

Before

Street View, Google Maps

After

Wajima

5. First floor collapsed

Before

Street View,
Google Maps

After

Wajima

6. Liquefaction evidence: sand ejecta, ground cracks and manholes uplift







Wajima

6. Liquefaction evidence: manholes uplift and settlement

Wajima

7. Collapsed seven-story building (toppled)

Before

Street View,
Google Maps

After

Wajima

8. Fire after earthquake

Wajima

9. Houses collapsed due to seismic landslide

Street View, Google Maps

Anamizu

- Two K-NET stations: ISK005 Anamizu (Soft site) and ISK015 Omachi (Medium stiff site)
- ISK005:
  - Bank and ground deformations are observed around the station, but it cannot be determined whether this is due to liquefaction.
  - Water pipeline broke in the street.
- Other houses and structures damage in the town.

Google Earth

Anamizu

1. House tilted and settled near ISK005

ISK005 Anamizu

Anamizu

2. Building tilted

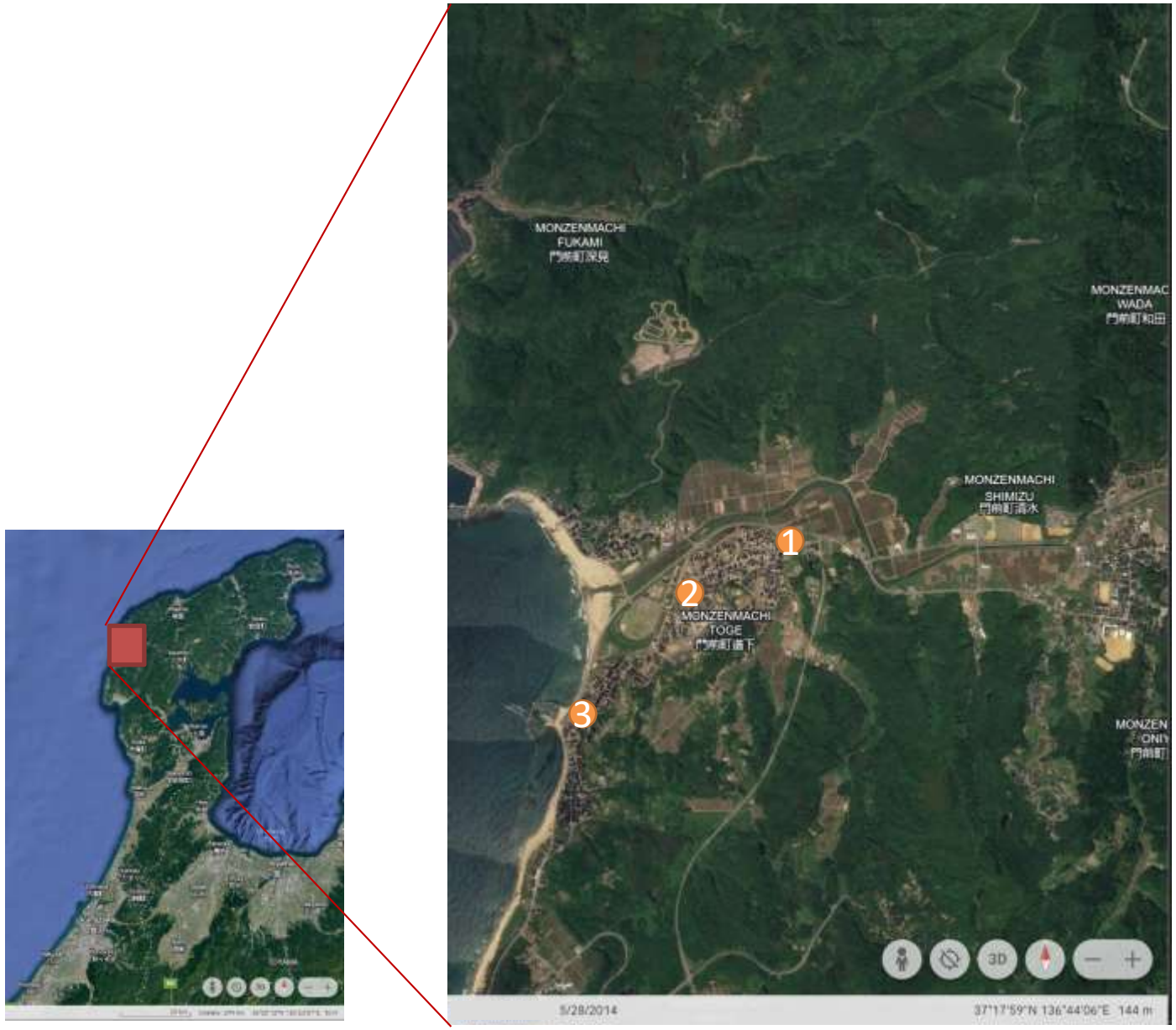
Before

Street View,
Google Maps

After

Wajima Monzen

- Many collapsed and damaged wood houses.
- Dry port
- Coast uplift



Google Earth

Wajima Monzen

1. Collapsed first floor

Before

After

Wajima Monzen

2. Tilted houses

Street View, Google Maps

Before

After

Wajima Monzen

3. Dry port and
Coast uplift

Before

Street View,
Google Maps

After

Wajima Monzen

3. Coast uplift

Street View,
Google Maps

Before

After

Summary of reconnaisance survey

- Liquefaction-induced damage particularly observed in Uchinada, mainly lateral spreading in a large area. The extend is currenty unknown.

- Areas with significant building damage were observed particularly in Wajima city center, Wajima Monzen, and Uchinada. But also damaged observed in Anamizu and Nanao
  - Cracks, settlement and uplift were visible on the road surface.
  - Sand ejecta, sinking poles and manholes uplift evidence liquefaction.
  - However, the causal relationship between building damage and liquefaction is currently unknown.

- K-Net and JMA stations visited were in good conditions but significant damage was observed in their surrounding.