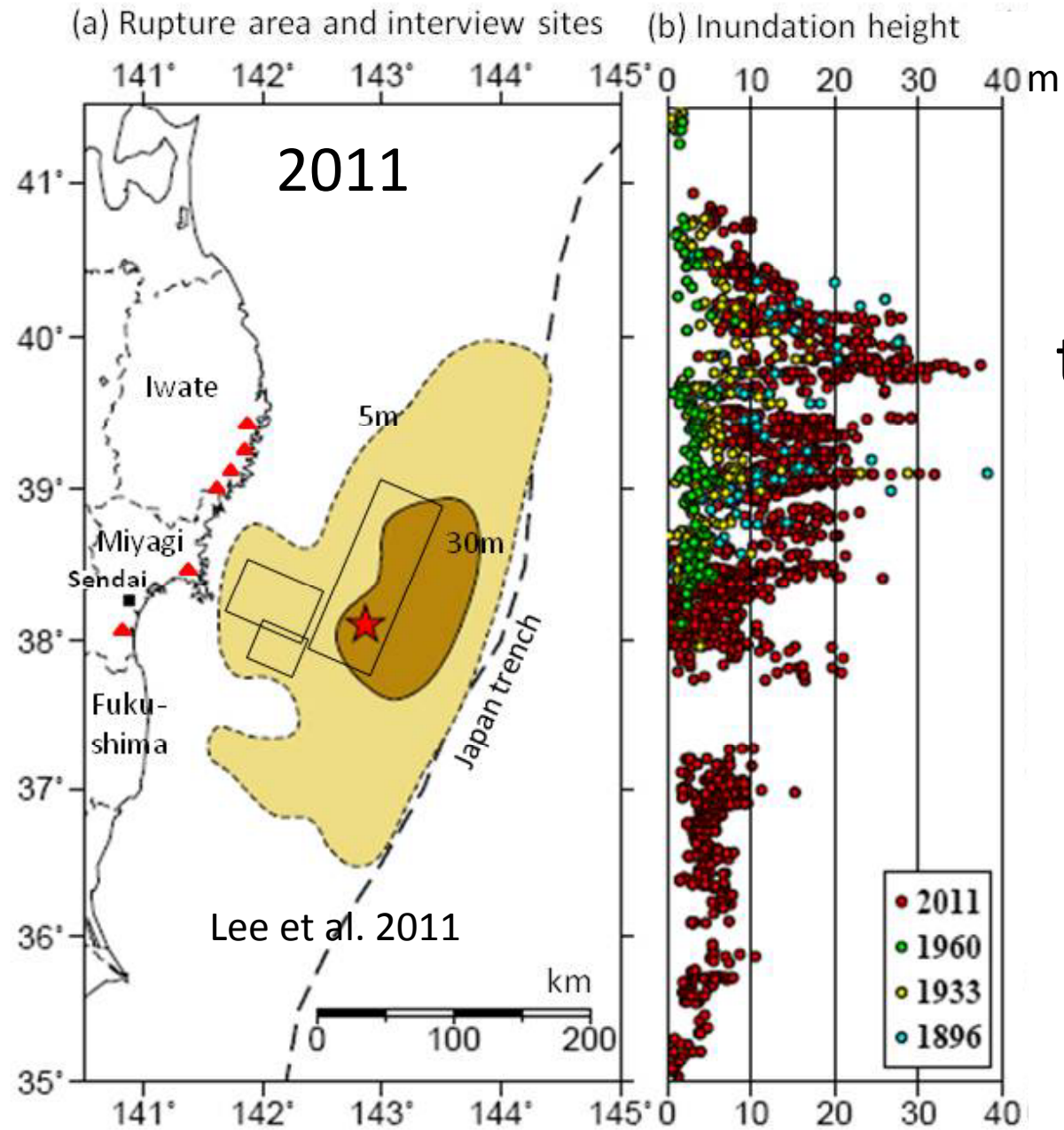


2011.10.25

The 2011 off the Pacific Coast of Tohoku earthquake Interviewing insights regarding the high fatalities inflicted by the earthquake

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3 historical tsunamis struck the region.

Why were there so many deaths in Tohoku?

Since the tsunamis of 1896, 1933 and 1960,

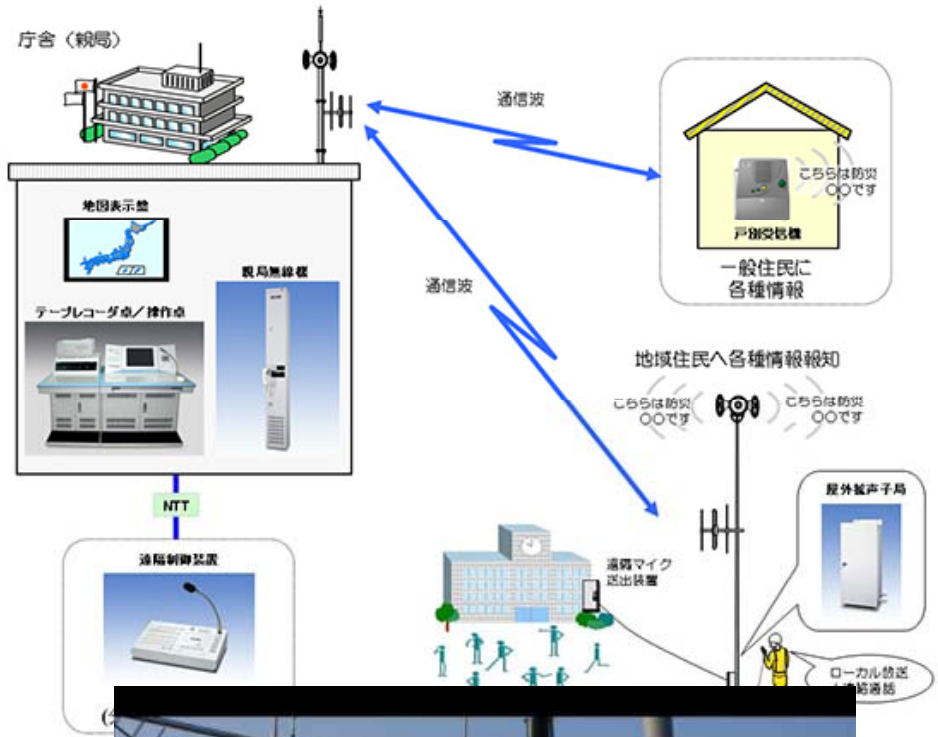
1. Numerous breakwaters, evacuation stairways and shelters, communication systems were constructed, and
2. Tsunami evacuation drills were carried out and hazard maps were distributed to local residents.

Taro, Miyako city





デジタル同報無線システム概念図（沖電気工業製）



Disaster Management Radio Communications

1. Radio + Batteries
2. Daily use



Despite these constructions
and preparedness efforts,
the March 11 Tohoku earthquake
caused numerous fatalities.

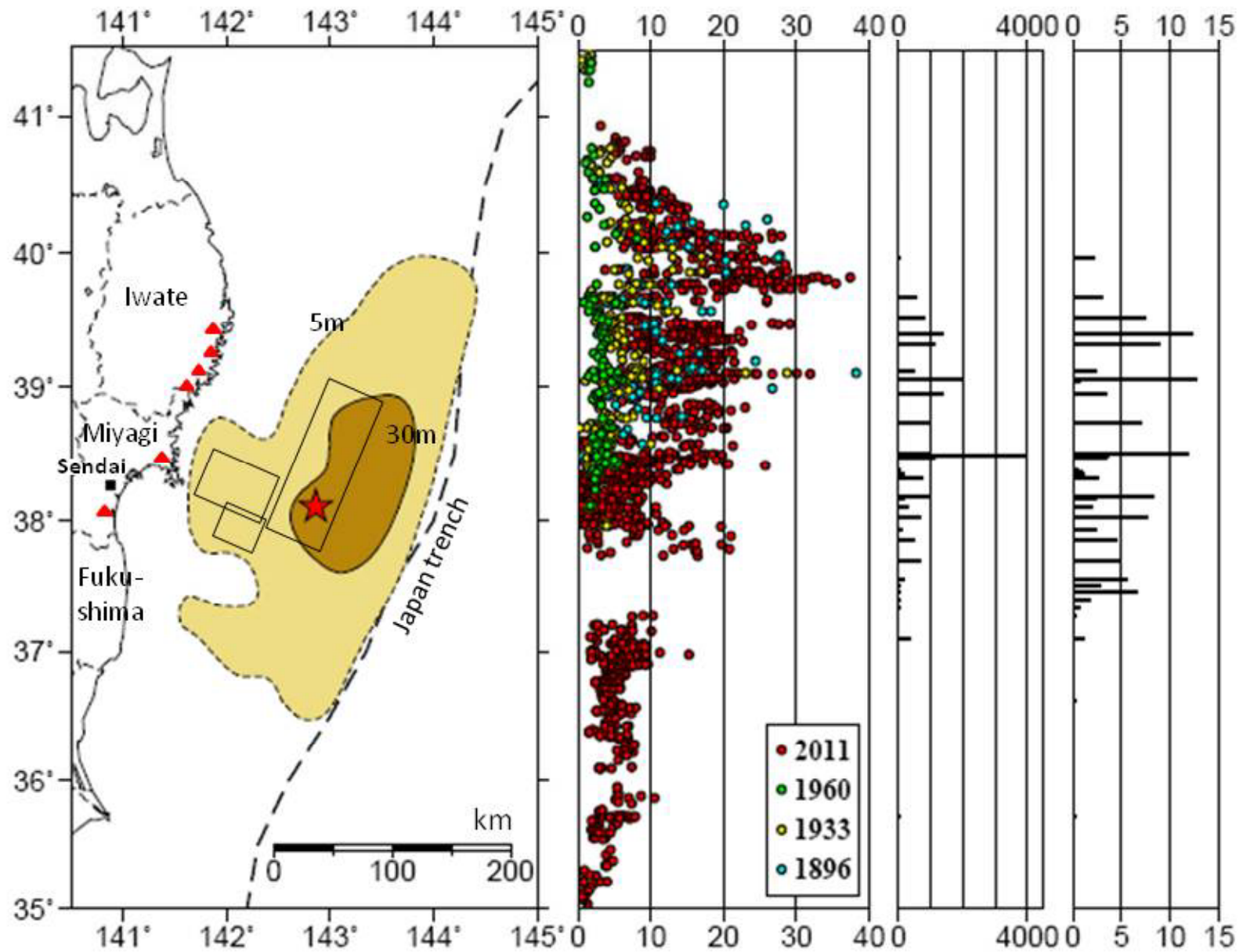
Evacuation behaviors

Most residents did not immediately evacuate, partly influenced by results from earthquake sciences.

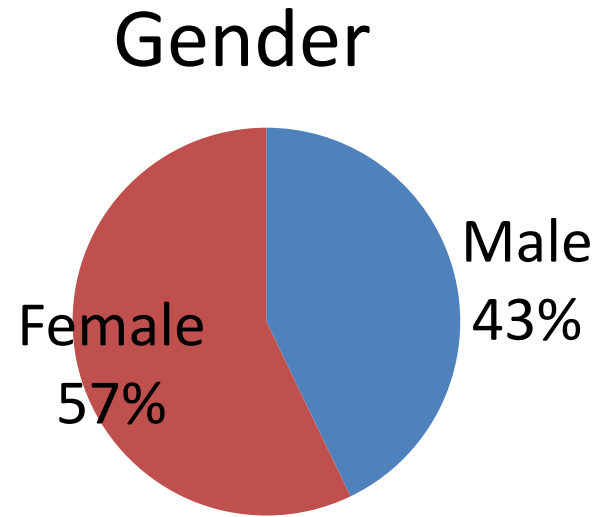
One of the interviewing sites a middle-high school's gymnasium



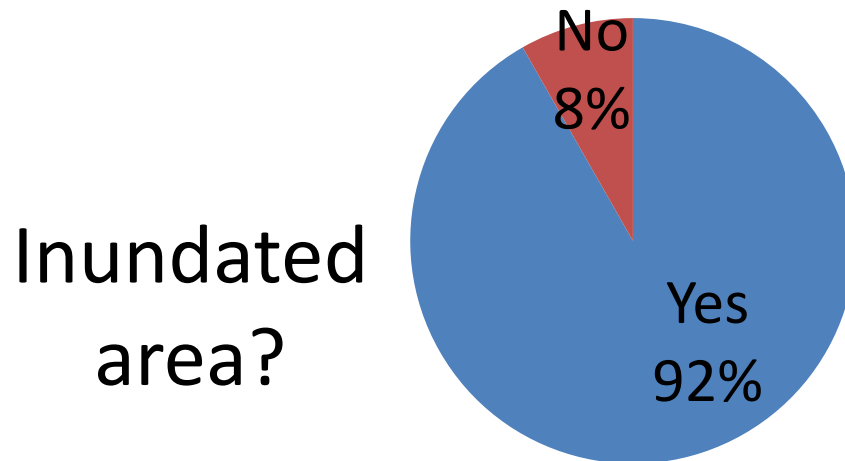
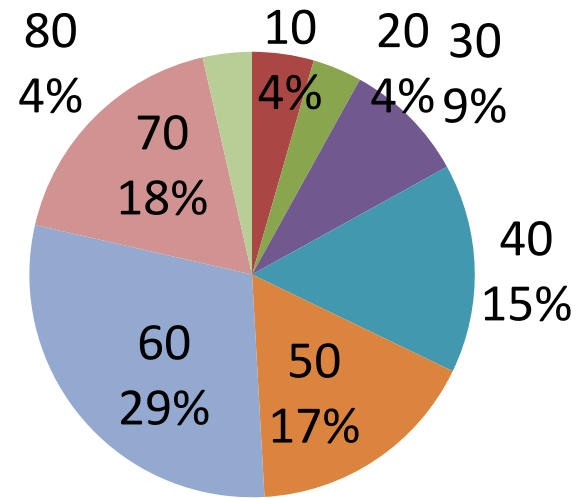
(a) Rupture area and interview sites (b) Inundation height (c) Death toll (d) Death ratio



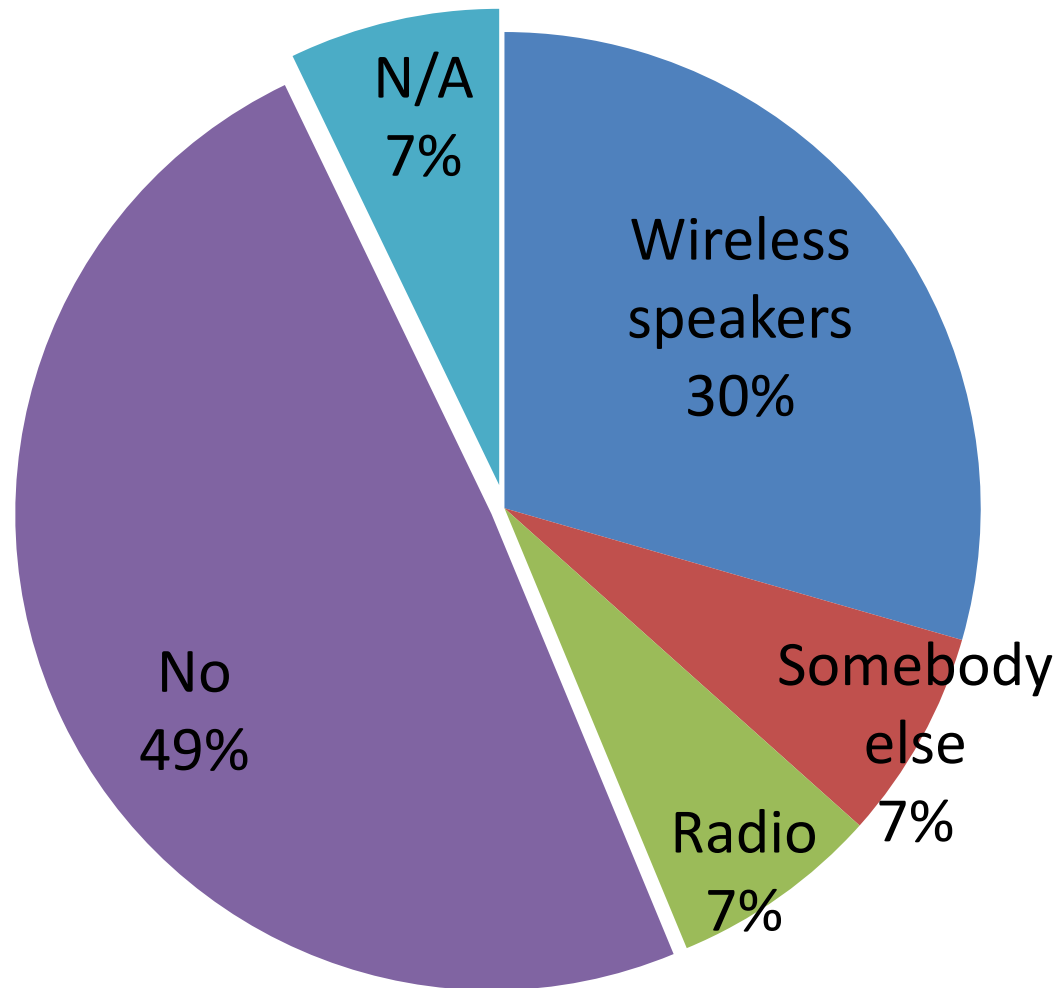
112 Interviewees



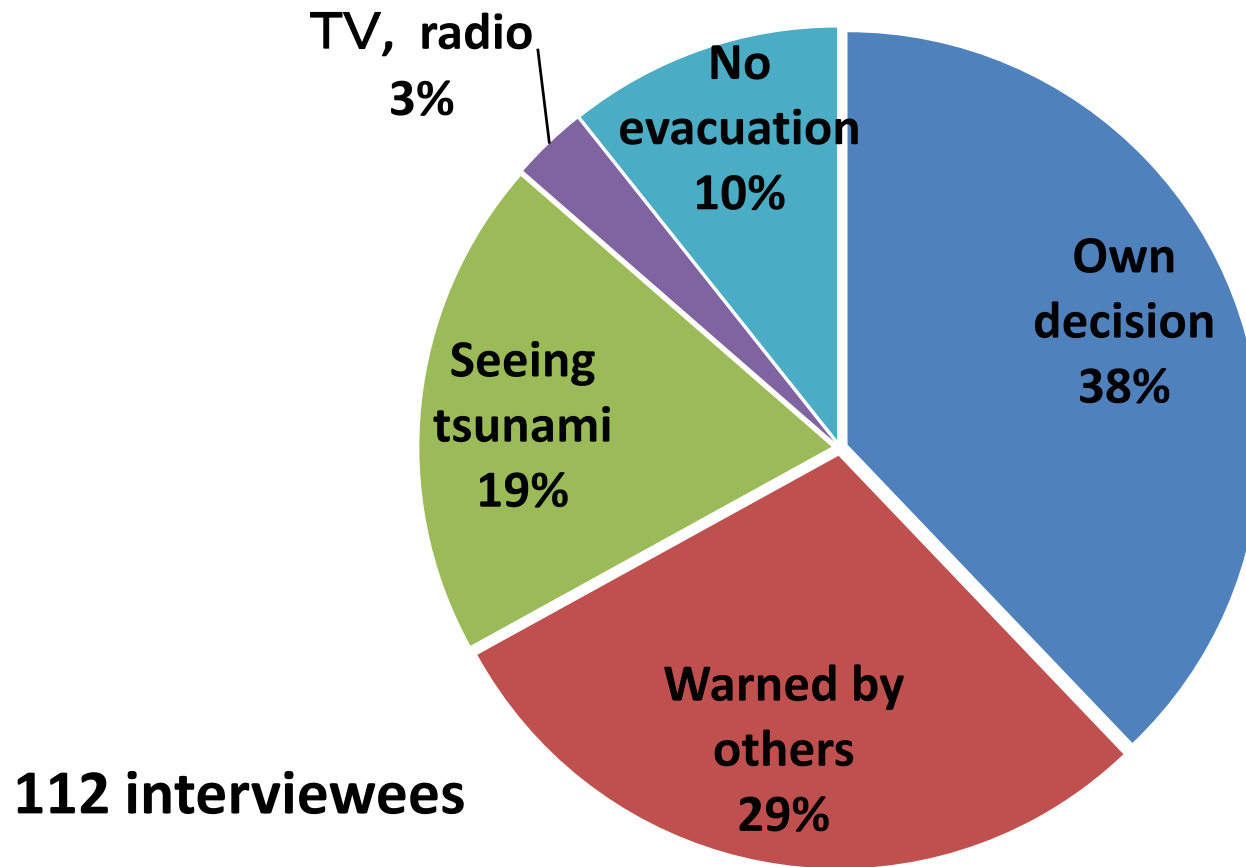
Age distribution

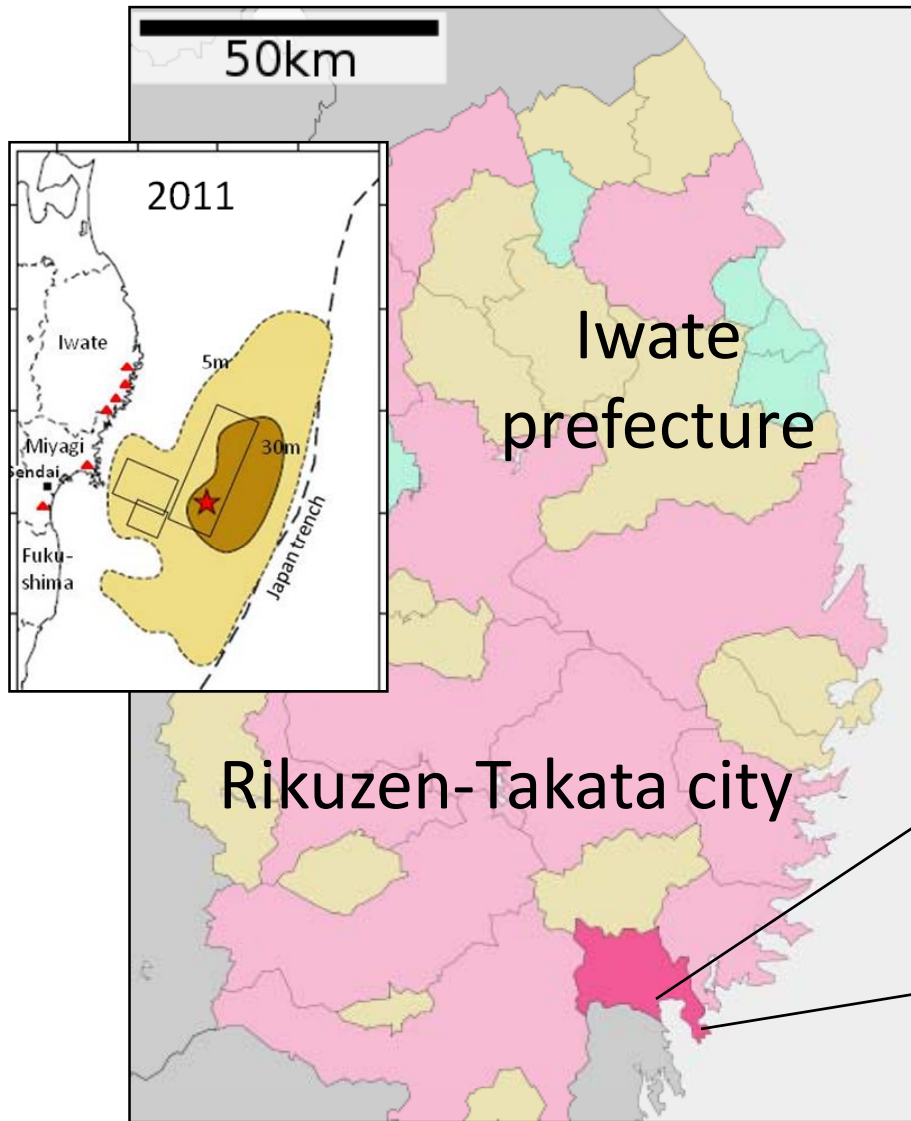


Did you hear the tsunami warning alert?

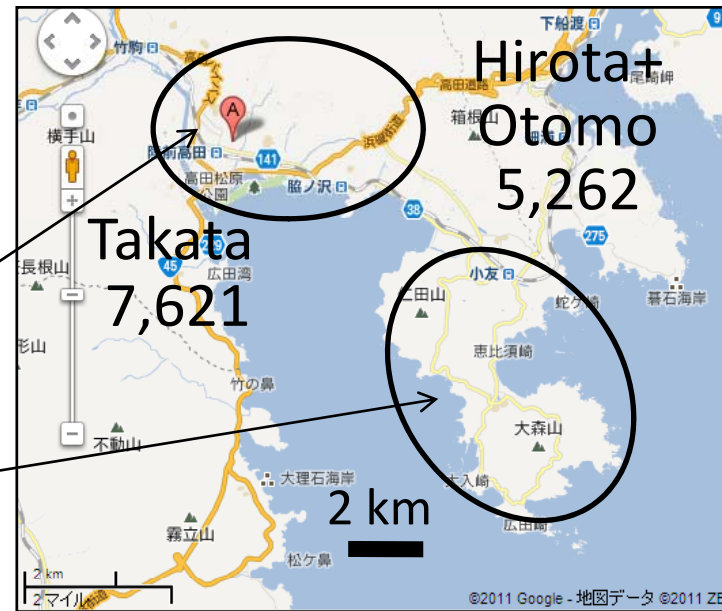


What made people evacuate?





Comparison of death ratios between bay and headland areas



White beach and Pine grove (白砂青松)



Takata before the earthquake



Rikuzen-Takata city



Before



City Hall Culture Center

After



Before

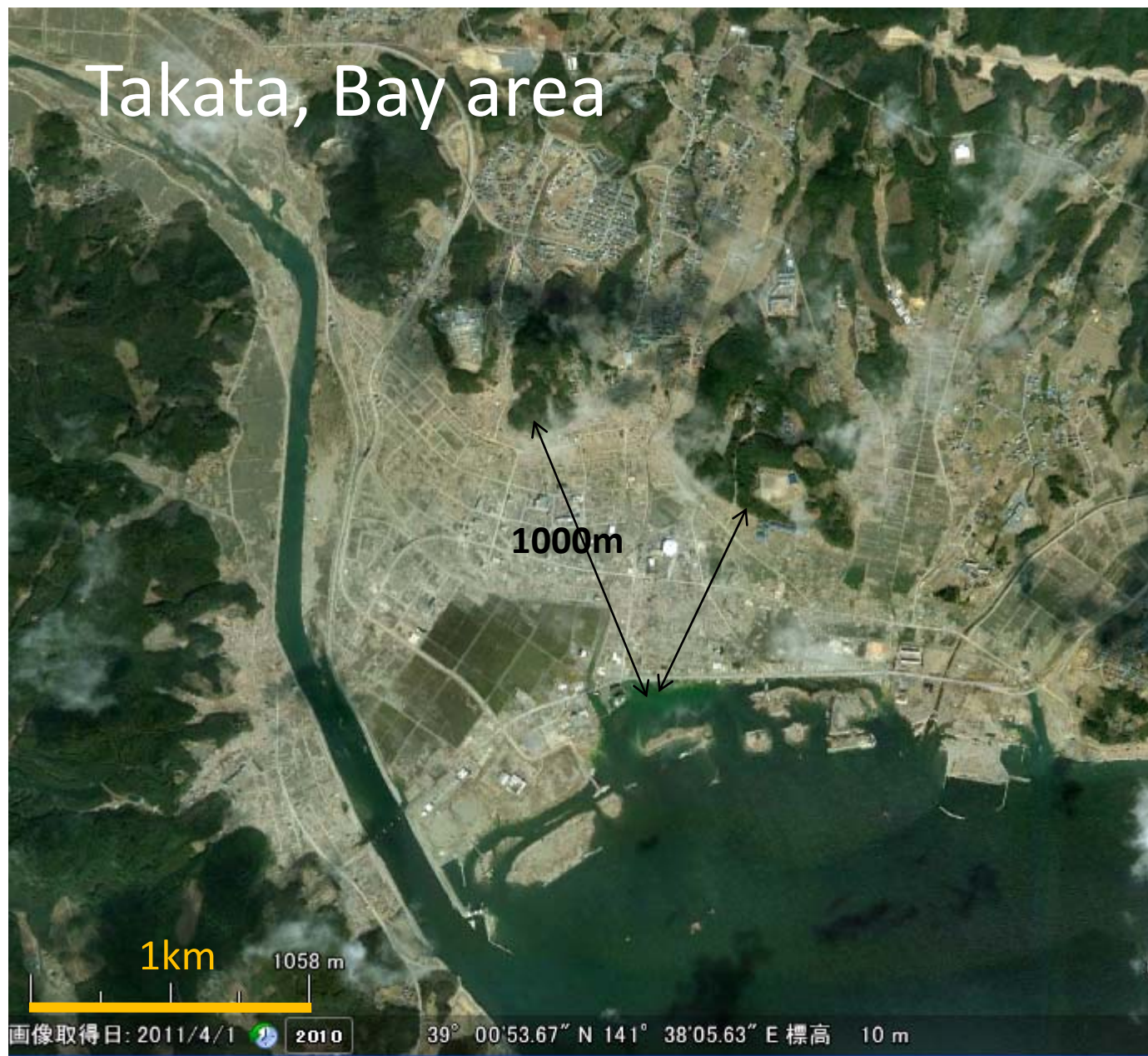


City Office

After



Takata, Bay area



Observed Tsunami

14:40

46: Origin time

14:50

53: OBPG 2m

15:00

00: OBPG 5m

15:10

15:20

25: major tsunami,
Sanriku

15:30

15:40

45: major
tsunami, Sendai

15:50

JMA tsunami warning

49 Large Tsunami Warning (>3m)

14: Warning renewed >6m

30: Warning
Renewed (>10m)

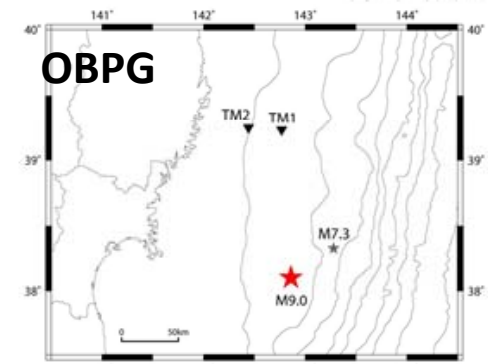
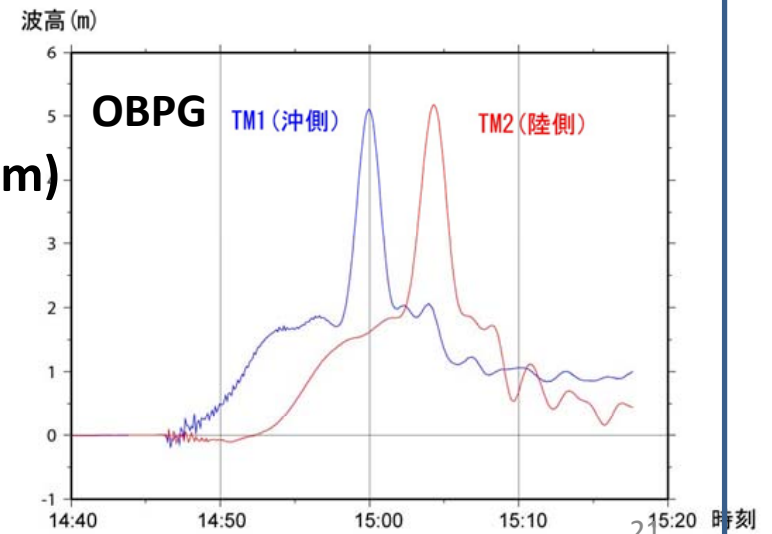
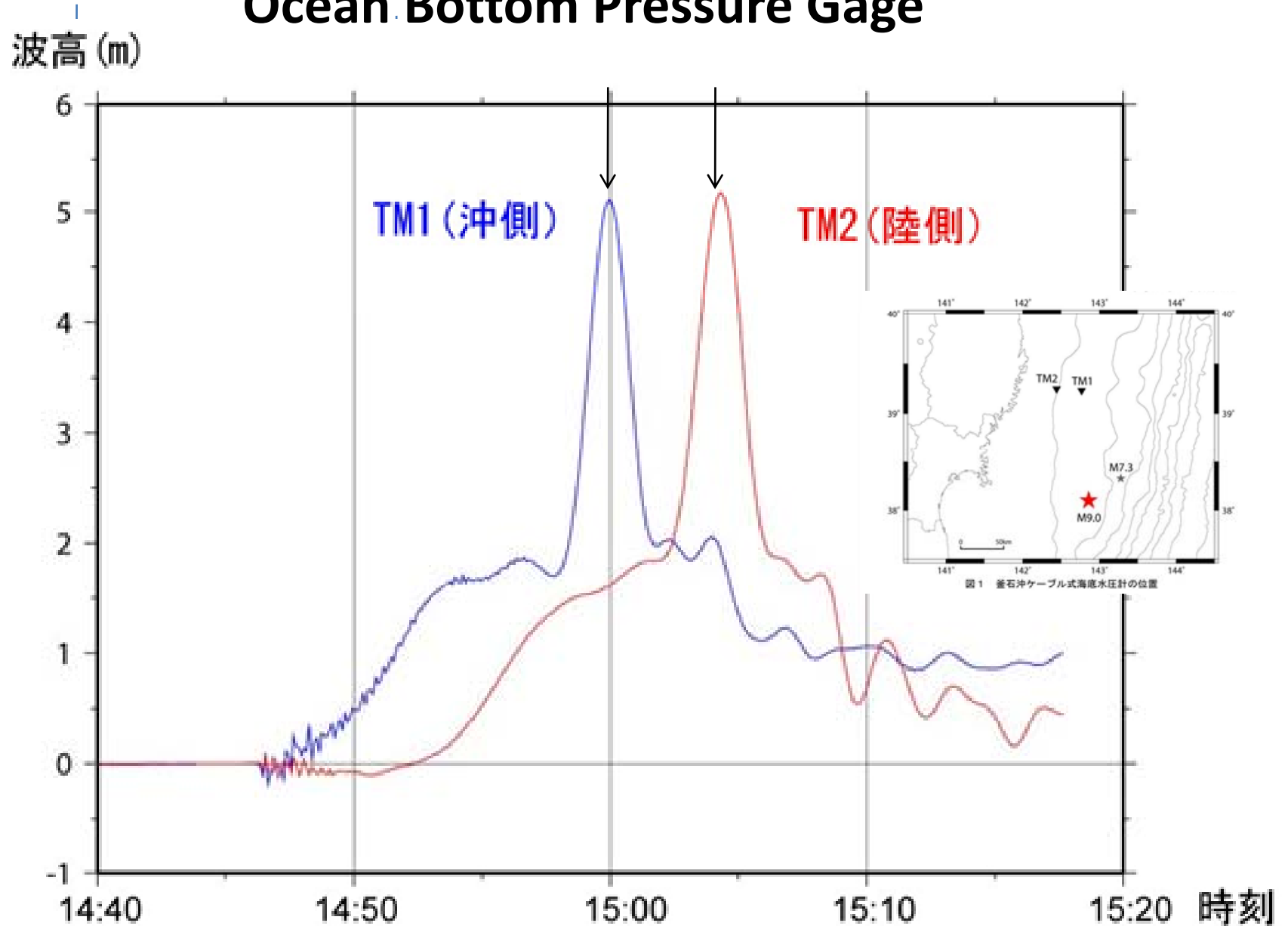


図1 釜石沖ケーブル式海底水圧計の位置



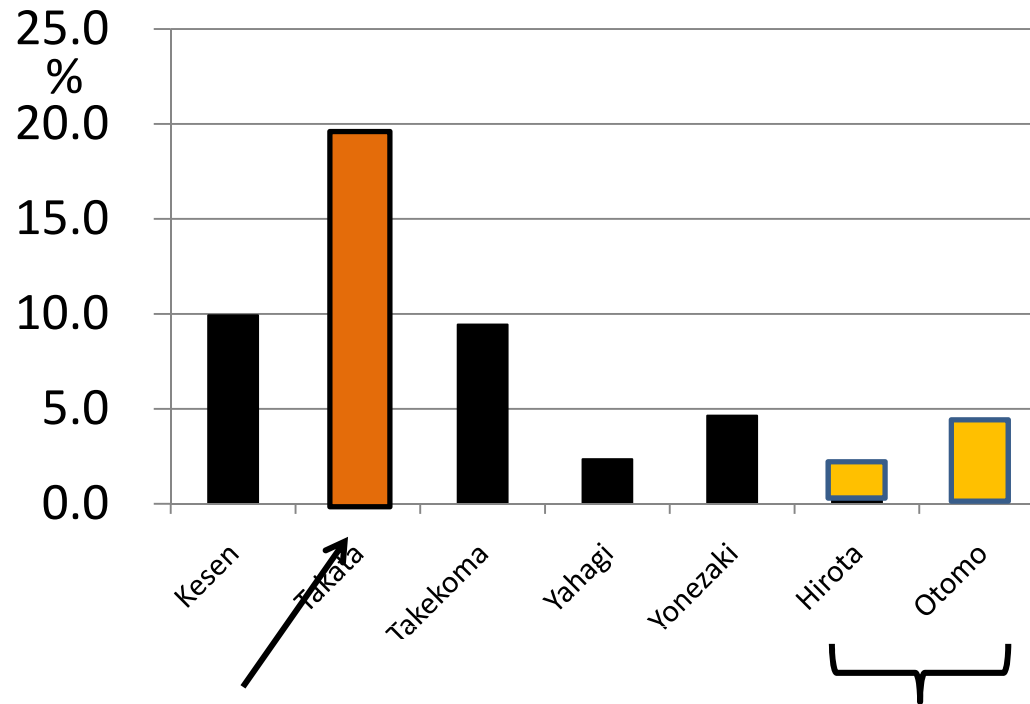
Ocean Bottom Pressure Gage



Hirota and Otomo Rikuzen-Takata



Death ratios of 7 subdivisions in Rikuzen-Takata city



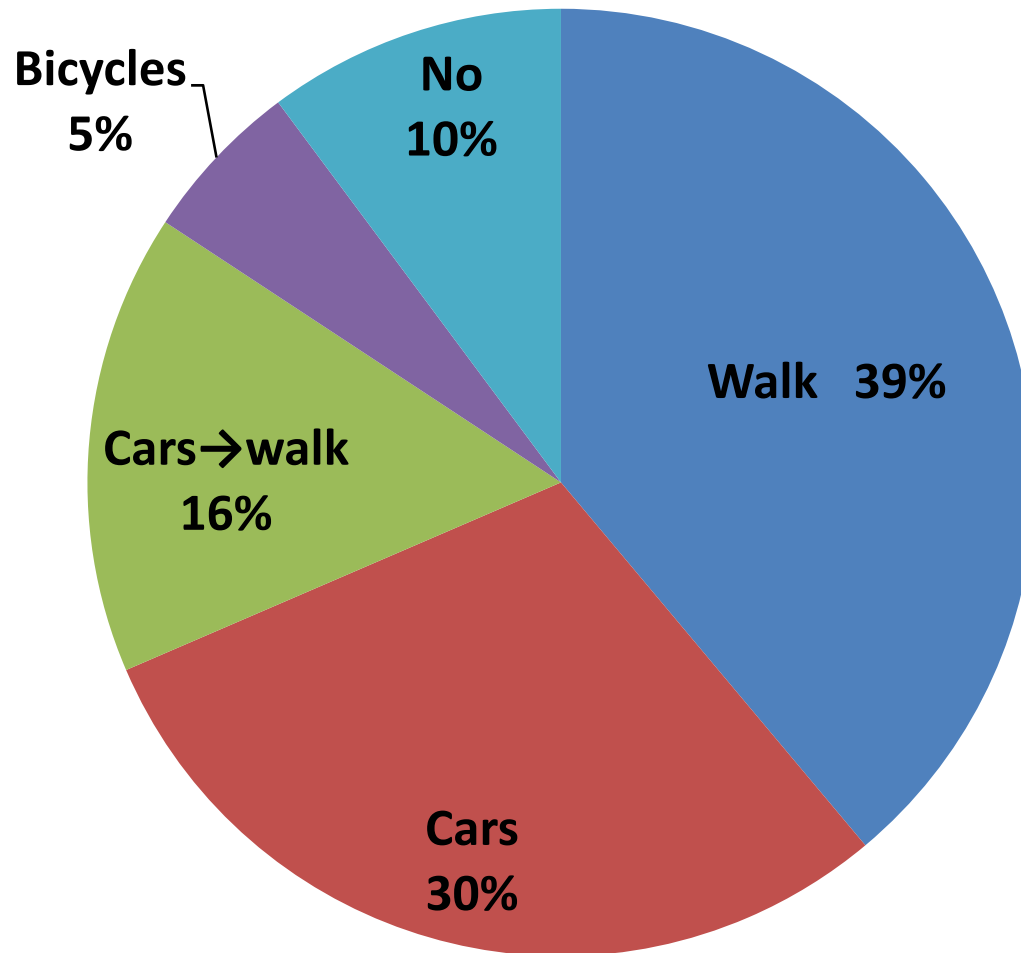
Takata, Bay area

**Hirota and Otomo
headland area**

Tsunami advisory, tsunami warning and major tsunami warning issued by JMA in the last 4 years

2007	2008	2009	2010
Peru, Mw8.0 22cm, 12h	Tokachi, Mw6.7 18cm, 1.5h	Samoa, Mw7.9 36cm, 6h	Chile Mw8.5 106cm, 24h
Sakhalin, Mw6.2 0cm, 0.8h	Fukushim, Mw6.9 23cm, 1.5h	Okinawa, Mw6.2 0cm, 0.6h, SS	Okinawa, Mw7.0, 13cm, 1.5h, SS
Niigata, Mw6.7 32cm, 1h		Okinawa, Mw6.6 0cm, 0.9h, SS	Okinawa, Mw6.5 0cm, 1h, SS
Okinawa, Mw6.4 0cm, 1h		Shizuoka, Mw6.5 36cm, 1h, SS	
Noto, Mw6.6 22cm, 2h		New Guniea, Mw7.6 36cm, 5.5h	
Kurile, Mw8.1 43cm, 8.5h			

Means of evacuation



About 50 % of survivors used cars for evacuation, which caused severe traffic jams and a number of tsunami victims.

Evacuation behaviors

- **Residents are unwilling to evacuate since they believed tsunamis rare.**
- **Many residents started evacuating after seeing or knowing tsunami approaching.**
- **Many cars were used for evacuation: which were sometimes effective, but in most cases caused fatal traffic jams.**

Responsibility of earthquake scientists

- **Incorrect earthquake forecast based on a short history**
- **Oversight of the large slip deficit on the plate interface**
- **Current observation systems and abilities were not fully used for tsunami warning**

Concluding remarks

1. The earthquake magnitudes and their resultant hazards assessed and publicized by the government are smaller presence to give rise compared to what occurred.
2. The first tsunami warning issued was for 3m in Iwate and Fukushima and 6m in Miyagi. This was the only warning that 44% of the interviewees received due to the immediate destruction of the regional power supply.

3. The JMA had issued 16 warnings or alerts of tsunamis for Japan's islands in the last 4 years. These frequent warnings with overestimated tsunami height influenced the behavior of the residents.
4. 50 % of the local residents above 55 years old experienced the 1960 Chile tsunami, which was significantly smaller than the March 11 tsunami. This sense based on their previous experience put their lives at very high risk.

5. Some inhabitants assumed, with the presence of a breakwater, only slight flooding would occur and moving to the second floor at home was sufficient.
6. Many interviewees did not understand the generation of tsunamis. Some people did not react immediately evacuate to safer areas.

Young children should be taught about the basic mechanism of tsunami generation