Sediment-related disasters and sabo-related facilities

- 「The 2011 off the Pacific Coast of Tohoku Earthquake」
  （March 11th 2011)
- 「The Northern Nagano Prefecture Earthquake」
  （March 12th 2011）
- 「Fukushima Prefecture Hamadori Earthquake」
  （April 11th 2011）

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1. Summary of sediment-related disasters

（Information as of April 21st 2011）

- The 2011 off the Pacific Coast of Tohoku Earthquake

  81 disasters（19 deaths）
- The Northern Nagano Prefecture Earthquake

  22 disasters
- The Eastern Shizuoka Prefecture Earthquake

  3 disasters

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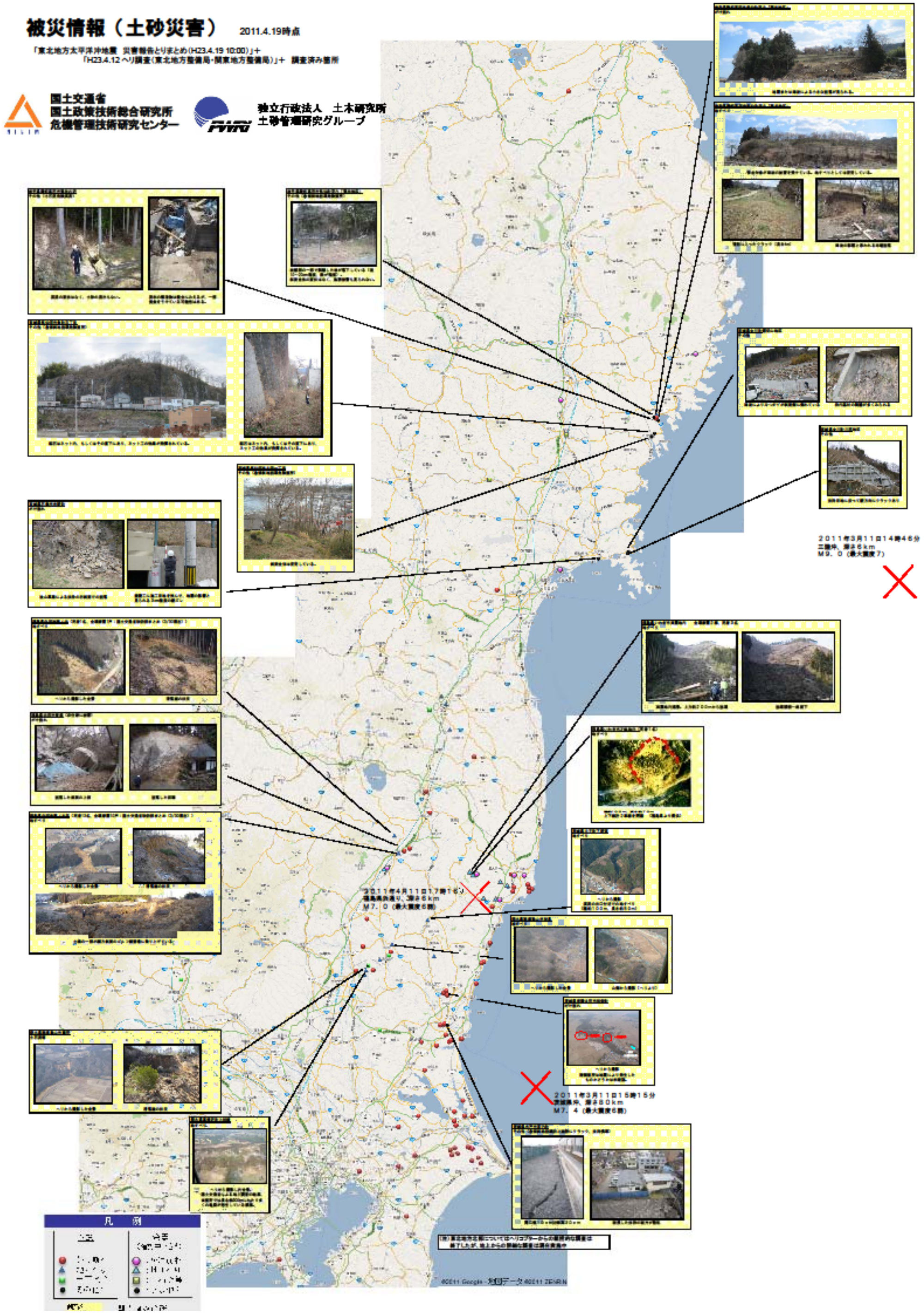
106 disasters（19 deaths）

○ Besides the above, many landslides occurred

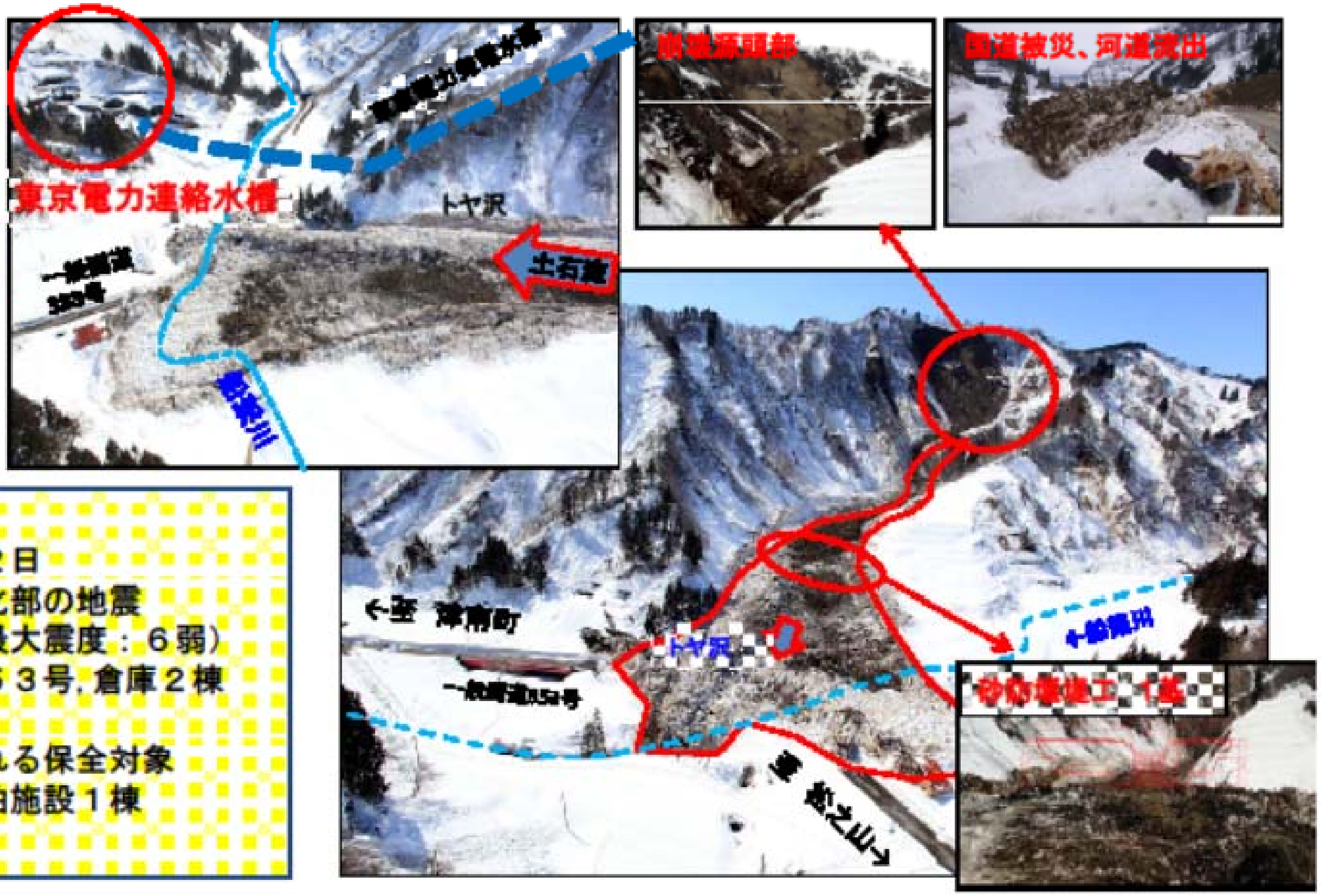
○ Wildfire occurred along the coastal area in Iwate Prefecture



Map of sediment-related disasters (as of 19th April 2011)

Landslide destroyed 1 house and caused 1 death in Taishin-Kumado (Okanouchi) area in Shirakawa City, Fukushima Prefecture

Debris flow disaster at Tatsunokuchi area in Tsunan Town, Niigata Prefecture caused by the Northern Nagano Prefecture Earthquake on March 12th 2011



○被害状況
・発生日時：３月１２日
・災害原因：長野県北部の地震
（地点最大震度：６弱）
・被害　：国道３５３号、倉庫２棟全壊
○対策工により守られる保全対象
・国道１５８号、宿泊施設１棟
水力発電関連施設

○ No large deformation was observed for the landslide dams generated by the Iwate-Miyagi Nairiku Earthquake in 2008 and the Mid Niigata Prefecture Earthquake in 2004

○ No large landslide dams were formed by the earthquakes including aftershocks (as of April 11th 2011)

Picture of landslide dam site (Yubama area in Miyagi Prefecture) caused by the Iwate-Miyagi Nairiku Earthquake in 2008
(The surface of the landslide slope in 2008 was thinly collapsed)

2. Distribution of sediment-related disasters

Features

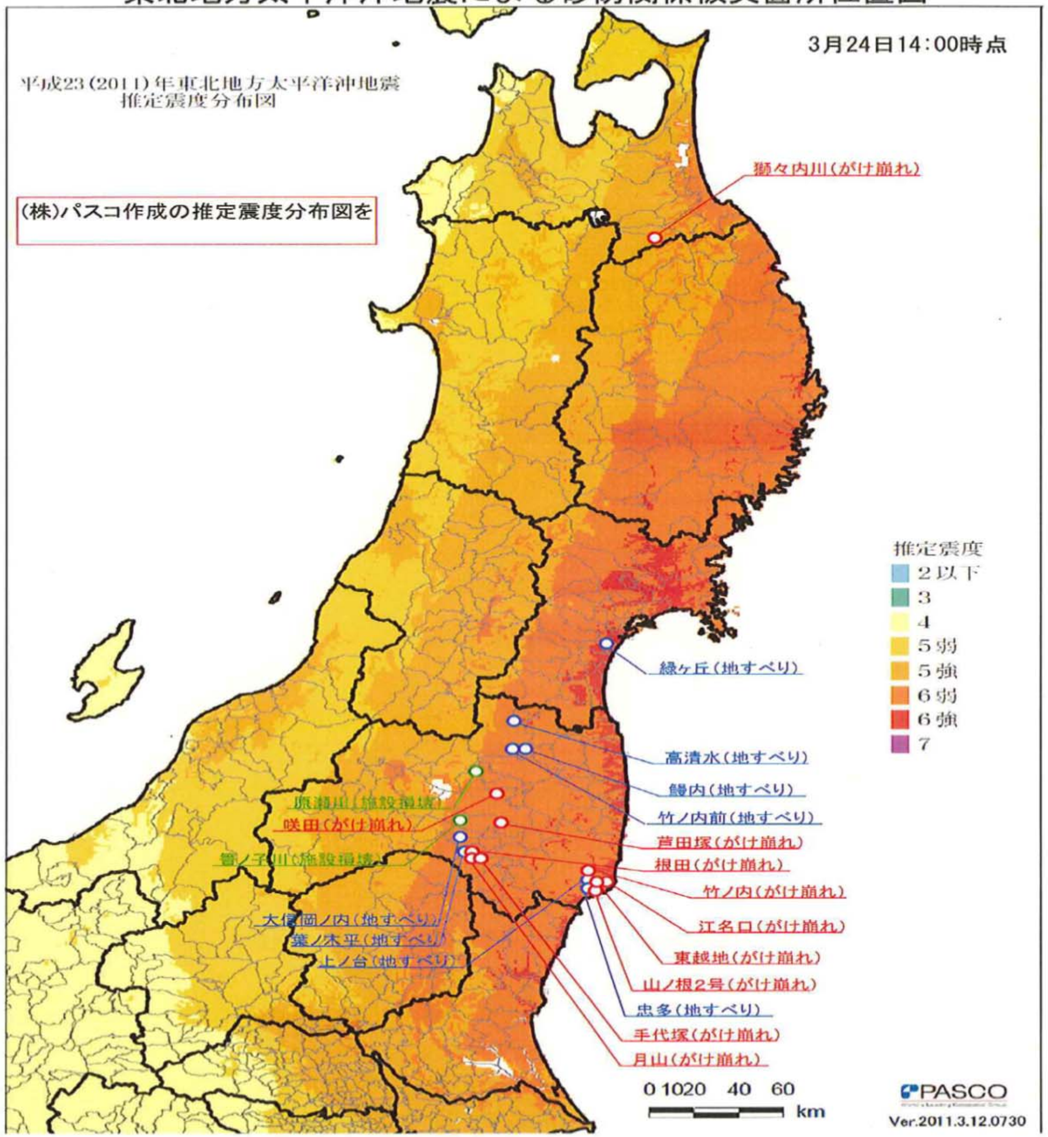
1. The number of landslides was small although strong shock (Japan Meteorological Agency (JMA) seismic intensity of over 5 upper) was felt in many areas

（The Iwate-Miyagi Nairiku Earthquake in 2008 caused approximately 3,500 landslides）

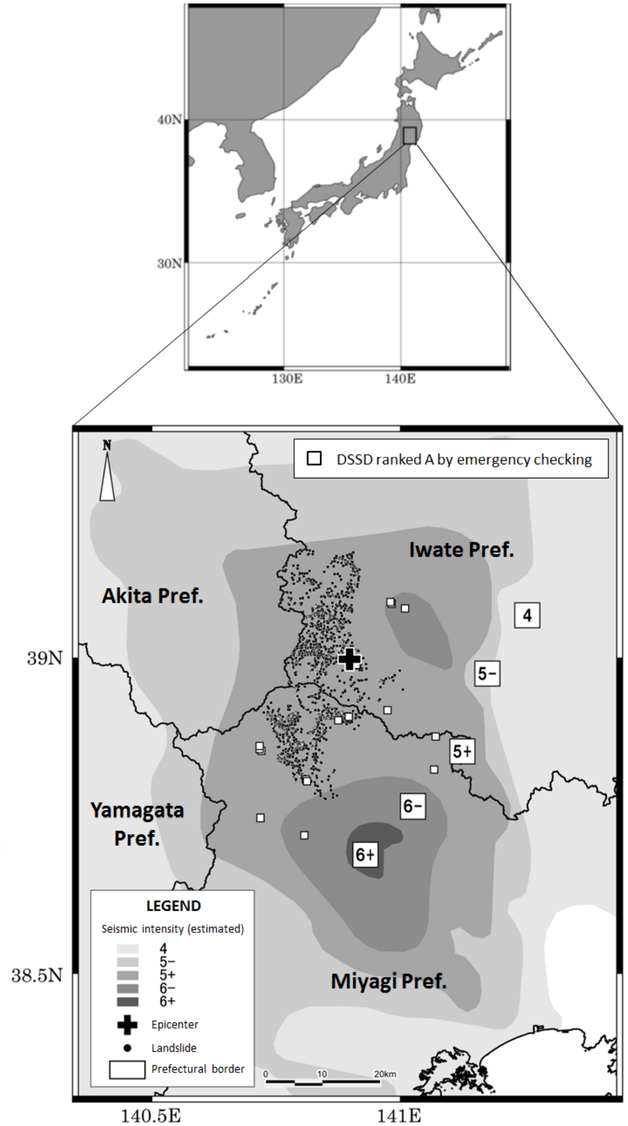
２. The density of sediment-related disasters did not necessarily correspond to the seismic intensity distribution

Location of sediment-related disasters as of 14:00 on March 24th 2011 (based on disaster reports)

東北地方太平洋沖地震による砂防関係被災箇所位置図



Location of landslides caused by the Iwate-Miyagi Nairiku Earthquake in 2008



○ Sediment-related disasters caused by intraplate-type aftershocks on April 11th and 12th

17:16 on April 11th Hamadori, Fukushima Pref., JMA seismic intensity of 6 lower
17:17 on April 11th Hamadori, Fukushima Pref., JMA seismic intensity of 5 lower
17:26 on April 11th Hamadori, Fukushima Pref., JMA seismic intensity of 5 lower
20:42 on April 11th Northern Ibaraki Pref., JMA seismic intensity of 5 lower

07:26 on April 12th Northern Nagano Pref., JMA seismic intensity of 5 lower
08:08 on April 12th East Off Chiba Pref., JMA seismic intensity of 5 lower
14:07 on April 12th Hamadori, Fukushima Pref., JMA seismic intensity of 6 lower

Landslide in Joban-Fujiwara, Iwaki City, Fukushima Prefecture (height: 100 m, width: 120 m) blocked the Prefectural Highway 14

④いわき市常磐藤原町（県道 14 号）

Landslide in Tabito, Iwaki City, Fukushima Prefecture (height: 170 m, width: 50 m) caused a landslide dam (height: 15 m, volume of stored water: 1,000－2,500 m^3)

①いわき市田人町石住

Sediment-related disasters

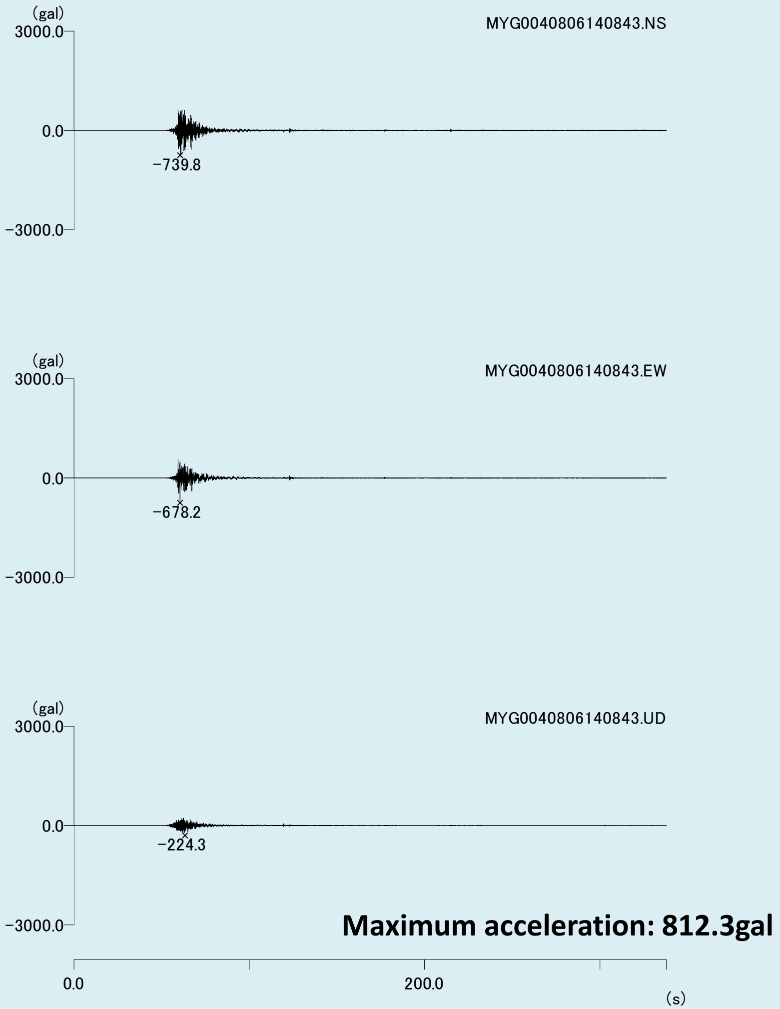
・Landslide destroyed 3 houses and caused 3 deaths in Tabito, Iwaki City, Fukushima Prefecture

・Sediments blocked the stream flow (Channel was already excavated)

Tsukidate, Miyagi Pref.

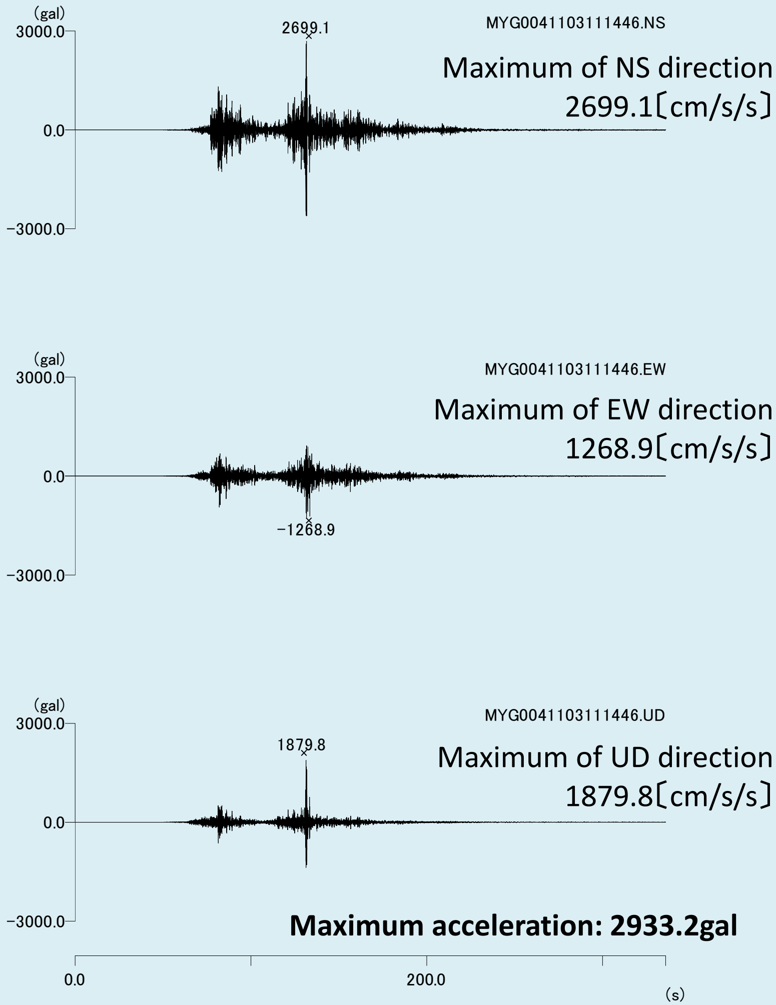
（M7.2）

The Iwate-Miyagi Nairiku Earthquake in 2008 (June 14th)



（M9.0）

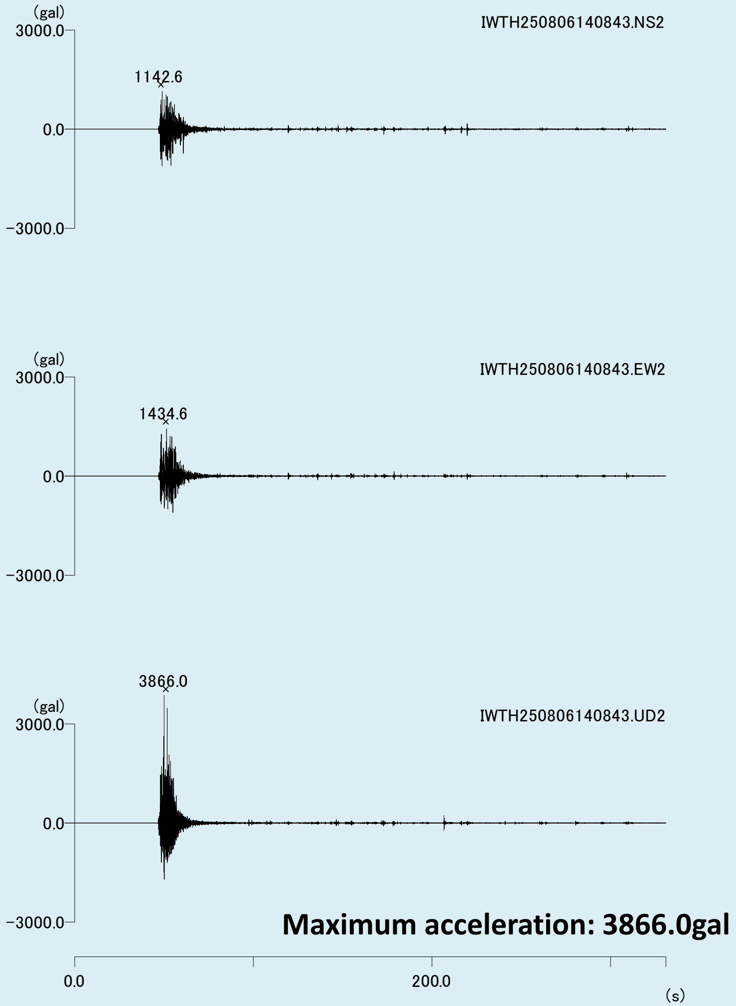
The 2011 off the Pacific Coast of Tohoku Earthquake (March 11th)



Western Ichinoseki, Iwate Pref.

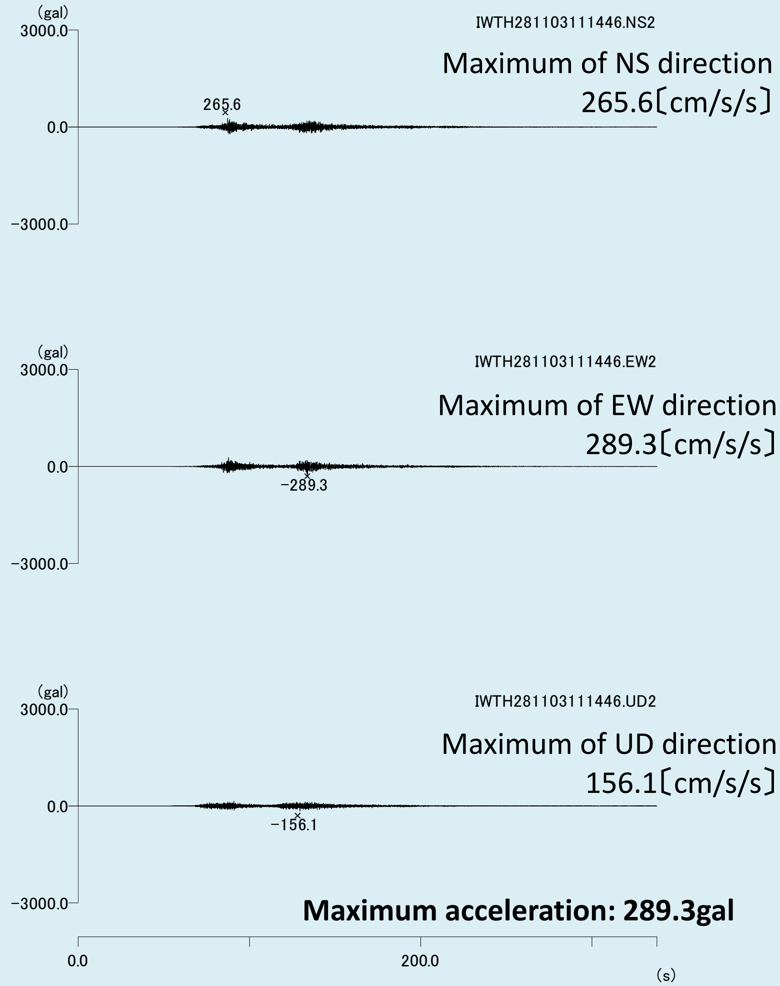
（M7.2）

The Iwate-Miyagi Nairiku Earthquake in 2008 (June 14th)



（M9.0）

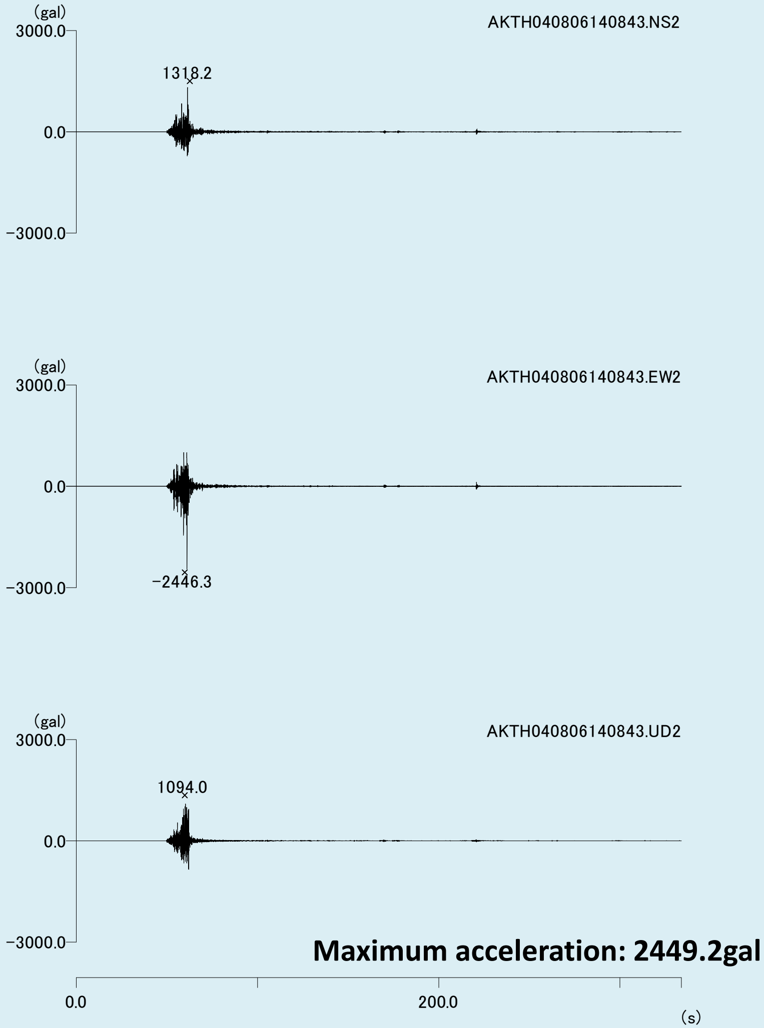
The 2011 off the Pacific Coast of Tohoku Earthquake (March 11th)



Eastern Naruse, Akita Pref.

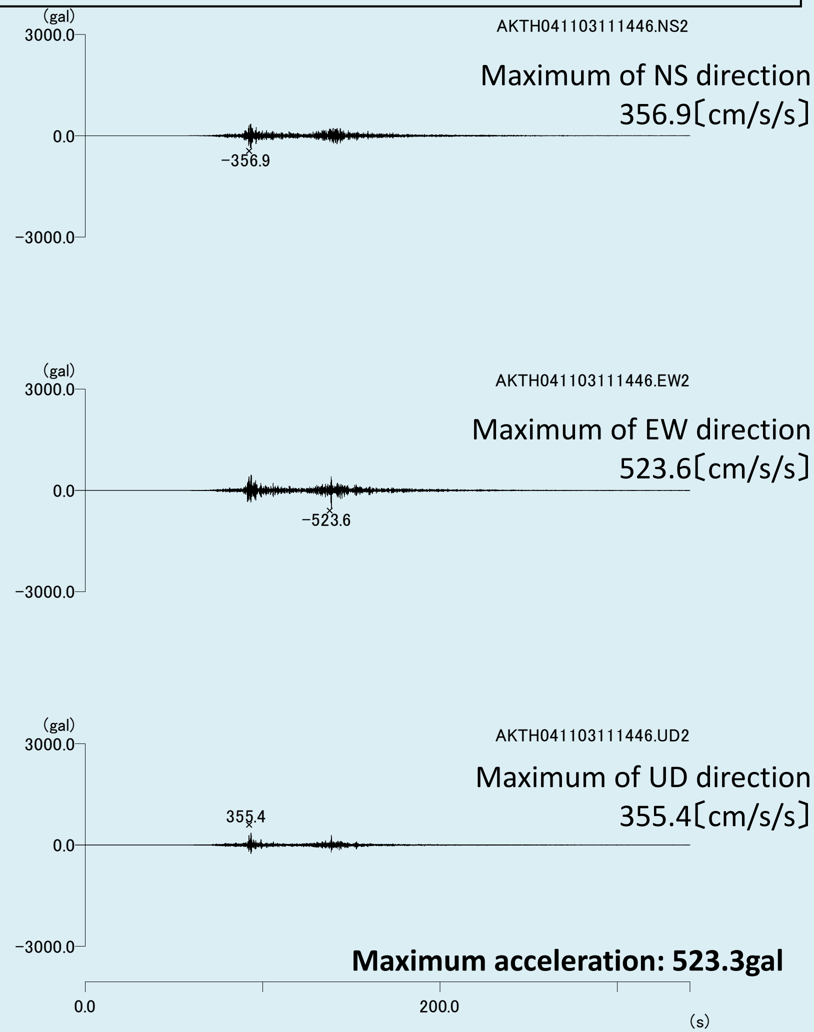
(M7.2)

The Iwate-Miyagi Nairiku Earthquake in 2008 (June 14th)



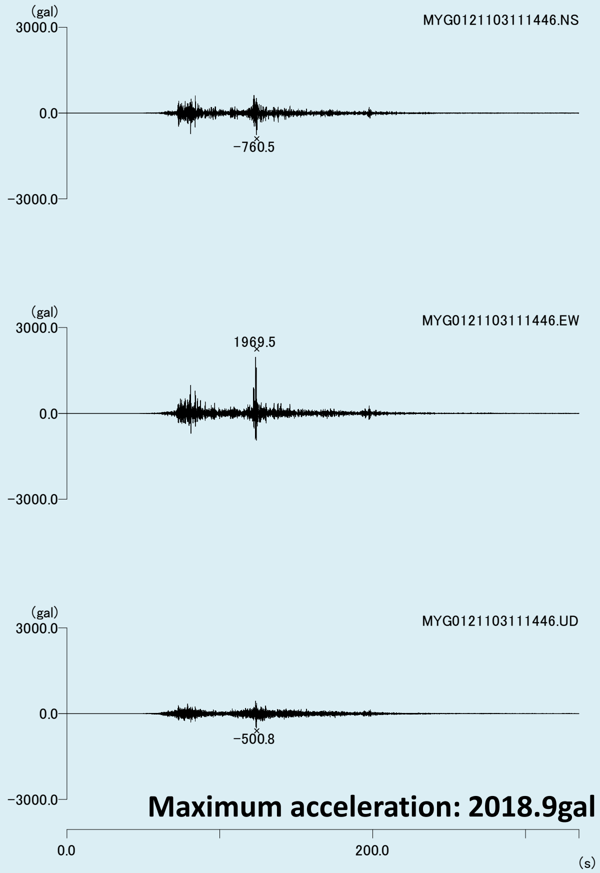
(M9.0)

The 2011 off the Pacific Coast of Tohoku Earthquake (March 11th)



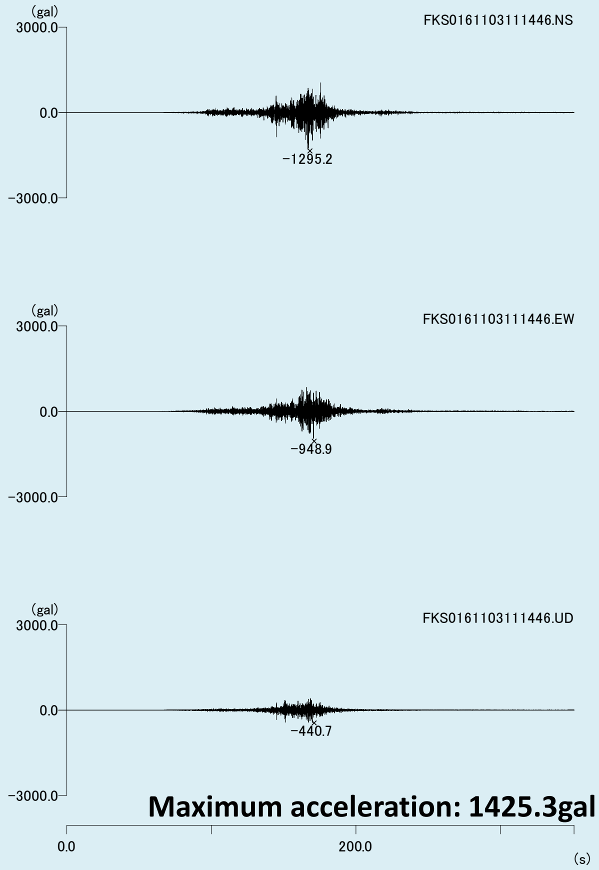
The 2011 off the Pacific Coast of Tohoku Earthquake （M9.0）

Shiogama City, Miyagi Pref.



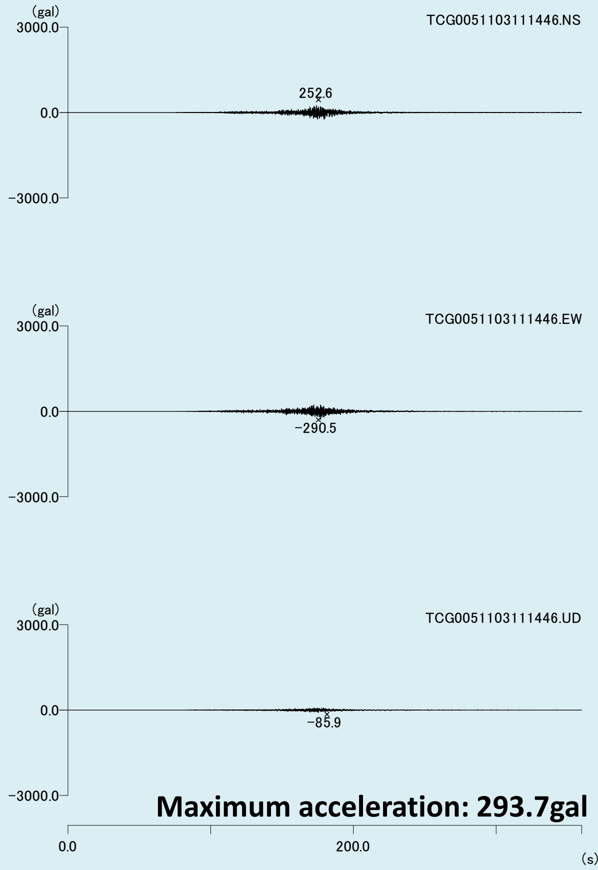
Maximum acceleration: 2018.9gal

Shirakawa City, Fukushima Pref.



Maximum acceleration: 1425.3gal

Yaita City, Tochigi Pref.

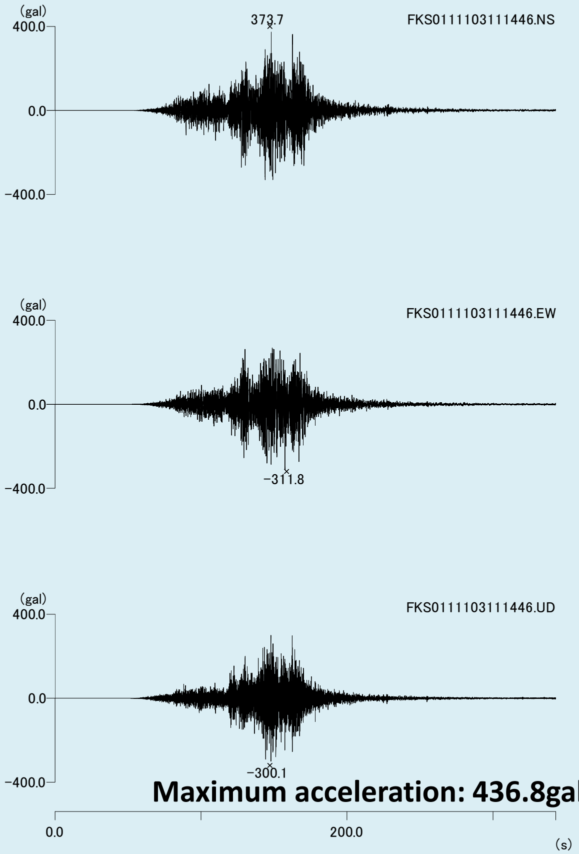


Maximum acceleration: 293.7gal

Iwaki City, Fukushima Pref.: Main quake on March 11th and aftershocks on April 7th and 11th

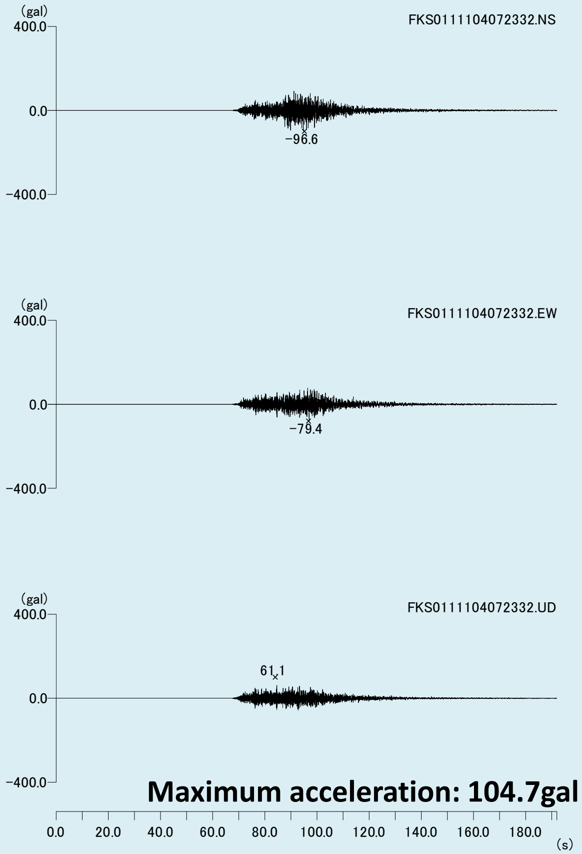
（vertical axis: 400gal）

Main earthquake on March 11th



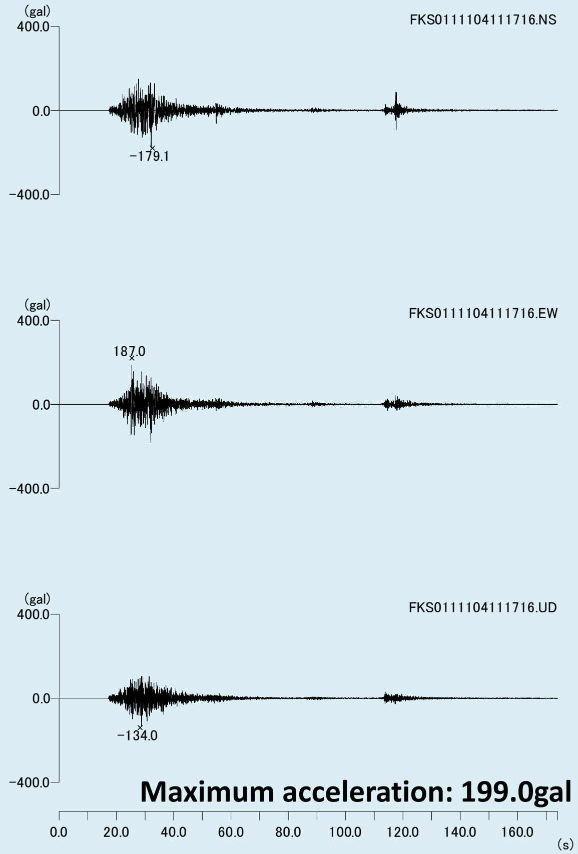
Maximum acceleration: 436.8gal

Aftershock on 7th April



Maximum acceleration: 104.7gal

Aftershock on April 11th



Maximum acceleration: 199.0gal

３．Damage to sabo-related facilities

No damage was observed for almost all facilities examined

MLIT work offices: 1,952 locations → No damage

17 prefectures: 4,029（/4,352）locations → **Partial damage**

Feature

●Damaged facilities were generally slope failure prevention facilities affected by tsunami.

●Damage included loss of foundation ground of crib works, cracks along joints of crib works, loss of base spray material of crib works, buckling of rockfall prevention fence on retaining wall, and scratch mark on retaining wall.

（All damage observed does not affect the function of slope failure prevention.）

Loss of foundation ground of crib works (Kawajiri area)

Cracks along joints of crib works (Kawajiri area)

Buckling of rockfall prevention fence

scratch mark on retaining wall

Onagawa Town, Miyagi Prefecture

Steel stairs for evacuation from tsunami

Sites prone to sediment-related disasters and flooded areas from tsunami in Kamaishi City, Iwate Prefecture

Damage in southern part of Horikiri-Yama in Onagawa Town, Miyagi Prefecture

4. Summary and remarks on sediment-related disasters

- More than 90% of sediment-related disasters caused by the earthquake were slope failures and landslides, but debris flows were generated at sites where meltwater made the sediment condition wet.

- Landslides were observed mainly at ridge-type slopes, planar slopes, and embankment slopes. This was similar to the general trend of landslides caused by earthquakes.

- Areas of high density of landslides were not necessarily the areas of strong seismic intensity caused by the main shock.

- Some landslides were caused by smaller seismic intensity (acceleration) by intraplate-type aftershock.

- Since landslide caused by earthquake often occurs at ridge-type slope and sometimes becomes large in scale, attention should be paid for locations without designation of location prone to general sediment-related disasters.

- Since it can be assumed that repeated quakes raised the potential of failure of steep, weathered slope even by the small seismic intensity (acceleration), attention should be paid for slope failure caused also by rainfall.

- Currently damage to the sabo-related facilities is small, but the repeated quakes can make the damage larger. Monitoring of sites prone to sediment-related disasters should be continued.

- It is desirable that quakes critical to landslides are analyzed and the efficiency of checking of sites prone to sediment-related disasters is thereby increased.