Tsunami Disaster by the 2011 off Pacific Coast of Tohoku Earthquake

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Tsunami

Tsunami Source analyzed by Meteorological Research Institute (MRI) by means of the inversion analysis of observed tsunami waveforms

Distribution of JMA Seismic Intensity

Japan Meteorological Agency

Tsunami Warning (Major Tsunami, Tsunami) and Tsunami Advisory revised at 03:20 on March 12

Earthquake: March 11, 14:46

Dead 4488
Missing 2934
D 9099/ M 5243
D 1583/ M 435

National Police Agency
Data on May 26

Japan Meteorological Agency
Tsunami Trace Heights

Preliminary result (May 20) by the 2011 Tohoku Earthquake Tsunami Joint Survey Group
(http://www.coastal.jp/tsunami2011)

Result of PARI/NILIM

Historical Tsunami Data is listed in Watanabe (1998)
### Numerical Simulation

#### Case of the Breakwater

- **Inundation height**
  - Measured: 6.9-9.0m
  - Calculated: 8.6m

- **Inundation height**
  - Measured: 8.1m
  - Calculated: 8.2m

- **Inundation height**
  - Measured: 7.4-7.8m
  - Calculated: 7.4m

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#### Case of no breakwaters

- **Inundation height**
  - Measured: 6.9-9.0m
  - Calculated: 14.5m

- **Inundation height**
  - Measured: 8.1m
  - Calculated: 13.6m

- **Inundation height**
  - Measured: 7.4-7.8m
  - Calculated: 14.4m

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*Black dotted line: inundated area estimated by the Association of Japanese Geographers with aerial photo analysis. Color: inundation depth at the time of the maximum inundation height at each point.*
Run-up height of tsunami: 15.9 m

North of Soma

less damage on upland

North of Soma
Tsunami-Debris

Vessels

Kamaishi Port

Shipping Containers

Sendai-Shiogama Port
Scouring

Damage at the corner of reclamation area

Induced rapid current of tsunami
Damage of Port Facilities

→ liquefaction + Tsunami flow

Soma

→ Destruction by collision of tsunami debris

Kuji

Damage of Oil Tanks

Inundation depth: 4.3 m
Present Discussion

Tsunami disaster mitigation

Level-1 Tsunami
- Return period: about 100 yrs (some decades – a hundred and some decades)
  - Protect human lives and properties
  - Structural measures

Level-2 Tsunami
- Return period: about 1000 yrs (?)
- Bigger than the Level-1 Tsunami
- Protect human lives at least
- City planning, structural measures including a tsunami-shelter, and non-structural measures including as evacuation system, evacuation drill, and public education
Thank you for your attention.