

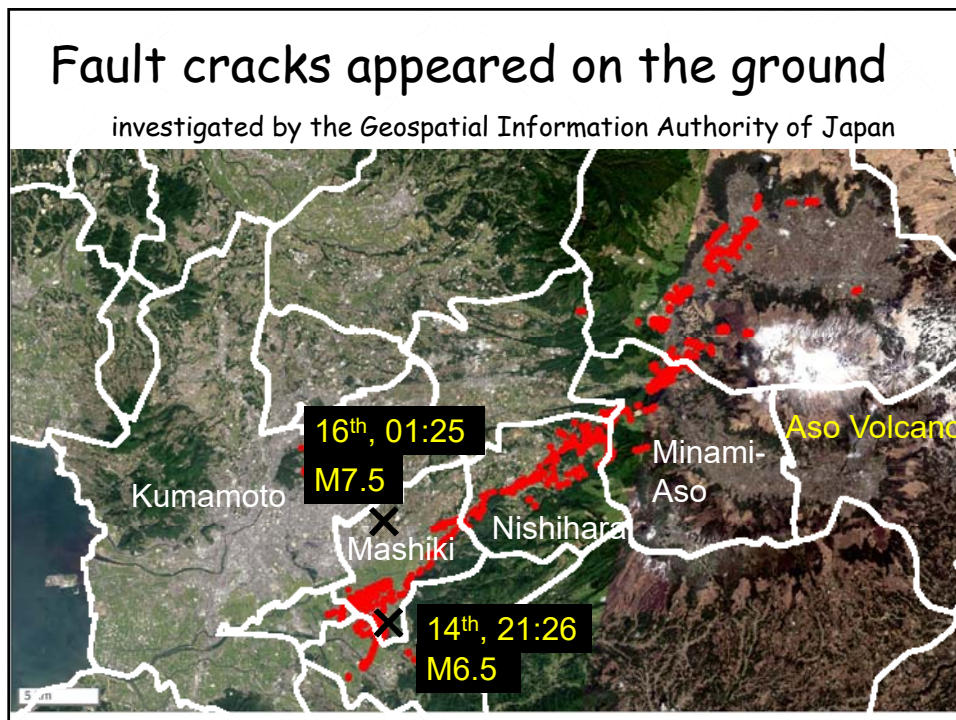
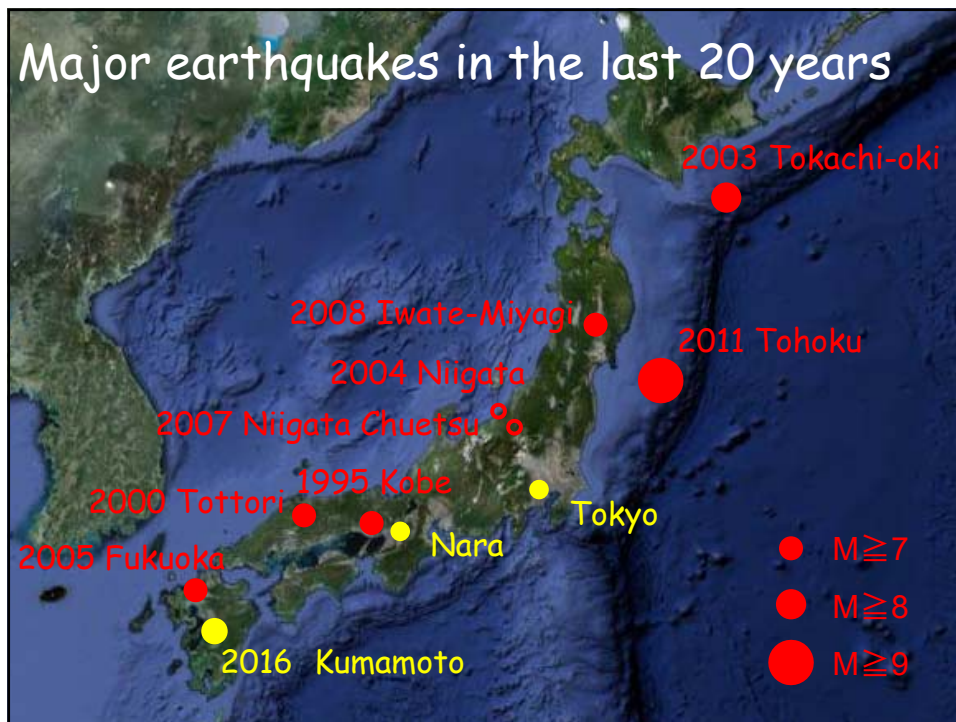
Building Damages in 2016 Kumamoto Earthquake

Mineo Takayama
Fukuoka University

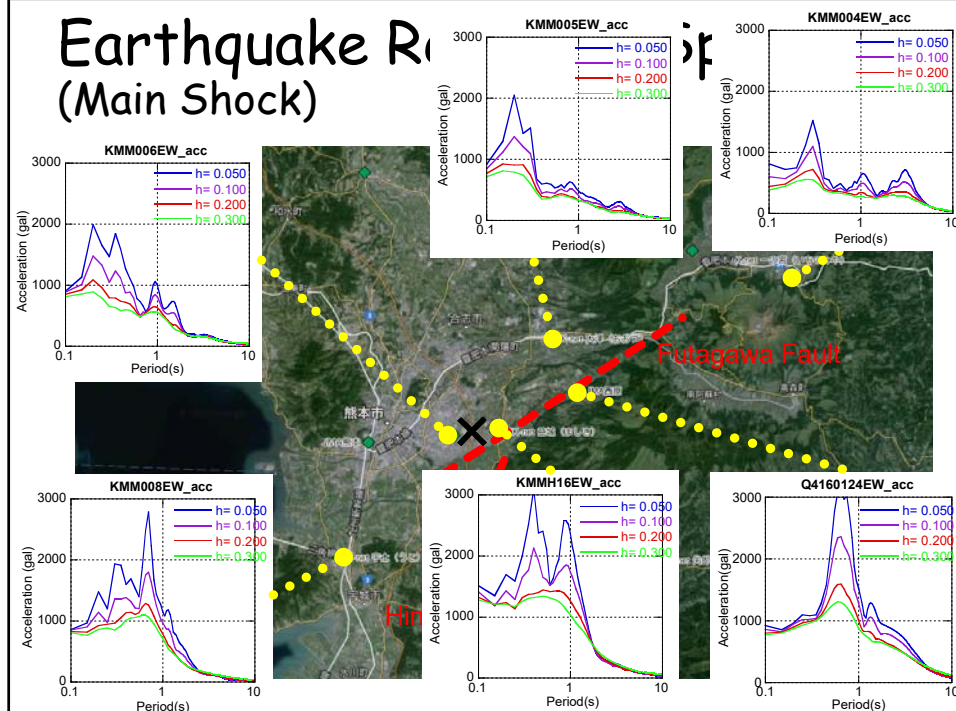


Topics

- Two large earthquakes has occurred consecutively in 28 hours.
- Damage of wooden houses was serious. Especially seismic resistance of old wooden houses was insufficient.
- Damage of historic buildings has been noticeable. In particular, such as Kumamoto Castle and Aso shrine etc.



Earthquake R (Main Shock)



Building damage due to foreshock and main shock



After foreshock



※本写真のみ4月24日に撮影

After Main Shock

Photo by Tatsuo Kanno (Kyushu Univ.)

Building damage due to foreshock and main shock



After foreshock



After Main Shock

Photo by Kazuya Koga (Fukuoka Univ.)

If Rapid Inspection has done.....



After foreshock

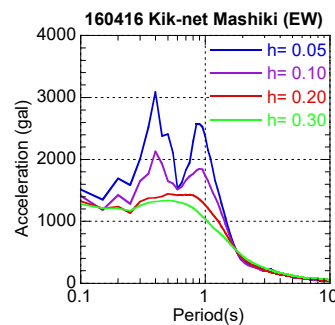
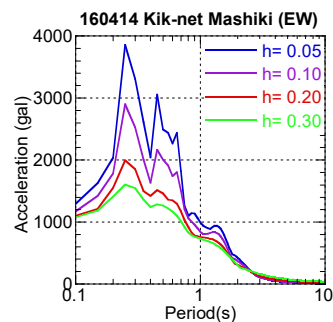


After Main Shock

Photo by Takehiko Yamamura (防災システム研究所)

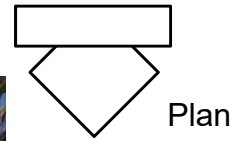
Seismic Design for Two Large Earthquake

- How to consider the two consecutive earthquakes in the seismic design?
- How to evaluate the residual performance of buildings after first earthquake?





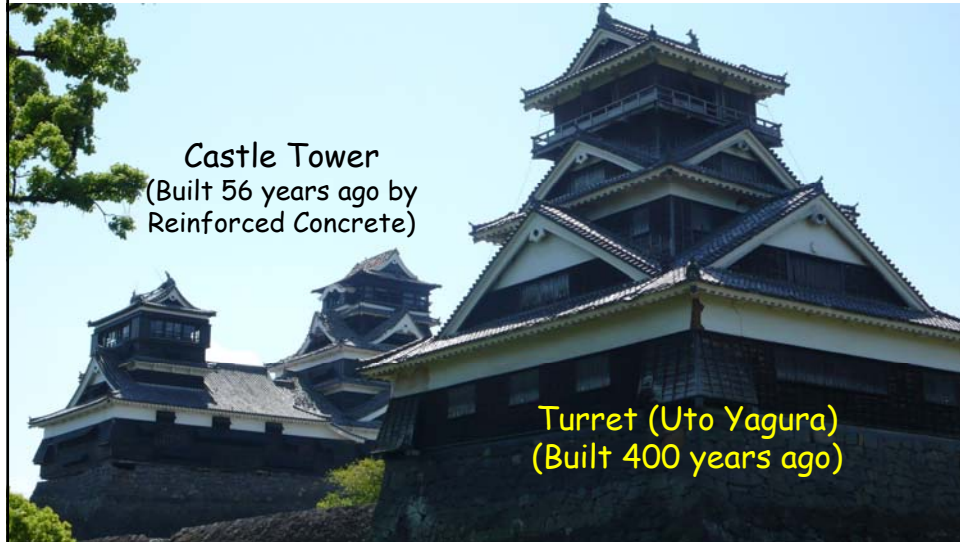
Uto City Hall



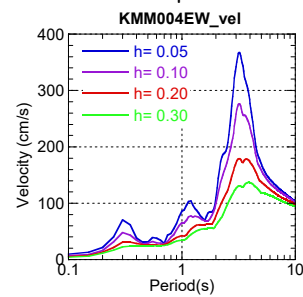
Seismic Reinforcement of Old Buildings

- Damage was concentrated in the old wooden house.
- In order to reduce the damage, it should promote the seismic reinforcement of old buildings.
- City Hall to be a disaster management centers was also severely damaged.
- It should be designed to have a high seismic performance depending on the building uses.

Kumamoto Castle



Aso Shrine (Important Cultural Asset)



Damage of Historic Buildings

- The Castle towers were damaged. However, the turret which was built 400 years ago was survived.
- Stone wall collapsed in 50 places or more in the Kumamoto Castle.
- The Aso shrine collapsed by resonance due to long-period ground motion.
- How to maintain and preserve historic buildings?

Thank you for your attention



Until Kumamoto Castle repair to the appearance before the earthquake

http://www.manyou-kumamoto.jp/users/files/120413160910_S3740267.jpg