Tsunami Risk Researches
-Development of evaluation method for tsunami risk using lessons learned from the March 11 Tohoku Tsunami-

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What was the lessons learned from the Tohoku Tsunami?

◆Huge tsunamis (Max inundation height 40.1m) associated with the mega earthquake that was not included in earthquake hazard assessment generated.
◆These earthquakes and tsunamis caused a vast amounts of damages.
⇒How should we assess tsunami hazard before the earthquake?
◆The excess regions assumed in tsunami hazard map was inundated.
◆This influenced on the tsunami evacuation action by residents.
⇒How should we visualize tsunami hazard assessment?

Example of handling methods for assumed tsunami hazard

◆To consider maximum scale of earthquake that have not occurred in the past, but is possible to occur geophysically in the future (The Cabinet Office, Kyusyu Electric Power Co. Ltd., Hokkaido Prefecture) (Fig.1, Fig.2)
◆To consider few kinds of slip distributions that is possible to occur (Fig.3)
◆To consider few kinds of moment magnitude
◆To set the level 1 tsunamis and the level 2 tsunamis (Japan Society of Civil Engineering)

Fig.1：Nankai Trough Mega Earthquake (The Cabinet Office, 2012)

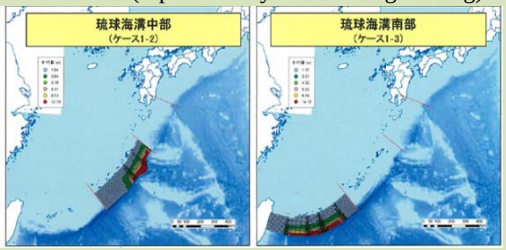

Fig.2：Ryukyu subduction zone Mega Earthquake (Kyusyu Electric Power Company)

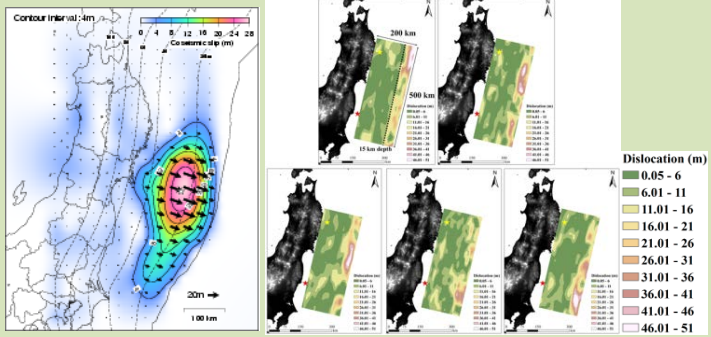

Fig.3：Few kids of slip distribution for the Tohoku Earthquake (Fukutani et al. (2014))

◆By conducting tsunami simulation considering few kinds of cases as shown left below, we can estimate uncertainty of tsunami wave height (Probabilistic tsunami hazard assessment (Fig.4)).
◆Assumed tsunami heights before earthquakes are not deterministic values.
◆Theoretically, we can confirm frequency distributions of tsunami height with once in a thousands (Fig.5).

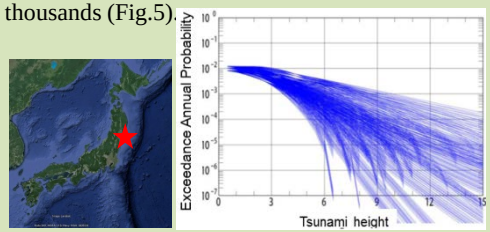

Fig.4：Relationships between tsunami height and generation probability (Japan Society for Civil Engineering(2012))

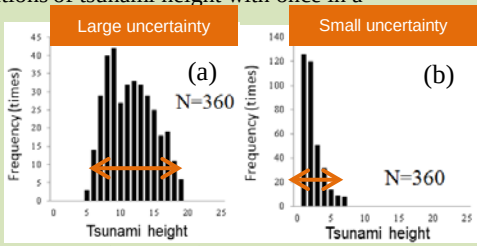

Fig.5：Probable frequency of tsunami height with once in thousands (a) off Iwate, (b) off Fukushima(Fukutani et al.(2014))

Dealing with the problem of tsunami hazard maps

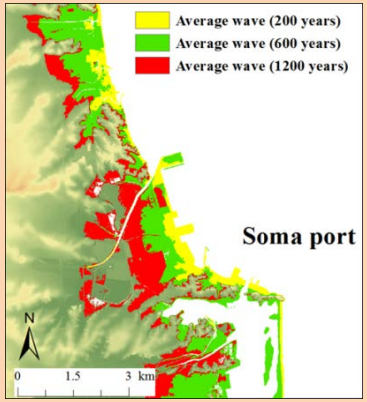

Fig.6：Probabilistic tsunami hazard map (Fukutani et al.(2014))

Quantification of tsunami risk using the results of probabilistic assessment

◆By integrating information for probabilistic tsunami hazard and fragility assessment, we can develop tsunami risk curve. (Fig.7 left)
◆Expected value of tsunami risk is equivalent to area below tsunami risk curve. (Fig.7 right)

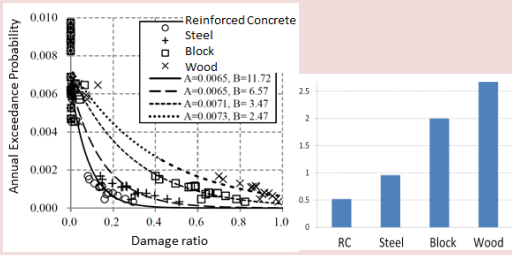

Fig.7：Tsunami risk curve (left) and expected value of tsunami risk (right)

参考文献

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