

Fragility curves research: The 2011 Great East Japan Tsunami

- ◆ Tsunami fragility curves is a statistical tool representing the probability of exceeding a given damage state (or performance) as a function of physical parameters of tsunami
- ◆ Fragility functions for building and boat by the great tsunami event such as the 2011 Great East Japan tsunami were developed by applying advanced statistical methods and consideration of impact of flow velocity and floating debris for better accuracy of the risk assessment.
- ◆ Results are key to support better future building damage assessments, land use management and disaster planning.

Damage data by the 2011 Great East Japan Tsunami

- ◆ About 250,000 damaged buildings data by Ministry of Land, Infrastructure, Transportation and Tourism (MLIT)
- ◆ About 20,000 damaged fishing boats data provided by an insurance company

内閣府提示の被害認定の分類			今回調査での区分
区分	状況	サンプル	
全壊	住家流失		全壊 (流失)
全壊	概ね1階天井まで浸水		全壊 (撤去)
			全壊 (条件付き再生可)
大規模半壊	床上浸水概ね1m		大規模半壊
半壊	床上浸水		半壊 (床上浸水)
一部損壊	床下浸水		一部損壊 (床下浸水)

Fig.1: Building damage data in case of the 2011 Great East Japan tsunami (6 damage levels) divided by materials, number of stories, construction year, coastal topography and land use type.

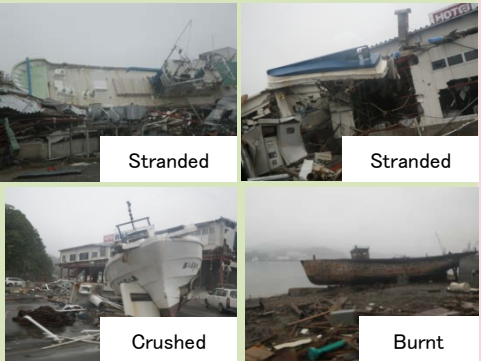
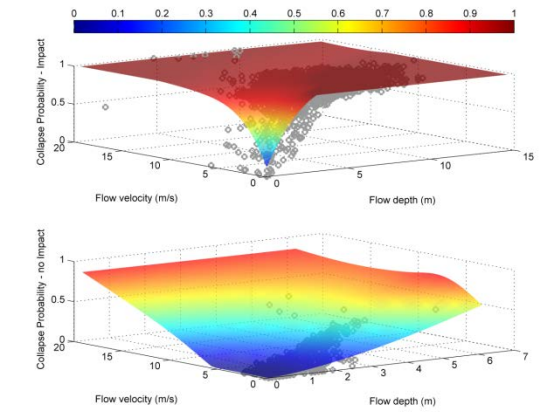


Fig. 2: Building damage data in case of the 2011 Great East Japan tsunami . Damage ratio= amount paid by the insurance company / insured value.

Fragility surfaces for building

Fig.3: Fragility surfaces representing the probability of exceeding collapse for wooden houses in Kesennuma with and without considering impact from debris (Upper and lower figure).
 Charvet, I., Suppasri, A., Mas, Kimura, H., Sugawara, D. and Imamura, F. (2014) Fragility estimations for Kesennuma City following the 2011 Great East Japan Tsunami based on maximum flow depths, velocities and debris impact, with evaluation of the ordinal model's predictive accuracy, *Natural Hazards*, (submitted)



Fragility surface for fishing boats

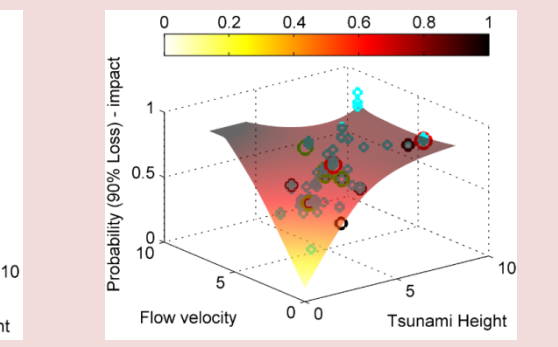
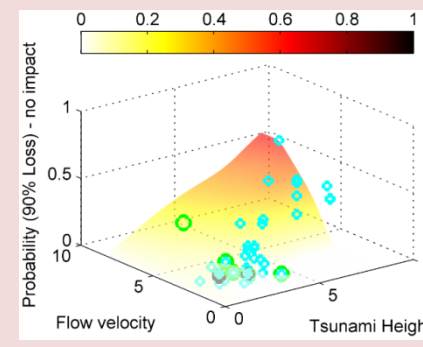


Fig.4: Fragility surfaces representing the probability of exceeding >90% damage for fishing boats in Fukushima-Chiba with and without considering secondary impact (Right and left figure).

Muhari, A., Charvet, I., Tsuyoshi, F., Suppasri, A., and Imamura, F. (2014) Fragility estimations for Kesennuma City following the 2011 Great East Japan Tsunami based on maximum flow depths, velocities and debris impact, with evaluation of the ordinal model's predictive accuracy, *Natural Hazards*, (submitted)

Reference

Ministry of Land, Infrastructure, Transportation and Tourism (2012) Survey of tsunami damage condition <http://www.mlit.go.jp/toshi/toshi-hukkou-arkaibu.html>