Significance of Disaster Debris Reduction for Disaster Waste Management

Nagahisa Hirayama[1*], Nobuo Fukuwa[1]

1: Disaster Mitigation Research Center, Nagoya University, Furo, Chikusa, Nagoya 464-8601, Japan

*corresponding author: hirayama.nagahisa@nagoya-u.jp

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INTRODUCTION

The cruciality of Nankai Trough earthquake has been pointed out, and the Ministry of Environment, the government of Japan reported that the amount of disaster debris after the presumed Nankai Trough earthquake and tsunami catastrophic disaster was estimated to 323 million tons (Ministry of the Environment, 2014). In addition, the disaster waste management guidelines, published by the Ministry of the Environment, pointed out the essential of disaster waste reuse and recycle.

Hirayama et al. (2018) indicated that a goal period of disaster debris treatment including constraints of the resources for disaster debris was calculated with 19.45 years and the resources for disaster debris operation after Nankai Trough earthquake and tsunami disaster is insufficient. The objective of this study is to reveal the effect on disaster debris reduction by the decrease in the number of dwellings based on the old earthquake resistance building standards.

MATERIALS AND METHODS

Estimation procedure for disaster debris

The amount of disaster waste after Nankai Trough earthquake and tsunami disaster is estimated using the results of hazard-based dwellings damage assumption and the per unit generation of disaster debris (Ministry of the Environment, 2014). In this study, the amount of disaster debris by each grid cell was estimated from the damage of houses by earthquake ground motion and tsunami inundation. The number of wooden and non-wooden houses by construction period was estimated from the grid cell mesh statistics of the national census and the housing and land statistics survey. The number of completely and partially damaged houses was calculated using the housing fragility functions, and the number of houses damaged by tsunami inundation was calculated from the relationship between the inundation depth and the building damage category based on the inundation depth distribution data. The amount of disaster debris in each grid cell was estimated using the number of dwelling by damage categories and the per unit generation of disaster debris.

Time series calculation for disaster debris in Nankai Trough earthquake and tsunami disaster

The National Census and the Housing and Land Survey are conducted every five years. For the years 2005 – 2018, the amount of disaster debris caused by the Nankai Trough earthquake and Tsunami in 2005, 2008, 2010, 2013, 2015 and 2018 using the national census statistics and the housing and land census for the survey years shown in Table 1.

Table 1 Time series calculation conditions for the years 2005 - 2018

Year	National census	Housing and land census	Grid cell	Year	National census	Housing and land census	Grid cell
2005	2005	2003	500m	2013	2010	2013	500m
2008	2005	2008	500m	2015	2015	2013	250m
2010	2010	2008	500m	2018	2015	2018	250m

RESULTS AND DISCUSSION

Times series of disaster debris after the Nankai Trough earthquake and tsunami disaster

The amount of disaster debris due to earthquake ground motion and tsunami inundation was calculated. As a result, the amount of disaster debris was estimated to be 327.5 million tons in 2005, 306.5 million tons in 2008, 316.4 million tons in 2010, 298.6 million tons in 2013, 220.0 million tons in 2015, and 208.0 million tons in 2018. Between 2005 and 2018, the percentage of wooden house with new seismic building standards has increased from 50.8% to 67.0%. That is the reason why the amount of disaster debris was reduced by 36.5%.

Disaster debris reduction by regional characteristics

Figure 1 shows the quantitative estimation results of disaster debris by prefecture in 2005 and 2018. This figure indicates that decreasing the number of houses vulnerable to disasters would result in the reduction of disaster debris. On the other hand, in prefecture where the damage caused by tsunami inundation is more serious, the effect of reducing the amount of disaster debris has been limited.

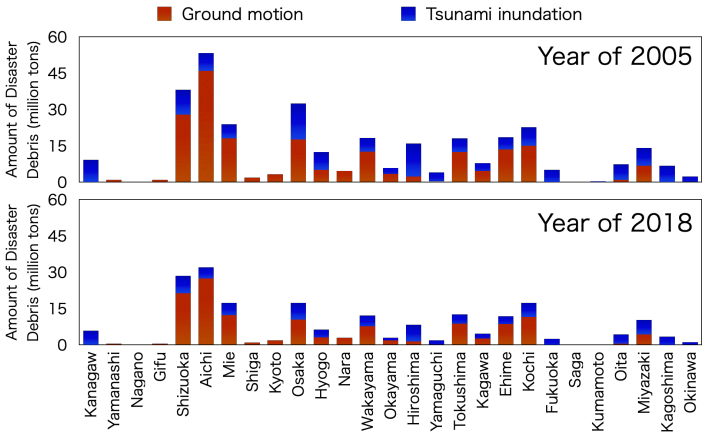

Figure 1 Quantitative estimation results of disaster debris by prefecture in 2005 and 2018

CONCLUSION

This study aimed to develop a time series quantitative estimation of disaster debris caused by earthquake and tsunami disaster. Consequently, it was indicated that it is essential to reduce the amount of disaster waste treatment through 3R of disaster waste, especially by making dwellings more disaster-resistant as an pre-disaster investment.

REFERENCES

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