



Population Changes in the Estimated Tsunami Inundation Areas of Shizuoka and Miyazaki Prefectures

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Abstract

Since the 1995 Kobe earthquake, Japan has been said to have entered an active period of seismicity. Thus, over 20,000 of people were killed in a devastating tsunami due to the 2011 earthquake off the Pacific coast of Tohoku, with a magnitude of 9.0. Today, Japan is facing the danger of a massive earthquake along the Nankai Trough. Major damage from the tsunami is expected along the wide coastal area in western Japan.

In this paper, the population and the number of households in the estimated tsunami inundation area is calculated using the National Population Census and the estimated tsunami inundation data for Shizuoka and Miyazaki prefectures provided by the Ministry of Land, Infrastructure, Transport and Tourism as the numerical land information. The data from the census used a 500 m x 500 m grid.

Here we compare the changes in the population and the number of households in the tsunami inundation area for 2005, 2010, and 2015, and we discuss these changes in the two prefectures. After analyzing the results using GIS, the population and the number of households in the tsunami inundation area were 281,305 (3,795,145 total) people and 99,941 (1,354,727 total) households in Shizuoka prefecture, and 174,582 (1,153,523 total) people and 69,510 (451,389 total) households in Miyazaki prefecture in 2005, and 253,538 (3,702,409 total) people and 99,138 (1,430,584 total) households in Shizuoka prefecture, and 167,242 (1,104,535 total) people and 71,013 (463,072 total) households in Miyazaki prefecture in 2015.

Thus, from 2005 to 2015, in Shizuoka prefecture, there was a 9.87% decrease in the population inside the inundation area and a 2.21% decrease in the population outside the inundation area; furthermore, there was a 0.803% decrease in the number of households inside and a 5.76% increase outside the inundation area. In Miyazaki prefecture, the population inside decreased by 4.20%, the population outside decreased by 2.63%, the number of households inside increased by 2.16%, and the number of households outside the inundation area increased by 4.12%. In Shizuoka prefecture, there was a remarkable difference between the population and the number of households inside and outside the inundation area. On the other hand, Miyazaki prefecture showed the same trend inside and outside the inundation area. In addition, the number of households inside the area in Shizuoka prefecture was found to have declined significantly from 2010 to 2015, despite an increase in the same trend as the number of households outside from 2005 to 2010. This means that the residents from the inundation area have moved since 2010, suggesting a great impact of the 2011 Great East Japan Earthquake on their residential choice behavior.

Keywords: estimated tsunami inundation area, national population census, population exposure, disaster risk



1. Introduction

Since the 1995 Kobe earthquake, Japan is said to have entered an active period of seismicity. Notably, in 2011, more than 20,000 people were killed in a devastating tsunami caused by the 9.0-magnitude Tohoku Earthquake off the Pacific coast. Currently, it is feared that prefectures along the southeastern coast face a massive earthquake threat from the Nankai Trough, in the southeastern seaboard. From such an earthquake, major damage and loss of life are expected from tsunami along the wide coastal areas of eastern Japan (e.g., Shizuoka and Miyazaki). The aim of this paper is to calculate populations and households within selected estimated tsunami inundation areas and to discuss the changes in demographics after the 2011 Pacific-coast earthquake.

2. Method and study area

Shizuoka and Miyazaki prefectures are chosen as focus areas of this study, because they contain lands highly vulnerable to tsunami, facing the Nankai Trough. Fig. 1 shows the two prefectures, wherein huge casualties and extensive damage would be caused by another major offshore earthquake. We use data from the Japan National Census [3] and the estimated tsunami inundation areas (Fig. 2) identified from the National Land numerical information download service [4]. Populations and households are analyzed along 500×500-m grids, and the tsunami inundation area uses a similar polygon model leveraged by a geographic information system (GIS).



Fig. 1 – Study area

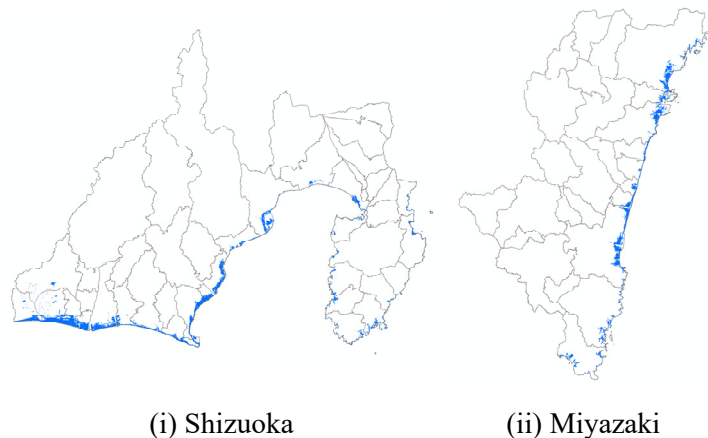


Fig. 2 – Estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures

3. Results

3.1 Population and numbers of households inside and outside selected estimated tsunami inundation areas

Table 1 shows population changes from 2005 to 2015 in the selected estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures. In 2005, Shizuoka prefecture reported 281,305 people within their tsunami inundation areas (7.41% of the total prefecture population) among 99,941 households within their tsunami inundation areas (6.85%). Using similar apportionments, in the same year, Miyazaki prefecture reported 174,582 people (15.1%) among 69,510 households (15.4%). In 2010, Shizuoka prefecture reported



272,405 people (7.23%) among 101,355 households (7.24%), and Miyazaki prefecture reported 171,908 people (15.1%) among 70,452 households (15.3%). In 2015, Shizuoka prefecture reported 253,538 people (6.85%) among 99,138 households (6.93%), and Miyazaki prefecture reported 167,242 people (15.1%) among 71,013 households (15.3%). When judging areas inside and outside the tsunami inundation area, inland municipalities (e.g., wards, cities, towns, and villages) without coastal areas were excluded.

Table 1 – Population and household changes in the selected estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures from 2005 to 2015

Prefecture	Area	Population			Number of households		
		2005	2010	2015	2005	2010	2015
Shizuoka	Inside	281,305	272,405	253,538	99,941	101,355	99,138
	Outside	2,245,552	2,231,037	2,195,821	813,162	840,651	859,998
Miyazaki	Inside	174,582	171,908	167,242	69,510	70,452	71,013
	Outside	592,515	588,160	576,935	233,777	240,518	243,397

3.2 Population changes

Figures 3 and 4 show populations and numbers of households from 2005 through 2015 inside and outside the estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures. During this period, in the Shizuoka prefecture, there was a 9.87% decrease of population inside the estimated tsunami inundation area and a 2.21% decrease in the population outside the estimated tsunami inundation area. Furthermore, there was a 0.80% decrease in the number of households inside the estimated tsunami inundation area and a 5.76% increase of households outside the estimated tsunami inundation area. Using a similar apportionment, in Miyazaki prefecture, the population inside decreased by 4.2%, the population outside decreased by 2.63%, the number of households inside increased by 2.16%, and the number of households outside increased by 4.12%.

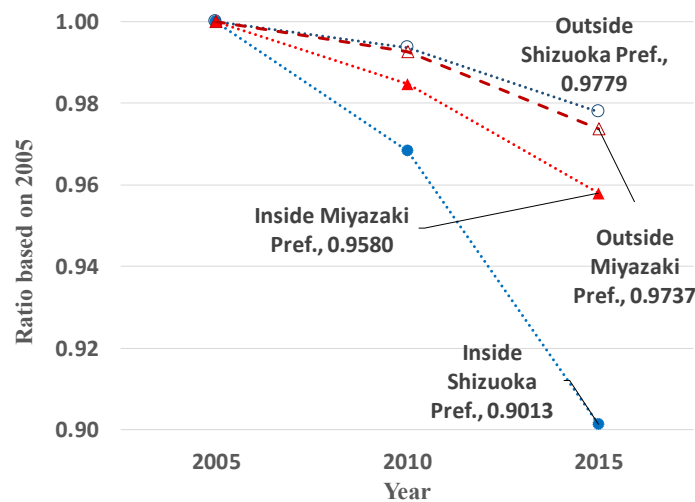


Fig. 3 – Population ratios from 2005–2015 inside and outside estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures

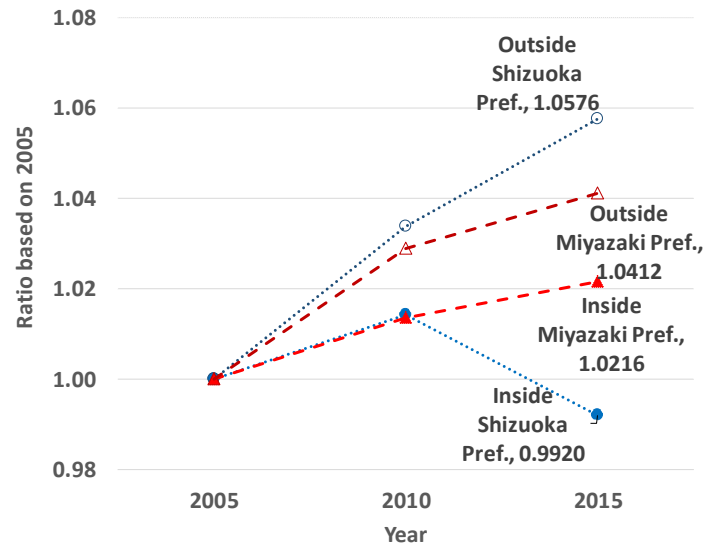


Fig. 4 – Number of household ratios from 2005–2015 inside and outside the estimated tsunami inundation areas of Shizuoka and Miyazaki prefectures

In the Shizuoka Prefecture, there was a remarkable difference between the population and the number of households inside and outside the inundation area. On the other hand, Miyazaki prefecture showed the same trend inside and outside the inundation area. In addition, the number of households inside the area in the Shizuoka prefecture was found to have declined significantly from 2010 to 2015, despite an increase in the same trend as the number of households outside from 2005 to 2010. This means that the residents from the inundation area have moved since 2010, suggesting a great impact of the 2011 Great East Japan Earthquake on their residential choice behavior.

4. Summary

In this study we calculated populations and numbers of households in and around estimated tsunami inundation areas by using census and GIS data. We discussed those changes with respect to the prefectures of Shizuoka and Miyazaki across a time period from 2005–2015. After analyzing the results using GIS, the population and the number of households in the tsunami inundation area were 281,305 (3,795,145 total) people and 99,941 (1,354,727 total) households in the Shizuoka prefecture, and 174,582 (1,153,523 total) people and 69,510 (451,389 total) households in Miyazaki prefecture in 2005, and 253,538 (3,702,409 total) people and 99,138 (1,430,584 total) households in the Shizuoka prefecture, and 167,242 (1,104,535 total) people and 71,013 (463,072 total) households in Miyazaki prefecture in 2015.

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In future research, we plan to analyse these changes using smaller spatial units based on reviews of the various disaster management policies of municipalities that are designated tsunami-hazard areas by the Act on Development of Areas Resilient to Tsunami Disasters of 2011.



5. References

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