

ESTIMATING THE DEATH RATE DUE TO THE GREAT EAST JAPAN EARTHQUAKE USING NATIONAL CENSUS AND THE LIST OF THE DEAD

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ABSTRACT: The Great East Japan Earthquake is one of the worst natural disasters in Japan. The toll of the dead and the missing is over 20 thousand, and over 90 percent of the dead drowned due to tsunami. In order to cut down the damage caused by future Tsunami in collaboration with occupation and livable place, this earthquake gives good lessons. Before acting, we have to know what happened and the cause of damage or death.

We focused on the population distribution at the time of occurrence. Since the tsunami rushed in the afternoon, the death rate of certain area cannot be calculated until estimating where each person was at the time. We estimated the population distribution and the death rate in several cities using the Population Census.

1. BACKGROUND

1.1 Introduction

The Great East Japan Earthquake killed and made lost over 20 thousand people. From Meiji era(1867~), the events that over 20 thousand people died in natural disaster were only Meiji-Sanriku earthquake, Great Kanto earthquake. So The Great East Japan Earthquake is one of the worst natural disasters in Japan.

One of the special features of The Great East Japan Earthquake is big tsunami. In Miyako, the height is recorded over 8.5m and tsunami run up to 38.9m high. Flood area was about 561 km². Figure 1 is taken of the same place, Ishinomaki-Kamaya.



Figure 1 Pictures of Ishinomaki-Kamaya

Left is before 3.11. Right is April 6th (pictures from google earth)

Japan was attacked by tsunami many times. In Sanriku area, which has a ria coast and is famous for being attacked tsunami often in Japan, they have taken many measures to protect themselves from tsunami. But in plain area, such as Sendai and Natori, we didn't act well for such big tsunami.

1.2 Objective

Against such background, the death rate of each Oaza area is estimated. The objective is to show what happened in order to prevent damage from future tsunami.

2. MATERIALS AND METHODS

2.1 Data

In order to calculate the death rate, we need the toll of population and the dead.

2.1.1 Population data: We used the population data from national census 2010 and 2005. This data is by Ministry of Internal affairs and Communications on October 1st every 5 years. This data shows the number of people living in koaza area. Each koaza is a part of oaza, so we can calculate the number of people living in one oaza. It contains region code.

We didn't use the population data from residential basic book by local governments. The reason is this data contains people who don't live in the place.

2.1.2 The data about the dead people: We used the dead list from the website of Miyagi Prefectural Police. It lists name, age, sex, and address of the dead announced to the public by July 22nd. There are 8412 people's address is listed in the data. It is updated almost every day.

The number of the dead people is reported 9336 in Miyagi, and 2553 people is missing by July 22nd. The list of the missing people was also in public, but the list doesn't contain address, and the list is not open to public now.

2.2 the method of connecting the address of the dead people and national census 2005, 2010

First, we joined national census 2010 and dead people's address, then connected each national census. Since some of the dead people's address can be something wrong, we inspected the address. We used address matching service by SPAT. It gives us longitude, latitude and the estimated address. The estimated address is divided to city and oaza or koaza. For example, Japanese address “東京都目黒区駒場 4 丁目” is thrown, the response is “東京都/目黒区/駒場/4 丁目”. We corrected the data by hand if the estimated address is not the same as inputted address. We removed the data whose address shows only city name.

We merged the census data 2010 and the dead people's address by comparing the address.

Connecting the national census 2005 and 2010, we used region code. Since one region code number cannot be reused to other place, we connect the national census data by region code first. Sometimes the region code can be changed by consolidation of local government or redevelopment. If the code is changed, we compared the address. When an address of some place is changed, we checked both data, and connect them by hand.

3. RESULT

There are 8412 address in the list of the dead people, and 8245 address matched to national census. From Figure 2 to 5 and Table 1 shows the death rate. Ishinomaki-Ogatsu, Ishinomaki-Kitakami whose area are printed “+” on Figure 2 is not oaza area, but former local government area, because the address of over 70% of the dead people in these area is filled with former government's name.

Figure 4 shows the death rate in coastal area of Sendai bay is around 5%. This show people died in flooded area. The death rate is not the same around Sendai bay. Compared to other coastal area of Sendai bay, the death rate of Iwanuma-Ushijima (printed “@” on Figure 5) is small, 1.4%. The Table 1 shows Ishinomaki-Kamaya, well known area for Okawa elementary school catastrophe that 70% of the students died, was the most dangerous area.

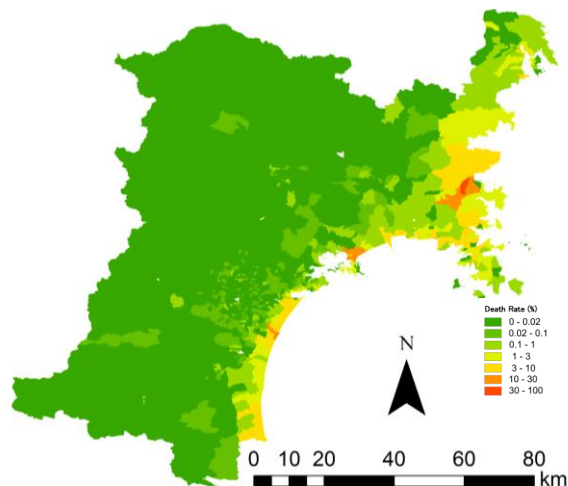


Figure 2 Death Rate of Miyagi

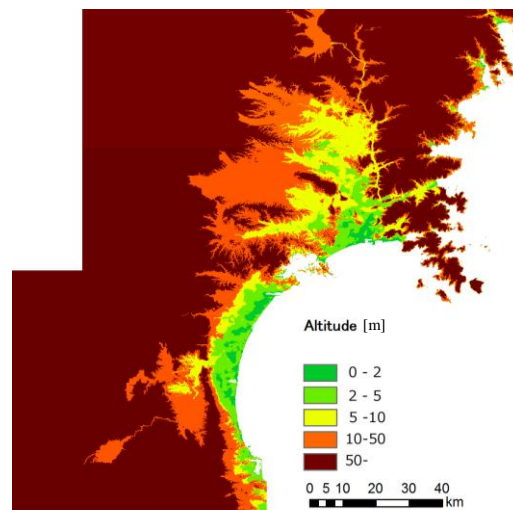


Figure 3 Altitude of Miyagi (Data from GSI)

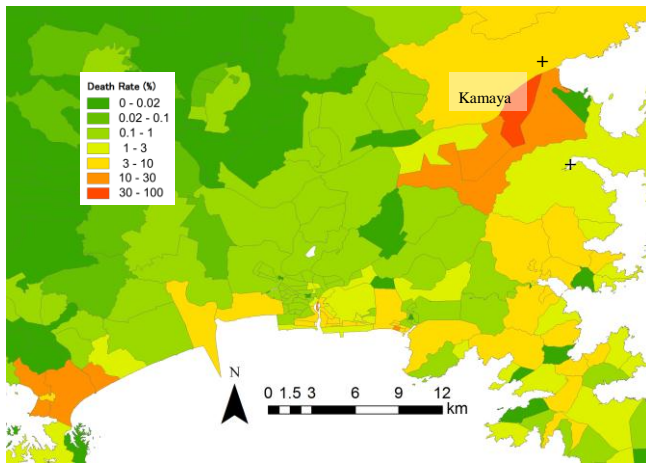


Figure 4 Death Rate of Ishinomaki

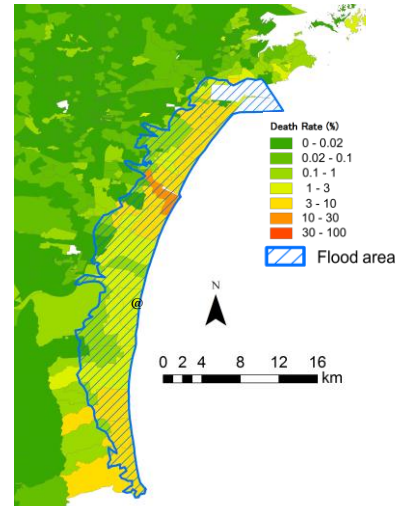


Figure 5 Death Rate of South Miyagi

Flooded area data is from Sawada-Takeuchi Laboratory.

Table 1 Ranking of Death Rate

Rank	Address	Rate (%)
1	Ishinomaki-Kamaya	33.9
2	Ishinomaki-Harioka	12.6
3	Ishinomaki-Nakase	11.9
4	Higashimatsushima-Otsuka	11.8
5	Ishinomaki-Matsubaracho	11.8
6	Ishinomaki-Nagamo	11.5
7	Higashimatsushima-Nobiru	11.4
8	Natori-Yuriage	11.3
9	Higashimatsushima-Hamaichi	10.1
10	Natori-Kozukahara	10.0

4. CONCLUSIONS AND FUTURE WORK

The death rate of people living in one area is estimated in this study. From this, which area was relatively safe or dangerous attached by The Great East Japan Earthquake is shown.

This is the 1st step of our objective. Since this earthquake hit in the afternoon, people moved to somewhere before attacked. Showing how dangerous the area was, we have to estimate the number of people in certain area and where each person died.

The next task is to estimate the people flow in Sendai city.

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