

Title: **Issues of the measure of evacuation against a storm surge by hitting a huge typhoon in Japan**

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## **1. Issues of operation of evacuation against a storm surge by authorities and municipalities in Japan**

It is expected that climate change due to global warming causes increasing intensity of tropical cyclones and a rise of 0.26 to 0.59m in sea level. In Japan, below-sea-level areas along the three major bays are over populated and have accumulation of property. So, when a storm surge by hitting a huge typhoon occurred there, the lives and property of many people will be affected. Therefore, it is important that people living in such areas evacuate so that they are not sacrificed by the disaster.

In America, when forecast that the hurricane hits the land of America, FEMA commands evacuation for concerned municipalities, and they announce the evacuation order. Moreover, FEMA offers regions necessary support of evacuation quickly such as to secure transport, shelters, and so on. For example, when the hurricane "Gustav" had hit in 2008, it succeeded that 1.9 million people have evacuated from a dangerous areas before the disaster occurred.

On the other hand, in Japan, it is provided that the municipality is authorized to lead residents' evacuation by the law. But, cooperation between municipalities about the evacuation is not enough, and the government authority doesn't lead residents' evacuation.

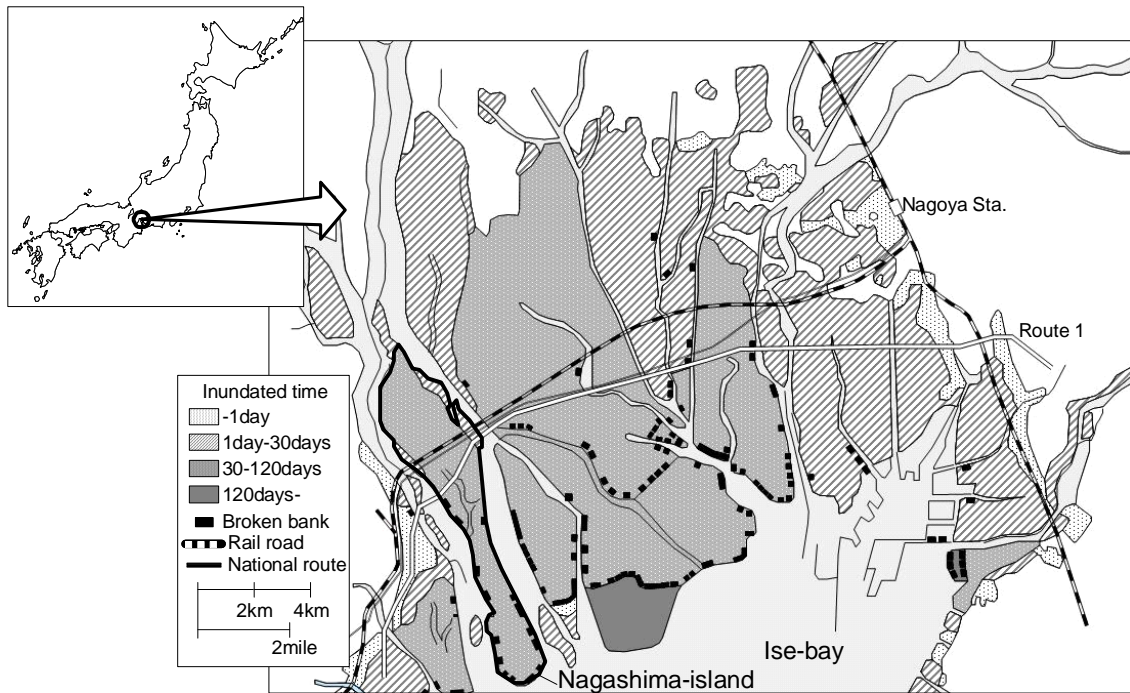
One reason why such the system has not been completely built up in Japan is as follows. A typhoon is brewing and developed in the low latitude, but it weakens near Japan gradually because the temperature of seawater falls in the high latitude. So, Japan had not suffered heavy damage from the storm surge caused by a huge typhoon for about 50 years, and it has not been necessary to the wide area evacuation.

However, the huge typhoon may hit Japan in the near future because of climate change. It is necessary that the authorities and municipalities discuss each other about the acceptance systems of the resident of evacuation before the disaster occurs.

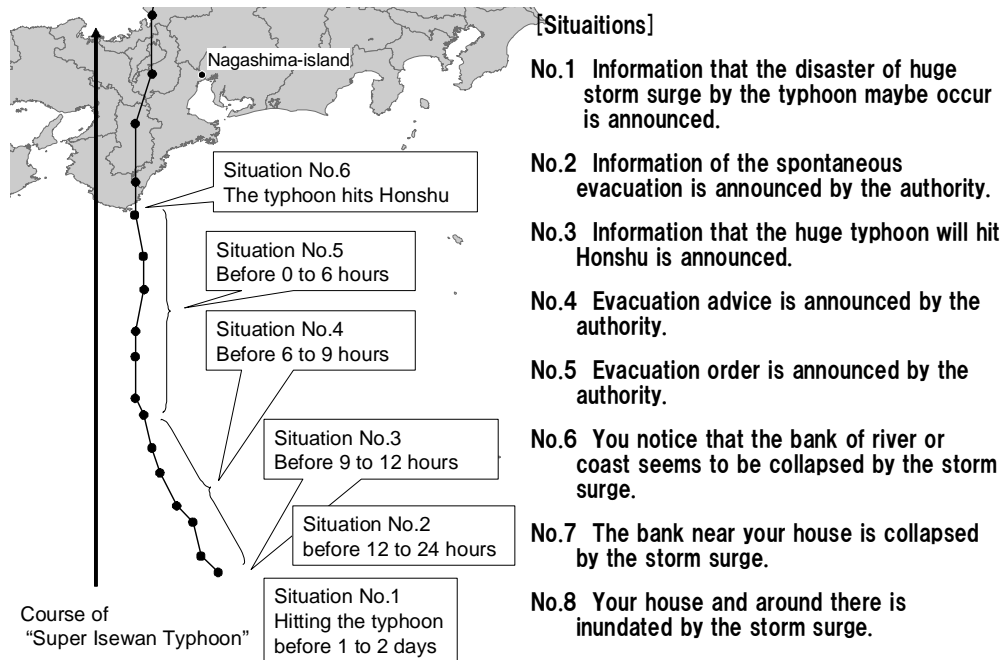
## **2. Issues of residents' intention of evacuation against a storm surge**

It is important that people living in below-sea-level areas evacuate so that they are not sacrificed by the disaster of storm surge. However, all residents do not necessarily evacuation at the disaster.

Then, we carried out the questionnaire survey in Nagashima-island in Kuwana City, Mie Pref., Japan.



**Figure 1. The situation of the inundation of the storm surge by Isewan typhoon in 1959**



About Super Isewan Typhoon:

- The barometer of the typhoon register 910 hPa at hitting Honshu. This is the same as the typhoon (Muroto Typhoon, 1934) of the atmospheric pressure that is the lowest observed till now in Japan.
- The typhoon goes along the route causing most serious damage to Ise bay area.

**Figure 2. The scenario of the Super Isewan Typhoon hitting Honshu in the questionnaire**

Nagashima-island had suffered heavy damage from the storm surge caused by Isewan Typhoon in 1959. Then, that area had inundated for 30-120 days. Nagashima-island is the below-sea-level area. So, when a storm surge by "Super Isewan Typhoon" that is assumed by the regional crisis management committee about disaster prevention against storm surge and flood (consists of the authorities, local governments, corporations of transportation and lifeline around Ise-bay area, and researchers) occur, residents have to

evacuate to safety shelters on the high land because the whole of the area in Nagashima-island will inundated above 3m depth. Moreover, the wind speed in Nagashima-island reaches 15m/s before 8 hours when the typhoon hits Honshu, and reaches 20m/s before 6 hours. So, residents should begin to evacuate before such the situation.

However, the actual states of residents' evacuation intention clarified by the questionnaire survey are as follows.

1) 24% residents answered that they will not evacuate although they live in the whole of the area that will inundated above 3m depth. The intention is influenced by the knowledge of past the disaster, characteristics of living place and so on.

2) Because many residents don't understand that they can't evacuate with blowing a strong wind, only 24% residents will begin to evacuate before situation No.4 that they can barely evacuate by the car.

3) About 60% residents will stay in shelters in Nagashima-island. Residents living in their region for a long time don't want to evacuate to shelters outside there. Moreover, it is difficult that physically handicapped people evacuate to distant shelters.

### **3. Conclusion: Measures against disaster of the storm surge that should be executed in Japan**

Japan has not the severe disaster of the storm surge by the huge typhoon during half a century, and the system of the operation of a wide area evacuation is not enough. In the future, because of climate change due to global warming, a huge typhoon will hit Japan and a disaster of storm surge may occur. Therefore, in Japan, it is necessary to build up the system by which authorities operate the wide area evacuation and support municipalities' activities like FEMA. Moreover, it is important to educate about the disaster of a storm surge by the huge typhoon and the necessity of the wide area evacuation for Japanese people.

### **Reference**

Tokai-Nederland regional committee about disaster prevention against storm surge and flood  
(2009) .*Crisis-management action plan*, [http://www.cbr.mlit.go.jp/kawatomizu/tokai\\_nederland/](http://www.cbr.mlit.go.jp/kawatomizu/tokai_nederland/) (Sep.1, 2010)