

# RESPONSE OF HOUSEHOLD TO WARNING SYSTEM UNDER DISASTERS

---COMPARING EARTHQUAKE AND FLOOD DISASTERS \*

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## 1. INTRODUCTION

In Japan, many places are subject to threats from both earthquakes and flood disasters. Analysis of the human behaviors under the two disasters is helpful for making integrated disaster plans. This paper first analyzes human behaviors during the different phases of an earthquake and flood, and then analyzes family evacuation behaviors.

## 2. PROCESS ANALYSIS OF FLOOD AND EARTHQUAKE DISASTERS

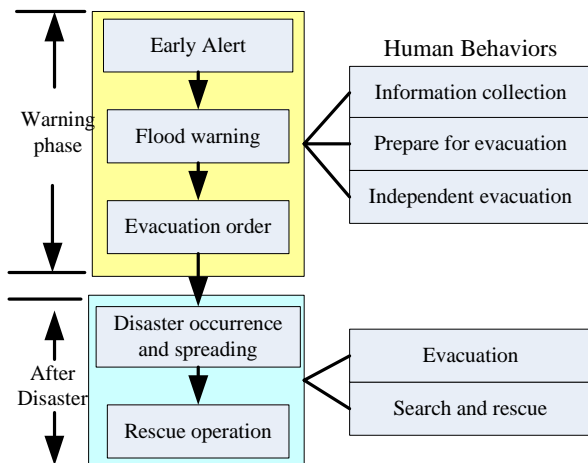


Fig. 1: flood disaster process

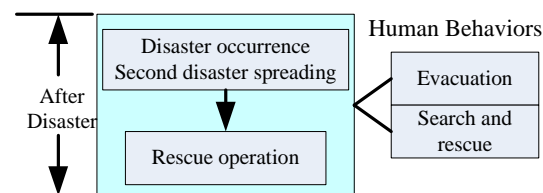


Fig. 2: Earthquake Disaster process

A flood disaster is often caused by heavy rainfall. Before the flood happens, an early warning system spreads information on rainfall, flood warning as well as evacuation order as shown in Fig.1. Corresponding to these phases, human will collect information, prepare for evacuation and take refuges. Under flood disaster, residents have relatively ample time to prepare for evacuation. For example, Niigata flood disaster in 2004, Kita area issued evacuation advice at 12:22 and flood happened at 13:45[1]. Inundation is a continuous process over space and time. Affected area will transform from warning phase to rescue phase one after the other.

Different from flood, an earthquake is instantaneous disaster that often lasts less than one minute. But the second damage provoked by an earthquake such as fire is a spreading disaster. Although there are special

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earthquake alerts, long alert period and very low accuracy make it difficult to be put into operation. Therefore, when earthquake happens, it is difficult to get effective warning information for residents. Human behaviors mainly show independent evacuation after an earthquake. According to a statistic report from Kobe earthquake, about 30% people chose direct evacuation after disaster and about 35% people evacuated after several hours after the earthquake.

The following part analyzes the evacuation behaviors of household in detail.

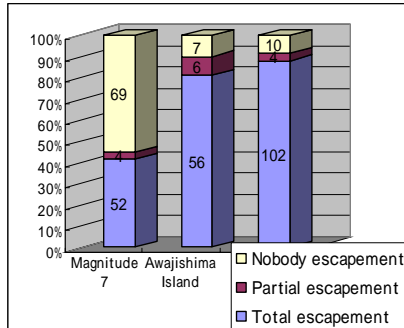


Fig.2 Hanshin-Awaji earthquake [2]

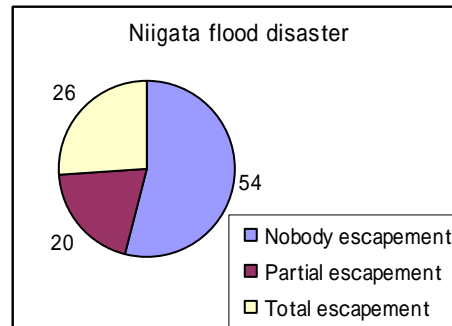


Fig.3 Niigata flood disaster [3]

From above figures, the total evacuation ratio under Niigata flood disaster is obviously less than that under Kobe earthquake but the partial evaluation ratio and non-evacuation ratio are distinctly more than those under Kobe earthquake. The main reason for non-evacuation in flood disaster is shown in Tab.1.

submersed beyond expectation	<b>29%</b>
<i>Home is safe</i>	23%
<b><i>There still time to evacuate</i></b>	<b>24%</b>

Tab.1: Non-evacuation reasons under flood [1]

Fear to aftershock	<b>54%</b>
<i>Lifeline can not be used</i>	39%
<b><i>Building danger and fire</i></b>	<b>38%</b>

Tab.2: Non-evacuation reasons under earthquake [2]

According to the statistic report of Typhoon 10 in 2003 in Hokkaido, 3058 households(7304 persons) took refuge after evacuation order but only 266 households(1101 persons) among them independently evacuated. According to a statistic report of Tokage Typhoon in Japan, while the City Mayor gave an evacuation order to 42,000 people, only 3,800 people actually evacuated [4]. It shows that early warning system does not play as important role as expected. The main gap lies in the accuracy of forecasting and residents' trust and evacuation consciousness of people. Under earthquake disaster, the total evacuation ratio is very high. The main reason is as shown in Tab.2.

### 3. SUMMARY

- Early warning plays a very important role for flood disaster mitigation compared to that under an earthquake. A high level of trust from residents in warning system is crucial to effective evacuation.
- It is necessary to raise awareness of disaster at community levels especially for flood disaster.

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