

REFUGEE-SEEKING BEHAVIOR DURING RAIN-INDUCED DISASTER: IN THE CASE OF FOUR DISTRICTS DAMAGED BY TYPHOON NUMBER 10, 1986

Iware MATSUDA

Abstract The refuge-seeking behavior of those who were affected by Typhoon Number 10 in 1986 was investigated through field work and a questionnaire survey which were conducted in four study areas whose natural and social conditions differed from one another. Two results were obtained by examining the facts surrounding this refuge-seeking behavior. One is that the heavier the damage in a given region, the lower the refuge ratio was. The other is that a normalcy bias was recognized in every study area.

Three factors which related closely with refuge-seeking behavior could be extracted by discriminant analysis on taking refuge. These are the depth of the flood waters, the frequency of participation in training for flood fighting and the number of stories in a house.

Several existing articles on refuge-seeking behavior during heavy rains were reviewed in order to examine the results obtained in this study and to generalize the characteristics of human behavior during a flood disaster.

Key words: refuge-seeking behavior, rainfall-induced disaster, discriminant analysis, evacuation order, northern Kanto

1. Introduction

Typhoon Number 10 in 1986 lashed the Kanto and Tohoku regions with heavy rains on the 4th and 5th of August. Twenty lives and 133 houses were lost; and about 112,000 houses were inundated. This paper will clarify the actual conditions surrounding the behavior of those who experienced this disaster, as determined through field work and a questionnaire survey. Also, the factors influencing refuge-seeking behavior will be examined by discriminant analysis; and the general characteristics of refuge-seeking behavior will be discussed in conclusion.

2. An Outline of Study Areas

Four damaged districts, whose natural and social conditions differ from one another, were selected as follows: Motegi Town, Mito City, Akeno Town and Ishige Town. Motegi Town is located in Tochigi Prefecture and the others in Ibaraki Prefecture. Their locations are shown in Fig. 1.

The study area of Motegi Town is the commercial district in the central part of the town, which is located on a small basin. The Saka River which runs through the district began to flood at about 23:00 on the 4th. The water level rose rapidly around midnight and began to recede after dawn, falling to the ordinary level around noon on the 5th. The duration of inundation was short, but the increase in water level was rapid, and the flood waters had high velocity.

The study area in Mito City is a residential district located in the flood plain on the left bank of the Naka River. But a bank had not been constructed along the river because this area had been designated as an urbanization control area. The water level of the Naka River rosed higher than the planned high-water level, and recorded the highest level up to the present. Accordingly, the inundated area spread more broadly than that had ever been experienced before. Two features can be pointed out in these flood conditions. One is that the Naka River began to flood 4 hours after it had risen to the warning water level. The other is that inundation began after dawn about 7:00 on the 5th. The rain had already ended by that time.

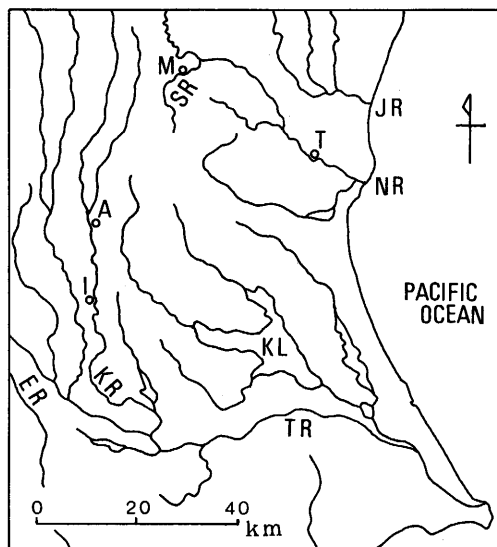


Fig. 1 Location of study areas
Study areas: M: Motegi Town, T: Mito City, A: Akeno Town, I: Ishige Town;
Rivers: ER: Edo River, JR: Kuji River, KR: Kokai River, NR: Naka River, SR:
Saka River;
Lake: KL: Kasumigaura

In the case of Akeno Town, the survey focused on the agricultural districts, which are located in the flood plain on the left bank of the Kokai River. These districts are generally inundated once every five years. The Kokai River recorded the highest water level up to the present, and the water surpassed the warning level about 9 hours before the Kokai River began to overflow its bank. When inundation occurred at about 8:00 on the 5th, the rain had already ended. After the bank collapsed at 13:30, flood waters spread quickly, even surging upstream. The study area was inundated for about 2 days. Flood waters were deep and the duration of inundation was long.

The districts surveyed in Ishige Town were also agricultural, located at about 12 km lower than Akeno Town. Though the water level of the Kokai River rose higher than the warning level at 7:30 on the 5th here, the waters did not overflow the bank. But a bank was broken at about 10:00 on the 6th. Flood waters surged out at about 1.0 km/hour, and the study area was inundated 1 to 2 hours after the bank collapsed. The depth of the flood waters was shallow and the velocity was low. The flooding occurred on the morning the day after the heavy rain.

The questionnaire survey was conducted in the beginning of October, 1986. A total of 1,200 flood survivors were selected at random from the four study areas; 400 from Motegi Town, 300 from Mito City, 300 from Akeno Town and 200 from Ishige Town. The numbers of valid answers were 228 (57.0 %) from Motegi Town, 136 (45.3 %) from Mito City, 137 (45.7 %) from Akeno Town and 108 (54.0 %) from Ishige Town. The total number of valid answers was 609 (50.7 %).

3. Evacuation Order and Refuge-Seeking Behavior

The depth of flood waters, the evacuation ratio, and the reasons for seeking or not seeking refuge for each study area are shown in Table 1. Damage was more serious in Mito City and Motegi Town, and slightest in Ishige Town. Though the respondents were selected in the inundated areas, some of them answered "Was not flooded" because their houses were built on a natural levee or banking.

An evacuation order was issued in all study areas. The transmission ratio of the order, however, differed greatly. The ratio was lowest in Mito City and the number of respondents who received the evacuation order was 42 (31 %). The evacuation order was issued at 3:00 on the 5th and was announced by sound cars. Although the river waters began to invade the residential districts at about 7:00 and rescue activities were started at 11:00, only 14 respondents received the evacuation order before 11:00. The evacuation order was not transmitted effectively.

The number of respondents who received the evacuation order was 129 (57 %) in Motegi Town. The evacuation order was issued around midnight and was announced by sound cars. Also, local government officials and firemen (A fireman is responsible not only for fire fighting but also flood fighting in Japan) tried to transmit the order to each family on foot. However, because the maximum rain fall was recorded between 1:00 and 2:00 on the 5th, the announcement by sound cars did not reach residents and the rise in water level prevented transmitting the order on foot.

Table 1 Damage, refuge ratio and reasons for seeking or not seeking refuge

Item		Motegi T.	Mito C.	Akeno T.	Ishige T.
		Number (%)	Number (%)	Number (%)	Number (%)
Depth of flood waters	Flooded above the floor level	187 (82)	118 (87)	66 (48)	6 (6)
	Flooded under the floor level	11 (5)	15 (11)	29 (21)	63 (58)
	Not flooded	21 (9)	2 (1)	33 (24)	33 (30)
	No answer	9 (4)	1 (1)	9 (7)	6 (6)
	Number of respondents (A)	228 (100)	136 (100)	137 (100)	108 (100)
Refuge ratio	All or part of family evacuated (refuge-seeking family) (B) (B/A)	42 (18)	47 (35)	74 (54)	87 (81)
	All or part of family didn't evacuate (C) (C/A)	125 (55)	86 (63)	88 (64)	39 (36)
	Family which received the evacuation order (D) (D/A)	129 (57)	42 (31)	109 (80)	101 (94)
	Refuge-seeking family which received the evacuation order (E) (E/D)	32 (25)	19 (45)	71 (65)	80 (79)
Reasons for seeking or not seeking refuge	Life was in danger (F) (F/B)	31 (74)	34 (72)	18 (24)	24 (28)
	Received the evacuation order (G) (G/B)	9 (21)	5 (10)	39 (53)	59 (68)
	Stayed behind to see what would happen (H) (H/C)	39 (31)	39 (45)	42 (48)	24 (62)
	Thought it was safer to stay at home (I) (I/C)	85 (68)	50 (58)	41 (47)	18 (46)
	Should do something in a house (J) (J/C)	6 (5)	16 (19)	33 (38)	14 (36)

The transmission ratio of the evacuation order in Ishige Town reached 94 %, and was in striking contrast to those in Mito City and Motegi Town. Only one respondent answered "Not received". The evacuation order was issued at 8:30 on the 6th, the day after the heavy rain, because the water level of the Kokai River had risen precipitously, and the river banks were in danger of collapse. At about 10:00, one and a half hour after the evacuation order was announced, the bank gave way. At the same time, refuge sites were designated for residents. Also, as the flood waters raced downstream at about 1 km/h, the evacuation order was announced in the lower reach regions by sound cars. Accordingly, most of the respondents were able to receive the evacuation order.

The evacuation order was issued at 7:30 on the 5th in Akeno Town, because the banks of the Kokai River were in danger of collapse. After half an hour, the river waters began to overflow the bank. After the bank collapsed at 13:30, the flood waters surged not only downstream but also gradually upstream. Only 12.5 % of respondents who had received the evacuation order took refuge before they were surrounded by the flood waters.

If a refuge-seeking family is defined as a family in which all or some of its members took refuge, the refuge ratio was 18 % in Motegi Town, 35 % in Mito City, 54 % in Akeno Town and 81 % in Ishige Town. Much difference can be seen among the refuge ratios. The shorter the time lag between the beginning of the rain and inundation, the lower the refuge ratio was. Also, Motegi Town, which was struck at night, recorded the lowest refuge ratio.

Refuge-seeking reasons were obtained by multipul-choice questions. Many respondents selected two reasons; "Life was in danger" or "Received the evacuation order". The

former was selected more in Motegi Town and Mito City than in the other two towns, and *vice versa* for the latter. The transmission ratio of the evacuation order was lowest in Motegi Town and Mito City. People there took refuge to escape dangerous conditions after the river began to flood. On the other hand, the residents in Akeno and Ishige Towns took refuge not because they felt threaten but because they were obeying the evacuation order.

The number of families in which all the members did not take refuge was 125 (55 %) in Motegi Town, 86 (63 %) in Mito City, 88 (64 %) in Akeno Town and 39 (36 %) in Ishige Town. The reasons why they did not take refuge were determined by multipul-choice questions. Two reasons in common with the four study areas were: "Stayed behind to see what would happen" and "Thought it was safer to stay at home". These two answers are considered to arise from a normalcy bias. The answer "Ought to do something in the house" was given more frequently in Akeno and Ishige Towns. It shows that the residents in these two towns could cope with the flood.

4. Discriminant Analysis on Refuge-Seeking Behavior

Extraction of independent variables

The refuge ratio was highest in Ishige Town and lowest in Motegi Town. The difference in the ratio reflects the features of the flood in each study area. Using refuge-seeking behavior (whether all or a part of a family took refuge or not) as the dependent variable and the quections as the independent variables, discriminant analysis was carried out in order to discuss other factors concerned with refuge-seeking behavior.

The questions which might be concerned with refuge-seeking behavior were selected from 54 questions used in the questionnaire survey. Chi-square tests were carried out

Table 2 Items concerned with refuge-seeking behavior

Group	Item	Significance level of χ^2 test result
I	1 Depth of flood waters	0.001
	2 Amount of mud seepage in a house	0.013
II	3 Receipt of heavy rain and flood warning	0.010
	4 Degree of uneasiness after receipt of warning	0.007
	5 Validity of warning	0.001
	6 Receipt of the evacuation order	0.001
III	7 Prior experience of flood disaster	0.003
	8 Validity of prior experience of flood disaster	0.004
	9 Place of the previous residence	0.019
IV	10 Training for flood fighting in community	0.002
	11 Participation in training for flood fighting	0.001
	12 Activities of public organization	0.031
	13 Cooperation of residents	0.001
	14 Cooperation of a respondent	0.001
V	15 Structure of a house	0.001
	16 Number of stories in a house	0.001

between the answers of each question and the refuge-seeking behavior. All answers taken from the four study areas were treated in the lump. A level of significance of 0.05 was required to reject the questions. As a result, 16 questions were regarded as significant. The items in Table 2 indicate the import of the questions, which can be classified into five independent groups: (I) the degree of damage, (II) heavy rain and flood warning, (III) prior flood disaster experience, (IV) flood fighting; and (V) the attributes of a respondent or his family.

In order to examine whether the items contained in the same group are independent of each other or not, chi-square tests were carried out again between the items in each group. If a high significance level ($P < 0.05$) was shown between two items, the item which had the higher significance level between refuge-seeking behavior was adopted. If a high significance level was not obtained, both items were adopted. But in the case of the group V, the structure of a house was rejected, because 79 % of respondents lived in a wooden house.

As a result, "the depth of flood waters" from the group I, "a degree of uneasiness felt after receipt of warning" and "receipt of the evacuation order" from the group II, "prior experience of flood disaster" from the group III, "participation in training for flood fighting" from the group IV and "the number of stories of a house" from the group V were adopted as the independent variables.

On the other hand, some questions did not show a high significance level, though they were thought to be concerned with refuge-seeking behavior. They are "How many years have passed since your last move?", "How old is your house?", "How old are you?", "Are you male or female?", "How many members are in your family?", "How is home ownership?", "Is there a member of a disaster fighting organization in your family?", "Have you ever felt anxiety about flooding in your dwelling place?", "Did all family members stay at home when the flood struck?" and so on.

Result of discriminant analysis

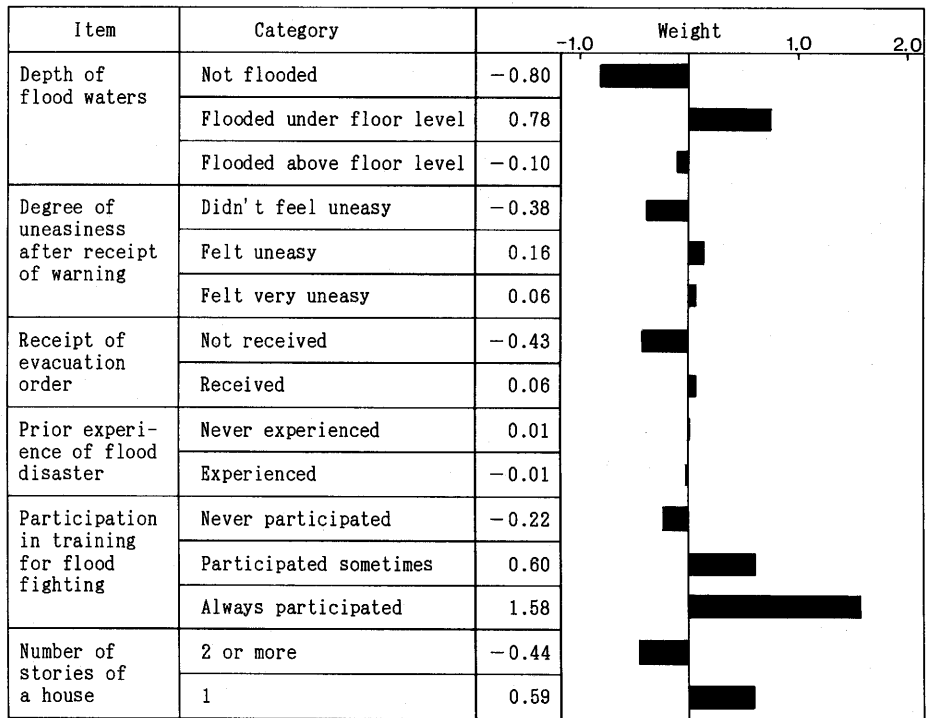
The number of samples which answered all six questions was 183; 57 from Motegi Town, 25 from Mito City, 57 from Akeno Town and 44 from Ishige Town (Table 3). The result of discriminant analysis about refuge-seeking behavior was shown on Fig. 2. The items indicate the import of questions. The categories indicate the answers.

Three items are more significant for refuge-seeking behavior. They are "the depth of flood waters", "participation in training for flood fighting" and "the number of stories in a house". The reason why the depth of flood waters and the number of stories in a house showed larger range, may be explained that people did not evacuate unless they had not got into danger. Especially, the weight of "two or more stories" of -0.44 meant that people would evacuate to the second story at the last moment. The minus weight of "flooded above the floor level" might have resulted from the fact that many in Motegi Town could not take refuge and those in other study areas evacuated to the second story.

The largest range of "participation in training for flood fighting" shows that people who were more concerned with flood disaster took refuge. However, the respondents who answered "Always participated in flood fighting training" were probably a member of an organization for flood fighting, and they did not evacuate but saw to the evacuation

Table 3 Number of the data used for discriminant analysis

Study area	Number	All or part of family evacuated (%)	None of family evacuated (%)
Motegi T.	57	16 (28)	41 (72)
Mito C.	25	8 (32)	17 (68)
Akeno T.	57	40 (70)	17 (30)
Ishige T.	44	37 (84)	7 (16)
Total	183	101 (55)	82 (45)

**Fig. 2** Result of discriminant analysis

of others.

As for the evacuation order, it may be said that people did not evacuate only because the evacuation order was issued. However, people who did not receive the evacuation order were less likely to take refuge. The item of "a degree of uneasiness felt after receipt of warning" shows that the respondents who answered "Did not feel uneasy" did not evacuate.

It was conspicuous that "prior experience of flood disaster" contributed little to refuge-seeking behavior. This went with the results obtained by an interview with the residents. Many people replied "Because this flood was the worst in my life, my past experience was not a useful countermeasure". Judging from their past experience, they made light of the flood.

5. Brief Review of Existing Articles on Refuge-Seeking Behavior

It is necessary to review several existing articles in order to examine the results obtained in the previous chapters and to generalize the characteristics of refuge-seeking behavior.

Yamaguchi and Nakamura (1975) carried out interview in the Tomoe River Basin, Shizuoka Prefecture which was damaged by heavy rains in 1974. They clarified two attributes of people who did not evacuate but stayed in their houses. One is that most of them were living in a two-storied house and took refuge on the second floor. The other is that receipt of the evacuation order did not increase the evacuation ratio. Also, Yamaguchi and Nakamura (1976) researched the behavior of people whose houses were flooded above the floor level. They pointed out that the evacuation ratio was heavily affected by the number of stories of a house and that there were two reasons why people did not evacuate. One is that they thought it safer to stay in the house. The other is that they were living in a two-storied house. These two reasons accounted for 87 % of those who did not take refuge.

Fujiwara and Tenma (1981) researched the flood disaster of 1972 in the Miyoshi Basin, Hiroshima Prefecture. The results concerned with human behavior were as follows:

(1) The more the people had experienced flood disasters, the less likely they were to take refuge; that is, in the case of a severer flood disaster than the severest in the past, prior flood experience prevented people from evacuating;

(2) There were great differences in flood fighting ideas between people who lived in newly developed residential areas and those who lived in old villages; flood fighting was carried out and more than one half of affected families took refuge before the evacuation order was issued in the latter;

(3) The evacuation order was more effective if it was issued following the evacuation preparation order.

Refuge-seeking behavior from the flood caused by the Kokai River in Ibaraki Prefecture, 1981 was surveyed by Kumagaya and Kobayashi (1982). In this case, people had enough time to take refuge. The survey clarified that (1) the depth of flood waters and the number of years since the last move contributed to selection of refuge-seeking behavior, (2) while the depth of flood waters was low, new residents were likely to evacuate, but not old residents, (3) receipt of the evacuation order did not contribute to an increase in the refuge ratio, and (4) experience of a flood disaster and the existence of an aged person or an infant were not important factors for refuge-seeking. Based on these results, Kumagaya and Kobayashi concluded that the last decision for taking refuge was made by comparing the present events with the past experience.

After the Nagasaki Heavy Rain Disaster of 1982, some research on refuge-seeking behavior were carried out independently. Imamoto *et al.* (1983) conducted a questionnaire survey in Nagasaki and Isahaya Cities. Some of their results are as follows:

(1) Experience of a disaster did not contribute to the independent evacuation in the inundated areas, but was effective in the areas struck by a mud-flow;

(2) In the areas struck by a mud-flow in Nagasaki City, most refugees evacuated under

the heavy rain on the basis of their own decision;

(3) On the other hand, in Isahaya City where the transmission ratio of the evacuation order was higher than that in Nagasaki City, many refugees followed the evacuation order. Imamoto *et al.* (1984) stated that although the evacuation order did not prompt people to take refuge, the evacuation ratio of those who received the order was higher than that of others.

Nagahashi (1984) carried out a questionnaire survey for the whole of Nagasaki City and extracted two main reasons for taking refuge. "The rain became heavier" was the reason that prompted refuge-seeking in the early stage of the flood disaster; and "Water and mud poured into the house" prompted those in the later. The other is that a house had only one story.

Many important results were obtained with a questionnaire survey conducted by the Research Group for Disaster and Information, Tokyo University (1984). Some of these results are as follows:

(1) "Didn't feel it dangerous to stay in the house" and "Taking refuge was more dangerous" were main two reasons of not seeking refuge;

(2) People were likely to think that when the depth of flood waters was shallow, taking refuge was rather dangerous, and that when it became deeper, staying in the house was safer; As a result, people were not likely to evacuate;

(3) Such the demographic characteristics as age and sex did not contribute to refuge-seeking behavior;

(4) Reasons for taking refuge were "The circumstances became more dangerous" and "The depth of flood waters became deeper";

(5) Only 7.4 % of the respondents received the evacuation order, and among them, 27.3 % took refuge; But 53.8 % of the respondents who received the evacuation order before 20:30 took refuge; People who received the evacuation order after 20:30 could not take refuge because circumstances had become too dangerous to do so; Accordingly, it is necessary to issue evacuation orders in the early stage.

Matsuda *et al.* (1985) surveyed the behavior of people whose houses were totally collapsed at the time of this disaster. They pointed out that people did not take refuge in the early stage of the heavy rain, but evacuated to escape from dangerous circumstances.

Misumi Town, Shimane Prefecture was struck by a torrential rain in 1983. The town headman proclaimed a state of emergency. Yamada (1988) carried out a questionnaire survey in this town. Although 82 % of the respondents received the proclamation and 60 % of them took refuge, most of the refugees were not prompted to take refuge by the proclamation. "Judged independently from the depth of flood waters or a state of a slope near the house" occupied 46 % of refuge-seeking reasons. Also, "Suffered damage from flood waters or a mud-flow" occupied 30 %. Only 12 % of the respondents followed the proclamation and took refuge. On the other hand, there was a district where all residents evacuated and 53 % of them answered that the proclamation prompted them to take refuge. In this case, it had been certain that this district would be damaged by flood waters from the Misumi River and a place of refuge had been designated.

6. Concluding Remarks

Refuge-seeking behavior has been discussed from three different aspects: the actual conditions, contributory factors for taking refuge and the general characteristics of refuge-seeking behavior. As for the former two points, the refuge-seeking behavior of those in the four regions struck by Typhoon Number 10 in 1986 was investigated. To answer the third aspect, several articles were reviewed. Some of the results are as follows:

(1) The degree of damage relates closely to refuge-seeking behavior, because it is generally understood that refuge is not sought as a preventive action before circumstances become dangerous, but as a means of escape from dangerous conditions. The refuge-seeking behavior observed in Motegi Town and Mito City is a case in point.

(2) People are not likely to respond to warning for a heavy rain or flood. Their behavior is prompted by dangerous conditions. Also, a normalcy bias restrains people from taking refuge.

(3) The effectiveness of an evacuation order depends on when it is issued. In the case of serious disaster, an evacuation order is likely to be too late for taking refuge. However, if an evacuation order is issued before the circumstances become too dangerous for taking refuge and if a place of shelter has been designated, people are likely to obey the evacuation order. In this study, Ishige Town was an example.

(4) If a flood is heavier than the heaviest in the past, previous flood disaster experience disturbs refuge-seeking. Matsuda (1987) pointed out in another report that there were many sufferers who misjudged what would happen. New residents, however, are likely to evacuate earlier.

(5) In general, the refuge ratio is higher in a district where a disaster fighting organization exists.

(6) People living in a two-storied house hesitate to take refuge.

(7) Such demographic factors as age and sex are not relative to refuge-seeking behavior.

Although evacuation was more necessary in Motegi Town and Mito City, the refuge ratio was lower. On the contrary, the refuge ratio was higher in Akeno and Ishige Towns where evacuation was less necessary. An evacuation order should be issued precisely and members of a disaster fighting organization must lead people to a designated place of refuge.

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References Cited

- Fujiwara, K. and Tenma, T.(1981): Inhabitant's behaviour in the flood of 1972, the Miyoshi River Basin, Western Japan. *Geogr. Sci. (Chiri Kagaku)*, **35**, 1-12.**
- Imamoto, H., Ishigaki, T. and Ohtoshi, K.(1983): Refuge of people in Nagasaki Flood Disaster in July 1982. *Disas. Preven. Res. Inst. Ann.*, no. 26B-1, 127-138.**
- , ——— and ——— (1984): Influence factors on refuge of people in the Nagasaki Flood Disaster in July 1982. *Jour. Japan Soc. Nat. Disas. Sci.*, **3**(1), 22-33.**
- Kumagaya, Y. and Kobayashi, A.(1982): Analysis of refuge behavior in disaster. *City Plan. Rev., Suppl. 17*, 541-546.*
- Matsuda, I. (1987): Some characteristics of flood disasters caused by the Typhoon 10th, 1986. *Comprehensive Urban Studies*, no. 30, 51-74.**
- , Hanai, T. and Mochizuki, T.(1985): Damage and behavior of residents during the Nagasaki Heavy Rain of July 23, 1982. *Jour. Geogr. (Chigaku Zasshi)*, **94**, 45-53.*
- Nagahashi, S.(1984): 1982nen 7gatsu 23nichi Nagasaki Gousaigai ni okeru jumin hisai no jittai chosa (A fact-finding research on sufferers due to the Nagasaki Heavy Rain Disaster of July 23, 1982). *Dai21kai shizen saigai kagaku sogo shinpojium koen yoshi shu (Proc. 21th Symp. Nat. Disas. Sci.)*, 515-518.*
- Research Group for Disaster and Information, Tokyo University (1984): *1982nen 7gatsu Nagasaki Suigai ni okeru Jumin no Taio (Measures of Residents in the Nagasaki Flood Disaster in July, 1982)*. 187p.*
- Yamada, K.(1988): Measures of Misumi-cho, Shimane Prefecture and refuge operations of the inhabitants, hard hit by downpour in July 1983. *Water Sci.*, **32**(5), 48-76.*
- Yamaguchi, T. and Nakamura, E.(1976): Shimizu-Shizuoka-chiku 49·7·7 gousaigaiji no kanmin no taio no jittai (Fact of measures taken by the local governments and people during the heavy rain disaster of 1974 in the Shizuoka and Shimizu region). *Dai12kai shizen saigai kagaku sogo shinpojiumu koen ronbun shu (Proc. 12th Symp. Nat. Disas. Sci.)*, 177-178.*
- and ——— (1976): Kozui saigai no yokeiho to hinan taisaku: Shizuokaken Tomoegawa gou saigai no baai (Warning for flood disaster and refuge measures: in the case of the flood disaster in the Tomoe River Basin, Shizuoka Prefecture). *Dai13kai shizen saigai kagaku sogo shinpojium koen ronbun shu (Proc. 13th Symp. Nat. Disas. Sci.)*, 19-20.*

(*: in Japanese, **: in Japanese with English abstract)