

Typhoon Borne Heavy Rain and the First “Emergency Warning”: How Urgent Information Was Relayed¹

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FUKUNAGA Hidehiko
Media Research & Studies

MASAKI Miki
KONO Kei
Public Opinion Research

NHK Broadcasting Culture Research Institute

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http://www.nhk.or.jp/bunken/summary/research/report/2014_01/20140101.pdf

Abstract

On September 16, 2013, due to heavy rain caused by Typhoon Man-yi (known in Japan as Typhoon No. 18), the Japan Meteorological Agency (JMA) issued for the first time a Heavy Rain Emergency Warning to the three prefectures of Shiga, Kyoto, and Fukui (62 municipalities). This study shows how JMA issued this first emergency warning, how it was relayed by the broadcasting media and local municipalities, and when and by what means residents learned of the warning and how they responded. The results of our study for this purpose are as follows:

■ Given that both the 48-hour precipitation and soil water index had exceeded a level of intensity observed only once in five decades in more than 50 cells of the 5 km x 5 km grid rainfall map for Shiga, Kyoto, and Fukui prefectures, and judging in addition that the heavy rain was likely to continue, the JMA issued a Heavy Rain Emergency Warning in these prefectures.

■ Immediately after the JMA issuing of the Emergency Warning, NHK broadcast it using News Flash subtitles accompanied by a chime alert, on local and nationwide television. On radio, NHK interrupted regular programming and broadcast the news flash at the local and nationwide levels. The text of the first announcement was written to communicate a sense of urgency using definitive forms of expression that would leave no doubt as to the seriousness of the situation. It also repeated, in easy-to-understand language, the meaning of the Emergency Warning and the necessary actions to be taken.

■ The cities of Kyoto and Fukuchiyama, where the rivers were threatening to overflow their banks, received the Emergency Warning amid their efforts to address the increasingly dangerous situation. They immediately relayed it to residents making full use of available information communication channels, such as emailing to portable telephones. Fukuchiyama, which had been preparing to announce an Evacuation Order to the entire area of the city, promptly added an Emergency Warning text to the Evacuation Order notification.

■ The Heavy Rain Emergency Warning reached most residents, but a large number of the elderly did not learn of the issuing of the warning and learned about it only later. Dissemination of the warning among the elderly, who are less mobile and need more time to evacuate, was inadequate. The seriousness of the situation was transmitted to residents to a certain extent, but not many took action to avert danger. People learned about the Emergency Warning mainly by television and email—more often by email within one hour following its issuing and more often by television after one hour.

The Japan Meteorological Agency (JMA) launched the Emergency Warning system on August 30, 2013. An Emergency Warning is issued when the JMA expects a natural phenomenon of a far greater magnitude than the level at which it issues a regular Warning.² It is intended to alert the public that they are in an emergency situation of extraordinary proportions.

The JMA established the Emergency Warning system because, at the time of Typhoon Talas (No. 12), which caused a serious heavy rain disaster on the Kii peninsula in 2011, and also at the time of the Great East Japan Earthquake and Tsunami in the same year, the JMA had failed to convey fully to the public the urgency of the danger of a major disaster and had not necessarily been able to persuade them to evacuate.

In the case of Typhoon Talas, the typhoon was not only large in scale but was moving slowly. Even after a Heavy Rain Warning and a Sediment Disaster Alert were issued, the rain

² For detailed information on Emergency Warning, see JMA site:
http://www.jma.go.jp/jma/en/Emergency_Warning/ew_index.html

kept on falling heavily in many areas. The total amount of rainfall since the rain had started was more than 1,000 millimeters over a broad area centering on the Kii peninsula. Total rainfall in some places reached more than 2,000 millimeters according to analysis of precipitation data from radar and on-the-ground gauges. Within only a few days such areas had half the amount of precipitation they usually receive in a year.³ That was a record heavy rain such as they “had never experienced before” and the danger of a major disaster was considerable. The JMA repeatedly warned local people to be on high alert against the continuous heavy rain, but its warning did not carry a strong enough message in clear enough language to convey the fact that the situation posed a higher level of emergency than a regular “Warning.” On later days, one municipality after another complained that simply “giving figures of rainfall alone is not enough to communicate the level of emergency that people face.”⁴

The Emergency Warning (Tokubetsu Keiho) is a designation newly established by the JMA for six types of natural events: heavy rains, storms, high tides, high waves, heavy snow, and blizzards. When the JMA predicts that a meteorological phenomenon with a level of intensity observed only once every several decades will occur in a specific area, an Emergency Warning is issued to municipalities in that area. Since this new warning designation is based on the possibility of a large-scale disaster that may cause damage over a broad area, often at the prefectural level,⁵ the warning is issued to a number of municipalities.

Several existing warning designations—Major Tsunami Warning, Volcanic Warning (residential area), and Earthquake Early Warning (Japan’s seven-stage seismic scale 6-lower or higher)—were made equivalent to Emergency Warnings.

To ensure the timely transmission of an Emergency Warning to the public, the Meteorological Service Act was amended to require that prefectures notify the relevant municipalities of the warning and that the municipalities take necessary measures to make it known to their residents and others.⁶

The adoption of the Emergency Warning system does not mean that the criteria for issuing existing Warning designations have been lowered. Local downpours occurring in very limited areas that are outside the scope of the requirements for issuing an Emergency Warning can cause serious damage. A situation that must be avoided by all means is one in which people make light of a Warning, thinking “We are sure to be safe because it’s not an Emergency Warning.” The JMA, municipal authorities, and the mass media need to assure that the public and their audiences fully understand the meaning of the Emergency Warning.

On September 13, 2013, about two weeks after the launch of the Emergency Warning system, Typhoon Man-yi formed near the Ogasawara (Bonin) Islands.⁷ It traveled northward

³ Japan Meteorological Agency, “Taifu 12-go ni yoru oame” [Heavy Rain by Typhoon Talas], report published in September 2011.

⁴ NHK Newsweb, News *tokusetsu* column “‘Tokubetsu keiho’ to wa” (What Is “Emergency Warning”): <http://www3.nhk.or.jp/news/0830keiho/>

⁵ JMA’s “Weather forecast regions by prefecture” consists of each prefecture as unit of forecast region except for Hokkaido, which is divided into seven regions, and Okinawa, which is divided into four.

⁶ According to the amended Meteorological Service Act, the prefectural notification to municipalities and the municipalities taking measures to make it known to residents are “obligations to make efforts” (*doryoku gimu*) in the case of a Warning while in the case of an Emergency Warning they are “obligations” (*gimu*) given the seriousness of the situation.

⁷ Typhoon Man-yi landed near the city of Toyohashi, Aichi prefecture a little before 8:00 a.m. on September 16 and moved northeast at an increasing speed from the Tokai region through the Kanto (Tokyo, etc.), Koshin (Yamanashi and Nagano prefectures), and Tohoku region until it subsided, transforming into an extratropical cyclone in eastern Hokkaido at 9:00 p.m. on the same day. According to the estimated JMA figures, as of 5:00 a.m., immediately before the issuance of Emergency Warning, the typhoon was located some 210 kilometers southwest of the city of

over the ocean south of Japan and, by 9:00 a.m. on the 14th, had developed to a large-scale typhoon with a strong wind area (velocity of 15 meters per second) covering a radius of more than 500 kilometers. The typhoon continued growing in force and by 6:00 p.m. on the 15th it had generated a storm area with a wind velocity of more than 25 meters per second.

As the typhoon drew near land, the total amount of rainfall on the 15th and into the 16th exceeded 400 millimeters in various parts of the Kinki (Osaka, Kyoto, etc.) and Tokai regions. Kyoto, Shiga, and Fukui prefectures had not had such heavy rain in several decades.

At 5:05 a.m. on the 16th, judging that the risk of a serious disaster occurring was extremely high, the JMA issued the Emergency Warning (heavy rain) for the first time to 62 municipalities in these three prefectures. It warned the local people to be on the highest alert, urging them to “act immediately to protect your lives” / *Tadachini inochi o mamoru kodo o totte kudasai*.

How did the JMA announce its first Emergency Warning? What did the municipalities do in response and how did the broadcast media convey the warning to their audiences? And, when and how did the residents learn that the Emergency Warning had been issued and how did they react? Did the seriousness of the situation get across to them? What are the important tasks that need to be tackled in transmitting such emergency information? The purpose of this study is to address these questions. Of these questions, the question about residents’ reactions to the Emergency Warning was studied through a telephone survey performed with a sample of 2,979 persons in the three prefectures where the Heavy Rain Emergency Warning had been issued. Sections I through IV below are written by FUKUNAGA Hidehiko and Section V by MASAKI Miki and KONO Kei.

I. WHAT IS THE HEAVY RAIN EMERGENCY WARNING?

A Heavy Rain Emergency Warning is issued when the possibility is considerably high that inundation or landslides may occur due to heavy rain. “Inundation” refers to “internal flooding,” i.e., inundation of houses due to the overflow of street drains and sewerage systems when heavy rains overwhelm the capacity of drainage systems. The Heavy Rain Emergency Warnings apply in the case of predictable hazards like landslides (mudslides) and inundation of homes. On the other hand, the Heavy Rain Emergency Warnings are not issued regarding the flooding of rivers caused by heavy rains—known as “external flooding.” Such outside water flooding is covered by “designated-river flood warnings” (issued jointly by a local meteorological office, its regional headquarters (a so-called “regional center”), and either a prefectural government or the Ministry of Land, Infrastructure, Transport and Tourism) or by a “flood advisory” or “flood warnings” issued by local meteorological offices for unspecified rivers.

What conditions must be met for the issuing of a Heavy Rain Emergency Warning? According to the JMA, the Emergency Warning is issued when “heavy rainfall with a level of intensity observed only once every several decades is predicted in association with a typhoon or similar event, or when heavy rainfall is predicted in association with a typhoon expected to have

Omaezaki, Shizuoka prefecture and was traveling northeast at a speed of 35 kilometers per hour, its central pressure 970 hPa, maximum sustained wind speed 30 meters near the center of the typhoon, maximum gust wind speed 45 meters; a storm with a wind velocity of 25 meters per second or more within a 90-kilometer radius from the center. As of October 18, according to a Cabinet Office survey of the damage from Typhoon Man-yi, 3 persons died, 5 were missing, more than 800 houses were partially or completely destroyed, and more than 5,000 houses were inundated by flood water.

a level of intensity observed only once every several decades or an extratropical cyclone with comparable intensity.”⁸

What is “heavy rainfall with a level of intensity observed only once every several decades”? What is “a typhoon expected to have a level of intensity observed only once every several decades”? The JMA identified conditions for creating criteria for judging whether to issue a Heavy Rain Emergency Warning. There are three criteria and a Heavy Rain Emergency Warning is issued when one of them is met.

(1) Long, Hard Rain

When 50 or more of the 5 km. x 5 km. cells of the rainfall map’s grid register 48-hour precipitation and soil water indices exceeding the level occurring once every five decades *and* when the rain is predicted to continue falling heavily.

(2) Short, Hard Rain

When in a broad, prefecture-wide area there are 10 or more 5 km. x 5 km. cells of the rainfall map’s grid that register both 3-hour precipitation and soil water indices exceeding the levels occurring once every five decades *and* when the rain is predicted to continue falling heavily. “Ten or more cells” of the grid here indicates that the 3-hour precipitation will be 150 millimeters or more for each cell.

(3) Typhoon- or Extratropical Cyclone-caused Heavy Rain

In the case of a massive typhoon—of the scale of Typhoon Vera (September 1959; known in Japan as the Ise Bay Typhoon)—with a central pressure of 930 hPa (hectopascal) or less, or a maximum wind speed of 50 meters per second or more, or an extratropical cyclone of a similar scale. For the Okinawa and Amami regions and the Ogasawara Islands, however, the case would be one when the central pressure is 910 hPa or lower, or when the maximum wind speed is 60 meters per second or more. The areas to which the Emergency Warning will be issued are, in the case of a typhoon, along the path of the typhoon’s approach maintaining the abovementioned central pressure and maximum wind speed. In the case of an extratropical cyclone, those areas where either the abovementioned maximum wind speed or a wind velocity of a similar scale is predicted.

The once-in-five-decades level reference point used for the precipitation and soil water indices in (1) and (2) is statistical estimates obtained by using data from observations made for 20 years from 1991 to 2010. In other words, a once-in-five-decades estimate is input for each cell beforehand and predictions made whether the predicted figure will be exceeded. To issue a Heavy Rain Emergency Warning there have to be a certain number of cells with such figures exceeding the estimate extent over a broad, prefecture-wide area.

The issuing of a Heavy Rain Emergency Warning is based on criteria assuming a situation in which the risk of a large-scale disaster striking in a relatively broad area is extremely high. It is not intended for warning against very localized downpours likely to cause disaster in small,

⁸ See [http://www.jma.go.jp/jma/en/EmergencyWarning/Relationships between criteria and indices.pdf](http://www.jma.go.jp/jma/en/EmergencyWarning/Relationships%20between%20criteria%20and%20indices.pdf) search='JMA heavy rain emergency warning criteria'

limited areas. The unit of area for the issuance of a Heavy Rain Emergency Warning, therefore, as in the case of issuance of a Heavy Rain Warning, is the municipality (city, town, or village) but is actually issued to a number of municipalities in a broad, prefecture-wide area.

At the time of writing this article, on October 16, 2013 a major disaster took place on the island of Izu Oshima, where intense rainfall, amounting to 334 millimeters within three hours by 5:00 a.m. due to the approaching Typhoon Wipha, caused a massive debris-avalanche that left 35 people dead and 4 missing.⁹ The island has nine rainfall map grid cells for 3-hour precipitation, and the estimated level observed once in five decades is an average of 147 millimeters. The 3-hour rainfall observed by the AMeDAS (Automated Meteorological Data Acquisition) system exceeded that amount in all the nine cells, but the JMA did not issue a Heavy Rain Emergency Warning, saying that the condition that heavy rain would continue falling in a broad, prefecture-wide area had not been met. (Izu Oshima Island, 120 kilometers away from the mainland Tokyo, is under the administration of Tokyo prefecture.) Even without a Heavy Rain Emergency Warning, there is still a good possibility that a major disaster may strike if a Heavy Rain Warning and a Sediment-related Hazard Warning are issued, as is the case with Izu Oshima Island.

The decision has to be quickly made as to whether or not one of the criteria (1) to (3) is met and an Emergency Warning needs to be issued as early as possible, before a major disaster occurs. In the case of a fierce typhoon with a force similar to that of Typhoon Vera (1959)—criterion (3)—a prediction of where the typhoon will be heading makes it possible to issue a Heavy Rain Emergency Warning to a specific area before it gets too close. In the case of (2), however, in which more heavy rain than expected falls within a short period of time, a Heavy Rain Emergency Warning is issued either when the risk of a large-scale disaster is imminent or after the disaster has struck. In criterion (1), the time from the issuance of a Heavy Rain Emergency Warning to the occurrence of a disaster may not be so short as in (2), but the situation is expected to be very serious and pressing at the time when it is issued.

The JMA, therefore, considers it crucial that, in places where a Heavy Rain Emergency Warning is issued, people will act immediately to protect their lives by following information from their city, town, or village office and either escaping to an evacuation center or, if it is dangerous to go outside, moving to a safer place in their house.

A Heavy Rain Emergency Warning is as a rule issued to municipalities in which a Heavy Rain Warning has already been issued. Basically, an Advisory, one level below the Warning, is not suddenly upgraded to a Heavy Rain Emergency Warning. It may happen, however, that an Advisory is upgraded to a Heavy Rain Emergency Warning when it is about to be changed to a Warning.

It is the JMA local meteorological offices that issue the Heavy Rain Emergency Warning. They do so in coordination with and under the supervision of the JMA Headquarters and its regional headquarters (so-called “regional centers”). When a forecaster on duty at a local meteorological office enters a Heavy Rain Emergency Warning into the information terminal, the warning will be relayed via communication channels to municipal governments and other disaster prevention organizations as well as the mass media.

⁹ Survey by Tokyo Metropolitan Government Office as of 3:30 p.m., November 8, 2013.

II. HOW THE FIRST EMERGENCY WARNING WAS ISSUED

This section discusses the process leading up to the JMA's first issuing of a Heavy Rain Emergency Warning.

1. JMA Press Conference (Evening, September 14)

On September 14, 2013, the day following the formation of Typhoon Man-yi, a special press conference was held at the JMA Headquarters in Otemachi, central Tokyo, beginning before 5:00 p.m. The chief forecaster explained the characteristics of Typhoon Man-yi, the prospects for wind and rain, and so forth. Around that time (as of 6:00 p.m. on the 14th), the typhoon was located over far-away waters south of the Japanese archipelago, moving northwest at a speed of 25 kilometers per hour, its central pressure 985 hPa, a maximum wind speed of 25 meters per second near the center of the typhoon. The strong-wind zone with a wind speed of 15 meters per second or more covered a wide area 650 kilometers northeast and 370 kilometers southwest from the center of the typhoon.

The chief forecaster said, "Starting on the 15th, before the typhoon gets closer to Japan, heavy rain is expected to hit Pacific coastal areas from Shikoku Island to the Tohoku region. From then into the 16th, the rainfall will most likely further increase." This comment was based on the prediction that from the 15th onward an autumnal rain front would move southward over the Sea of Japan, and the warm moist air around the typhoon would flow in over the Japanese archipelago in large quantities.

Asked by a reporter about the possibility of a Heavy Rain Emergency Warning being issued for the first time due to the severe rain to be brought by the approaching typhoon, the chief forecaster replied, "Yes, there is that possibility."

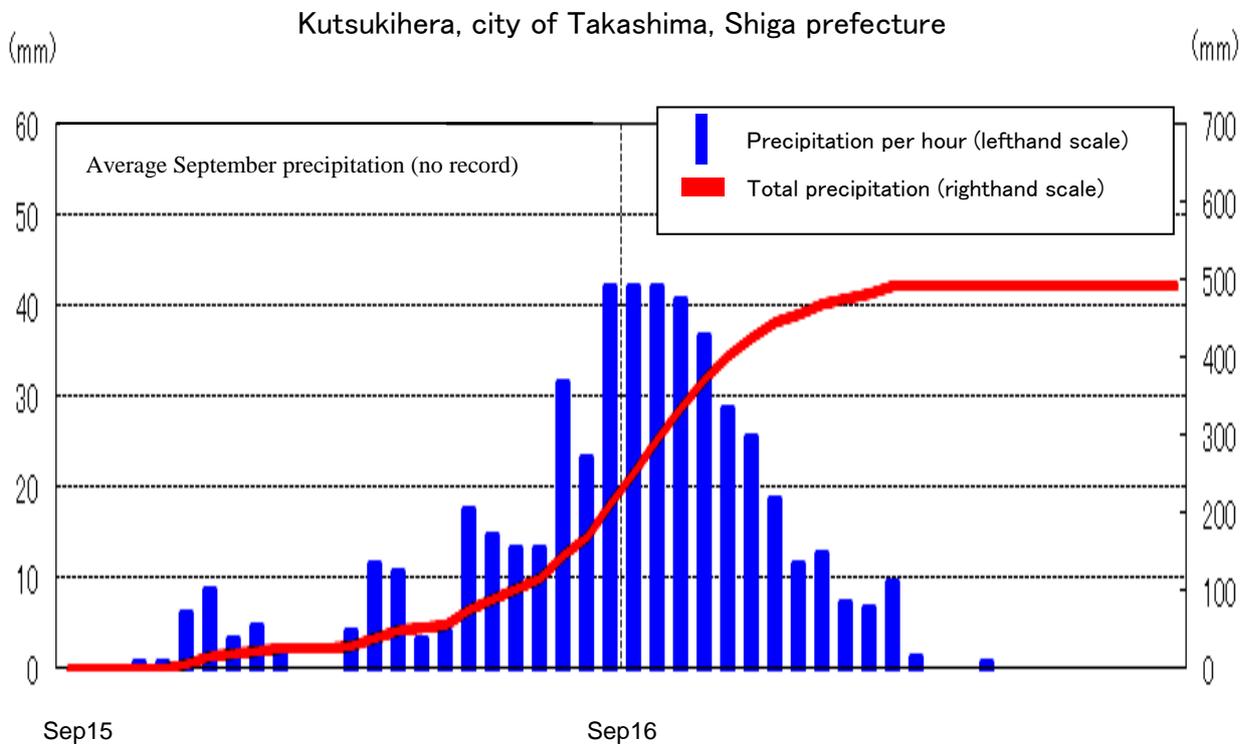
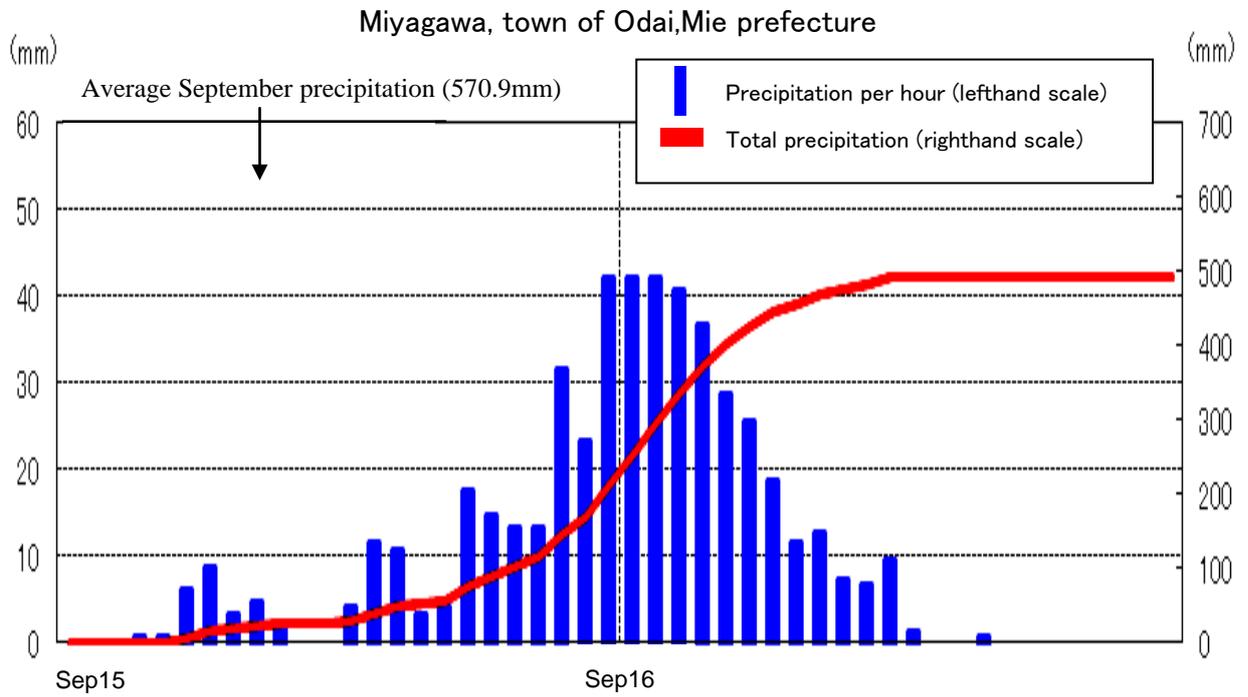
Given the typhoon's central pressure and maximum wind speed, it was highly unlikely that the criterion (3) for issuance of a Heavy Rain Emergency Warning might be fulfilled even if the typhoon grew in force. If Emergency Warning were issued, that would be in the case of (1) or (2), most likely (1). At that point of time the JMA itself was not certain as to what areas it would issue a Heavy Rain Emergency Warning to if it turned out to do so.

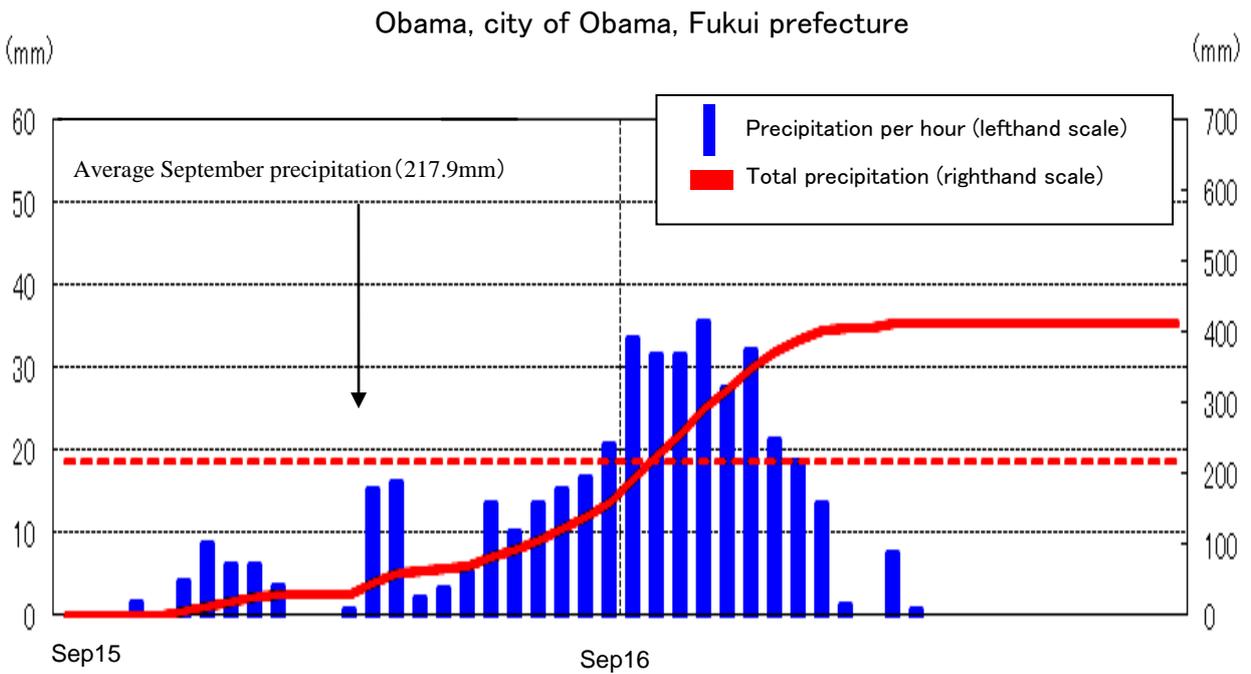
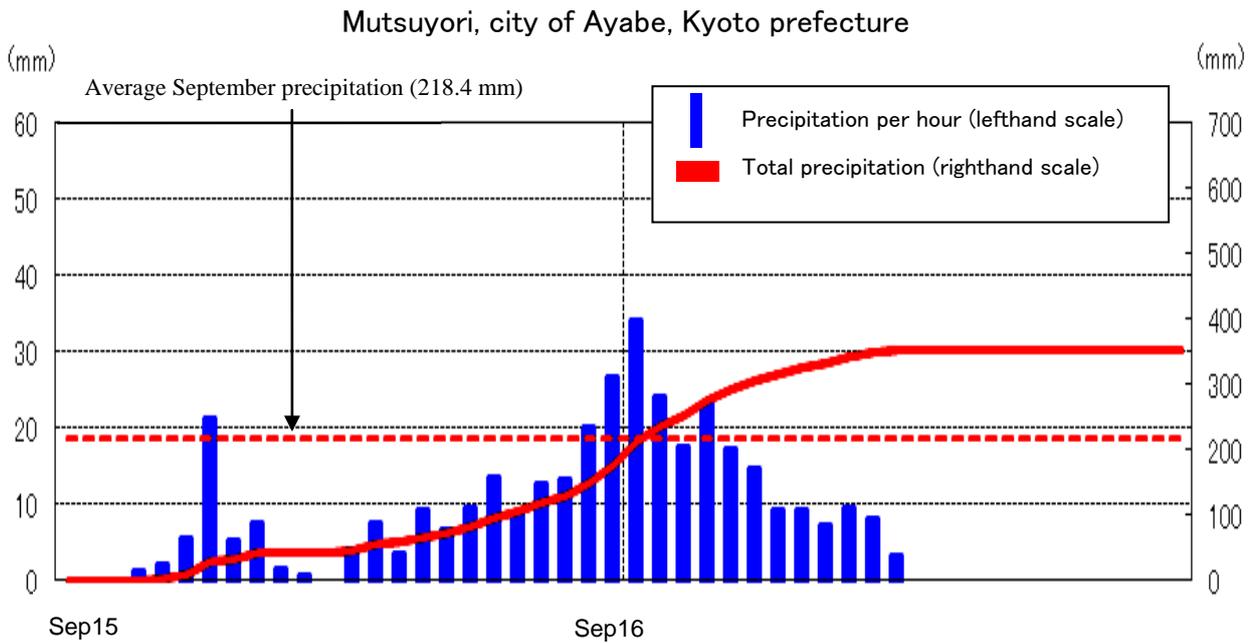
2. Chronological Fluctuations in Precipitation (on the 15th-16th)

According to the "Overall Information about the Typhoon" issued by the JMA at 6:00 a.m. on the 15th, even before the typhoon drew near, a large amount of warm moist air had flowed in over the Japanese archipelago and rain clouds had formed mainly over the Pacific coastal area. The JMA predicted that in some areas of the Kinki and Tokai regions total precipitation might reach as high as 600 millimeters by the morning of the 16th.

As predicted, heavy rainfall of more than 400 millimeters was recorded in many areas mainly in the Kinki and Tokai regions. The total amount of rainfall on the 15th-16th was 575.5 millimeters in Miyagawa, Mie prefecture, 542.5 millimeters in Kamikitayama, Nara prefecture, 494.5 millimeters in Kutsukihera, Shiga prefecture, 413.5 millimeters in Obama, Fukui prefecture, and so on. The Radar-AMeDAS precipitation analysis (i.e., the estimated amount of rainfall by radar is revised using AMeDAS data) shows that a massive downpour engulfed the city of Hamamatsu and two other places (approximately 110 millimeters per hour) and the city of Kyotango (Kyoto prefecture) and three other places (approximately 100 millimeters per hour). At 9:25 p.m. on the 15th, the JMA issued a Record Short-term Heavy Rain Information notice to Kyoto prefecture.

Figure 1. Chronological Change in Precipitation





*Source: Japan Meteorological Agency, "Taifu 18-go ni yoru oame"[Heavy Rain by Typhoon Man-yi],
September 18, 2013.

In Figure 1, amounts of rainfall recorded at four AMeDAS observation points on the 15th and 16th are shown chronologically by the hour. The horizontal axis represents the passage of time, the vertical axis on the left shows amount of rainfall per hour, and the vertical axis on the right shows the total rainfall.

The bar graph indicates hourly rainfall, the line graph cumulative amounts of rainfall since its commencement, and the dotted line the normal year's monthly rainfall for September.

Figure 1 shows that in all four areas the rain started falling hard in the evening of the 15th and peaked after midnight. In the cities of Ayabe and Obama, by around 2:00 a.m. on the 16th the cumulative amount of rain since it started had exceeded the normal year's September precipitation. When did the JMA enter into the decision process for issuing a Heavy Rain Emergency Warning?

3. Decision Process (at Dawn on the 16th)

Forecasters at the JMA Headquarters and its regional headquarters and local meteorological offices had kept monitoring the computer screens that showed the 48-hour precipitation, 3-hour precipitation, and soil water indices for the rainfall map cells. The map has some 14,000 cells for each of the three categories nationwide. The estimated rainfall with a level of intensity observed only once in five decades was entered into each cell beforehand, and when the actual amount of rainfall rose above that level, the color of the cell would change from white to red. The actual amounts of rainfall for 48-hour and 3-hour precipitation are computed by the Radar-AMeDAS precipitation analysis.

Just after 00:00 a.m. on the 16th, among some 1,000 cells in the Kinki region, one in Shiga prefecture turned red.

In the forecasting office in the Osaka Regional Headquarters, where forecasting officials on duty had been increased from the usual three to nine the previous day, they confirmed the decision process with the Hikone Local Meteorological Office in case of need as soon as the red cell appeared.

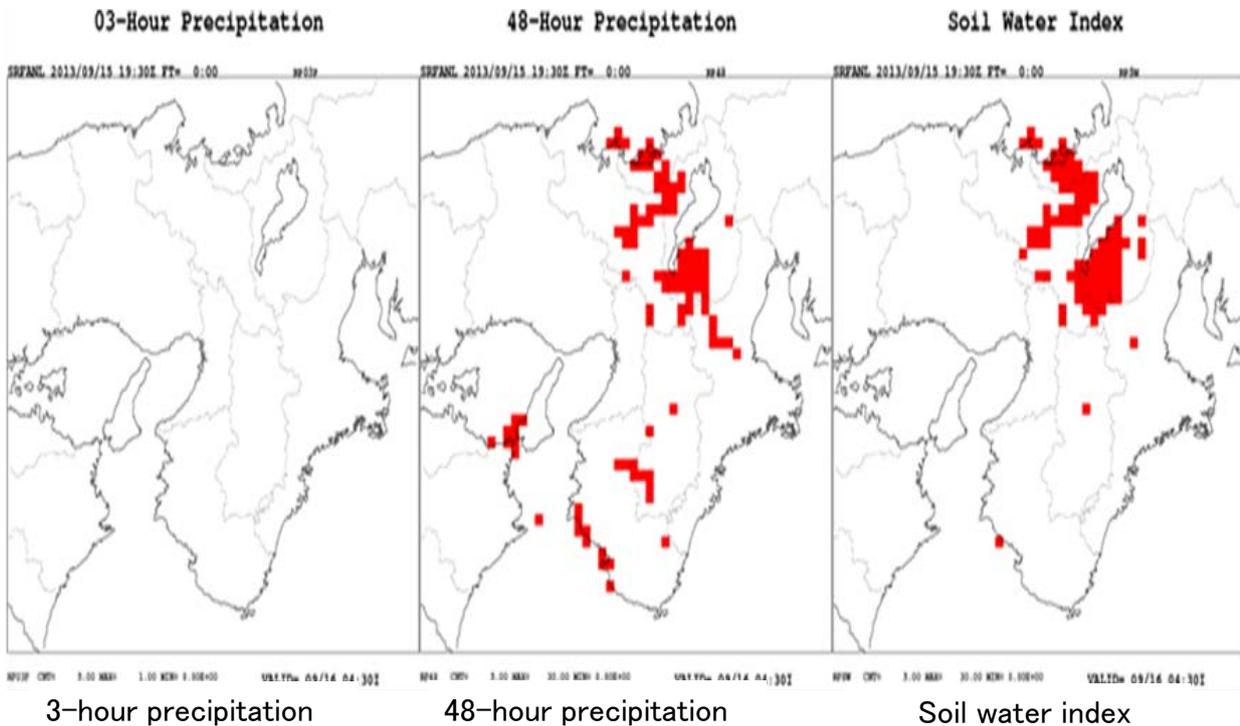
The cell computations were updated every thirty minutes. At around 4 o'clock in the morning the computer showed the cells as of 3:30 a.m. indicating that in Shiga and Kyoto prefectures there were 26 red cells for 48-hour precipitation and 55 red cells for the soil water index. The JMA immediately entered into the process of deciding on the issuing of a Heavy Rain Emergency Warning. Since almost all the cells for 3-hour precipitation remained white, the decision process was performed on the basis of criterion (1) described above.

A Heavy Rain Emergency Warning cannot be issued only because of the number of the cells that have exceeded or are about to exceed the estimated rainfall level of intensity observed once in five decades. The issuance also requires an accurate prediction that the heavy rain will continue. At that time, the JMA implemented the decision process using the Precipitation Nowcast and the Short-term Rainfall Forecast,¹⁰ as well as radar images. It concluded that the rain would continue to fall heavily until around 8:00 a.m., at the earliest.

At around 4:50 a.m. the cells as of 4:30 a.m. were shown on the computer display. In Shiga and Kyoto prefectures the number of red cells for 48-hour precipitation was 61 and that for soil water index was 89, which met the condition of "50 or more cells" of criterion (1). In other words, as of 4:30 a.m. the number of cells where the observed data exceeded a once-every-five-decades level had already reached the numbers required. The distribution of red cells expanded to Fukui prefecture. Figure 2 shows red-cell distribution maps as of 4:30 a.m.

¹⁰ Based on fluctuations in precipitation areas and the current distribution of precipitation, the Short-term Rainfall Forecast and the Precipitation Nowcast provide precipitation distribution forecasts with a spatial resolution of one kilometer square, one to six hours ahead. The Short-term Rainfall Forecast, which provides six-hour precipitation forecasts in one-hour increments, is announced every thirty minutes. The Precipitation Nowcast provides 60-minute forecasts of precipitation intensity in five-minute increments.

Figure 2. Red-cell Distribution Maps as of 4:30 a.m. on September 16, 2013



*Source: Provided by the Forecast Department, Osaka Regional Headquarters, JMA

At 4:55 a.m. JMA decided to issue its first Heavy Rain Emergency Warning to 62 municipalities in Osaka, Kyoto, and Shiga prefecture, excluding Shiga's town of Toyosato to which a Heavy Rain Warning had not been issued.

At 5:05 a.m. on September 16, the forecasters in charge at the Kyoto, Hikone, and Fukui local meteorological offices simultaneously clicked their computer's mouse to transmit JMA's first Heavy Rain Emergency Warning to the relevant municipal governments and other disaster prevention organizations as well as NHK and other media. Nineteen minutes earlier, at 4:46 a.m., the Fukui Local Meteorological Office had notified the Fukui prefectural government that the JMA was preparing to issue a Heavy Rain Emergency Warning. From 5:12 to 5:45 a.m., soon after the Emergency Warning was announced, it telephoned 17 municipal governments in the prefecture to convey the issuance.¹¹ After the announcement of the Emergency Warning, one of forecasters at the Osaka Regional Headquarters said he had confirmed the situation in a TV news flash and that, as he had been watching a river's rising and other impending scenes on television, he had earnestly wished urgency of the message of the Emergency Warning would get across to the residents.

¹¹ Survey by the Meteorological Disaster Prevention Office, Forecast Department, JMA.

III. HOW NHK REPORTED THE EMERGENCY WARNING

Among Japan’s broadcasting media, only public broadcaster NHK is required, under the terms of the Meteorological Service Act, to broadcast regular Warnings and Emergency Warnings. How did NHK handle the first issuing of an Emergency Warning? Based on observations mainly by NHK reporters present at the time, this section records in as much detail as possible the sequence of events.

1. On Alert for Issuing an Emergency Warning (From Sept. 13th)

When Typhoon Man-yi formed at 4:30 p.m. on September 13, a meeting was called at the NHK Broadcasting Center in Tokyo. Those present included representatives of the Current Affairs Division and the Video Coverage Division—both in charge of gathering news about the typhoon—as well as of the television and radio production divisions, the offices for liaison with local stations, and the Programming Department, which determines appropriate time slots for programs. The Current Affairs Division briefed those present on the strength and course of the typhoon and the prospects for its rains and winds. The Division’s news desk presented its warning that, “Lots of moist air has already moved in from the Sea of Japan side, and as the typhoon comes closer, the JMA may issue its first Emergency Warning.”

At that stage, the JMA had not yet notified NHK of the possibility that the Emergency Warning might be issued. But, partly because heavy rains had fallen in Akita, Iwate, Yamaguchi, and Shimane prefectures between the end of July and the early part of August 2013 that would have met the conditions for issuing an Emergency Warning—the Emergency Warning system was launched in late August that year—NHK Current Affairs Division had been on alert that an Emergency Warning might be issued.

Typhoon Man-yi was approaching the Japanese archipelago and landfall was predicted as coming on the 15th of September, a Sunday, with the following day a national holiday (Respect-for-the-Aged Day). Many companies would be closed for three days straight, starting on Saturday, the 14th. People would travel in large numbers during the consecutive holidays. NHK therefore decided to issue an early warning about the approaching typhoon. NHK General TV began reporting on Typhoon Man-yi on its regular evening news program, “NHK News 7,” aired at 7:00 p.m. on the 13th, and from then on it gave the typhoon highest priority in other national network programs as well.

On “NHK News 7” the following day, the 14th, footage was shown of JMA’s chief forecaster speaking at a press conference held earlier in the evening of that day, about the possibility that a Heavy Rain Emergency Warning would be issued. A news flash caption saying, “An Emergency Warning may be issued” appeared on the TV screen (Figure 3).

From the night of the 15th, Heavy Rain Warnings and Flood Warnings began to be issued to municipalities in the Kinki and Tokai regions, and NHK local stations promptly reported on them. NHK General TV aired news about the typhoon nationwide almost every hour, starting at

Figure 3. Scene from “NHK News 7,”
aired September 14, 2013



Caption says, “An Emergency Warning may be issued.”

*Note: The person on the screen is the JMA chief forecaster.

00:00 a.m. on the 16th. At 3:00 a.m., the typhoon was located in waters about 80 kilometers south of Shionomisaki Cape, Wakayama prefecture, moving north-northeast at a speed of 30 kilometers per hour. Part of the prefecture fell into the storm zone.

According to the NHK Current Affairs Division news desk, the satellite image a little after 3:00 a.m. showed breaks in the rain clouds over areas of Japan's Pacific coast that were part of the storm zone, but no breaks at all in the clouds over the Sea of Japan coastal area along Wakasa Bay and the northern Kinki region.

At 4:30 a.m., the Current Affairs Division received a telephone call from one of its reporters who was stationed at JMA, saying, "The JMA is now in the process of deciding to issue a Heavy Rain Emergency Warning. The warning seems very likely to be issued for Kyoto, Shiga, and Fukui prefectures." The Current Affairs Division immediately relayed the information to the news desk both at the NHK Osaka station (which supervises the Kyoto and Otsu stations) and at the NHK Nagoya station (which supervises the Fukui station). Together with the production staff of the morning news program "Ohayo Nippon" (Good Morning Japan), the Current Affairs Division began preparing news flash captions. It also prepared a draft reporting the Heavy Rain Emergency Warning. A little before 5:00 a.m., the JMA-based reporter sent in a message that the Heavy Rain Emergency Warning would soon be announced. The news desk was concerned, given that it was a time of day when most people were asleep, whether people would even see the news flash.

2. News Flashes of the First Emergency Warning (Dawn on the 16th)

2 (1) At Local Station Level

At around 4:30 a.m., when the NHK Current Affairs Division [in Tokyo] received the information that the decision process on issuing the Emergency Warning had begun at JMA, the NHK Osaka station news floor was a vortex of activity, with nine news desk people along with numerous staff members and others all mobilized for news reporting on the typhoon. Then the news came in from the Otsu station news desk that the Hikone Local Meteorological Office was preparing to issue a Heavy Rain Emergency Warning in Shiga prefecture. Osaka station reporters then contacted the Osaka Regional Headquarters of JMA and learned that it was not just "in Shiga prefecture," but in Kyoto and Fukui prefectures as well. The information was confirmed when they inquired of the NHK Current Affairs Division about it. A little past 4:55 a.m., the news came in that the Hikone Local Meteorological Office would soon announce the Emergency Warning. After checking at the Osaka Regional Headquarters of JMA and the NHK Current Affairs Division, the Osaka station confirmed that the Emergency Warning would very soon be issued to the three prefectures. The chief of the Osaka station news desk announced by microphone that "A Heavy Rain Emergency Warning will very soon be issued" to let everyone on the news floor know.

At around 5:00 a.m., a member of the Osaka station news desk staff was waiting for the Heavy Rain Emergency Warning text message to come in through the receiving terminal. At 5:05 a.m., the terminal's alert sounded and the emergency warning message was received. The moment the message came in, an emergency information terminal in the sub-control booth in front of the news studio sounded the alarm, "Emergency Warning, Emergency Warning," indicating that the subtitled script for the news flash had been automatically created. After confirming the content, the television news production chief clicked the "send out" button, and at 5:05 a.m., immediately after the Emergency Warning text message was received, the news flash captions conveying the first Heavy Rain Emergency Warning were aired, accompanied by an alert chime, on NHK General TV and Educational TV in the Kinki region.

There were two captions: the first read, “Emergency Warning Announcement; Danger of a Once-in-Several Decades Disaster,” followed immediately by the second that showed the names of municipalities where the Heavy Rain Emergency Warning was being issued. There were a total of 45 municipalities—19 cities and towns in Shiga prefecture and 26 cities and towns in Kyoto prefecture (Fukui is not part of the Kinki region)—so the latter captions consisted of 17-sheets.

On radio, meanwhile, for about five minutes from 5:10:52 a.m., following the nationwide news flash by the NHK Radio Center in Tokyo, the NHK Osaka station aired the first report of the Heavy Rain Emergency Warning to the Kinki region on NHK Radio 1 and NHK-FM. The announcer read the text prepared by the NHK Current Affairs Division twice.

As of 5:05 a.m., when the Emergency Warning was announced, one person was missing in Shiga prefecture and four had been injured in Hyogo and Wakayama prefectures as a result of the heavy rain brought by the typhoon. Flood Alert Information notices had been issued in the Katsura and Yura river basin areas of Kyoto prefecture, and Evacuation Advisories or/and Evacuation Orders had been issued to some 46,000 people in 19,900 households of Kyoto prefecture and some 7,140 people in 5,530 households of Shiga prefecture. “Damage had been reported in many parts of the Kinki region, so I thought the issuing of the Emergency Warning was only natural,” says the above-mentioned news desk chief of the NHK Osaka station. “We’re so busy identifying the areas where damage was reported that we didn’t give new instructions on news gathering even after the Emergency Warning was announced. As a person engaged in reporting natural disasters, I would like to urge that Emergency Warnings will be announced as early as possible, before any serious disaster strikes.”

At 5:06 a.m., the NHK Fukui station aired news flash captions, accompanied by a chime alert, to General TV and Education TV audiences in Fukui prefecture. One caption said, “Emergency Warning Announced; Danger of a Once-in-Several Decades Disaster,” and the other caption, “(Heavy Rain) Emergency Warning Issued for All of Fukui Prefecture.” NHK Radio 1 aired a news flash in Fukui prefecture for 2 minutes 40 seconds starting at 5:12:10 a.m. Later, on NHK FM, too, announced the news flash.

2 (2) At the National Network Level

At NHK, local stations report JMA regular warnings in news flashes to their local audiences. However, in the case of an Emergency Warning, NHK reported it in news flashes both at local and national network levels. That is because an Emergency Warning is issued only when an extraordinary meteorological phenomenon occurs that far exceeds the criteria for issuance of regular Warnings. That means that the danger of a large-scale disaster striking in a relatively broad area is imminent.

In the case of nationwide television broadcasting, at 5:07 a.m., two minutes after the Emergency Warning was announced, NHK aired news flash captions with accompanying chime alert on General TV, Educational TV, and BS1 BSPremium. Of the two captions for nationwide audiences, one read, “Heavy Rain Emergency Warning / Take Greatest Possible Precautions / Shiga, Kyoto, and Fukui Prefectures,” and the other, “Heavy Rain Emergency Warning / Secure Your Own Safety Immediately / Shiga, Kyoto, and Fukui Prefectures.” The captions were alternately repeated at intervals of a few seconds; they appeared on the TV screen over and over again for more than two minutes. (See Figure 4.)

Figure 4. “News Flash” Captions Announcing Heavy Rain Emergency Warning



(NHK General TV, September 16, 2013)

As for radio, at 5:07:50 a.m. NHK interrupted its usual programming on Radio 1, Radio 2, and FM, and aired the first news flash of the Heavy Rain Emergency Warning simultaneously over the three channels for about 1 minute 40 seconds.

The texts of the first news flash for television and radio were written using definitive forms of expression to clearly get an urgent message across to audiences. The following is a translation of the text prepared by the Current Affairs Division, which was aired on NHK General TV starting at 5:09 a.m. (boldface added by the author to show assertive wording in the text).

*Earlier, a little after 5 o'clock in the morning, the Japanese Meteorological Agency issued a Heavy Rain Emergency Warning in Shiga, Kyoto, and Fukui prefectures. A once-in-several-decades heavy rain has been falling in Shiga, Kyoto, and Fukui prefectures, and **there is imminent danger that a large-scale disaster could occur. Take the greatest possible precautions** (“daikibo na saigai no hassei ga sematte imasu. Saidaikyu no keikai ga hitsuyo desu”).*

*The JMA urges you to observe the situation around you and secure your safety immediately. . . . In these areas a once-in-several-decades heavy rain has been falling, and **there is imminent danger that a large-scale disaster, such as landslides, mudslides, inundation of low-lying areas, flooding of rivers, could occur. Take the greatest possible precautions.** . . .*

According to the Current Affairs Division, if assertive wording is used too often its effectiveness might be reduced. An Emergency Warning is probably issued twice at most in one year, and the Current Affairs Division says it is studying ways to effectively get across imminent danger.

Only half a month had passed since the launch of the Emergency Warning system, and NHK was at pains to plainly and articulately convey to its audiences the meaning of the Heavy Rain Emergency Warning and what they were supposed to do once it was issued.

On NHK General TV, a reporter in charge of disaster reporting appeared on a news program at 5:10 a.m. to talk about the Emergency Warning, explaining it as “a warning informing residents that a life-threatening emergency is imminent.”¹² Asked by an announcer what people should do in the areas where the Heavy Rain Emergency Warning had been issued, he said, “They need to act to protect their lives immediately. Following the information provided by their local governments, they need to evacuate to a safe place right away. Or, since it is still night, and it may be very hard what’s going on outside. There might be flooding due to heavy rain, and in that case, going out may be very dangerous. You could stay home and, say, move to a second or higher floor—actions like that might be better than going out. People should observe the situation around them and, considering the latest information they have, they should judge whether to evacuate elsewhere or stay at home.”

In the weather forecaster’s segment of the news program from 5:19 a.m., with a large computer graphic of a house near a cliff shown covering the whole TV screen, the forecaster stressed, among other advice, that those who stay at home might be safer upstairs and that moving to a room farther away from the cliff was important.

Even in the areas where a Heavy Rain Emergency Warning was not issued, as long as a Heavy Rain Warning or a Sediment Disaster Alert has been issued, there is danger of a serious disaster. At 5:29 a.m. the reporter appeared again and said, “You can’t assume you are safe just because an Emergency Warning hasn’t been issued. Even if only a regular Warning has been issued, that is enough to tell you that serious damage might occur.”

Seeing that the rain had stopped falling intensely, JMA downgraded the Heavy Rain Emergency Warning to a Heavy Rain Warning in Kyoto prefecture at 9:58 a.m., in Fukui prefecture at 10:56 a.m., and in Shiga prefecture at 11:30 a.m. NHK warned the audiences in those prefectures that they should stay on alert; the danger had not gone yet.

IV. EMERGENCY WARNINGS AT THE MUNICIPALITY LEVEL

How did municipalities notify residents of the first Emergency Warning? This study examines the cases of the cities of Kyoto and Fukuchiyama, which suffered severe damage as a result of the heavy rain accompanying Typhoon Man-yi. For these cities, a fairly large part of the damage was due to river flooding. As noted above, the Heavy Rain Emergency Warning is not issued to prevent disasters caused by river flooding, but this study conducted an interview survey in the two cities to learn about local responses to the Emergency Warning amid the imminent threat of massive flooding from the heavy rains.

1. Kyoto City

1 (1) Initial Alertness and “Evacuation Information”

In the city of Kyoto, the Japan Meteorological Agency issued a Heavy Rain and Flood Advisory at 4:26 p.m. on the 15th of September, followed by a Heavy Rain (Sediment-related Hazard) Warning at 7:15 p.m. on the same day. Based on the Regional Plan for Disaster Prevention, the city immediately set up a Disaster Alert Headquarters in response to the Heavy Rain and Flood Advisory and then a Disaster Control Headquarters in response to the Heavy

¹² Records of what he said are reproduced here as faithfully as possible to convey a tense situation immediately after the announcement of the Emergency Warning.

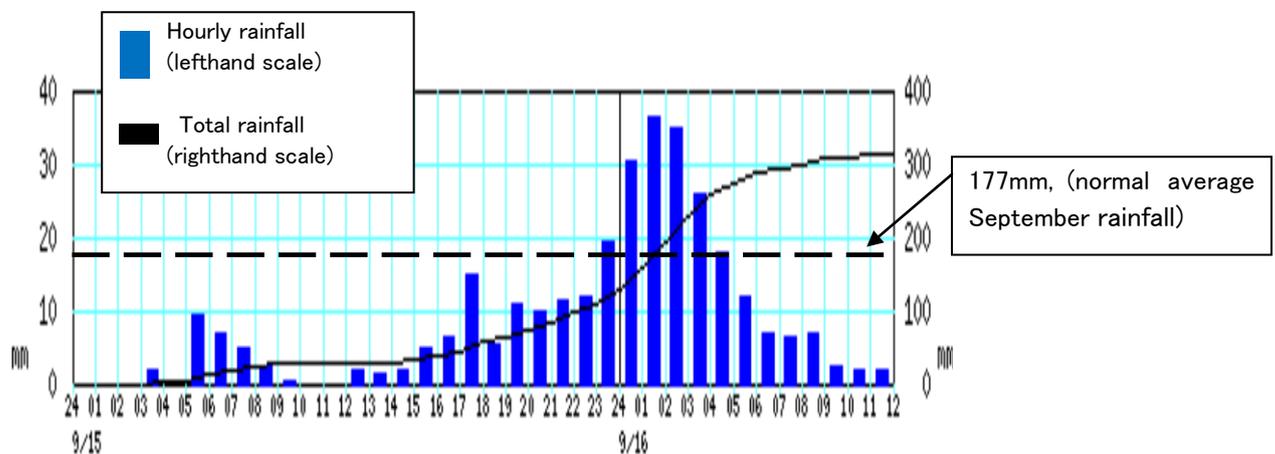
Rain Warning. With the establishment of the Disaster Control Headquarters, a total of 1,317 people—the staff of the city’s Disaster Prevention and Crisis Management Office, the members of fire stations, and people in charge of disaster prevention in each of the wards of the city—were deployed for disaster prevention activities, some to monitor rain gauges and river water gauges, others to patrol areas subject to river-flooding and sediment-related hazards.

At the time the Heavy Rain Warning was issued a little past seven in the evening, the rain was not very strong, but the city had earlier received information from the local meteorological office that the typhoon featured heavy rain of long duration rather than short localized downpours. The staff of the Disaster Control Headquarters were on alert, worrying that “if rain continues long in the upper reaches of the Katsura and other rivers, there might be trouble.” But many did not expect at all that the rain would be so heavy that an Emergency Warning would be issued.

At 9:51 p.m. a Flood Warning was issued in the city of Kyoto and at 11:56 p.m. the Heavy Rain (Sediment-related Hazard) Warning was reinforced as a Heavy Rain (Sediment-related Hazard and Inundation) Warning. At 00:35 a.m. on the 16th, a Sediment Disaster Alert was issued to the city’s seven wards, including Kita, Sakyo, Ukyo, and Higashiyama wards.

Figure 5 shows the rainfall hour by hour between 00:00 a.m. on the 15th and noon on the 16th at the Keihoku AMeDAS observation point in the northern part of the city. The horizontal scale shows the passage of time and lefthand scale shows hourly rainfall; the righthand scale shows total precipitation. The bar graph represents hourly rainfall and the line graph the cumulative rainfall since the rain began. The dotted line indicates the average monthly rainfall for September.

Figure 5. Chronological Rainfall Data Recorded at Keihoku, Ukyo Ward, Kyoto City



*Note: Based on figures compiled by the Kyoto Local Meteorological Office.

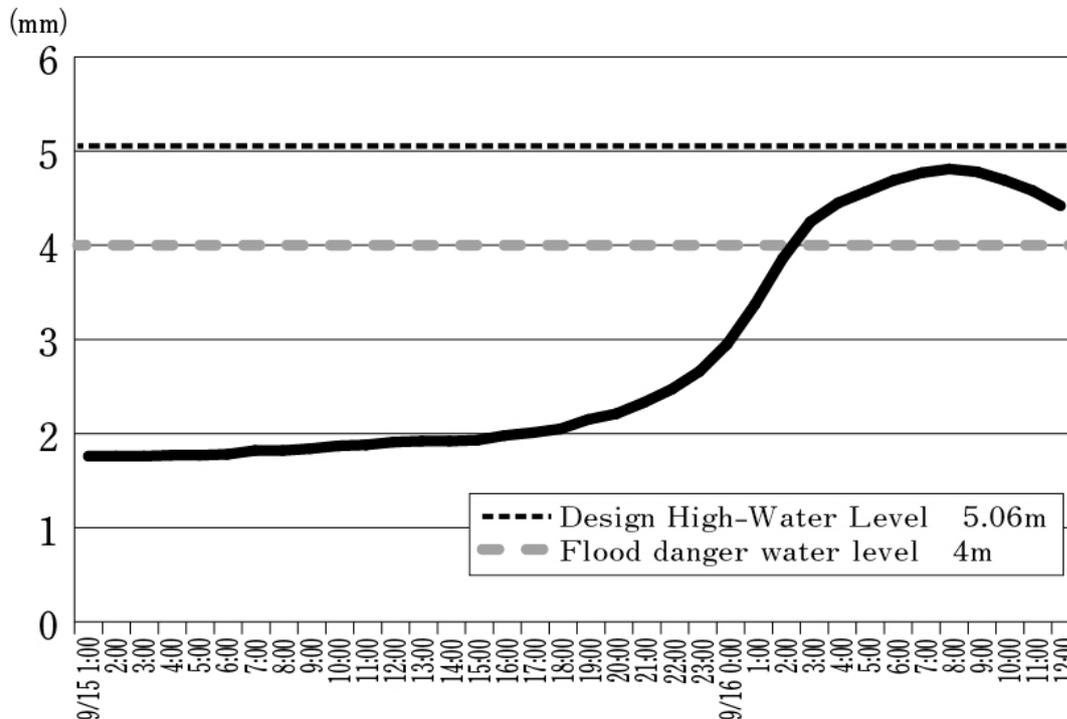
Monthly rainfall in September in a normal year is 177 mm in northern Kyoto, but at the time of the 2013 typhoon, the cumulative precipitation from the time the rain started on the 15th to 2:00 a.m. on the 16th had reached 195 mm, which means that more rain fell in a day than the precipitation for the whole month of a normal September. By noon on the 16th, cumulative precipitation had reached as much as 313 mm.

It was not “violent rain” with an hourly rainfall of more than 80 mm. It was heavy rain of long duration.

Due to the heavy rain, prior to 2:30 a.m. the water level of the Katsura river had risen above the four-meter danger level—the level at which flooding could occur—at the Katsura

Water Level Observatory, located in the lower reaches of the river. The Togetsukyo bridge in the Arashiyama area of Kyoto was submerged (Figure 6).

Figure 6. Data from the Katsura Water Level Observatory (Katsuragawa River)



*Note: Compiled on the basis of hydrology and water quality database from the Ministry of Land, Infrastructure, Transport and Tourism.

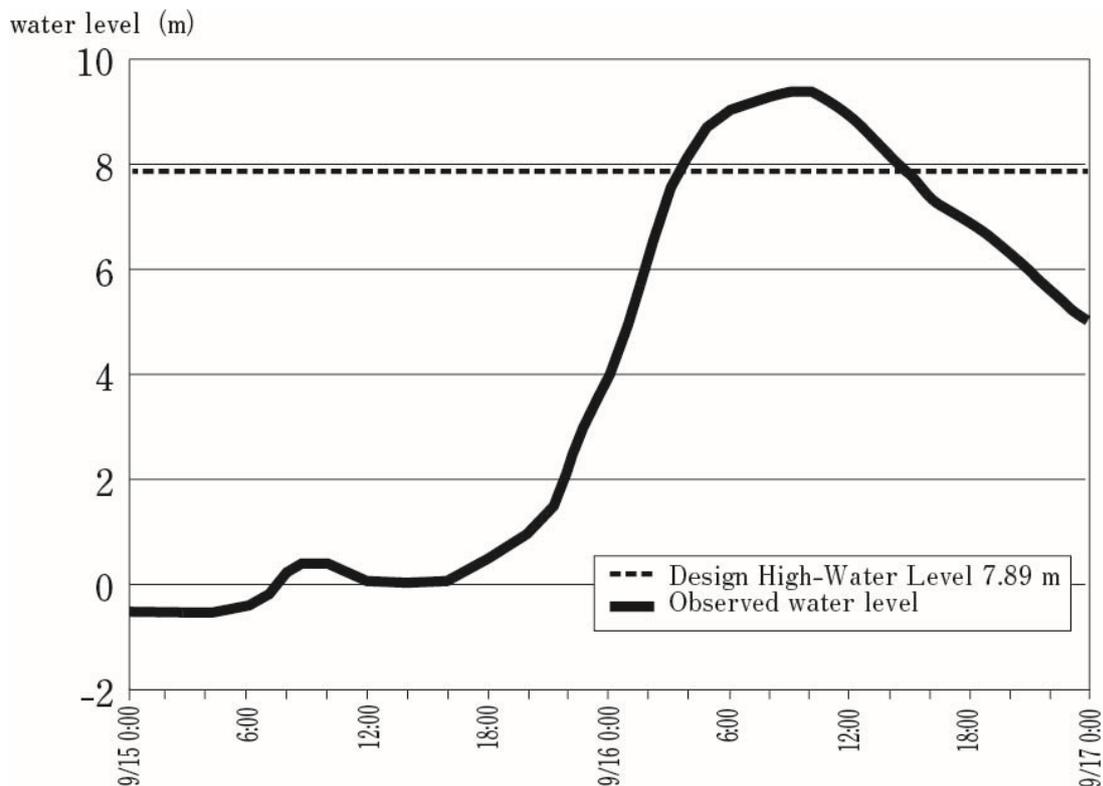
At 2:30 a.m., therefore, the city’s Disaster Control Headquarters issued a Prepare-for-Evacuation Notice to the school districts in Ukyo ward’s Saga and Arashiyama areas near the Togetsukyo bridge. The Headquarters was informed from a Keihoku Ward Office official who was on patrol that the water level of the Yugegawa river running through the northern part of the city had been rising. Since the river water had exceeded the “evacuation water level” of 2.8 meters, the Headquarters issued a Prepare-for-Evacuation Notice to Keihoku Gohonmatsu, Hyaku-no-sumi Keihoku Shuzan, and other areas in Ukyo ward at 2:45 a.m. and 3:10 a.m.

A little before 3:50 a.m., the chief of the flood control corps, who had been monitoring the water level from a bridge, confirmed the rapid rising of the water level of the Katsura river near the Hazukashi bridge in Fushimi ward in the southern part of the city. The banks along the Katsura river were somewhat low in the Hazukashi area, which therefore was designated as a special danger zone in the Regional Plan for Disaster Prevention. At 3:55 a.m., the city issued a Prepare-for-Evacuation Notice to the school districts of Hazukashi, Koganomori, Yoko-oji, and elsewhere in Fushimi ward.

At around 4:00 a.m., the water level observed at the Hazukashi Water Level Observatory reached a “Design High-Water Level,” the highest level the embankment was designed to contain.¹³ (See Figure 7.)

¹³ See Kinki Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, “Heisei 25-nen Taifu 18-go saigai gaiyo” (A Summary of the Disaster Caused by Typhoon No. 18 [Man-yi] in 2013,” preliminary version, September 30, 2013, and preliminary version II, October 22, 2013. Because of some leeway to

Figure 7. [Data Recorded at] Hazukashi Water Level Observatory (Katsuragawa River)



*Note: From preliminary version II (October 22, 2013) of the summary of the damage caused by the September 2013 typhoon, compiled by the Rivers Department, Kinki Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism.

Meanwhile, the waters of the Yugegawa continued to rise, and at 4:00 a.m. an Evacuation Advisory was issued to the aforementioned Keihoku Gohonmatsu and other areas in Ukyo ward.

From 4:00 a.m. to 5:00 a.m. “slightly strong rain” of less than 10 to 20 millimeters per hour continued in the city of Kyoto. At 4:09 a.m., firemen rescued eleven people isolated in Nakanoshima Park—located on a sandbar in the Katsura riverbed near the Togetsukyo Bridge—where a shop had been inundated above floor level. At around 5:00 a.m. water was about to flood over the banks near the bridge. By then a Flood Alert Information notice had been issued to the areas in the lower reaches of the Katsura river. The Kamo and Uji rivers, too, had been rising steadily. In this urgent situation, a Heavy Rain Emergency Warning (sediment-related hazard and inundation) was finally issued.

1 (2) First Emergency Warning Conveyed

It was via television, email and fax messages from the JMA, fax messages from the Kyoto Prefectural Government, and other means that the Kyoto City Disaster Control Headquarters learned that the Heavy Rain Emergency Warning had been issued a little earlier. It later said it had not been informed beforehand that the Emergency Warning would soon be issued.

The Disaster Control Headquarters had prepared a draft notification of the Emergency Warning to circulate among residents, so after revising the draft, it announced the notification to

the bank height, even when an observed water level exceeds the “Design High-Water Level” flooding will not occur immediately. Still, the situation is very dangerous in terms of flood control.

residents approximately 15 minutes after the Emergency Warning was issued. The notification read:

Heavy Rain Emergency Warning (Kyoto City) Notification

This is the Kyoto City Disaster Control Headquarters.

At 5:05, a (Heavy Rain) Emergency Warning was issued to Kyoto City.

The city expects to be hit by the heaviest rain ever recorded. If you are located anywhere that seems likely to be flooded, take action to protect your life by, for example, moving to second or higher floor for safety.

Please remain alert for more information from Kyoto City office.

The notification was circulated among residents by various means: (1) disaster information services provided by three mobile phone carriers¹⁴; (2) Kyoto City's original "Flood Information System"; (3) public-address system-equipped vans operated by the city; and (4) use of telephone and fax communications to independent disaster prevention organizations, etc.

Kyoto City's original "Flood Information System" conveys information such as the notification to the heads of the independent disaster prevention organizations, the managers of underground shopping malls, and the managers of institutions for people who need special support at the time of evacuation. From among four types of media—email, fixed telephone, mobile phone, and fax—these responsible persons choose up to three types. In the case of email, if the recipient clicks on a button that indicates, "Have read," the city side can confirm their reception of the information. When no click is made and the city side cannot confirm, then a synthetic voice is played to convey information via fixed telephone line or mobile phone. If there is no response on the other end of line even then, the information will be sent by fax.

A senior official of one of the city's divisions in charge of disaster prevention says regarding the announcement of the Heavy Rain Emergency Warning: "Our greatest concern at that time was whether or not the water level of the rivers would overflow the embankments. So, even though the Emergency Warning was issued, we did not take any special measures relating to it." Still, there were reportedly some residents who "thought of evacuating because the Emergency Warning was issued."

As Figures 6 and 7 show, even at around 6:00 a.m. the Katsura was still rising. The Disaster Control Headquarters received one call after another from the site reporting that the river's water levels were getting higher and higher. Gazing at the fuzzy images of the river visible through on-site surveillance cameras, the staff at City Hall managed to confirm the condition of the river in the dim predawn light. At 5:50 a.m., partly because the sky began growing lighter, the city issued an Evacuation Advisory to a total of 45,575 people of 18,945 households in the four school districts of Saga, Arashiyama, and elsewhere in Ukyo ward and the Arashiyama Higashi school district in Nishikyō ward. At 6:15 a.m., the city issued the same advisory to 47,039 people in 17,451 households in the four school districts of Hazukashi, Koganomori, Yokooji, and Yodo in Fushimi ward, and from 6:30 a.m. to 6:45 a.m. to 35,781

¹⁴ Those services are "Area Mail" provided by NTT Docomo and "Emergency Rapid Mail" by KDDI (au) and "Urgent News" by SoftBank Mobile. Through a contract with local and national government agencies, the three major carriers pinpoint broadcast distribution of evacuation information, disaster warnings, etc. to specific areas. Since email addresses are not used, there is no danger of congestion of mobile phone.

people in 13,818 households in the school districts of Yodo-minami and Shimo-toba in Fushimi ward and the school districts of Matsuo and Katsuragawa in Nishikyo ward, respectively.

The aforementioned senior official in charge of disaster prevention said, “It depends on the water level and other conditions at the site, but if an Evacuation Advisory is issued in the middle of the night it could be the cause of a secondary disaster. We were pressed to make very difficult decisions.” According to Kyoto city officials, the national government and Kyoto Prefecture were so concerned, now that the Emergency Warning had been issued, that they even put in phone calls urging the city to raise its evacuation instruction level from “Advisory” (*kankoku*) to “Order” (*shiji*).

1 (3) The Katsura River Overflows Its Banks

As dawn came, the actual flood conditions became clear. After 7:00 a.m., surveillance cameras of the Ministry of Land, Infrastructure, Transport and Tourism showed the muddy waters of the Katsura river flowing over the Togetsukyo Bridge (Figure 8). The waters of the Kamo river, too, were shown overflowing an embankment within Fushimi ward and flowing into the streets of Shimo-toba Kitasanchō, which is situated in the basin of the river. It was confirmed prior to 8:00 a.m. that the Katsura river had overflowed near the Togetsukyō Bridge in Arashiyama.

Earlier, at 6:00 a.m., the Hiyoshi Dam Control Office in the upper reaches of the Katsura river had notified Kyoto City and other local government bodies in the vicinity of the river that, because the water level of the dam had continued rapidly rising, the Dam Control Office planned to start the emergency discharge of water.¹⁵ In response, Kyoto city officials urged the dam office to postpone the emergency discharge, pleading with them to “hold out by all means,” because the river had already risen dangerously in its lower reaches, flooding in some areas.

Given the flooding of the Katsura river, the need for emergency discharge of the reservoir upstream, and coming of morning’s light, the city’s Disaster Control Headquarters decided to upgrade the Evacuation Advisory that had been issued to the most endangered areas along the river to an Evacuation Order, and to issue an Evacuation Order to additional districts.

From 7:45 a.m. to 9:30 a.m., the Disaster Control Headquarters issued an Evacuation Order to 26 school districts in the four wards of Fushimi, Ukyo, Nishikyo, and Minami. After 8:00 a.m., the water level of the Uji river running through the southern part of the city exceeded a “Design High-Water Level” at the Mukaijima Water Level Observatory, and so, at 8:23 a.m., the Headquarters newly issued an Evacuation Order to 28,899 people in 12,122 households in Mukaijima, Mukaijima-minami and three other school districts in Fushimi ward, and at 9:00 a.m. to 33,993 people in 15,304 households in Minamihama and two other school districts, also in Fushimi ward.

During Typhoon Man-yi, the Kyoto City Disaster Control Headquarters issued Evacuation Advisories and Evacuation Orders to a total of 302,438 people in 125,359 households. Of these people, 2,499, or 0.8 percent, went to evacuation shelters within the city. Regarding this, Kyoto

¹⁵ The emergency discharge operation is undertaken to make the volume of water inflow to the reservoir equal to that of water outflow. In Kyoto at that time this would have meant a greater volume of outflow water would be released than usual. Emergency discharge is conducted when water inflow threatens to exceed the flood control capacity of the reservoir, an occurrence probability of which is once in 20 years. To meet the requests of the city of Kyoto and elsewhere, the water flowing into the reservoir at the Hiyoshi Dam was retained as long as was possible until it was finally discharged at noon on the 16th, but by then the water level in the lower reaches of the Katsura river had begun to recede.



**Figure 8 .
Inundation of Togetsukyo Bridge
over the Katsura River**

*Note: Courtesy of the River Department, Kinki Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism.

City presumes that there were many who went upstairs for safety or evacuated to places other than the shelters.

The Japan Meteorological Agency cancelled the Heavy Rain Emergency Warning at 9:58 a.m., but through the ward authorities, Kyoto City advised residents in the evacuation shelters that they should stay there for a while “because the flood waters have not yet receded.”

In Kyoto City, the typhoon left behind considerable damage: three people were injured, 132 houses destroyed, 591 houses inundated above floor level, 813 houses flooded below floor level, and roads damaged at 296 places.¹⁶ Most of the damage was caused by river flooding and landslides.

2. City of Fukuchiyama

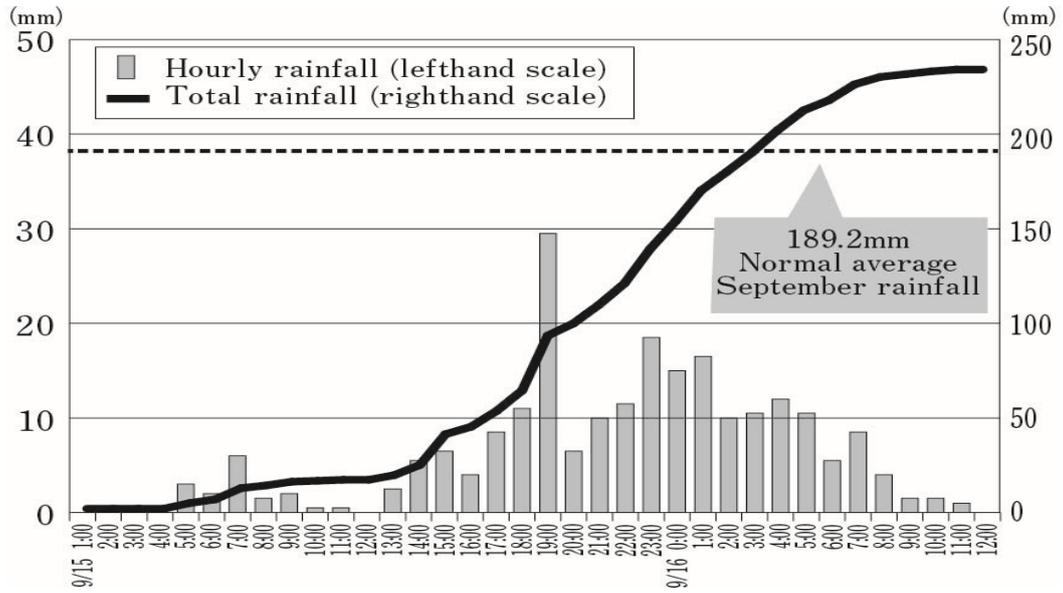
2 (1) Initial Alert Stance and “Evacuation Information”

The Japan Meteorological Agency issued a Heavy Rain (Sediment-related Hazard) Warning to the city of Fukuchiyama in northern Kyoto prefecture, at 7:15 p.m. on the 15th of September. The city authorities immediately set up a Disaster Alert Headquarters in accordance with the Regional Plan for Disaster Prevention.

In Fukuchiyama, as shown in Figure 9, rain was falling heavily at a rate of 29.5 millimeters per hour between 6:00 p.m. and 7:00 p.m. The weather forecast having announced that, with the approach of the typhoon, warm and moist air would surge in from the south and likely cause heavy rain, most of the city personnel had been on alert. Little did they expect at that time, however, that the rain would be so heavy that a Heavy Rain Emergency Warning would be issued and that the Yura river would flood for the first time in nine years.

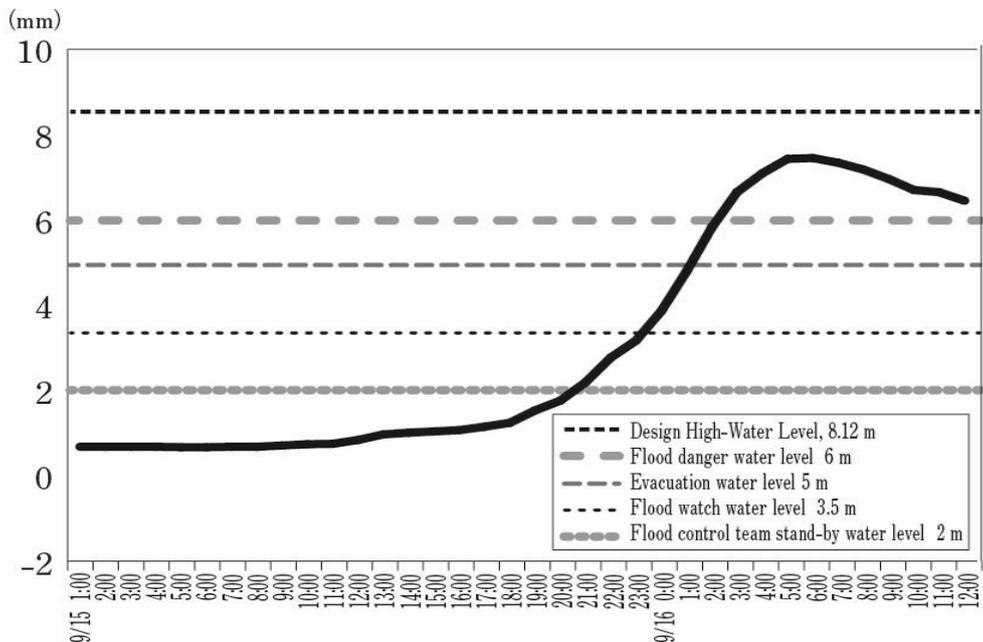
¹⁶ Kyoto-shi Gyozaisei-kyoku (Kyoto City Administrative and Financial Bureau), “Taifu 18-go ni tomonau Kyoto shinai no higai jokyo ni tsuite (10-gatsu 31-nichi 17-ji genzai)” [An Overview of the Damage in the City of Kyoto Caused by Typhoon No. 18 (Man-yi), as of 17:00, October 31].

Figure 9 . Chronological Rainfall Data Recorded at Aza Araga, Fukuchiyama City



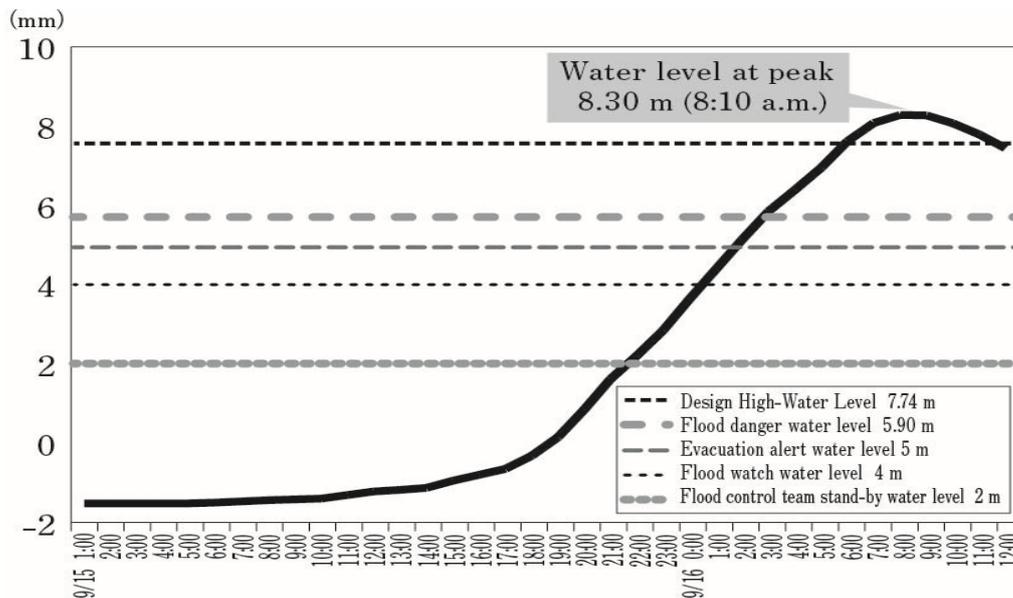
*Note: Compiled from Japan Meteorological Agency AMeDAS

Figure 10 . Ayabe Water Level Observatory (Mikata, Ayabe City) in the Middle Reaches of the Yura River



Note: Compiled from the Ministry of Land, Infrastructure, Transport and Tourism hydrology and water quality database.

Figure 11 . Fukuchiyama Water Level Observatory (Tera, Fukuchiyama City) in the Lower Reaches of the Yura River



Note: Compiled from the Ministry of Land, Infrastructure, Transport and Tourism hydrology and water quality database.

Figures 10 and 11 show data recorded at two water level observatories, one in the city of Ayabe in the middle reaches of the Yura river and one in the city of Fukuchiyama in the lower reaches of the river. The greater part of Fukuchiyama is situated in the lower reaches of the river but part is in the middle reaches. The vertical axis represents the water level (unit: meter) and the horizontal axis the passage of time. Observed data is indicated by the line graph. The five horizontal lines indicate, as numbered: (1) “Flood control team stand-by water level” (2 meters) at which level the flood control team would be put on stand-by; (2) “flood watch water level” (3.50 meters in Ayabe, 4 meters in Fukuchiyama) at which point the municipal authorities make a decision on issuing a Prepare-for-Evacuation Notice; (3) “evacuation water level” (5 meters) at which level the municipal authorities make a decision on issuing an Evacuation Advisory; (4) “flood danger water level” (6 meters in Ayabe, 5.90 meters in Fukuchiyama); and (5) “Design High-Water Level” (8.12 meters in Ayabe, 7.74 meters in Fukuchiyama).

The Ministry of Land, Infrastructure, Transport and Tourism Fukuchiyama River and National Highway Office, which has jurisdiction over the Yura river, and the Kyoto Local Meteorological Office announce Flood Forecasts for areas in the middle and lower reaches of designated rivers when the observed water level exceeds (2), (3), and (4) and there is a possibility that the water level will continue to rise.

At 9:40 p.m., the water level in the lower reaches of the Yura river that runs through the city of Fukuchiyama exceeded 2 meters, that is, the “flood control team stand-by water level,” so the Fukuchiyama City Disaster Alert Headquarters decided to open 13 shelters in a broad area along the Yura river.

At 11:06 p.m., a Flood Warning concerning all rivers in general was issued in Fukuchiyama. Taking the possibility of sediment-related hazards into consideration, the city decided to open 57 shelters throughout the city.

Prior to 0:00 a.m. the following day, the 16th, at the Ayabe Water Level Observatory located in the middle reaches of the Yura river, the observed water level exceeded the “flood watch water level” ([set at] 3.50 meters in Ayabe). About one hour later, at the Fukuchiyama Water Level Observatory in the lower reaches of the river the observed water level also exceeded the “flood watch water level” (4 meters in Fukuchiyama), and at 1:10 a.m. the Fukuchiyama City Disaster Alert Headquarters issued a Prepare-for-Evacuation Notice to 32,488 people in 14,434 households, as well as 113 residents’ associations in the areas along the river.

At 1:30 a.m., a Sediment Disaster Alert was issued by the Japan Meteorological Agency and Kyoto prefecture to the entire area of the former Fukuchiyama City prior to the 2006 merger of towns and villages into the city, as well as to the towns of Miwa and Oe, both incorporated into the city at the time of the merger.

A little before 2:00 a.m., the observed water level rose above 5 meters (the “evacuation water level”) at both water level observatories in Ayabe in the middle reaches of the Yura river and at Fukuchiyama in the lower reaches. Using telephone hotlines, Fukuchiyama City inquired of the Fukuchiyama River and National Highway Office and the Kyoto Local Meteorological Office about the prospects of the rise of the river and projected volume of rainfall. At 2: 20 a.m. upon receiving answers to the inquiries, the city upgraded the Prepare-for-Evacuation Notice that had been issued to 113 residents’ associations along the river, to an Evacuation Advisory. Regarding the decision at that time, a senior official responsible for the city’s disaster prevention says, “Given the experience in which two Oe Town residents were killed in flooding of the Yura river in 2004, we wanted our residents to secure their safety as early as possible. Even though it was the middle of the night, we issued the Evacuation Advisory without hesitation.” Simultaneously with the issuance of the Evacuation Advisory, the city upgraded the Disaster Alert Headquarters to a Disaster Control Headquarters.

The water level of the Yura river continued rising rapidly. It rose above the “flood danger water level” both in Ayabe (6 meters), a little after 2:30 a.m., and in Fukuchiyama (5.90 meters), about one hour later. How long would the rising of the river continue? About when would the water level peak, and at what level? The Fuchiyama City Disaster Control Headquarters tried to make the inquiries to the Fukuchiyama River and National Highway Office and the Kyoto Local Meteorological Office, but it was very difficult to get through to them via telephone hotline at that time. City personnel were sent directly to the Fukuchiyama River and National Highway Office to find out, but the Fukuchiyama City Disaster Control Headquarters continued to find it difficult to obtain a reliable prognosis of the situation.

Figure 6 shows that at 3:00 a.m. the amount of rainfall reached 191.5 millimeters from the time the rain had begun on the 15th, which was more than the normal monthly average rainfall for September.

Just before 5:00 a.m., the Fukuchiyama City Disaster Control Headquarters decided to issue an Evacuation Order to 81,246 people in 35,474 households as well as 327 residents’ associations in the entire area of the city. The reasons cited for the decision include: observed water levels kept rising in the middle and lower reaches of the river; the Sediment Disaster Alert had not yet been lifted; and due to heavy rainfall by that time there was a danger of flooding from inland water (inundation of houses from overflowing street drains and sewerage systems).

At 5:05 a.m., immediately after the Headquarters’ decision to issue an Evacuation Order, the Japan Meteorological Agency issued a Heavy Rain (Sediment-related Hazard) Emergency Warning in Fukuchiyama City.

2-(2) First Emergency Warning Conveyed

Only a little after the Heavy Rain Emergency Warning was issued did the Fukuchiyama City Disaster Control Headquarters learn that it had been issued, through email and fax from the Kyoto Local Meteorological Office, email (personal computer) from the Kyoto Prefectural Government, email (mobile terminal) from a private meteorological company, and so forth. The Headquarters says it had not been informed beforehand that the Emergency Warning would soon be announced.

The Headquarters had been busy making preparations to announce an Evacuation Order when the Heavy Rain Emergency Warning was issued, causing turmoil in the Headquarters.

The notice for circulating the Emergency Warning to residents of the city had already been prepared, but the Headquarters decided to quickly add the wording of the Emergency Warning notification to the Evacuation Order it had been preparing, thus announcing them simultaneously. Finalizing of the wording of the text to be announced took time, and it was at 5:40 a.m., 35 minutes after having received the Heavy Rain Emergency Warning that the Headquarters conveyed the Emergency Warning to residents. Regarding the simultaneous announcement, the Headquarters side says that since it is a rule to sound emergency sirens when issuing an Evacuation Order they think they were able to convey the Emergency Warning to residents with a stronger sense of crisis than simply conveying it using the emergency broadcast system, email and so on.

The means of communication used were: the above-mentioned emergency siren; the outdoor loudspeakers of the emergency broadcast system, and house-specific receiving equipment; emails to portable phones sent by the three mobile phone carriers; emails from fire stations (other than fire station-related people, the heads of residents' associations are registered); municipal public-address vans, and so forth.

The Evacuation Order and Heavy Rain Emergency Warning notification prepared by the Fukuchiyama City Disaster Control Headquarters referred to the rising water level of the Yura river and provided instructions as to what the residents should do in the areas subject to sediment-related hazards and flooding from inland water.

Notification of Evacuation Order and Heavy Rain Emergency Warning (Fukuchiyama City)

This is the Fukuchiyama City Disaster Control Headquarters.

The emergency siren you have just heard is to inform you that we have issued an Evacuation Order for the entire area of the city of Fukuchiyama.

The Heavy Rain Emergency Warning has been issued to the city of Fukuchiyama. There is a possibility that the greatest disaster that we have ever experienced might occur. The water level of the Yura river has risen above 7 meters and could continue to rise.

We are now in a situation when serious disaster might occur any time.

If you live in an area subject to inundation or exposed to heavy-rain-caused sediment-related hazards, evacuate immediately. As you evacuate, proceed with due caution.

If you don't have time to evacuate or if it is difficult to do so, don't force yourself to evacuate. Instead, do whatever you can to protect your life by, for example, moving to a place that is even a little safer.



Figure 12.
Flooding of the Yura River in the
Kisaichi Area of Fukuchiyama City

*Note: Photograph taken around 1:00 p.m. on September 16, 2013. Courtesy of River Department, Kinki Regional Bureau, Ministry of Land, Infrastructure, Transport and Tourism.

2 (3) The Yura River Overflows

In Fukuchiyama in the lower reaches of the Yura river, as shown in Figure 11, the observed water level exceeded the “Design High-Water Level,” of 7.74 meters a little after 6:00 a.m. While the water level in Ayabe in the middle reaches of the river began falling after 7:00 a.m., the river kept on rising in Fukuchiyama, and at 8:10 a.m. the observed water level peaked at 8.30 meters.

In the darkness of the night, it was difficult to approach the river to confirm as to whether the waters were flooding or not. After 7:00 a.m., as the skies grew lighter, the Disaster Control Headquarters began receiving one report after another on the flooding of the river from fire fighters and others at the site. One observer reported that flooding had begun at a part of the embankment that had not been completed in the Toda area of the city, causing flooding into many houses. In the Kisaichi area on the other side of the river, another report said, a small-scale embankment had collapsed (Figure 12). Flooding occurred in other places over a broad area, including the Oki, Isa, Kannonji, and Tsuchi areas (besides the aforementioned Toda) of central city and the Shimo-amazu, Oe-cho (Mikawa and Yujin) areas of northern city.

In the city of Fukuchiyama, the typhoon caused great damage, leaving two houses completely destroyed, 309 houses partially (some seriously) destroyed, 432 houses partially damaged and inundated above floor level, 356 houses flooded below floor level, as well as 9 landslides, and damage to 16 streets and roads.¹⁷ Most of the damage was caused by Yura river flooding.

Of 81,246 people to whom the Evacuation Order was issued, only 2 percent, or 1,578 people, evacuated to one of the shelters the city had opened in the entire area of the city. Regarding this, Fukuchiyama City says, “There were presumably many who did not evacuate to designated shelters but either evacuated to residents’ association-owned meeting places and elsewhere for safety or “evacuated vertically,” that is, moving to the second floor of their houses.”

V. HOW RESIDENTS RESPONDED

How did local residents respond to the first issuing of the Heavy Rain Emergency Warning? Was the sense of the danger of a serious disaster properly communicated to them? What actions did people take when they saw or heard the Emergency Warning? What tasks

¹⁷ Fukuchiyama City, “Heisei 25-nen Taifu 18-go saigai no kiroku” [Records of the Damages Caused by Typhoon No. 18 (Man-yi) of 2013], preliminary version (October 2013).

remain in the area of transmitting information? In order to answer these questions, the NHK Broadcasting Culture Research Institute conducted a telephone survey of residents in Fukui, Shiga, and Kyoto prefectures, where the Emergency Warning was issued. The outline of the survey is shown in Figure 13. The simple tabulation results and breakdown of the sample are given at the end of this paper.

Figure 13. Outline of the Survey

Survey period	4 (Fri.) - 6 (Sun.) October 2013
Survey method	Telephone (RDD method)
Survey target	Fukui, Shiga, and Kyoto prefectures*; 2,979 men and women 20 years and older
Responses (response rate)	1,809 (60.7%)

*Notes: The Emergency Warning was issued 16 September 2013. Shiga prefecture’s Toyosato-cho, where the Emergency Warning was not issued, was omitted from the survey.

1. Prior Knowledge and Situation on Day of Emergency

1.1 Prior Knowledge of Emergency Warning: “Already knew” (52 percent)

When asked whether they had known that the Emergency Warning system had been newly put in place before Typhoon Man-yi, more than half (52 percent) answered that they “already knew” (Figure 14). “Did not know” made up 31 percent and “Knew, but could not tell what it meant,” was 15 percent.

Looking at the male/female breakdown, the results showed that women (50 percent) were slightly less aware than men (57 percent).

There were no differences by prefecture for Fukui, Shiga, or Kyoto.

By age bracket, 42 percent of those in their 20s and 30s and 61 percent of those in their 60s “already knew,” showing that the older the residents the more they were aware of the warning system (Figure 15). Among the younger brackets, the figure was about the same for those who “already knew” and “did not know,” but for those in their 50s and older, those who “already knew” were more numerous.

Figure 14.

Degree of Knowledge of the Emergency Warning System before the Typhoon (by Gender)

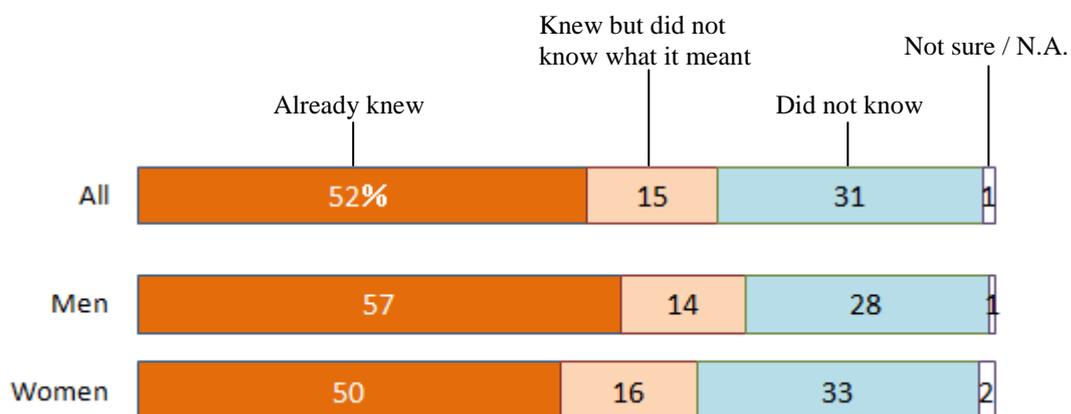
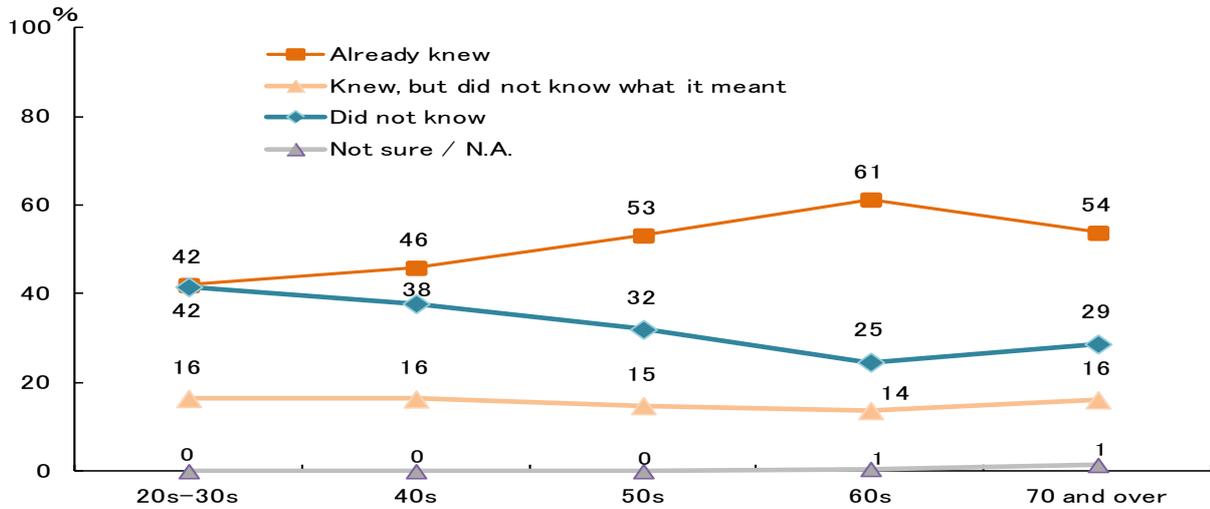


Figure 15.

Degree of Knowledge of the Emergency Warning System before the Typhoon (by Age Bracket)



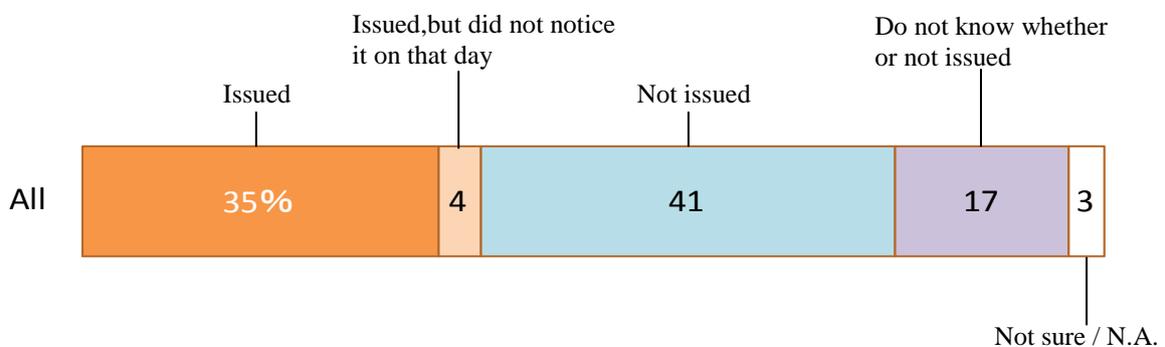
1(2) “No Inundation Damage” 98 percent

The result of the survey question concerning inundation damage received on the day the Emergency Warning was issued was that 98 percent said they had had “no inundation damage,” with only 1 percent having had “flooding under the floor” and 0 percent “flooding over floor level.” There were no differences among the results for Fukui, Shiga, and Kyoto prefectures.

1(3) Thirty-five Percent Aware of Issuing of Evacuation Advisory/Order

The survey asked whether an Evacuation Advisory or Order had been issued by the municipality where they were living at the time of the heavy rains of Typhoon Man-yi. Such advisories or orders were not necessarily issued to whole areas of local municipal units; rather in most cases the advisories/orders were issued for parts of such units. The results showed that 35 percent said “Issued” and 41 percent said “Not issued” while 17 percent said “Do not know whether or not issued” (Figure 16).

Figure 16. Awareness of Issuing of Evacuation Advisory/Order



. 2 How Residents Learned of the Issuing of the Emergency Warning

2(1) Sixty-nine Percent “Learned of It”: Many Elderly “Did Not Learn of It”

Sixty-nine percent of people said they “learned of it” the issuing of the Emergency Warning in the area where they lived while 25 percent said they “didn’t learn of it” (Figure 17).

By prefecture, Shiga prefecture showed the highest percentage (74 percent) of people who said they “learned of it.”

By age bracket, the percentage of people who “learned of it” was higher than the percentage who “did not learn of it” for all age brackets (Figure 18). Those who “learned of it” accounted for a broad swath (around 80 percent) of those in their 20s through those in their 50s.

As the age rises to 60s, however, the “learned of it” responses decreased and “did not learn of it” increased. The figure for those 70 and older, in particular, rose to 38 percent. The older the age bracket the more knew that the Emergency Warning system had been launched before the typhoon, but the older the age bracket the fewer learned that the warning had actually been issued on the day of the heavy rains. The Emergency Warning was thus not well circulated among the elderly, even though they are particularly vulnerable in the case of an emergency.

Figure 17. Did You Learn of the Issuing of the Emergency Warning (by Prefecture)

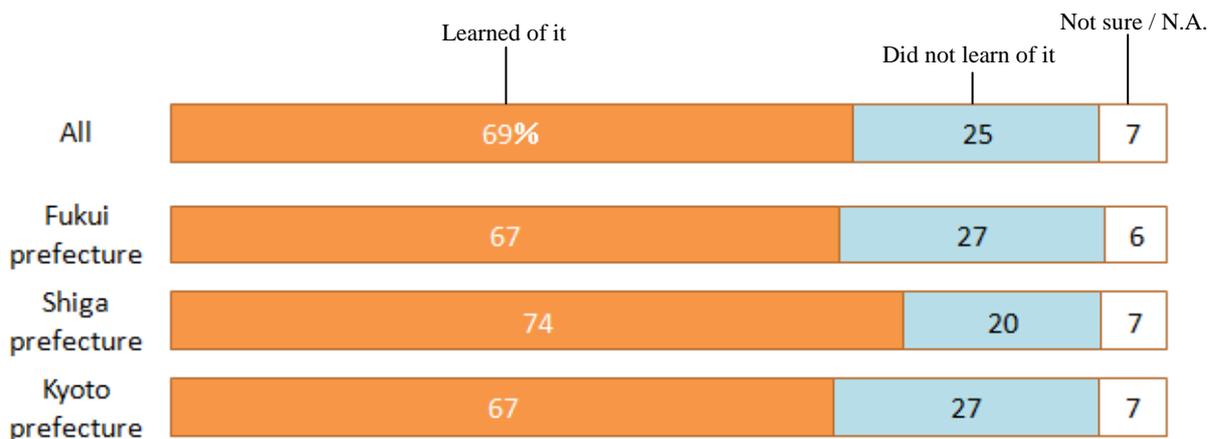
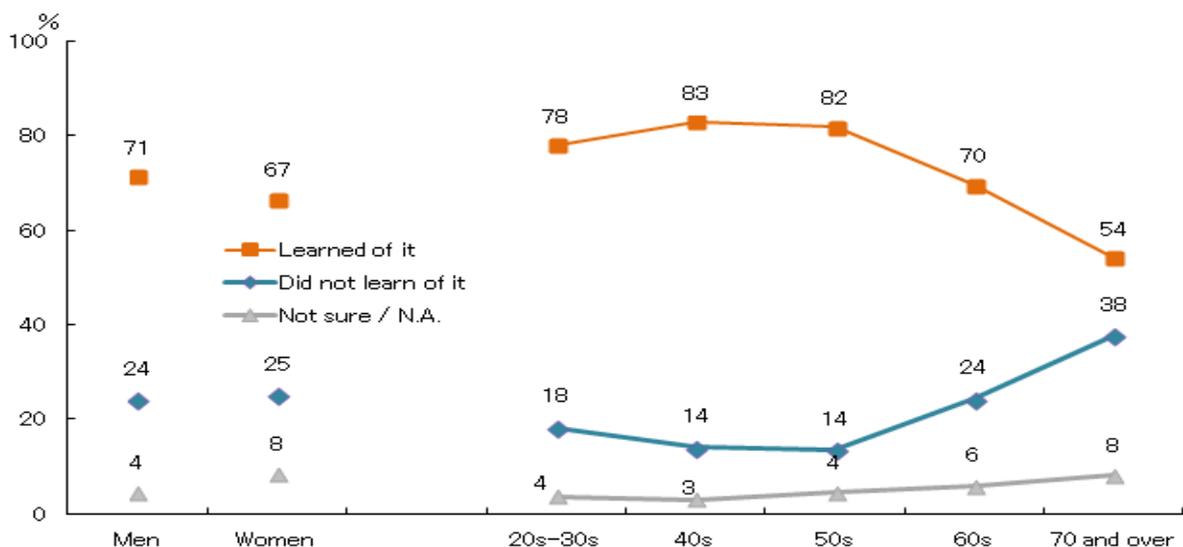


Figure 18.

Did You Learn of the Issuing of the Emergency Warning (by Gender, Age Bracket)



2 (2) *Forty-one Percent Noticed within One Hour of Issuing*

When did the Emergency Warning issued at 5:05 a.m. come to local residents' attention? When the survey asked for the time they noticed that the warning had been issued, the most (41 percent) said within one hour or "between around 5:00 and 6:00 a.m."; 25 percent said "between around 6:00 and 7:00 a.m." and 18 percent said "between around 7:00 a.m. and noon" (Figure 19). Six percent said they had noticed the warning sometime in the afternoon of the day or later, after the Heavy Rain Emergency Warning had been downgraded to a Heavy Rain Warning.

The Heavy Rain Emergency Warning was information of high urgency aimed at letting people know that they could face grave danger, but quite a large number of people did not realize the warning until more than an hour after its announcement, probably because the hour was early in the morning, while many were still asleep.

When we look at the results by prefecture, the largest number of people who noticed the Emergency Warning between 5:00 and 6:00 a.m. were 46 percent in Kyoto prefecture (Figure 19).

Figure 19. Time Learned of the Emergency Warning (by Prefecture)

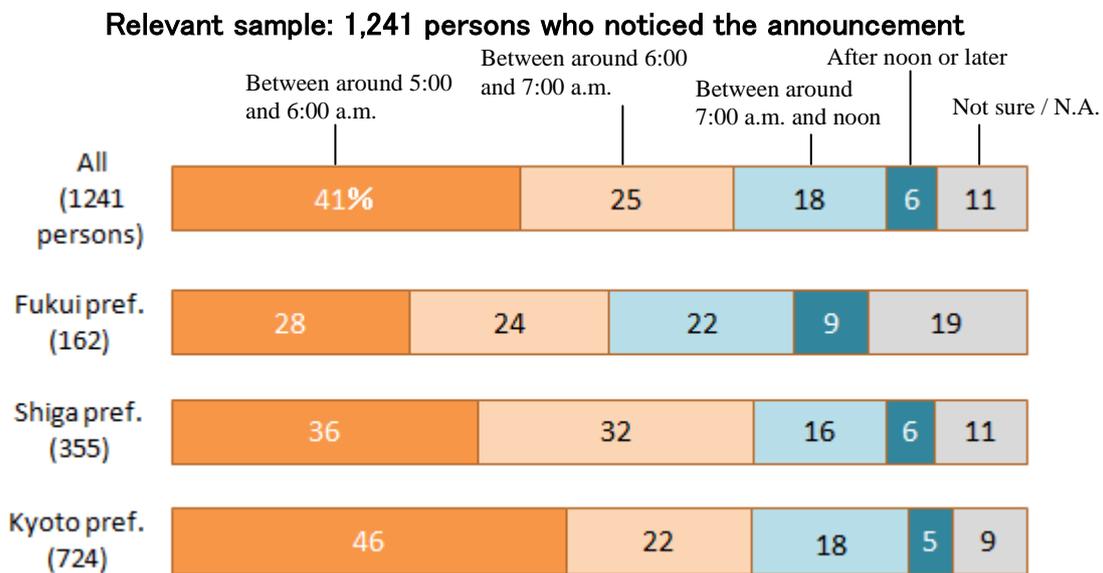
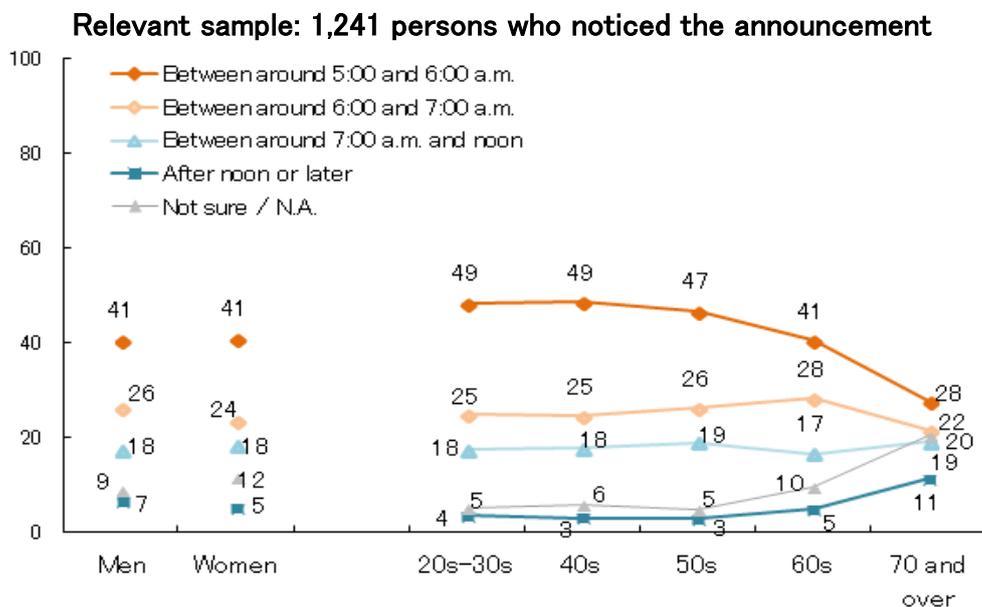


Figure 20. Time the Issuing of the Emergency Warning Noticed (by Gender, Age bracket)



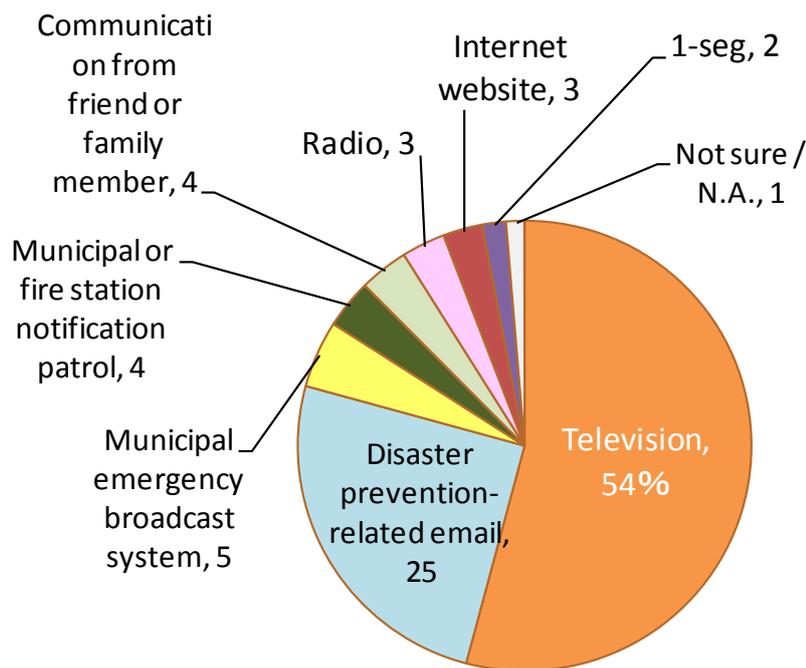
By age bracket, about 50 percent of those up to their 50s noticed at an early stage (between around 5:00 and 6:00 a.m.), as did 41 percent of those in their 60s, only 28 percent of those 70 and over noticed about it at that early hour (Figure 20).

A sizeable percentage (11 percent) of those 70 and over only noticed “after noon or later,” after the Heavy Rain Emergency Warning had been lifted. Not only did more of those in the older age brackets not learn that the Emergency Warning had been issued, they noticed it later than others.

2 (3) Most Alerted by Television and Email

Through what media did people first learn about the issuing of the Emergency Warning? We asked them to choose one from eight options (see Figure 21). The majority alerted by television (54 percent), followed by “disaster prevention-related email” message (25 percent). Those who chose the other options (see the figure) were few.

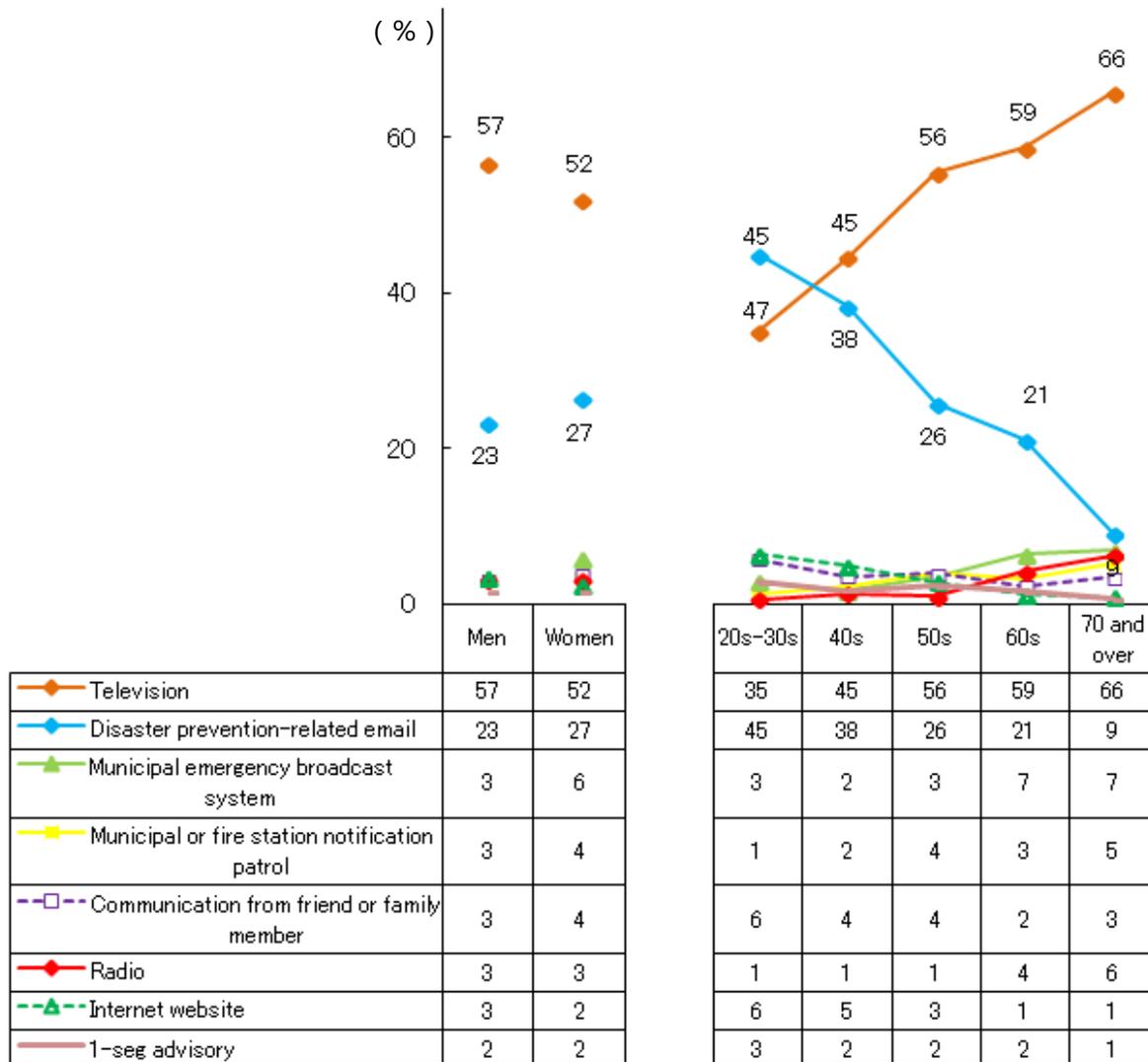
Figure 21. Means by which Alerted to the Emergency Warning
relevant sample: 1,241 persons who learned of the announcement



By age bracket, the older the age bracket the higher the percentage who learned via television: 35 percent for those in their 20s and 30s, 45 percent for those in their 40s, more than 50 percent for those in their 50s and 60s, and 66 percent for those 70 and over (Figure 22).

By contrast, the percentage of people who learned by “disaster prevention-related email” is lower with increased age: 45 percent for those in their 20s and 30s, 38 percent for those in their 40s, between 20 and 30 percent for those in their 50s and 60s, and 9 percent for those 70 and over.

Figure 22. Means by which alerted to the Emergency Warning (by Gender, Age Bracket)
Relevant sample: 1,241 persons who learned of the announcement



2 (4) By Email Immediately After; By Television at Later Time

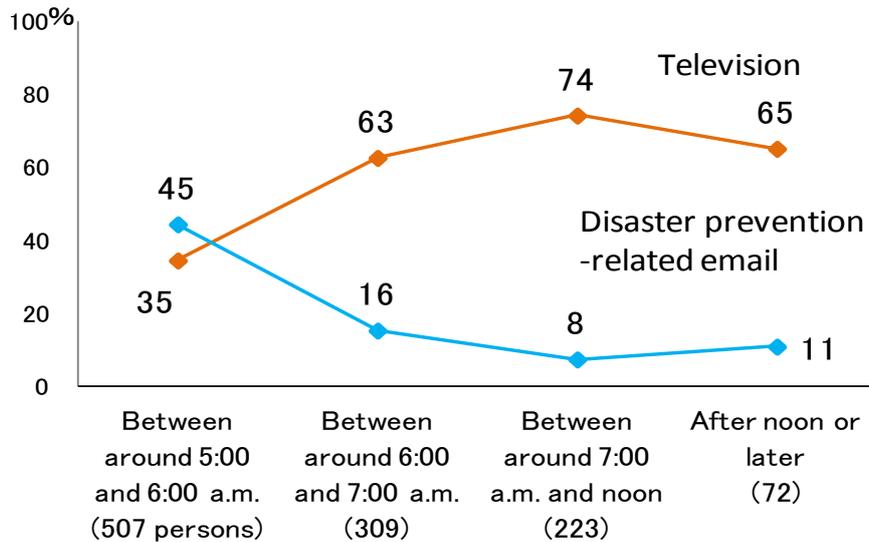
Was there a disparity in how people learned about the Emergency Warning depending on the time of day? Figure 23 charts the figures for “television” and “disaster prevention-related email” which were the two most numerous responses. For those who learned within an hour of the announcement (between around 5:00 and 6:00 a.m.), the largest percentage (45 percent) learned by email. However, from the “between around 6:00 and 7:00 a.m.” time slot onward, far more people learned via television than via email.

Televisions and radios have to be turned on to be seen/heard, but email to a mobile phone comes in automatically as long as it is turned on. This survey data shows that media such as mobile phones are effective in transmitting emergency information.

As demonstrated in 2 (3) above, since the elderly are often not familiar with the use of mobile phones or other communication devices, they are likely to be late in learning about emergency announcements.

Figure 23. Means by which Alerted to the Emergency Warning (by Time of Day)

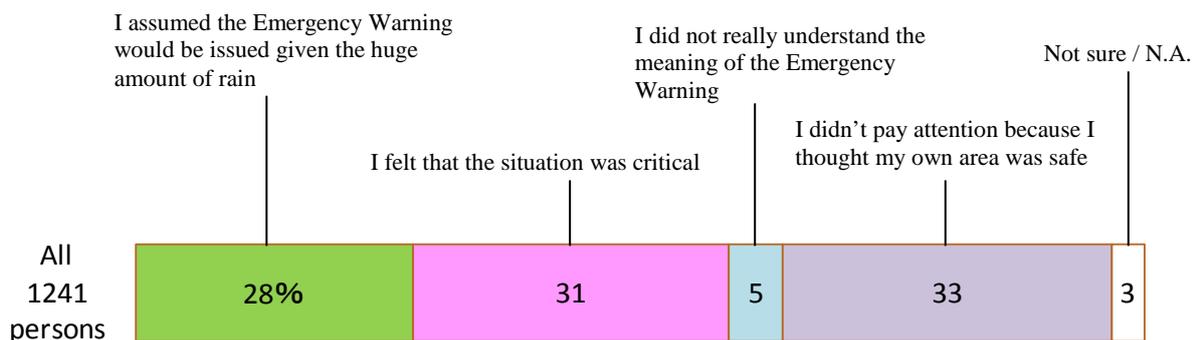
Relevant sample: 1,241 persons who learned of the announcement



2 (5) Reaction to the Emergency Warning

The results of the survey giving people four choices regarding what they thought when they learned of the issuing of the Emergency Warning are presented in Figure 24. Thirty-three percent said they “didn’t pay attention because I thought my own area was safe,” but 31 percent said they “felt a sense of crisis.” A sense of the seriousness of the situation was communicated to that 31 percent. Twenty-eight percent responded, “I assumed the Emergency Warning would be issued given the huge amount of rain” and only 5 percent said “I did not really understand the meaning of the Emergency Warning.” These figures suggest that the Emergency Warning was to a certain degree successful in communicating the seriousness of the situation.

Figure 24. Reaction to the Emergency Warning
Relevant sample: 1,241 persons who learned of the announcement



3. Action Taken After Hearing about the Emergency Warning

3 (1) One Percent “Evacuated”; Seventy Percent “Did Nothing in Particular”

The Japan Meteorological Agency calls on people to react promptly in order to assure their own safety when an Emergency Warning is issued: If they have not evacuated already, they should go to a nearby evacuation facility or, if it is dangerous to leave their homes, they should move to a part of the house that is safe.

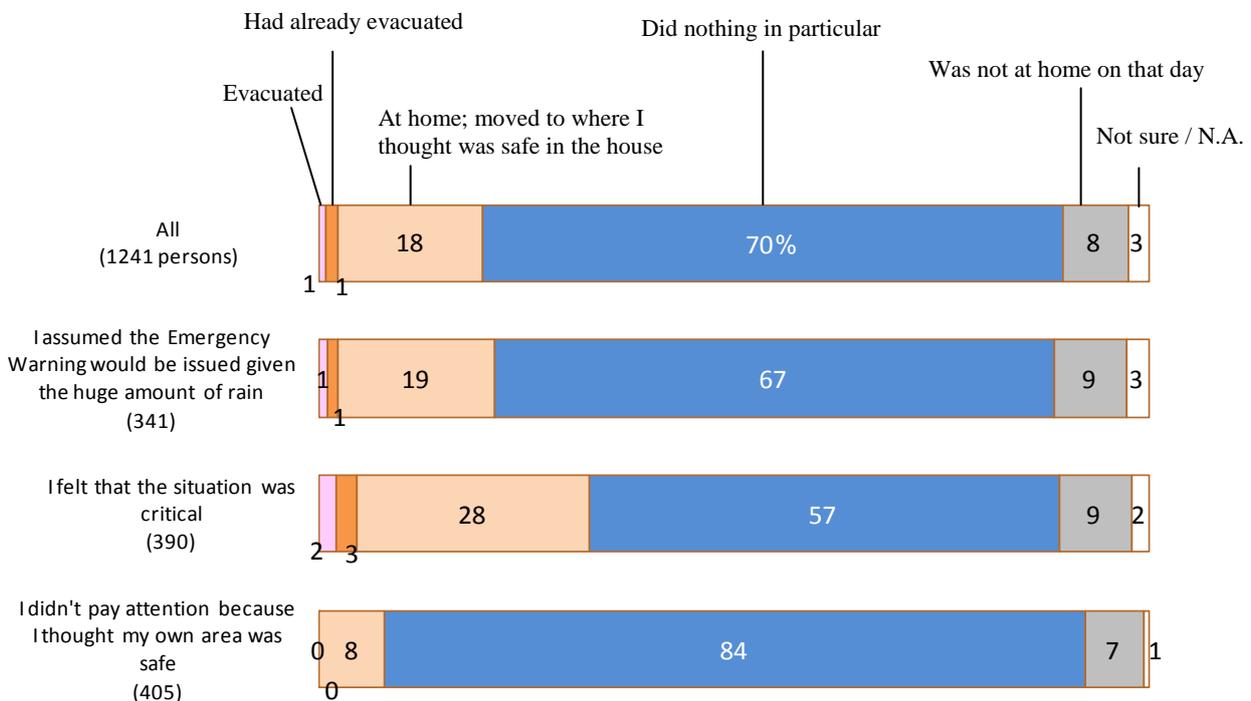
When the survey asked what people did after learning about the announcement of the Emergency Warning, 70 percent said they “did nothing in particular. Those who had “already evacuated” or who “evacuated” were both as few as 1 percent (Figure 25). Eighteen percent said they “stayed at home and moved to where I thought was safe in the house.” There were no differences in such behavior from one prefecture to another.

The issuing of the Emergency Warning did communicate the seriousness of the situation to residents to a certain extent, but it did not necessarily prompt them to take action to avoid grave danger. It is said that in order for people to evacuate or take other action to avoid crisis, the information must be such that they feel they are personally and physically in danger. The Emergency Warning is issued over a wide area consisting of a number of municipalities on the prefectural level, but from the point of view of individual residents, if they cannot see what kinds of danger are posed to specific places immediately around them, such as rising waters in nearby rivers and streams, it is difficult for them to know what evasive action to take. From this point of view, then, let us look at the differences in what people thought when the Emergency Warning was issued and how they reacted (Figure 25). Among those who “felt that the situation was critical” 28 percent, the highest figure, reacted by moving “to where I thought was safe in the house.”

Figure 25.

Action After Learning that the Emergency Warning Had Been Issued (by Way of Reacting)

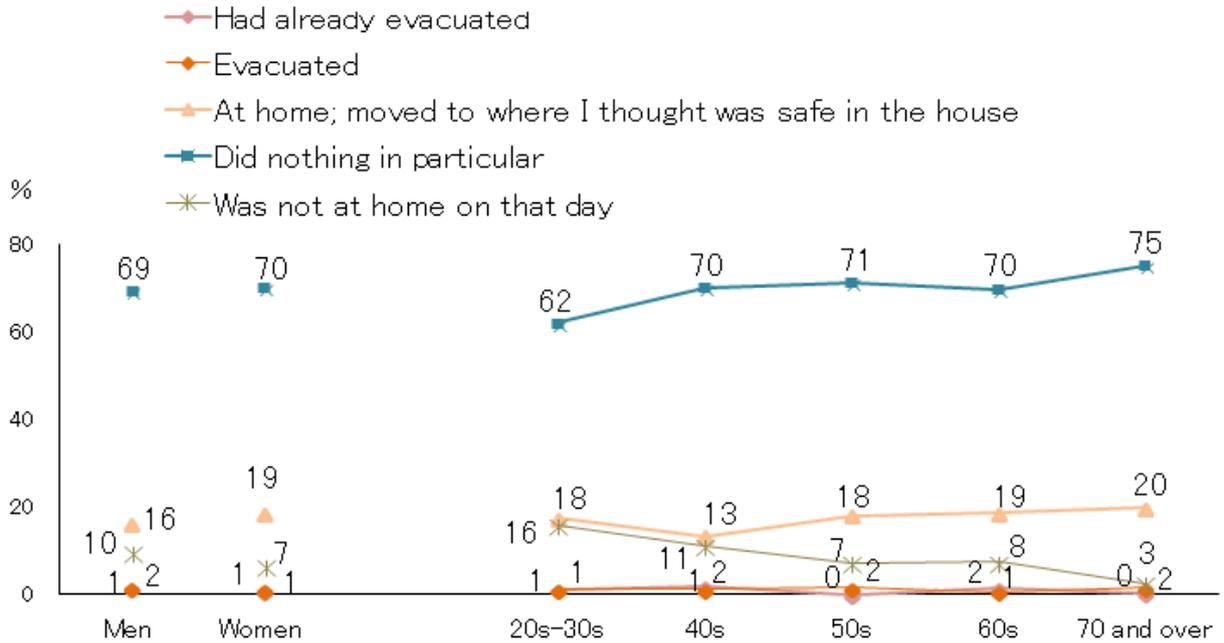
Relevant sample: 1,241 persons who learned of the announcement



*The results for “I did not really understand the meaning of the Emergency Warning” were very few, so have been omitted in this diagram.

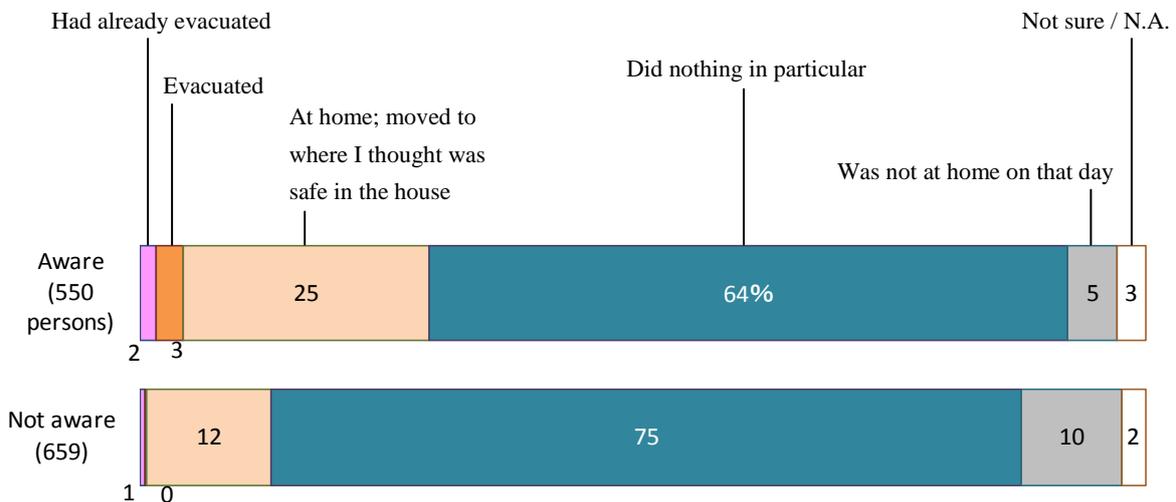
**Figure 26. Action After Learning that the Emergency Warning Had Been Issued
(by Gender, Age Bracket)**

Relevant sample: 1,241 persons who learned of the announcement



**Figure 27. Action After Learning that the Emergency Warning Had Been Issued
(by Awareness or Not of the Evacuation Advisory/Order)**

Relevant sample: 1,241 persons who learned of the announcement



Looking at actions taken by age bracket, we see that “Did nothing in particular” was the majority for all the age brackets, and was as high as 75 percent for those 70 and over (Figure 26).

How did people who learned of the earlier announcement of the advisory/order to evacuate react following the issuing of the Emergency Warning (Figure 27)? Those who responded that the evacuation advisory/order had been “issued” are referred to as “aware” and those who said,

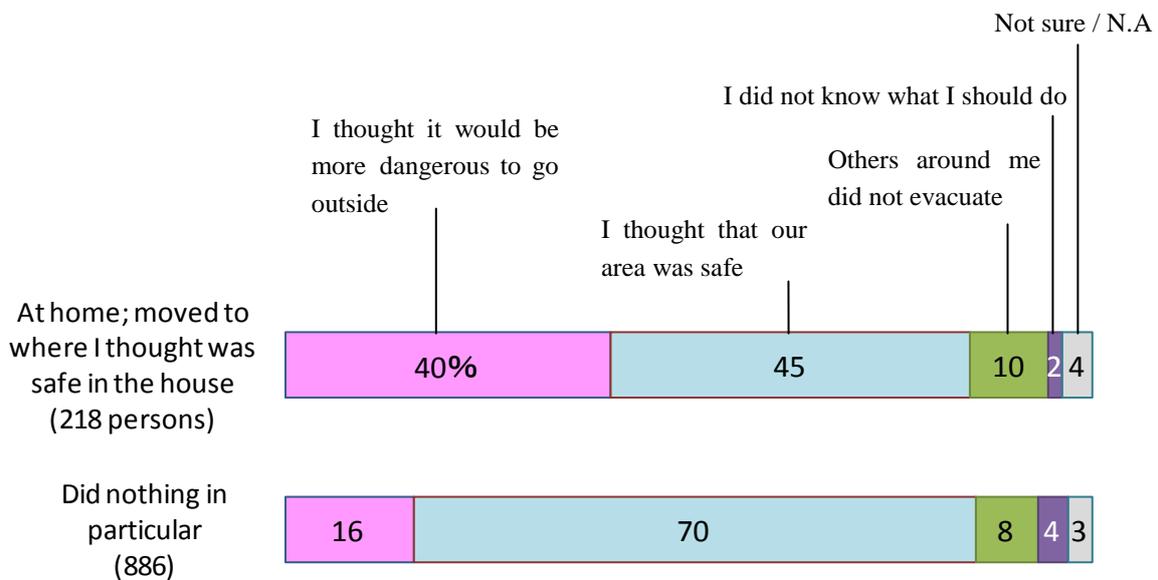
“Issued, but did not know about it on that day,” “Not issued,” or “Do not know whether or not issued” are referred to as “not aware.” Organized this way, of those who were “aware,” 3 percent “evacuated” after the issuing of the Emergency Warning, and of those who were “not aware” 0 percent. Also, of those who were “aware,” 25 percent “moved to where I thought was safe in the house.” while, of those who were “not aware,” 12 percent did so, meaning that more people who were “aware” took some action.

3 (2) “Did Nothing in Particular” because “Thought It was Safe”

Figure 28 shows results of the question asking those who did not evacuate even after they learned of the issuing of the Emergency Warning, to choose one of four options for the reason they didn’t. Those who said they “moved to where I thought was safe in the house.” cited at about the same rate the reasons “I thought it would be more dangerous to go outside” and “I thought our area was safe.”

Figure 28. Reasons Did Not Evacuate (by Action Taken)

Relevant sample: 1,084 persons who did not evacuate



Meanwhile, for those who said, “Did nothing in particular,” the reason given by the clear majority was “I thought that our area was safe.” Sixteen percent of those who took no action did so because they “thought it would be more dangerous to go outside” and 4 percent because “I did not know what I should do.”

In fact, heavy rain does not, in most cases, post an immediate danger, but another possible factor is that people’s psychological tendency, even when information suggesting danger is provided, is to be swayed by the “normalcy bias.”¹⁸

¹⁸ This term used in social psychology and disaster psychology refers to the tendency of people to grasp things within the scope of normalcy even under somewhat abnormal conditions.

4 Evaluations of the Emergency Warning

4 (1) Evaluations of the Timing of the Issuing and Lifting of the Warning

How did residents evaluate the timing of the issuing and the lifting of the Emergency Warning? The questionnaire asked those who learned of the issuing of the Emergency Warning to choose between “too early,” “appropriate,” and “too late.”

Seventy percent said the timing was “appropriate,” while 9 percent said it was “too early,” and 10 percent said it was “too late,” so the majority agreed that it was appropriately timed (Figure 29).

By gender and age bracket, more than 60 percent of both men and women of all age brackets thought the timing of the issuing of the Emergency Warning was “appropriate.”

By prefecture, there was very little variance in seeing the timing appropriate (Fukui prefecture 72 percent; Shiga prefecture 68 percent, and Kyoto prefecture 70 percent).

Figure 29. Evaluation of the Timing of the Issuance of the Emergency Warning (by Prefecture)

Relevant sample: 1,241 persons who learned of the announcement

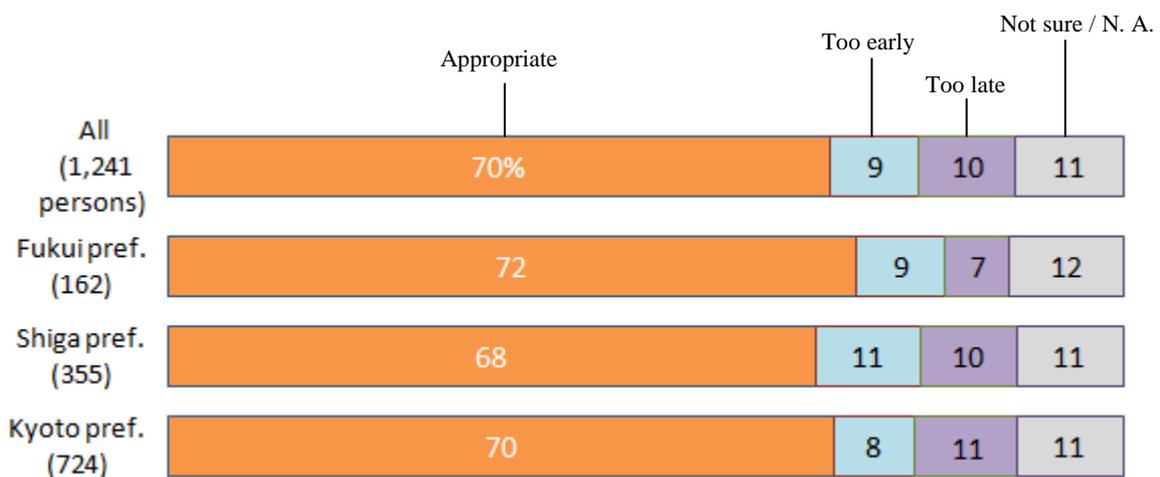
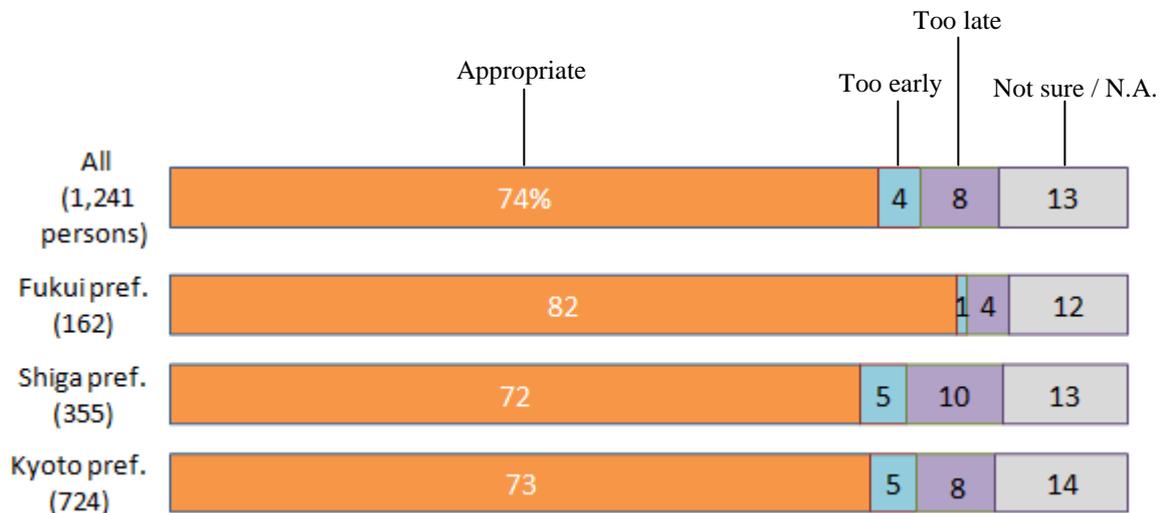


Figure 30. Evaluation of the Timing of the Lifting of the Emergency Warning (by Prefecture)

Relevant sample: 1,241 persons who learned of the announcement



Regarding the timing of the lifting of the Emergency Warning, more residents indicated their approval than for the issuing of the warning (appropriate 74 percent; too early 4 percent; too late 8 percent) (Figure 30).

By gender and age bracket, more than 70 percent of both men and women of all age brackets thought the timing of the lifting of the warning was “appropriate.”

By prefecture, those who thought the timing was appropriate were particularly numerous for Fukui prefecture.

4 (2) Majority Approved of the Emergency Warning

When the survey asked whether the Emergency Warning issued September 16 helped to protect the lives of residents, 20 percent said “very helpful,” 52 percent said “somewhat helpful,” while 15 percent said “not very helpful” and 4 percent said “not at all helpful.” This means “helpful” 72 percent, and “not helpful” 19 percent, indicating that a majority approved of the effectiveness of the Emergency Warning (Figure 31).

Looking at the responses by prefecture, approval in Fukui prefecture (75 percent) was slightly higher than in Shiga prefecture (71 percent) and Kyoto prefecture (72 percent).

Among those who learned that the Emergency Warning was issued, 81 percent said it was “helpful.”

By the media via which people first learned about the Emergency Warning, 78 percent of those who first learned via television took the warning “helpful,” and an even higher percentage (85 percent) in the case of those who first learned by email.

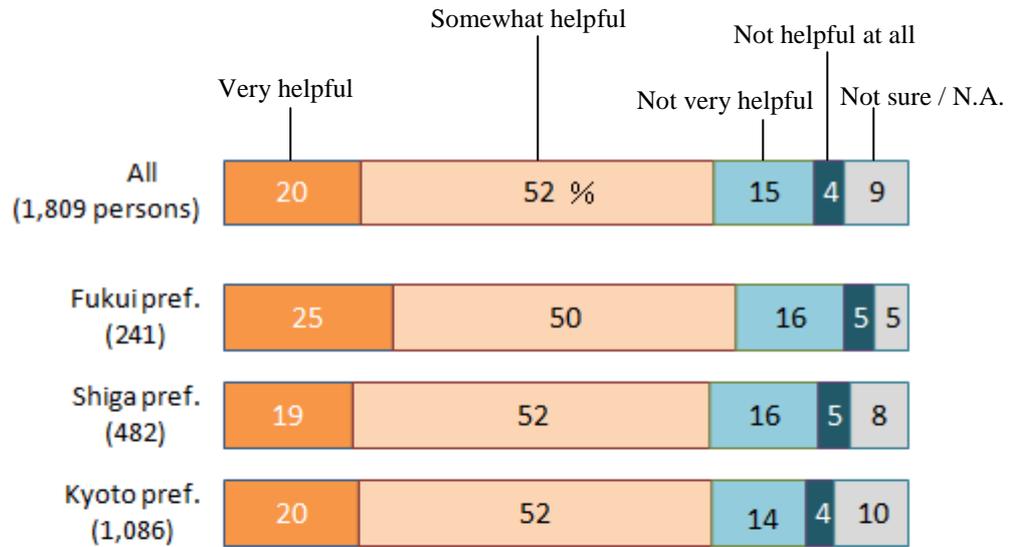
By gender and age bracket, 72 percent of both men and women said it was “helpful,” and while around 80 percent of those in their 50s and younger took it “helpful,” fewer in the higher age brackets took it so (73 percent for those in their 60s and 65 percent for those 70 and over; Figure 32).

Those who answered that the Emergency Warning was “helpful” and those who said it was “not helpful,” differed concerning evaluation of the timing of the “issuing” and “lifting” of the warning (Figure 33). Seventy-six percent of those who answered that it was “helpful” said that the timing of its issuing was “appropriate” and 79 percent that the timing of its lifting was “appropriate,” overall approving of its timing.

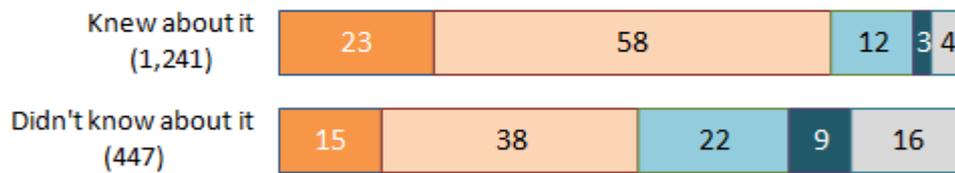
By contrast, among those who answered that the Emergency Warning was “not helpful,” only 42 percent said that the timing of the issuing was “appropriate” and 58 percent that the timing of the lifting was appropriate, a lower rate for approval of the issuing of the announcement. The timing of the issuing, therefore, must be considered as a factor behind dissatisfaction with the Emergency Warning.

Figure 31.

Was the Emergency Warning Helpful? (by Prefecture; Awareness of Issuing; Means Known)



Did you know about the issuing of the Emergency Warning?



By what means did you first learn of the issuing of the Emergency Warning?



Figure 32. Was the Emergency Warning Helpful? (by Gender, Age Bracket)

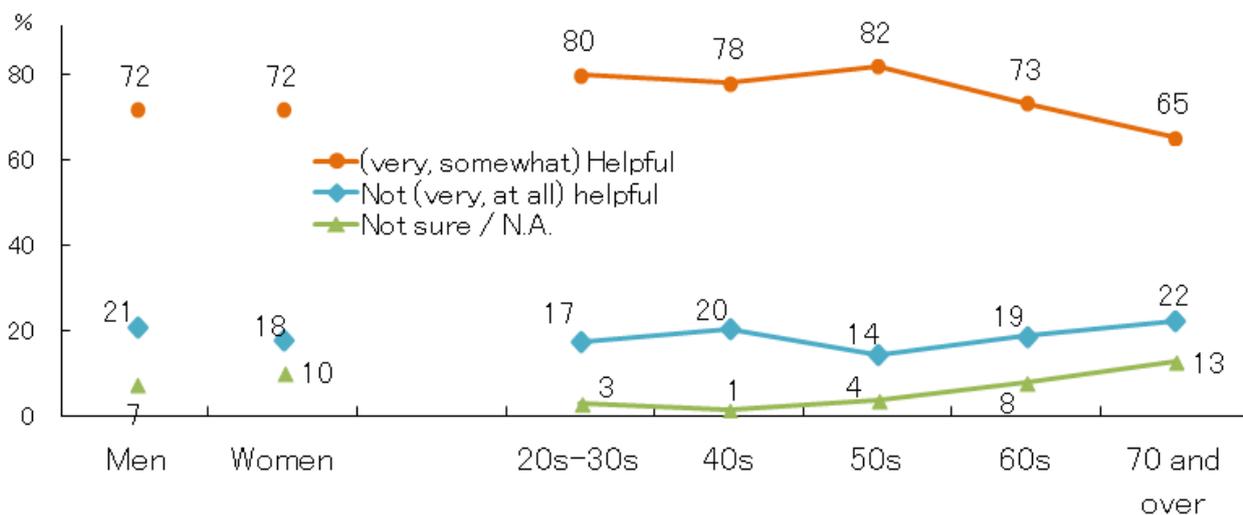
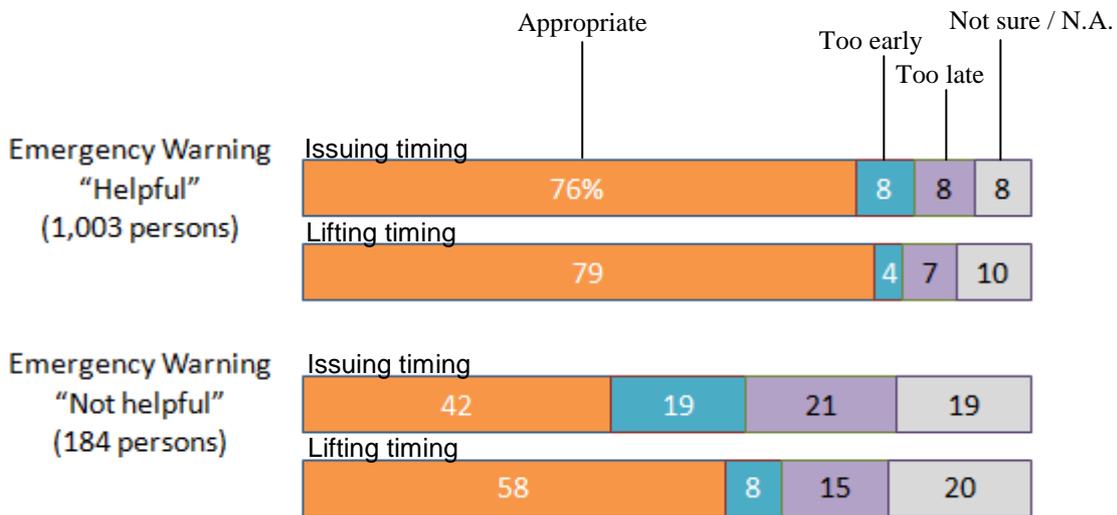


Figure 33. Evaluation of the Timing of the “Issuing” and “Lifting” of the Emergency Warning (by “Helpful” / “Not Helpful” Evaluation)
 Relevant sample: 1,241 persons who learned of the announcement



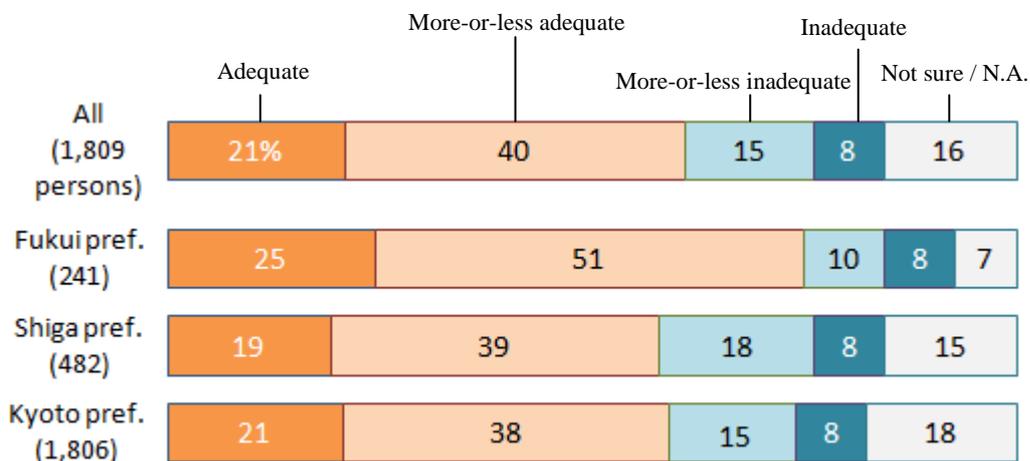
4 (3) Local Government Responses: Majority Approval

When the survey asked about residents’ views of their local government response to the heavy rains of Typhoon Man-yi, 21 percent said the response was “adequate,” 40 percent said “more-or-less adequate,” 15 percent “more-or-less inadequate,” 8 percent “inadequate,” for a total of 61 percent approving of the response. Only 24 percent disapproved¹⁹ (See Figure 34).

By prefecture, the “adequate” evaluation was highest for Fukui (Fukui 75 percent; Kyoto 59 percent, and Shiga 58 percent).

In Fukui prefecture, the percentage of people who considered the Emergency Warning helpful and the percentage of people who considered the timing of its lifting appropriate were greater than for either Shiga or Kyoto prefectures.

Figure 34. Evaluation of the Local Government Response (by Prefecture)



¹⁹ When adding up the figures for the response results, the percentages have been calculated on the basis of real numbers, so they are not necessarily the same as the percentages added up.

Conclusion

The purpose of this study is to evaluate various questions relating to the Japan Meteorological Agency's first issuing of the Emergency Warning, including how the broadcasting media and local government bodies transmitted the warning, when and by what means residents learned of the Emergency Warning, how they reacted to the warning, whether or not the warning appropriately transmitted to residents the seriousness of the situation, and what kinds of issues remain in the transmission of the information. To support the study, we conducted a qualitative survey through interviewing and by conducting an opinion poll by telephone (quantitative survey). The conclusions of the study are as follows.

Conclusions of the Study

■ The Japan Meteorological Agency predicted from quite an early stage in the approach of Typhoon Man-yi that heavy rains would fall over many areas of the Japanese archipelago. The day after the typhoon formed, the JMA indicated that an Emergency Warning might be issued.

When the rainfall in Shiga, Kyoto, and Fukui prefectures rose to the once-in-the-five-decades level in more than 50 of the 5-kilometer-square cells both for 48-hour precipitation and soil water index in the grid map of these areas, and based on the prediction that the heavy rain would continue to fall, the JMA issued the Heavy Rain Emergency Warning.

■ NHK picked up on information that the JMA was working on the decision about issuing the Emergency Warning about 30 minutes before the issuing. Immediately after the warning was issued, on television, NHK broadcast on both its local and national channels news flash captions accompanied by a chime alert. On radio, it interrupted its regular programming on national and local area broadcasting to present the first announcement of the issuing of the Emergency Warning. The text of the first announcement was written to communicate a sense of urgency using the definitive form of expression that would leave no doubt as to the seriousness of the situation. It also repeated, in easy-to-understand language, the meaning of the Emergency Warning and the necessary actions to be taken.

■ The cities of Kyoto and Fukuchiyama, where the rivers threatened to overflow their banks, received the Emergency Warning amid their feverish efforts to address an increasingly dangerous situation. They adjusted the text of a previously prepared Emergency Warning notification for residents and communicated it to their residents through all sorts of media. In Fukuchiyama, which had been preparing to announce an Evacuation Order to the entire area of the city, promptly added an Emergency Warning text to the Evacuation Order notification. In some municipalities, therefore, disaster-prevention response functions become congested, so if information can be provided beforehand about the imminent issuing of an Emergency Warning, the information will go out more smoothly

■ The Emergency Warning reached most residents, but among the elderly, a large number did not notice the warning and learned about it only later. Dissemination of the warning among the elderly who are less mobile and need more time to evacuate was inadequate.

■ The means through which people learned of the Emergency Warning was in most cases television or disaster prevention-related email. Those who learned of the issuing of the warning within one hour most likely did so via an email received. Those who learned of the issuing of the warning one hour or more after the announcement most likely did so through television. Disaster prevention-related email received via a mobile phone has the characteristic of so-called “push” technology—display on a pop-up screen accompanied by a sound alert upon being sent out by the sender of the information—so that it was effective in alerting many people who were asleep at the time the Emergency Warning was issued.²⁰

■ The seriousness of the situation was transmitted to residents by the Emergency Warning to a certain extent, but not many took action to avert danger.

This paper examines the first issuing of the Heavy Rain Emergency Warning from the point of view of information transmission; it does not attempt to consider the matters such as rules for issuing the warnings or guidelines for such rules nor the appropriateness of the announcements on the broad prefecture-wide scale. At this writing (mid-November 2013), not long after the launching of the Emergency Warning system, it was too early to attempt a deeper appraisal of the system.

We will continue our steady efforts at survey and research so as to explore the optimal features of the Emergency Warning in order to most appropriately transmit the gravity of the situation and help people to keep out of harm’s way.

²⁰ “Push”-type transmission of information is that sent out unilaterally by the sender. Pull-type transmission is that in which the receiver initiates the action to obtain information desired, performs some operation, and accesses information provided by the sender. Web searches via the Internet are categorized as pull-type transmission, while television and radio are often categorized as push-type transmission.