International Congress
INTERPRAEVENT 2002 in the Pacific Rim - MATSUMOTO/JAPAN
Congress publication, volume 1, pp.467-474

RECENT SITUATION CONCERNING THE PRACTICAL USE OF THE INTERNET DURING A HEAVY RAINFALL DISASTER IN JAPAN

Motoyuki Ushiyama[1] and Kaoru Takara[2]

ABSTRACT

The rainfall observation systems in Japan have largely been improved. The Japan Meteorological Agency, the Ministry of Land, Infrastructure and Transport, prefectural governments, and other administrative bodies have increased the number of raingauges in the country. The density of observatories is now one per several km grid square. In addition, heavy rainfall information transmission systems have been improved. The Internet was popularized in the late 1990s, and has been used for the transmission of heavy rainfall disaster information by government sectors since 1998. Internet accessible cellular phones have been popular in Japan since 1999. Such phones are expected to be useful in disaster warning transmissions at the time a disaster occurs, because they can automatically notify users of the arrival of e-mails. The use of the Internet during natural disasters is groundbreaking in Japan today. However, in order to improve disaster information dissemination, it is necessary to investigate how to use information at the time of the disaster, and to suggest methods on the effective use of information technology.

KEYWORDS: heavy rainfall disaster information, Internet, disaster warning, cellular phones

INTRODUCTION

There have been dramatic changes in heavy rainfall disaster information dissemination in Japan during the past 10 years. There are two principal reasons for the changes, the first being the advances in rainfall observation and forecasting technology, and the second being the advances in information and communication technology. Japanese citizens are now able to easily use many kinds of specialized disaster information as a result of these advances. This information is expected to support warnings and the evacuation of populations during heavy rainfall. However, the methods for using this information and the problems caused by these rapid advances have rarely been studied. This paper describes the history of heavy rainfall disaster information dissemination in Japan, especially rainfall observation and

[1] Disaster Control Research Center, Graduate School of Engineering, Tohoku University, Aoba 06, Sendai, 980-8579, Japan (http://www.disaster-i.net)
[2] Disaster Prevention Research Institute, Kyoto University, Uji, Kyoto, 611-0011, Japan (takara@rdp.dpri.kyoto-u.ac.jp)

transmission, for a state-of-the-art review. In addition, issues expected to arise in the future are discussed.

HISTORY OF HEAVY RAINFALL DISASTER INFORMATION IN JAPAN

Progress of Rainfall Observation Network

Modern rainfall observation in Japan started in the 1870s. Initially, there were mainly weather offices; after that, the number of cooperative observatories increased. In 1910, there were about 1200 observatories all over Japan. The data collected by these observatories was administered by the Central Meteorological Observatory (the present JMA). The present observatory network, run by the Japan Meteorological Agency (JMA), has more than 1300 observatories.

Since the 1960s, the JMA started automatic observation and real time data collecting in the JMA cooperative observatories. The AMeDAS (Automated Meteorological Data Acquisition System) is the final product of such efforts by the JMA. It was developed in the 1970s, and completed in 1978. It has about 1320 observatories all over Japan, with one station per 17 * 17 km grid square (Figs. 1 and 2). Temperature, precipitation, wind, and the number of hours of sunshine are observed every hour. The observation data is collected through the telephone line in real time. The AMeDAS is the most popular weather observation network in Japan. About 20 years has passed since the AMeDAS was completed, and, therefore, this network has been used to obtain climatic statistics such as normal values.

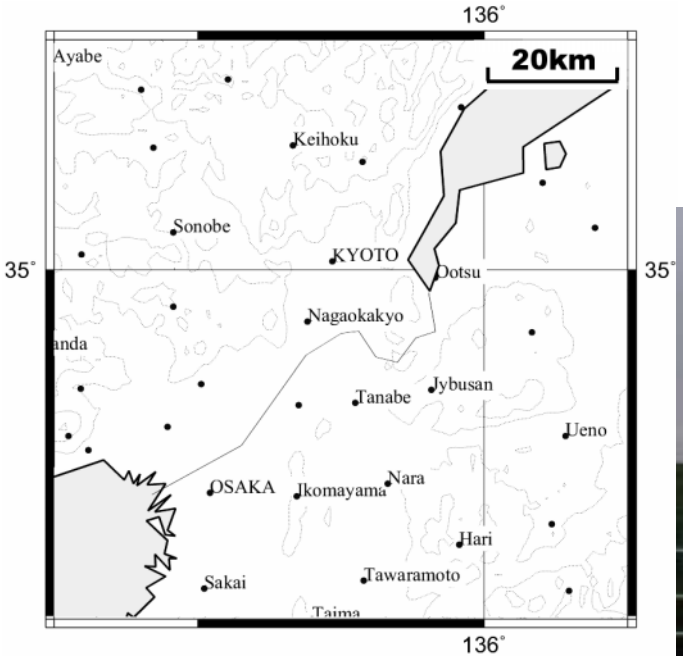

Fig.1 Distribution map of AMeDAS observatories

Fig.2 AMeDAS observatory

In the 1990s, the prefectural precipitation observatories were improved. In 1995, there were 1321 observatories run by the JMA, 2886 observatories run by Ministry of

Construction (the present Ministry of Land Infrastructure and Transportation), and 2199 observatories run by prefectures (Hydrology Study Group, Ministry of Construction, 1996). The number of prefectural observatories has recently been increasing. For example, Nagano Prefecture had 97 observatories in 1991, but had 156 (one observatory per 8.3 * 8.3 km grid square) in 1999. In addition, observation and data collection were automated in the observatories during the past 10 years.

Practical Use of WWW for Heavy Rainfall Disaster Information

The number of Internet users in Japan was estimated to be 32 million in February 2001, and the percentage of households using the Internet was estimated to be 46.5% (Association of Internet, 2001). However, the history of Internet use in Japan is short. The first use of the Internet for disaster information was in around 1995, when the Hanshin-Awaji earthquake occurred. Initially, citizens and private sector groups used various Internet sites for the exchange of relief information. In 1996, private weather companies started to supply weather information, e.g., weather forecast, precipitation observation data, weather radar data, etc., through Internet.

The first full-fledged use of the Internet by the government sector was at the time of the Tochigi and Fukushima heavy rainfall disaster in August, 1998 (Ushiyama, 1999). Local governments such as the Tochigi prefectural office, the Fukushima prefectural office, and the Kouriyama city office, which were heavy damage area, disseminated information on their homepages shortly after the disaster. By 2000, almost all central government, prefecture, city, town and village offices had their own homepages. Several governmental homepage played an active part in transformation of disaster information at the time of Tokai heavy rainfall disaster in September 2000 (Fig. 3).

Fig. 3 The active Web page about heavy rainfall event in September 2000 by Gifu Prefecture.

On the other hand, it is of note that several public offices did not use their homepages for disaster information dissemination, as pointed out in a newspaper article on the disaster (Fig. 4, Inoue et al., 2001). Namely, we may say that homepage is becoming more widely used to provide disaster information.

Fig.4 The article of Asahi Newspaper in September 14, 2000

Until around 1999, most disaster information homepages were opened temporally after the disaster. These homepages mainly contained damage reports and relief information. Since 2000, the number of permanent homepages for disaster information has been increasing (e.g., Fig.3). In 2001, the types of disaster information homepage existing on the Internet consisted of:

1) The Weather forecast
2) Heavy rainfall warnings and advisories
3) Meteorological satellite image data
4) Weather radar rainfall data
5) AMeDAS observatories precipitation data
6) Precipitation and river water level, reported by the Ministry of Land Infrastructure and Transportation or the local prefecture
7) Short range forecasting precipitation
8) Disaster damage statistics and the actions being taken by the government sector
9) Relief information offered by voluntary groups and the like.
10) Hazard maps provided by government sectors (dangerous zones, evacuation zones, hazard simulation data, etc.)
11) Disaster research reports and basic knowledge about the disaster, provided by government sectors or by scientists.

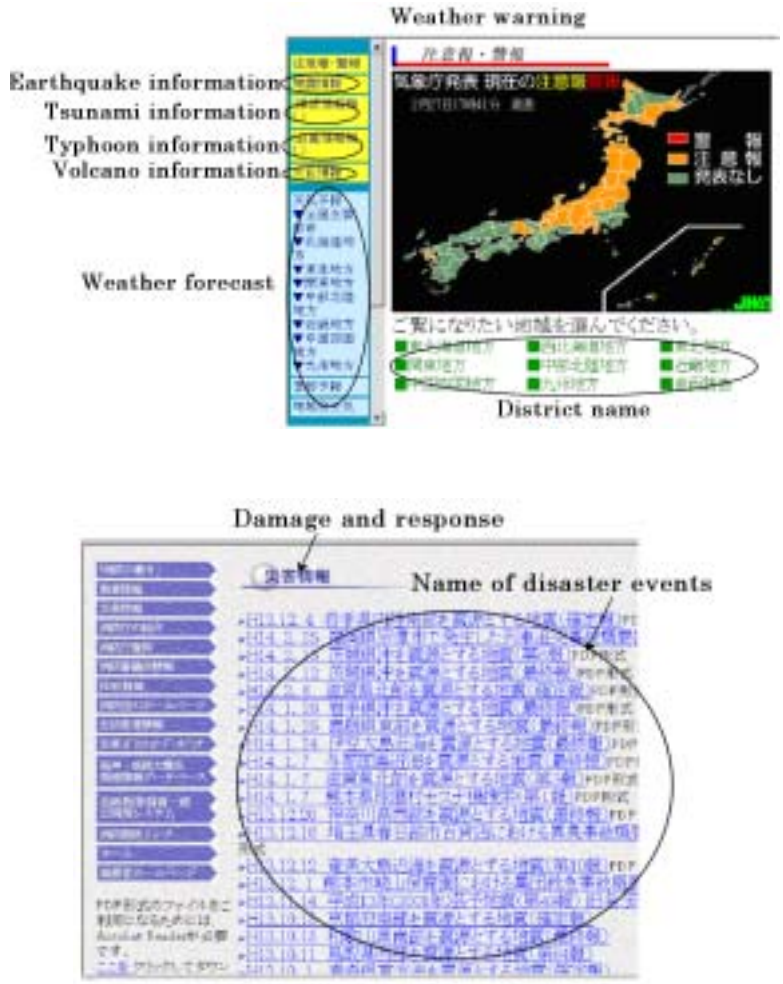

Fig.5 Example of disaster information homepages

Top: Weather warning and advisory (Japan Weather Association, http://tenki.jp/), Bottom: Disaster damage statistics and the action of government sector (Fire and Disaster Management Agency, http://www.fdma.go.jp/html/infor/index.html)

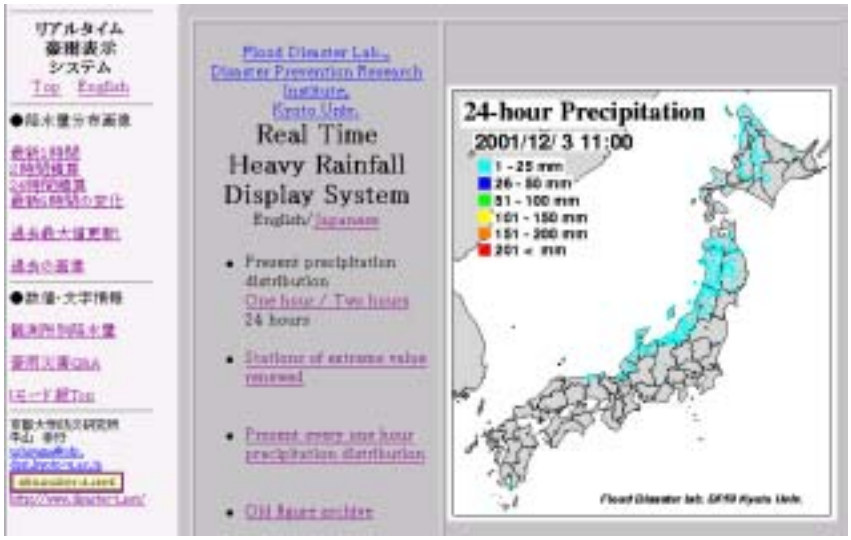

Fig.6 AMeDAS observatories precipitation data

Real Time Heavy Rainfall Display System (created by Ushiyama, http://www.disaster-i.net/rain/)

Practical Use of Internet Accessible Cellular Phone

In Japan, the use of cellular phones accessible to the Internet has spread in advance of the rest of the world. The most popular system is the "i-mode" introduced by NTT DoCoMo in February, 1999 (Fig. 7). The i-mode can send and receive Internet electric mail (e-mails); and can also browse HTML files. As of February 2001, the number of Internet users was 32,636,000. The percentage of households using the Internet in Japan 2001 was estimated to be 46.5%, while that of households using cellular phones is estimated to be 28.4% (Internet Association, 2001). The number of users of Internet accessible cellular phones is increasing today.

Systems like the "i-mode" are expected to be useful tools for collecting and exchanging information at the time of a disaster, though they require time to process image data and have limitations on the contents (or characters) they can display on the liquid crystal display of a cellular phone. One reason for the expectation that these types of systems will be used in disasters is that "i-mode" phones can be used to access the Internet without personal computers, PDA, etc. "i-mode" accessible information is increasing. Already, the "i-mode" can browse various kinds of disaster information, as shown in the preceding paragraph.

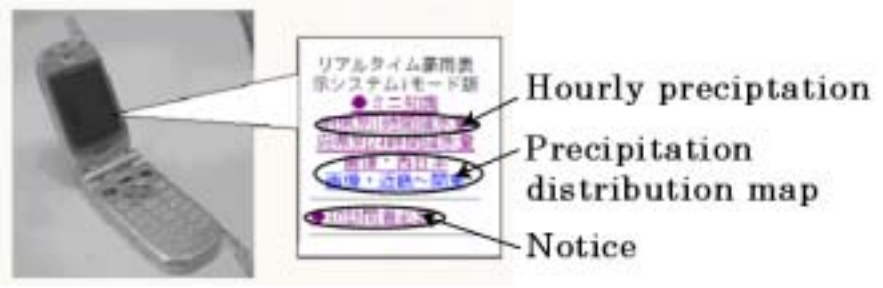

Fig.7 Image of "i-mode" phone

The top page of the Real Time Heavy Rainfall Display System (i-mode version)

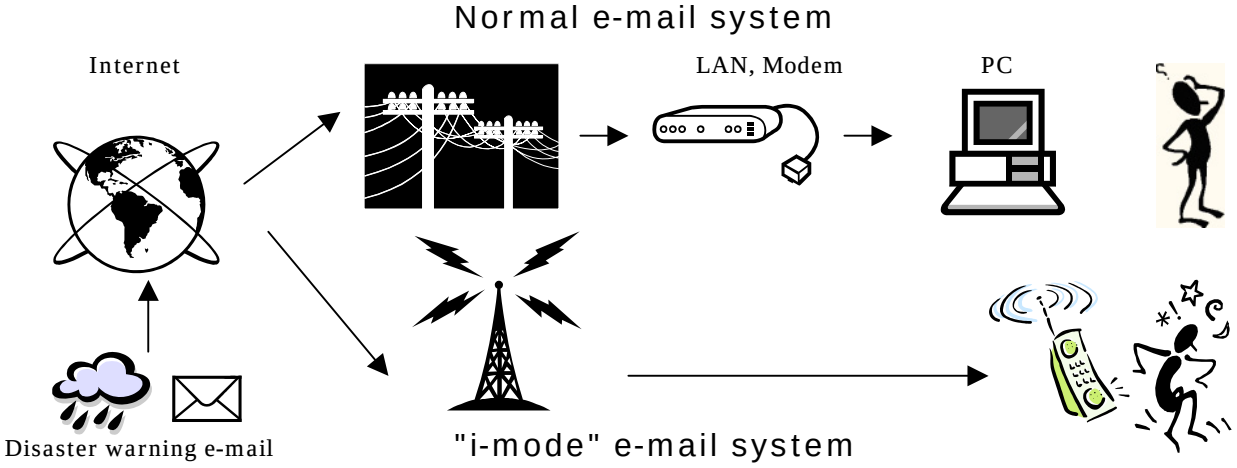

Fig.8 The "i-mode" and normal e-mail system

Another reason is that "i-mode" phones can automatically receive e-mail (Fig.8). In normal e-mail systems, a user must access an e-mail server first; but the "i-mode" system can notify the user that e-mails have been received at any time. Therefore, the "i-mode" phones can automatically receive not only precipitation data but also some disaster warning information during times of heavy rainfall. Most pagers, which are called "Pocket Bell" in Japan, can be used similarly, because the pagers are able to receive Internet e-mails.

CONCLUSIONS

The recent changes in heavy rainfall disaster information dissemination in Japan are summarized as follows:

1) The high density automated meteorological observatories network of JMA (AMeDAS) was completed in 1979. Recently, the data obtained through this network has been widely used.

2) After the 1990s, local (prefectural) governments improved their rainfall observatories networks. Many raingauges have been made automatic. As the number of observatories was increased, the raingauge density in Japan is now one raingauge per several-km square.

3) Since the late 1990s, Internet usage has progressed quickly, and has become widely used in the public and private sector. The first full-fledged Internet usage for rainfall disaster by governmental sectors was at the time of the heavy rainfall disaster in August 1998. Since around 2000, many governmental home pages continuously provide information on disasters for the general public in Japan.

4) Since 1999 in Japan, the use of Internet accessible cellular phones has become widespread, in advance of the rest of the world. Such phones are expected to be useful tools for information collection and exchange at the time of disaster, because they are able to receive warnings at the time of heavy rainfalls, and can notify the user when e-mails have been received.

The quantity and quality of heavy rainfall disaster information in Japan has made remarkable progress during the past 10 years. In the USA, the "Tone Alert Radio" or "Weather Radio" a radio type weather or disaster information transmittance system, was popularized before the Internet (J. Sorensen, 2000). However, Japan never had such a system, and the Japanese have little know-how about disaster information usage. Ushiyama (1999) indicated that many people did not understand rainfall information well, including the methods used in rainfall observation and the unit of measurement used to measure rainfall (the fact that it is measured in mm). It is important to educate people by not only providing simple data, but also by explaining the information supplied.

It is well known that telephone line congestion often occurs at the time of disasters. In Japan, most Internet users access the Internet through the telephone

line. Therefore, it was presumed that many Internet users were not able to access the Internet at the time of a disaster. Nakamura (2001) reported that this occurred during the Geiyo Earthquake in March, 2001.

These are groundbreaking years in terms of the Internet disaster information age in Japan. It is necessary to investigate how to use the information at the time of disaster, and to suggest methods on the effective use of the information technology available.

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