

Delivering Tsunami Warnings via “Area Mail” Early Warning System

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1. Introduction

NTT DOCOMO has been providing the “Area Mail^{*1}” early warning system since December 2007. Relaying earthquake early warnings from the Japan Meteorological Agency (hereinafter referred to as “JMA”), NTT DOCOMO delivers “Area Mail (earthquake early warnings)” to areas that are expected to experience strong tremors (seismic intensity 4 or more), or delivers “Area Mail (disaster and evacuation information)” from national or local public bodies, which includes safety information for the general public such as evacuation information. From July 2011, Area Mail (disaster and evacuation information) has been provided free of charge to information distributors such as national and local public bodies, and as of 15th of March 2012, there are approximately 960 of these institutions using the service.

Although a year has passed since the Great East Japan Earthquake of March 11, 2011, the memory is still fresh in people’s minds. In this unprecedented event, the destruction caused by the tsunami triggered was far greater than the damage caused by the actual shaking resulting from the earthquake.

“Area Mail (disaster and evacuation information)” enables national and local public bodies to deliver tsunami warnings to the population. However, because people working in national and local public bodies need to perform operations to deliver a warning, and because these information distributors can only deliver the information to the municipalities in which they exist, tsunami warnings are not always promptly delivered to cell phones in all the areas targeted for the warning. Furthermore, since the Great East Japan Earthquake, NTT DOCOMO has received demands for automated Area Mail systems that operate similar to “Area Mail (earthquake early warnings)” issued from some national and local public bodies, to deliver tsunami warnings issued by the JMA to target areas.

Against this backdrop, and in view of our role in society as a mobile telecommunications service provider, we commenced delivery of tsunami warnings via Area Mail from February 24, 2012. This emergency warning service, which delivers tsunami warnings automatically, is the first of its type in the world. This article describes an overview of the Area Mail tsunami warning delivery service and the technological aspects needed to bring it about.

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*1 **Area Mail:** A service for instantly broadcasting alerts such as earthquake early warnings from the JMA.

2. Service Overview

Figure 1 describes the service image. The characteristics of the service are as follows:

1) Purpose of the Service

This service aims to quickly provide mobile terminals in target areas with JMA-issued tsunami warnings.

2) Content of Warnings Delivered

The service delivers “major tsunami warnings” and “tsunami warnings” which are defined by the JMA. Both of these warnings are termed “tsunami warnings” (**Table 1**) [1].

3) Delivery Areas

Warnings are delivered to municipalities in the area for which a “tsunami warning” has been issued. The JMA has defined 66 coastal zones nationwide (tsunami forecast regions) as warning delivery areas [2].

4) Content of Messages Displayed

To enable users to quickly and easily recognize the warning, the straight-to-the-point message reads ‘A “tsunami warning” has been issued’ (**Figure 2**). Details such as the size of the tsunami and its estimated time of arrival are not delivered. That information is available via disaster prevention radio, TV, radio or “Area Mail (disaster and evacuation information)” distributed from national and local

public bodies [3].

5) Ring Tone

A special warning ring tone (a chiming sound) is pre-installed in NTT DOCOMO’s Area Mail compatible models (feature phones (i-mode terminals), smartphones and tablets). The ring tone is the same ring tone used for “Area Mail (disaster and evacuation information),” because the ring tone used for “Area Mail (earthquake early warnings)” is a special buzzer sound, and is already a well established as the sound used for earthquake early warnings, we chose the chiming ring tone to distinguish the warning type [3].

6) Delivery Time

Similar to “Area Mail (earthquake early warnings),” delivery can take up to ten or so seconds after the JMA issues a warning.

7) Other Aspects

Because this service aims to provide promptly and easily recognizable warnings, it is limited to delivery of the first warning only. Updates or warning cancellation are not delivered or retransmitted. However, if the number of areas targeted for the delivery increases with updated information, the warning is delivered to those new target areas only.

3. Technology Overview

To achieve this “tsunami warning” development,

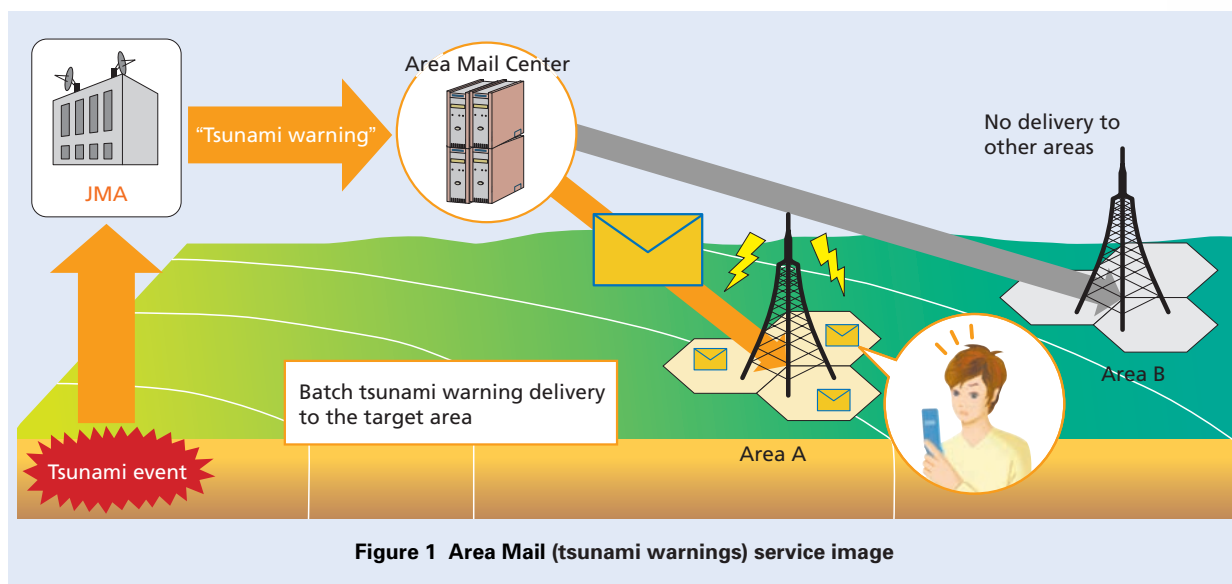


Figure 1 Area Mail (tsunami warnings) service image

the Cell Broadcast Center (CBC)^{*2} which provides the broadcast distribution platform for the current Area Mail service is used. The following describes specific requirements for “tsunami warning” delivery.

The formats of the warning messages received from the JMA are different for earthquake early warnings and “tsunami warnings”. Earthquake early warning information to be distributed is received in an earthquake early warning signal format defined by the JMA. On the other hand, “tsunami warnings” are received in a special tsunami eXtensible Markup Language (XML) format^{*3} also defined by the JMA. For this reason, functions that interpret the XML format (Figure 3) were developed.

For “tsunami warnings,” consideration was given

Table 1 Tsunami warning definitions

	Major tsunami	Tsunami
“Tsunami warning”	Peak predicted tsunami height greater than 3 m	Peak predicted tsunami height around 2 m



to the fact that the target delivery areas may increase and successive information delivery be required if multiple earthquakes are triggered - after-shocks and so forth - even though there may only be one initial earthquake (Figure 4).

For this reason, if CBC receives subsequent “tsunami warning” delivery information, it decides not to resend tsunami warnings to areas to which they have already been delivered. Table 2 shows an example of a tsunami warning delivery decision.

These decisions in CBC are made based on the information below, specified in XML format.

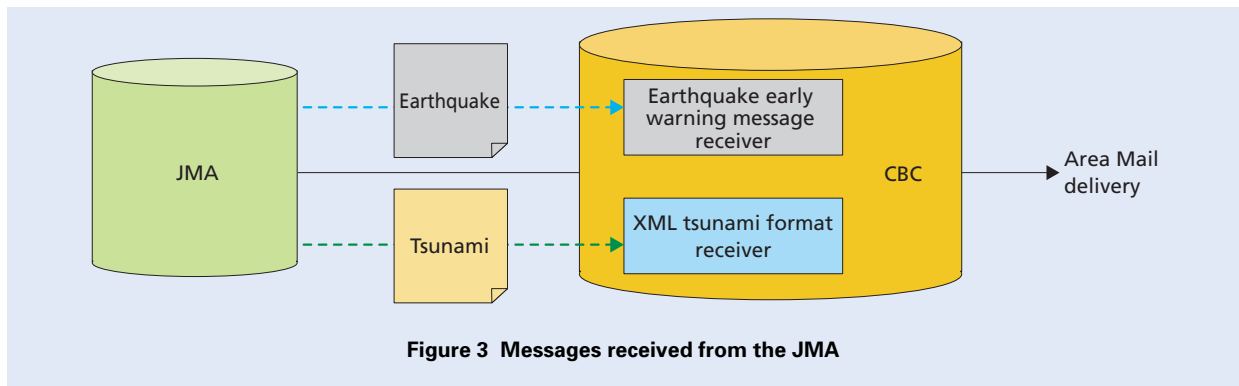
- Kind: Disaster prevention meteorological information element
- Last Kind: Previous disaster prevention meteorological information element

The Kind/Last Kind elements contain warning types including ‘major tsunami warning,’ ‘tsunami warning,’ ‘tsunami advisory,’ ‘tsunami forecasts (changes in sea level)’ and ‘no tsunami’.

The content described in XML format includes the target delivery area (e.g. XX prefecture, Pacific Coast), the type of warning for the target area (described in the Kind element), the previous type of warning for the target area (described in the Last Kind element) etc.

If the Last Kind element warning type is ‘no

^{*2} **CBC:** The terminal interface with the JMA - sends messages to Radio Network Controller (RNC) and Mobile Management Entity (MME).
^{*3} **XML format:** Previously, a unique JMA format was used, but XML was introduced for consistency of disaster prevention information. XML is a markup language proposed by the World Wide Web Consortium (W3C) that describes the meaning and structure of text and data. It is expandable, and users can specify their own unique tags.



tsunami,' and the Kind element warning type is "major tsunami warning/tsunami warning," then the message is determined to be an object for delivery. Also, if the type of warning is raised from 'tsunami advisory/tsunami forecast/no tsunami' to 'major tsunami warning/tsunami warning,' the message is also determined to be an object for delivery. In areas to which a tsunami warning has already been delivered, delivery is not performed because those areas match the previous condition, since the con-

tent quoted in the Last Kind element is 'tsunami warning' or 'major tsunami warning.'

Areas targeted for delivery of "tsunami warnings" are extracted based on the JMA's 'area codes' (tsunami forecast regions) in the XML message. Because the 'area codes' are separate from the earthquake early warnings, special delivery to tsunami warning areas was achieved by equipping the CBC with internal data (for tsunamis) that indicates the "delivery address" (a municipality code - a

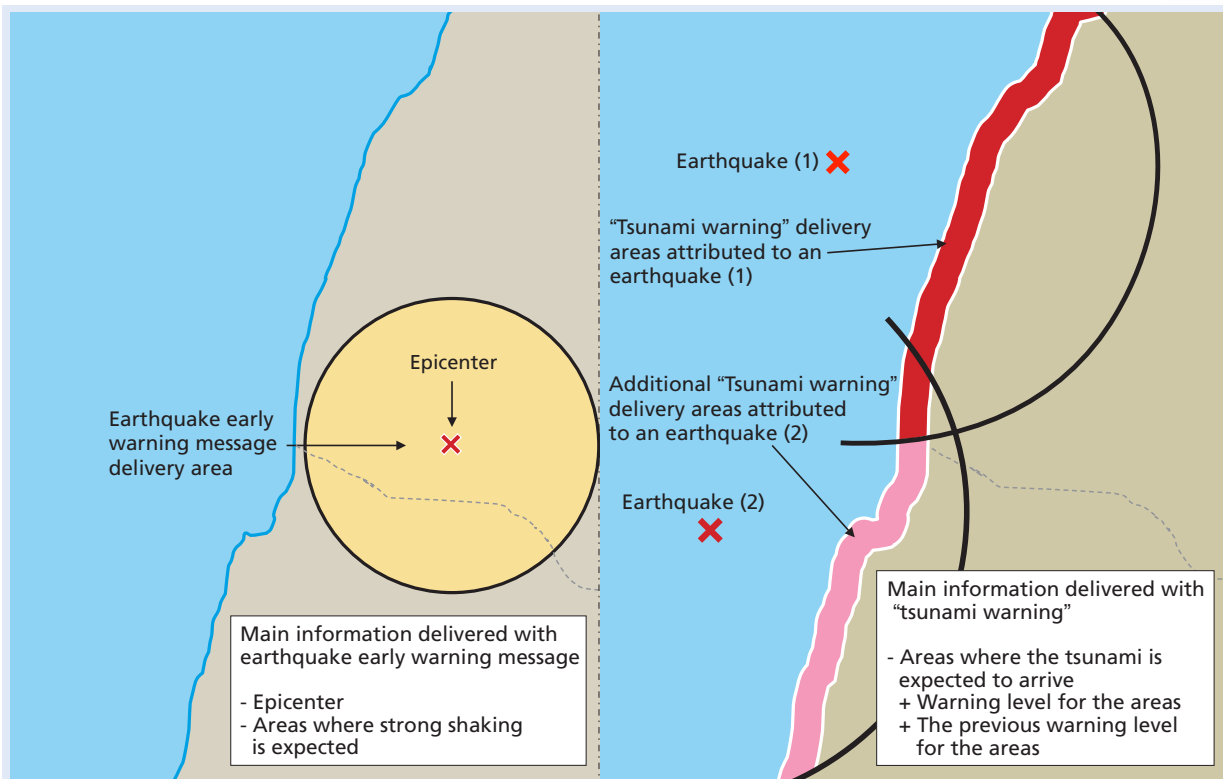


Figure 4 Earthquake early warning/tsunami warning delivery area image

Table 2 "Tsunami warning" delivery decision example

	09:00		09:10		09:30	
	Last Kind	Kind	Last Kind	Kind	Last Kind	Kind
Area A	"No tsunami"	"Tsunami warning"	"Tsunami warning"	"Tsunami advisory"	"Tsunami advisory"	"Tsunami warning"
	Delivery		No delivery		Delivery	
Area B	"No tsunami"	"Major tsunami warning"	"Major tsunami warning"	"Tsunami warning"	"Tsunami warning"	"Tsunami warning"
	Delivery		No delivery		No delivery	
Area C	"__*1"	"__*1"	"No tsunami"	"Tsunami warning"	"Tsunami warning"	"Major tsunami warning"
	(Not judged)		Delivery		No delivery	

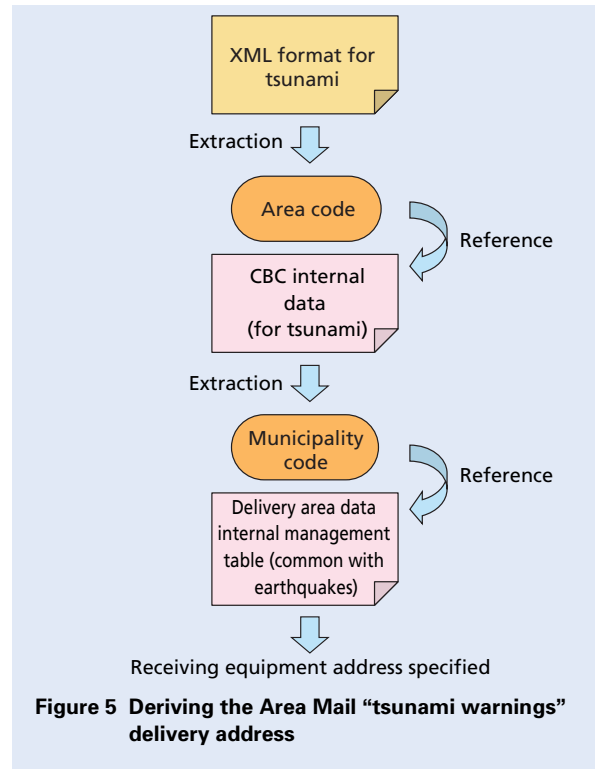
*1 No information

unique code for each municipality in Japan) in the area code in the message (municipality codes can be added or updated). After the special municipality code has been extracted, Area Mail can be delivered to the target area by deriving data for the target area (the cell^{*4} data) from an internal management database (into which municipality and cell data has been recorded), and specifying the address of equipment to which the Area Mail message is to be sent (Figure 5).

4. Conclusion

NTT DOCOMO began offering Area Mail services for smartphones and tablets in the summer of 2011. The 'Photo Panel 04' released in March 2012 also supports this system. We are also taking actions to include Area Mail reception capabilities in all of our products, and to further our contribution to disaster prevention and mitigation, we are considering linkages to area one-seg broadcasts for disaster applications.

Governments of other countries and other communications businesses have also expressed interest in broadcast delivery systems (e.g. Cell Broadcast Service (CBS)^{*5}) that use control signals like the Area Mail system, because these rapid emergency information delivery services contribute to the safety of citizens. Into the future, we look forward to further deploying the technology that NTT DOCOMO has developed to an even greater level of effectiveness.



REFERENCES

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<http://www.seisvol.kishou.go.jp/eq/eng/fig/tsunamiblock.pdf>
- [3] NTT DOCOMO: “About Area Mail Disaster Information Service.”
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*4 **Cell**: The smallest area unit for sending and receiving radio signals between a cellular mobile communication network and mobile terminals.

*5 **CBS**: A broadcasting service for simple textual information, standardized by 3GPP.