Making the Original Earthquake Early Warning System including epicentral earthquake

Protecting your life and minimizing damage.

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What is the Earthquake Early Warning System

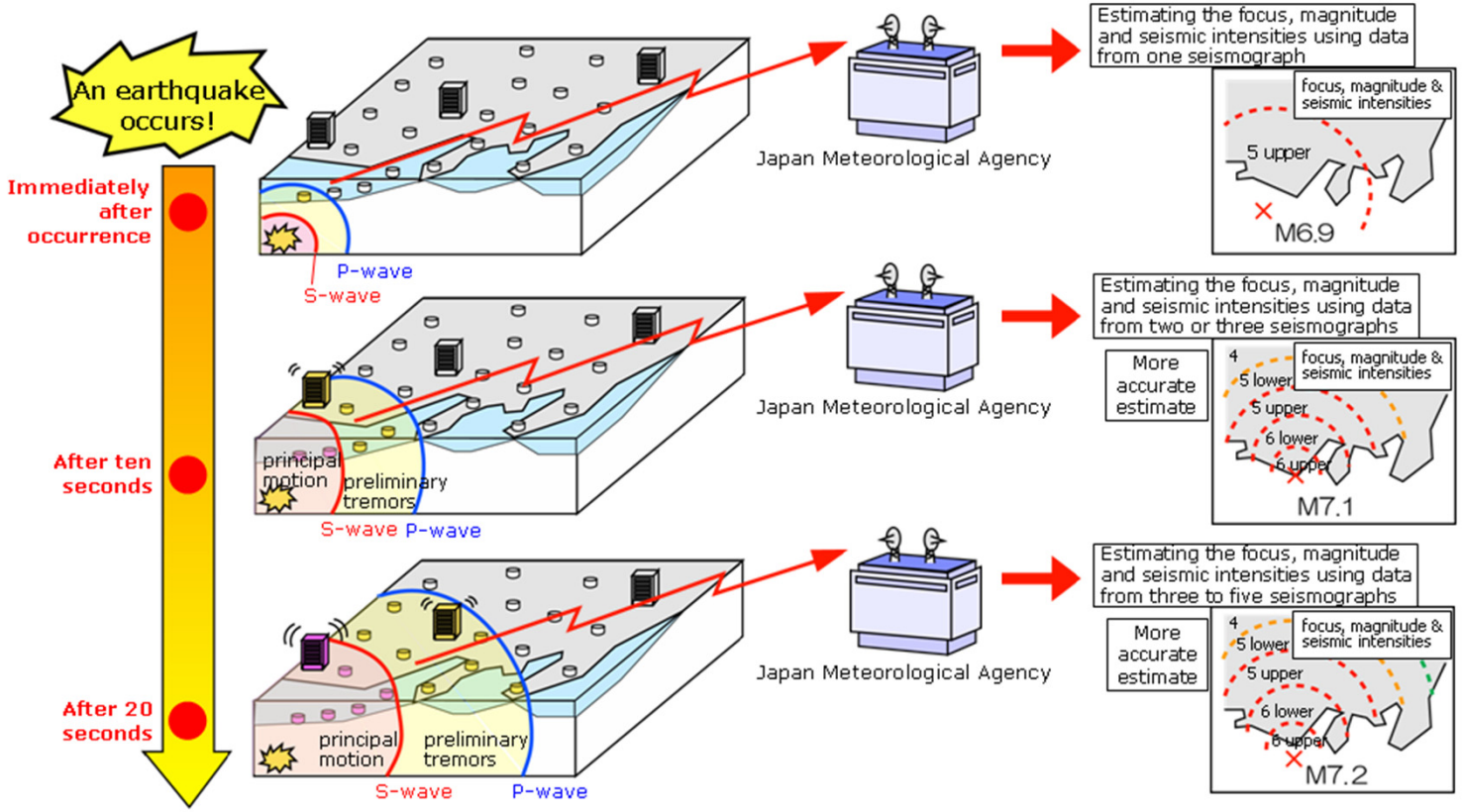
- The Earthquake Early Warning system provides advance announcement of the estimated seismic intensities and expected arrival time of principal motion. These estimations are based on prompt analysis of the focus and magnitude of the earthquake using wave form data observed by seismographs near the epicenter.

- The Earthquake Early Warning is aimed at mitigating earthquake-related damage by allowing countermeasures such as promptly slowing down trains, controlling elevators to avoid danger and enabling people to quickly protect themselves in various environments such as factories, offices, houses and near cliffs.

How the Earthquake Early Warning Works

- Tremors extend out from the seismic focus in a wave-like motion. There are two main types of seismic waves: P-waves, or initial tremors, and Swave, or main tremors. P-waves are the first to travel outward. They are followed by S-waves, which cause stronger tremors. Most earthquake-induced damage results from these Swaves.

- The purpose of the earthquake early warning is to quickly announce to the public that an earthquake has occurred and to inform them of the estimated seismic intensity several seconds or more before the arrival of strong tremors caused by the quake. In those areas close to the focus of the earthquake, however, the earthquake early warning may not be transmitted before the tremors hit.

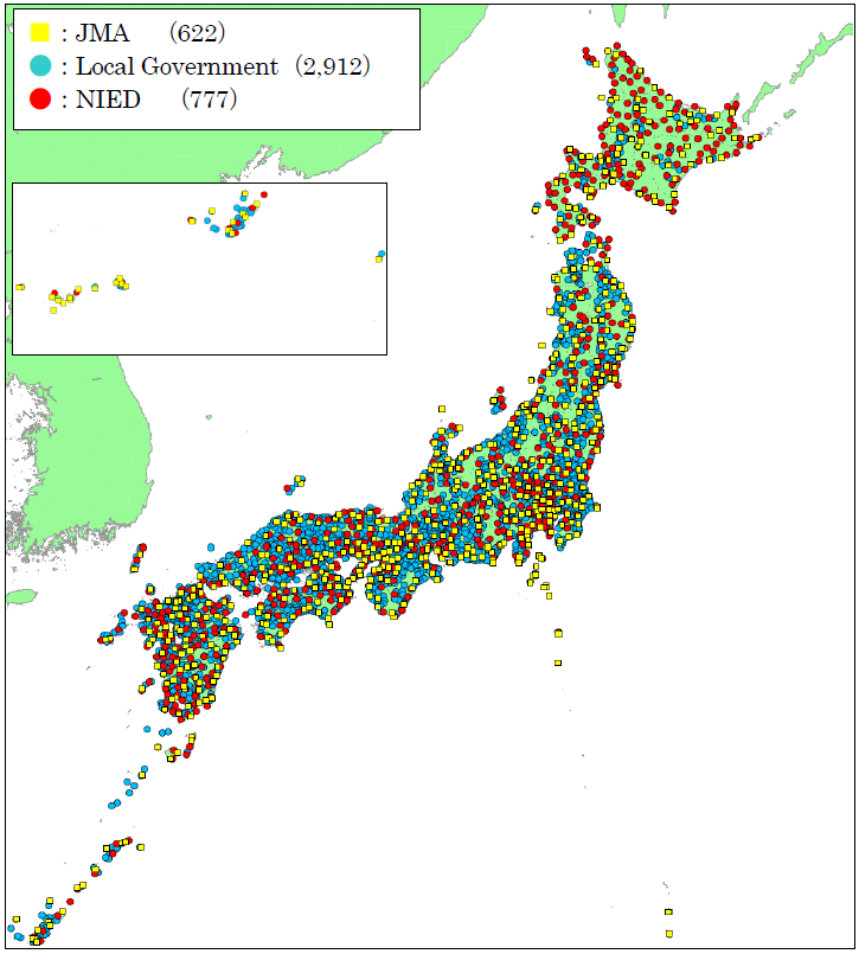

An earthquake occurs!
Immediately after occurrence
After ten seconds
After 20 seconds
P-wave
S-wave
principal motion
preliminary tremors
S-wave P-wave
principal motion
preliminary tremors
S-wave P-wave
Japan Meteorological Agency
Japan Meteorological Agency
Japan Meteorological Agency
Estimating the focus, magnitude and seismic intensities using data from one seismograph
focus, magnitude & seismic intensities
5 upper
M6.9
Estimating the focus, magnitude and seismic intensities using data from two or three seismographs
More accurate estimate
4
5 lower
5 upper
6 lower
6 upper
M7.1
Estimating the focus, magnitude and seismic intensities using data from three to five seismographs
More accurate estimate
4
5 lower
5 upper
6 lower
6 upper
M7.2

The Earthquake Early Warning System in Japan

To monitor earthquakes, JMA operates an earthquake observation network comprised of about 200 seismographs and 600 seismic intensity meters. It also collects data from over 3,600 seismic intensity meters managed by local governments and the National Research Institute for Earth Science and Disaster Prevention (NIED). The data collected are input to the Earthquake Phenomena Observation System (EPOS) at the headquarters in Tokyo and the Osaka District Meteorological Observatory on a real-time basis.

When an earthquake occurs, JMA immediately issues information on its hypocenter, magnitude and observed seismic intensity. If the seismic intensity is 3 or greater, the Agency issues a Seismic Intensity Information report within one and a half minutes. The information is provided to disaster prevention authorities via dedicated lines, and reaches the public through local governments and the media. This information also plays a vital role as a trigger for the initiation of rescue and relief operations related to earthquake disasters.

Monitoring of Earthquakes in Japan



Limitations of the Earthquake Early Warning

Timing

The window of time from the announcement of an Earthquake Early Warning until the arrival of the main tremors is very short, i.e. a matter of seconds (or between several seconds and a few tens of seconds).

In areas that are close to the focus of the earthquake, the warning may not be transmitted before strong tremors hit.

False alarms

When using data from only one seismograph, false Earthquake Early Warnings may occur as a result of noise from accidents, lightning or device failure.

Magnitude estimation

There are limits to the accuracy of estimating magnitude, especially for large earthquakes.

It is difficult to separate earthquakes and provide accurate warnings when multiple earthquakes occur almost simultaneously or in close proximity to each other.

Seismic intensity estimation

There are limits to the accuracy of estimating seismic intensity by statistical attenuation formula, as well as limits to the prediction of land surface amplification.

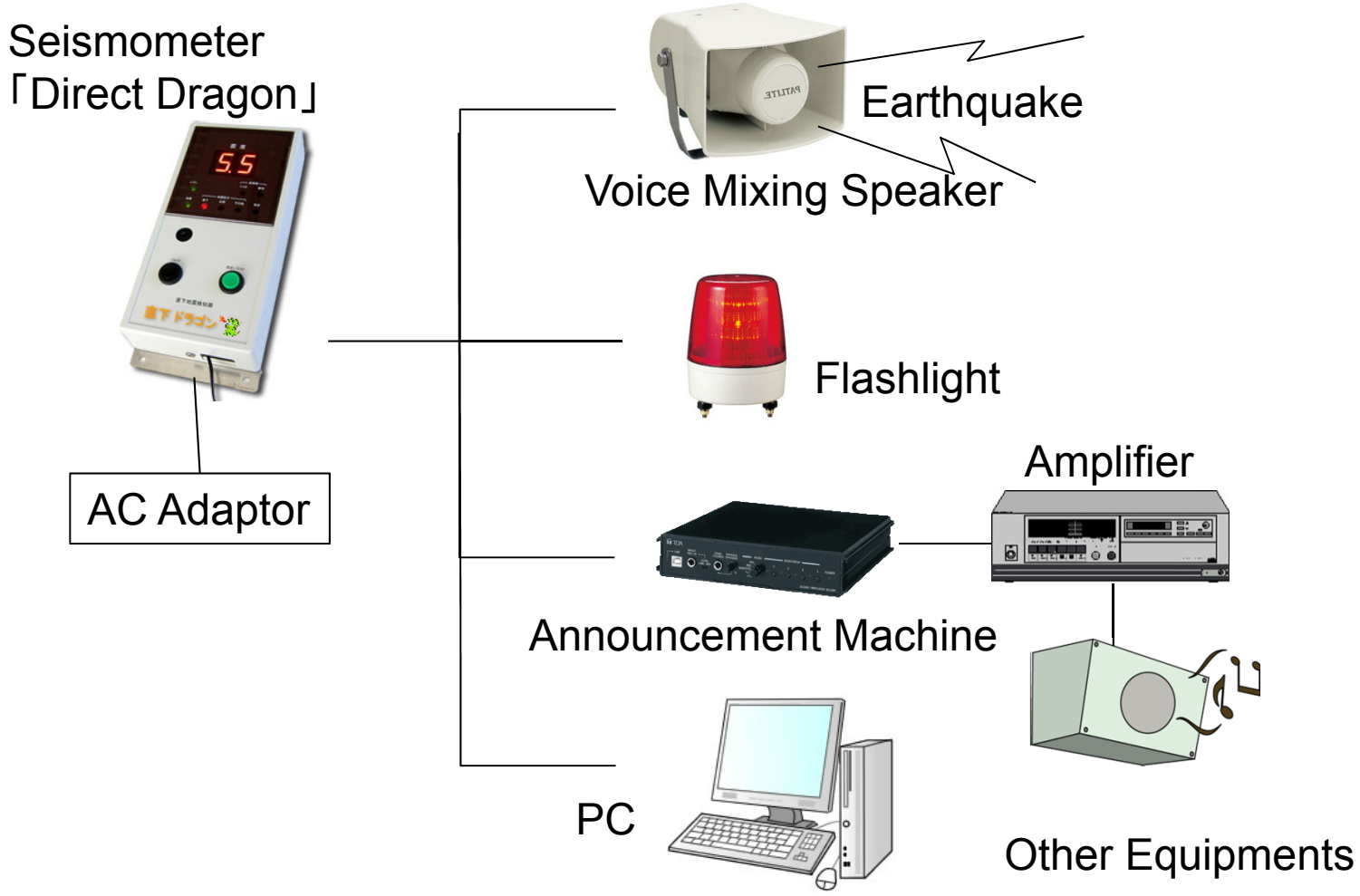
Making the Original Earthquake Early Warning System

If there are no public early earthquake warning systems in your country and an area,how do you protect your life and assets?

We will propose making the original earthquake early warning system using the independence type seismometer.

This can also detect epicentral earthquake.

A system example by the independence type seismometer



Advantage of the independence type seismometer

- When catching the seismic waveform by the place and establishing the independence type seismometer you can warn of an alarm, observation network deployment doesn't need special infrastructure, so it doesn't also require a huge cost. It is also prepared for an epicentral earthquake.
- We're selling the seismic detector which can be used for such use “Direct Dragon".

What is “Direct Dragon"

“Direct Dragon” detects and analyzes P-wave(Primary wave), and outputs the alarm signal before arrival of S-wave(Secondary wave) which causes intense shaking. Therefore we assume that people are able to urgent refuge, and the equipment will be stopped safely.

The information and communication charge are not necessary, so even if communication is blocked by great earthquake, it is not affected.

When even supplying a power supply, (about 1 day for single 1 or 8) it normally functions, so it’s most suitable for earthquake disaster prevention in important facilities.

There are also no malfunctions by which an earthquake beyond seismic intensity a little less than 5 overlooks and chooses as weak earthquake and noise.

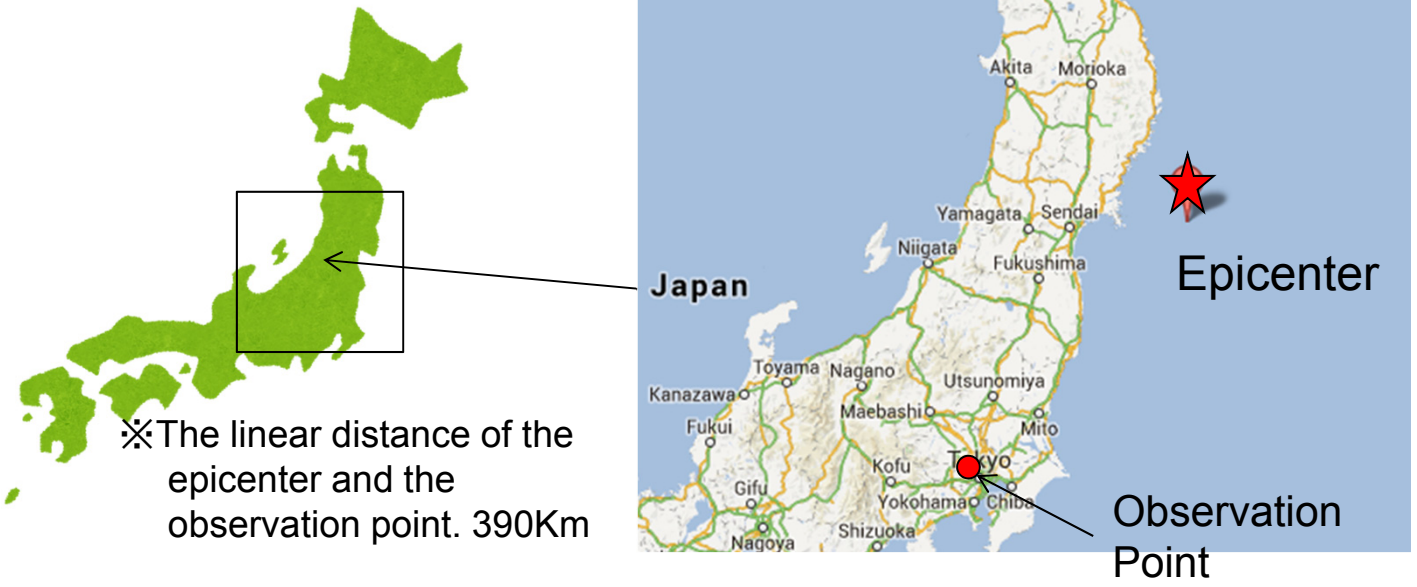
The feature of “Direct Dragon"

- It can use at the epicentral earthquake. ※①
- It works independently.（The network is unnecessary.）
- It's possible to indicate the seismic intensity. ※②
- It‘s possible to output tsunami alarm（option）※③

※①In most cases, an epicentral earthquake can be predicted before 3 seconds.
※②it can record the seismic intensity by analog output. it is used to analyze that the one of the seismic ground motion from primary wave arrival to earthquake ending as well as maximum seismic intensity Time change and duration of strong motion, etc.
※③It’s possible to output tsunami alarm by Earthquake wave duration.

Working case
the Great East Japan Earthquake ①

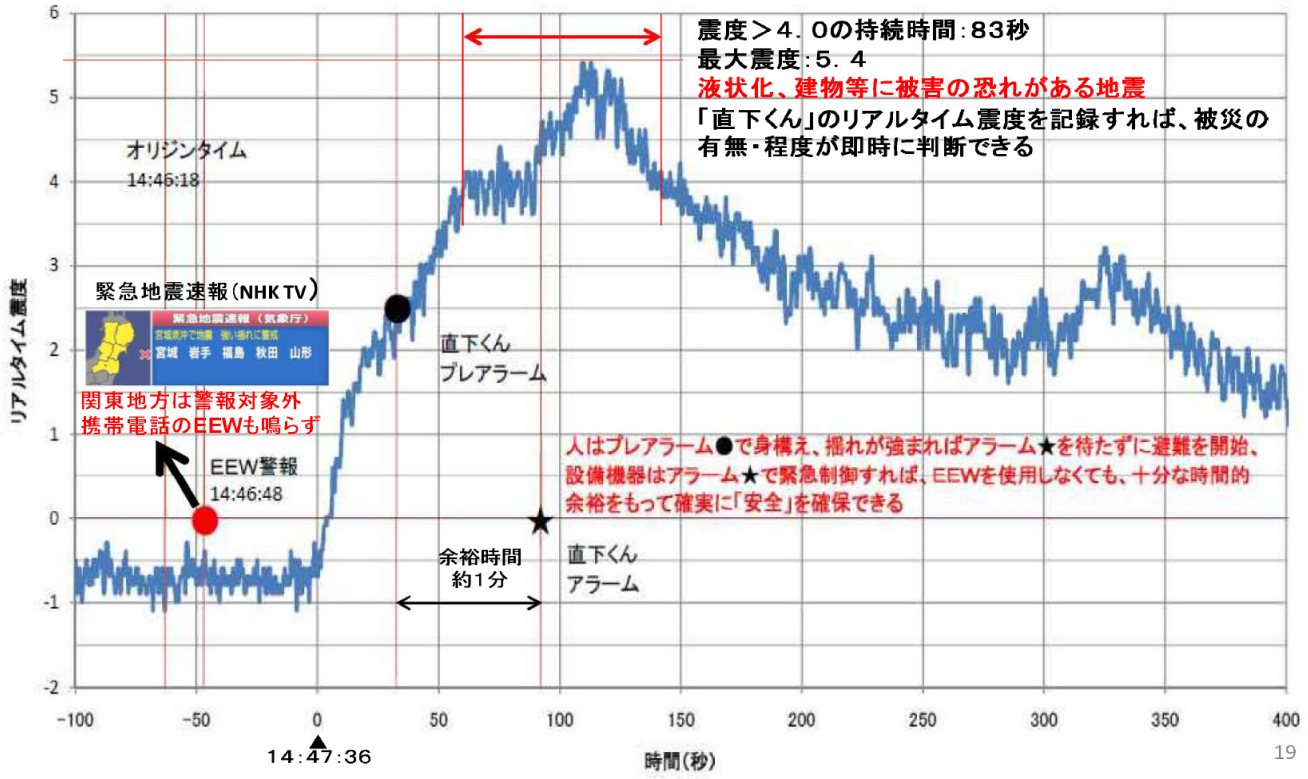
(1) Date　Mar. 3.11, 2011(Tue)14:46
(2) Name　Gread East Japan Earthquake
(3) Epicenter　Sanriku-oki(north latitude38.0 East longitude142.9)
(4) Depth　24km
(5) Magnitude　9．0
(6) damage　The dead and missing person18,554、398,649Houses



Working case
the Great East Japan Earthquake ②

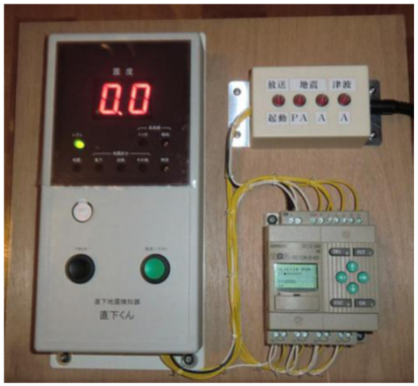
It warned of an earthquake of seismic intensity a little less than 5 before about 1 minute.

Detection example of「Direct Dragon」in the Great East Japan Earthquake
Building 5F made with RC, Wakaba, Shinjyuku-ku, Tokyo



Using tsunami option in a coastal area

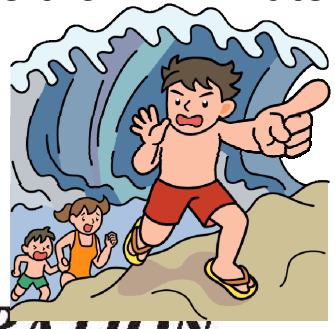
When this option is used, it can alarm the tsunami.



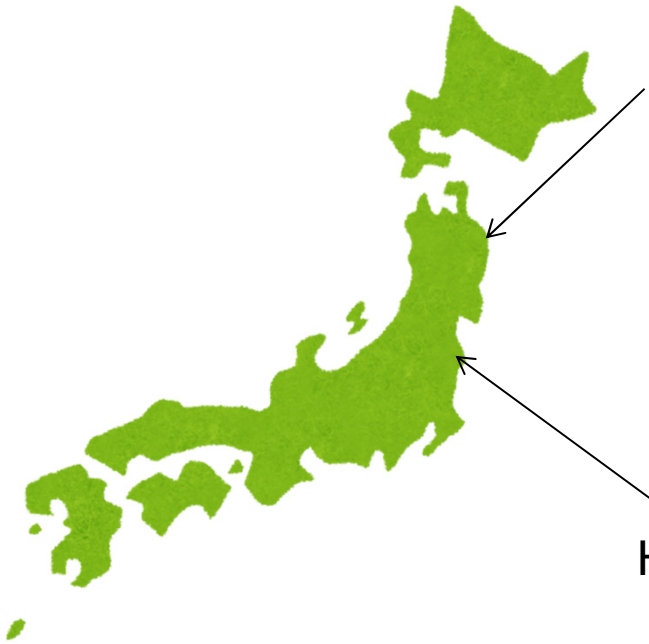
The first equipment which can alarm the tsunami !

When a big earthquake occurs at the bottom of the sea, tsunami occurs.
The seismic center, near land, if, a tidal wave surges in several minutes.
If you protect your life from tsunami, you take refuge in a hill quickly. There are no ways in outside.
"Dairect Dragon" will alarm tsunami when the earthquake of seismic intensity more than 4. and more than 1 minute continuously.

Tsunami!!

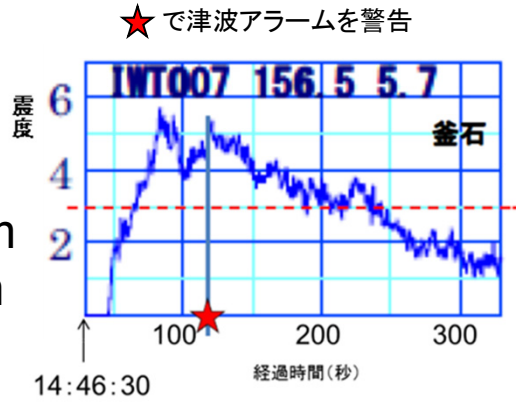


When the Great East Japan Earthquake if this system is in various places



Kamaishi:

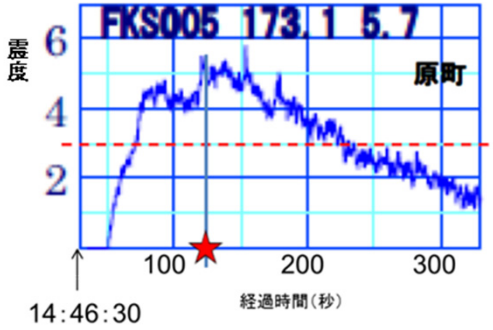
14:46:50	Earthquake
14:48:30	Tsunami alarm
15:21	Tsunami 9.3m



※The warning about 35 minutes before the largest wave reached

Haramachi:

14:46:55	Earthquake
14:48:40	Tsunami alarm
15:51	Tsunami 12.2m



※The warning about 65 minutes before the largest wave reached

Specifications

Power ：DC12／24V 10W 以下（Tolerance：DC9～28V）

Output：Dry Contact（Rating DC30V 2A）

Dimensions and weight： 110×250×53mm　1.2kg

Environmental condition： Temperature0～50℃
Humidity：20～90%RH
Recommendation10～40℃ 、20～80%

Sensor：3-axis semiconductor acceleration sensor
Seismic intensity measurement accuracy： ±0.5

For installation and maintenance

Installation requirements：
Fixed with anchor bolts to the basic and structures such as buildings.（Select an artificial place without vibration and shock）

Installed on the pillars or walls with made by RC

Maintenance：Sensitivity calibration of the acceleration sensor is required once a year