Characteristics of damage in recent natural disasters and initiatives aimed at mitigating damage

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1. Introduction

In 2009 alone, July brought torrential rains to Chugoku and northern Kyushu, while August saw an earthquake with its epicenter in Suruga Bay and flood damage caused by Typhoon No. 9. And no sooner had the new year started than a powerful earthquake struck Haiti, causing damage that threatened to ruin this Caribbean island nation. As well as enumerating the issues that have come clear as a result of these disasters, this paper will introduce initiatives being undertaken by the Research Center for Disaster Risk Management to develop technology designed to mitigate the damage caused by natural disasters.

2. Main disasters in 2009 and the issues they highlighted

The torrential rains that ravaged the Chugoku region in July caused 22 deaths, mainly in the city of Hofu, Yamaguchi Prefecture. There alone, a debris flow buried an old people's home, killing seven people. Throughout Japan, as many as 13,800 old people's homes and other facilities for disaster-vulnerable persons are at risk of sediment disasters like this. Conventionally, places like this have been subject to priority countermeasures; even the location in question was said to have recently undergone a survey for development of *sabo* (erosion control) facilities. We need to step up work for the development of *sabo* dams and other facilities in places considered vulnerable to calamitous damage.

Owing partly to fiscal constraints, however, it is inconceivable that *sabo* dams and other facilities will all be developed at once. This increases the importance of "soft" countermeasures, such as clearly specifying the scope of hazards and making them publicly known in line with the Sediment-Related Disaster Prevention Act, controlling the use of land in hazardous areas, and giving warnings and encouraging early evacuation at times of danger due to heavy rains, etc.

The disaster location in question had already been designated as a sediment disaster warning zone, and the disaster occurred three and a half hours after the announcement of sediment disaster warning information. Boulders in the debris flow were sedimented on flat land upstream of the old people's home, which was made of steel-reinforced concrete. However, smaller debris entered the facility through the windows. When this happened, most of the residents were evacuated to upper floors by staff, but seven lost their lives.

Besides the conventional problem that, even when sediment disaster warning information has been released, no recommendation is made by the municipal leader for residents to evacuate, or the recommendation is delayed, other major issues emerge. For example, even if an evacuation recommendation is issued, few of the residents actually evacuate; or, as seen in this disaster with the old people's home, issues remain in deciding how to evacuate disaster-vulnerable persons in need of assistance or care, and how to ensure their safety.

Meanwhile, when Typhoon No. 9 struck land in August, the town of Sayo-cho in Hyogo Prefecture was particularly hard hit. Nine members of three households who were voluntarily evacuating from their homes to the evacuation site due to flooding from the Makuyama River were caught up in the deluge and tragically lost their lives. This was a "voluntary disaster prevention activity" prior to the issue of an evacuation recommendation by the town, at a time when the rainfall volume had increased dramatically. Since the homes of the disaster-affected residents were only damaged by flooding on the ground floor, problems pointed out include the timing of evacuation in conditions of flooding at night, and the need for selective judgment of appropriate evacuation routes and sites in accordance with the situation. On the other hand, depending on the situation, in some cases it may not even be completely safe to evacuate to the top floor of a house, as the house could be carried off in the flood flow. In the damage at Sayo-cho, moreover, the local council office, which should have become a focal point at the time of a disaster, had its own floor covered in water, creating a situation that hindered disaster relief. From these facts, another issue was seen in creating and providing information that would allow residents to choose the appropriate action in the event of an emergency.

In these disasters caused by torrential rains, the damage in both Hofu and Sayo was caused by sudden heavy rains in excess of 70mm in one hour. From these facts, the speed with which information on torrential rains, water levels and furthermore floodplain situations, etc., can be ascertained and provided is of

paramount importance.

Also, to encourage early warning and evacuation, another issue will be how to provide sediment disaster warning information with an indication of imminence, including supplementary information, and how to inform residents, as receivers of information, at both normal and abnormal times.

Furthermore, flood hazard maps are expected to provide necessary information whereby residents can choose appropriate evacuation in accordance with the situation, such as the risk of homes collapsing or being washed away, etc., together with floodwater depth information.

It is also thought important to study realistic safety assurance methods, such as ascertaining and analyzing the distribution and structures of old people's homes and other facilities for disaster-vulnerable persons in anticipated flood zones and sediment disaster warning zones, and methods of evacuation in accordance with the situation of the respective facilities.

3. Developing support technology aimed at improving crisis response capability

In the earthquake that struck Haiti on January 13th this year, although the conditions differ greatly from those in Japan, catastrophic damage to urban and residential facilities due to the earthquake striking a major urban area led to a massive death toll in excess of 150,000. It also led to the loss of administrative and information functions, and the rescue operation for disaster victims is colossal in scale. At times of damage of this order, it is considered necessary, firstly, to ascertain information on what sort of damage or disaster phenomena have specifically occurred where, including forward projections, as soon as possible; and then to incorporate this information into speedy recovery measures as quickly as possible.

We are therefore researching techniques for instantaneous damage prediction (Fig. 1) to support the initial mobilization of local headquarters for disaster countermeasures in the event of an earthquake. With this technique, we ascertain an outline of damage near the epicenter and estimate damage to management facilities, based on analysis of seismic motion data obtained from the strong motion seismographs network immediately after the occurrence of an earthquake.

Immediately after the occurrence of a disaster, meanwhile, there is a period in which the local residents have no choice but to cope by themselves with self-help or helping each other until public support from the government and others arrives. Even here, support measures from the administration are considered necessary to improve the disaster prevention capability of local residents, such as being fully prepared for disasters in advance and safely evacuating in the event of occurrence. We are therefore studying techniques for improving local disaster prevention capability, as a task common to disasters, we are drawing on the center functions of the Research Center for Disaster Risk Management and are studying the issue in a Disaster Risk Management Team set up in April 2009.

4. Conclusion

Mainly based on notable disasters in 2009, I have described the issues for damage mitigation that have been clarified by them, and have also introduced some of the support technology being developed by the Research Center for Disaster Risk Management to improve crisis response capability in the event of a disaster.

In Japan, a country where major disasters are prone to occur, disaster countermeasures are a basic theme at the very core of the nation. Although it is difficult to prevent disasters completely, we will continue our efforts to develop technology that will mitigate their effects as far as possible, as well as tackling technical support aimed at reducing damage in the event of a disaster.

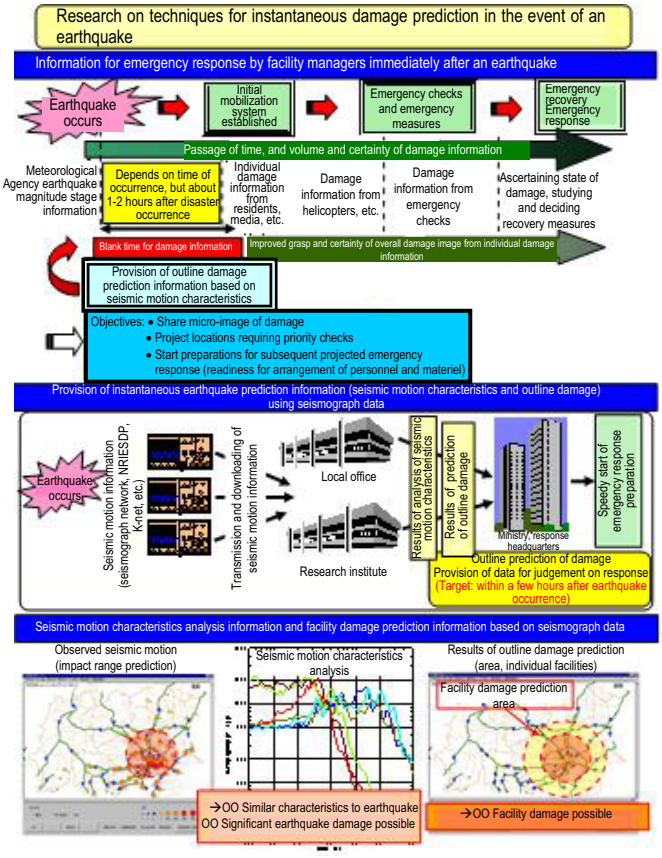

Fig. 1 Research on techniques for instantaneous damage prediction in the event of an earthquake