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THE APPLICATION OF TSUNAMI ANALYSIS AND EVACUATION ANLAYSIS TO KAMAISHI PORT AND THEIR VISUALIZATION

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SUMMARY

The Great East Japan Earthquake on 11 March 2011, characterized not only by the big earthquake and the unprecedented Tsunami wave height but also ground subsidence, breakwater collapse as well as other factors of influence, inflicted further damage on coastal cities in the Pacific side of northern Japan. It is said that the above mentioned components contributed to the mega-disasters. We can witness the reality of actual Tsunami movements and the devastating power of tsunami and various evacuation behaviors though the TV broadcasting footage and so on. These materials might provide us with examples to cope with water-related mega-disasters and we should conceptualize new evacuation plans to respond to complex Tsunami movements. There is now a need for enhancement of such countermeasures against Tsunami as it has reached a major turning point. Tsunami analysis and evacuation behavior analysis technologies with greater sophistication and diversity are now on the rise.

In this study, we aimed to investigate the effects of Tsunami barrier in the Tsunami analysis and the value of existing hazard maps in the evacuation behavior analysis. This is done by creating a tsunami analysis model including Tsunami barrier collapse based on damage records of coastal area in Kamaishi city, Iwate prefecture and evacuation behavior analysis model based on that Tsunami analysis results. In addition, we suggested diverse methods of using virtual reality based on Tsunami propagation and evacuation behavior which is derived as a result of these two kinds of numerical analysis.

To achieve these goals, we initially performed the Tsunami analysis of Kamaishi port which has been seriously damaged by the tsunami caused by the Great East Japan Earthquake. At that time, Kamaishi port had installed tsunami barriers but it had partially collapsed due to the devastating power of the tsunami. Tsunami propagation seems to be changed due to the collapse of the tsunami barrier. Hence, considering the possibilities of a tsunami barrier collapse make it possible to estimate with greater accuracy, the arrival time and flow direction in the coastal land area. We calculated the Tsunami propagation through finite difference method of solving shallow water equation. After the Tsunami simulation, we calculated the evacuation behavior in response to the simulated Tsunami propagation in Kamaishi port.

We also proposed a new type of hazard map called the next generation tsunami hazard map using virtual reality which increases public awareness of disaster prevention and recognizes the evacuation routes. The next generation tsunami hazard map consists of three-dimensional visualization, and provides not only fluid analysis results but also other useful information about disaster prevention including houses, cars and evacuation of people. In the three-dimensional virtual space, we can simulate various kinds of disaster such as structure collapse and be able to move to any viewpoint like a house, moving car, moving airplane and underground, to name a few. Therefore we can use the next generation tsunami hazard map for multiple purposes.

We can expect that these new approaches will be able to mitigate water-related disaster risks.