REPRODUCTION ANALYSIS OF HUMAN DRIFTING BEHAVIOR DURING TSUNAMI USING NUMERICAL CALCULATION

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INTRODUCTION

Along with the 2011 Great East Japan Earthquake (Mw 9.0), a huge tsunami exceeding a maximum wave height of 15 m occurred. Many people and objects were destroyed and drifted by the tsunami. In addition, these debris were trasnpoeted to various places that could not be predicted, resulting in significant secondary damage and increase in the number of missing. Therefore, in order to reduce the amount of damage, it is important to predict the behavior and landing points of person after set adrift in a tsunami.

PURPOSE

The best way to increase the rescue rate is to predict in advance the area that people will be drifted, and prioritize searching operations at that area. Although there has been considerable number of studies which handle the drifting behavior of containers and ships (e.g., Kaida et al., 2016), the prediction of drifting areas focusing on people has not been conducted. Moreover, a drifting area prediction method has not yet been established. The purpose of this study is to conduct a hydraulic experiment using a flat water tank, and observe the drifting area of the drifting object. Then, we conducted numerical calculations and compared simulation results with the experimental ones.

NUMERICAL MODEL

The storm surge a tsunami simulator STOC-ML (Tomita et al.,2009) was used in this study. Floating matter calculation can be coupled with STOC-ML and the drifting movement model STOC-DM, which was developed by Tomita et al. (2009). The hydraulic force acting on the object is calculated using the drag coefficient and inertial force coefficient.

HYDRAULIC EXPERIMENT

The hydraulic experiment used a flat-water tank that which is 8.78 m long, 2.0 m wide, and 58.5 cm high. The land topography installed in the wave tank which is 4.0 m long, 2.0 m wide, and 0.28 m high, with a slope of 1/10. The slope was 2.6 m long and 0.26 m high (Fig. 1). Figure 1 shows the state of each terrain and the locations of the wave height meters (WG) and current meters (VG). Experiments were conducted by changing the initial arrangement of the drifting object.

CONCLUSION

It was shown that the way of the drifting behavior spreads depends on the initial position of the drifting object. From Fig. 2, the direction of drifting behavior in the experiment was varied. While, in the numerical calculation, the result showed that the objects flowed straight toward downstream direction without variation. Although there are the variations in the transport direction of floating objects, it was confirmed that the results were almost consistent with the numerical calculation results. However, in the case of detailed investigation of drift behavior, the reproduction of current velocity is not sufficient. The cause of the variation is due to parameters such as flow, vortex, friction between land and drifting objects. Improving the reproducibility of numerical calculation by studying those parameters is a future issue.

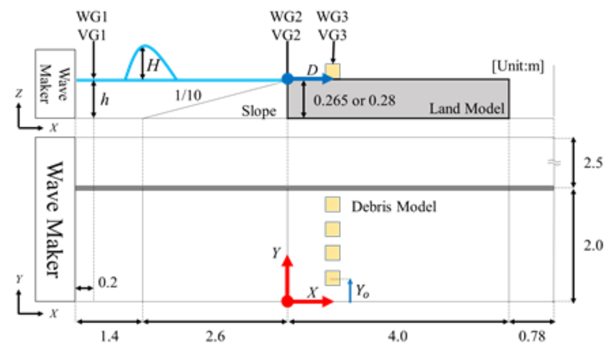

Figure 1 -Outline of experiment (h: water depth, Y_0: Initial distance in the Y direction from the reference point to the center of gravity of the drifting object)

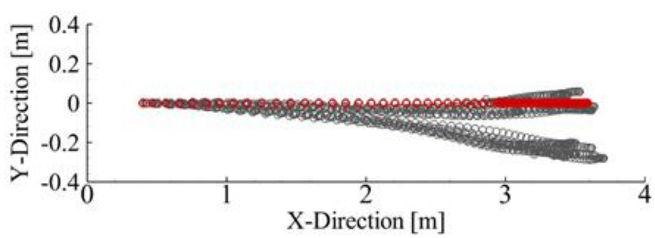

Figure 2 - Comparison of numerical and experimental drift behavior

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