INUNDATION FLOW ANALYSIS IN A LOW-LYING AREA AND ITS APPLICATION TO ESTIMATION OF PUMP CAPACITY EFFECTS

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Recently in Japan, flood disasters due to heavy rainfall occur frequently in highly urbanized area, which result in severe damage over a large area. An accurate simulation model becomes more and more significant as one of the non-structural countermeasures against this kind of flood disasters.

In this study, a comprehensive numerical model, which can simulate inundation flow caused by heavy rainfall in a low-lying area, is developed and applied to the Isahaya area, Nagasaki Prefecture, Japan. This model comprises the Hommyo River channel, the Isahaya low-lying area and hillside area with steep slopes, and each part adopts (1) one-dimensional unsteady flow model using characteristics method, (2) two-dimensional inundation flow model using unstructured meshes (Kawaike, 2000) and (3) runoff model using kinematic wave method integrating surface and sub-surface flow (Tachikawa, 1997), respectively. Fig. 1 shows the computational unstructured meshes and those adjacent steep slopes used in this study. Temporal change of rainfall intensity observed at Isahaya shown in Fig. 2 is uniformly given to the flood-prone and hillside areas, and the rainwater is drained to the Hommyo River through the pump stations.

The validity of this model is discussed by comparing the simulation results with the actual records of inundated area and water level of the river network observed at the disaster of 1999. Fig. 3 shows the comparison of the inundated area between them, and the inundated area around the center part of the studied area can be well expressed by this simulation. But because of inappropriate spatial distribution of precipitation, there are some disagreements between the simulation results and actual records in the other parts of the studied area.

Then, as the application example of this model to countermeasures against flood disasters, the effect of additional pump capacity is discussed. From the simulation results (Fig. 4), the relationship between additional pump capacity and inundated area can be obtained. This simulation results can be useful information to determine the flood prevention planning.

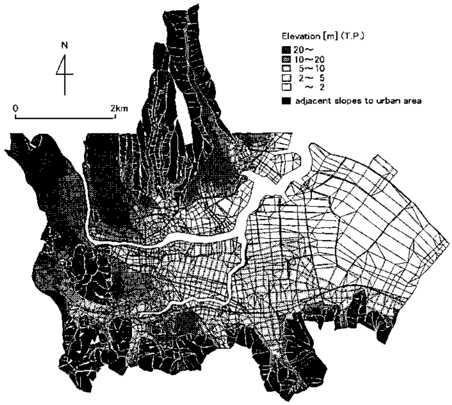


Fig. 1 Slopes and computational meshes

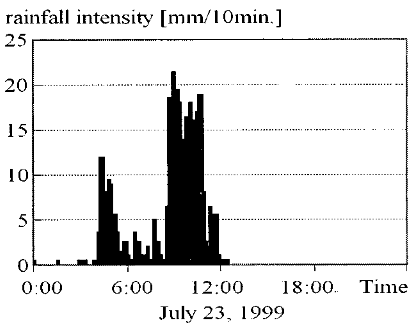


Fig. 2 Rainfall intensity

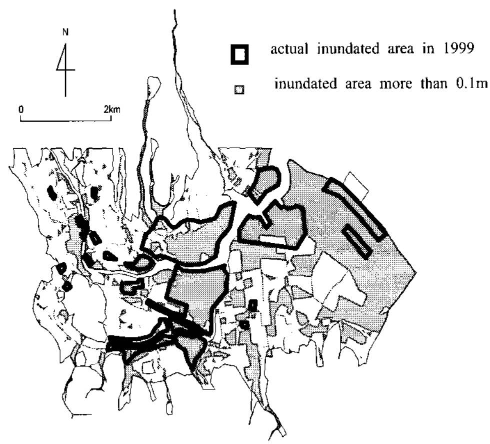
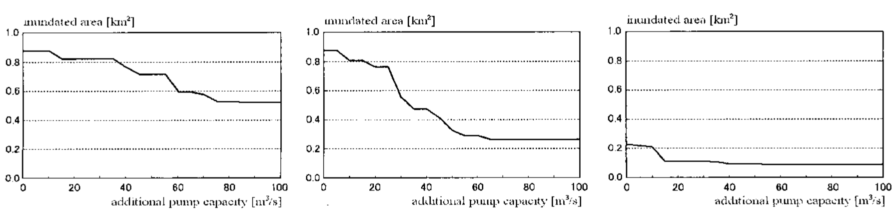


Fig. 3 Comparison between the actual inundated area and the simulation result



(a) A zone (b) B zone (c) C zone

Fig. 4 Relationship between additional pump capacity and inundated area

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