

Numerical Estimation of Pump Stations Effects under Heavy Rainfall in Low-Lying Area using Inundation Flow Analysis

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Recently in Japan, flood disasters due to heavy rainfall in highly urbanized area occur frequently, which bring severe damage. As an example, the Isahaya low-lying area in Nagasaki Prefecture, Japan, has been suffering from frequent flood disasters due to heavy rainfall. Actually, a severe flood disaster due to heavy rainfall occurred in this area on July 23, 1999.

In this study, a numerical simulation of inundation flow due to heavy rainfall in the Isahaya low-lying area is conducted. This simulation model consists of three parts: Hommyo River channel, Isahaya low-lying area and its adjacent hillside area. In the Hommyo River channel, one-dimensional unsteady flow analysis using characteristics method is adopted. In the Isahaya low-lying area, two-dimensional inundation flow analysis based on the unstructured mesh model [1] is conducted. In the hillside area with steep slopes, runoff analysis using the kinematic wave method [2] is applied. The obtained runoff discharge at the downstream end of the slope is given as the boundary condition of the Isahaya low-lying area. There are pump stations at the downstream end of small drainage channels in the low-lying area, and rainwater is drained into the Hommyo River channel through those pump stations.

Using this simulation model and the rainfall intensity observed at Isahaya on July 23, 1999, the effects of newly planned pump stations is estimated. From the simulation results, urban area and paddy fields in the low-lying area are widely inundated under the present pump capacity. Then using this simulation model, the relationship between reducing inundated area and additional pump capacity can be obtained. Consequently, this kind of simulation can help decide how large pump capacity is necessary to flood disaster prevention.

References

- [1] Kawaike, K., Inoue, K. & Toda, K. Inundation flow modeling in urban area based on the unstructured meshes, *Hydrosoft 2000, Hydraulic Engineering Software*, **VIII**, WIT Press: 457-466 (2000).
- [2] Tachikawa, Y., Haraguchi, A., Shiiba, M. & Takasao, T. Development of a distributed rainfall-runoff model based on a tin-based topographic modeling, *Jour. of Hydraulic, coastal and environmental engineering*, JSCE, **565/II-39**: 1-10 (1997). (in Japanese)