THE INUNDATION ANALYSIS SYSTEM ON URBAN AREA AND ITS APPLICATION

MAKOTO TAKEDA[1], NAOKI MATSUO[1], SIGERU HIRASHIMA[2], YASUNORI HIRAYAMA[3], MASAHIRO TANAKA[4] and TOSHIHIKO TAKAHASHI[4]

[1] Department of Civil Engineering, Chubu University,
1200 Matsumoto, Kasugai, Aichi 487-8501, JAPAN
(Tel: +81-568-51-1111, Fax: +81-568-51-1495, e-mail: mtakeda@isc.chubu.ac.jp)
[2] Civil Engineering Design Division, Kajima Corporation,
5-30, Akasaka 6-chome, Minato-ku, Tokyo, JAPAN
(Tel: +81-3-6229-6690, Fax: +81-3-5561-2152, e-mail:hirashima@kajima.com)
[3] IT Solution Department, Kajima Corporation, 5-30,
Akasaka 6-chome, Minato-ku, Tokyo, JAPAN
[4] Environmental Engineering and Bioengineering Group, Kajima Technical Research Institute, 19-1, Tobitakuu 2-Chome, Chofu-shi, Tokyo 182-0036, JAPAN

The potential of water disaster in urban area increases by urban development and frequency of heavy rain. Despite of increasing demand for establishment and examination of measures on water disaster, development of numerical simulation model dealing with complex urban water behavior is not sufficient. Moreover, a lot of input data is required prior to simulation. The input data preparation system must be firstly developed for numerical analysis of inundation water behavior in urban area. The analysis system with three subsystems, the data preparation subsystem, the inundation analysis subsystem in urban area and the demonstration subsystem of analysis results is developed in this study.

THE DATA PREPARATION SUBSYSTEM FOR INUNDAITON ANALYSIS IN URBAN AREA: The examination of measures for water disaster takes a lot of money and time because of preparation for a large quantity of input data. It is very convenient for us if the input data are easily available. The subsystem proposed here prepares a lot of input data semi-automatically based on GIS. This subsystem provides information data whether the grid is analyzed or not, ground elevation data, embankment data, occupation rate of building to the grid for urban area, correlation data between river grid and urban grid. Furthermore, the data of the sewer system are checked by the relationship of the elevations between sewer, manhole and ground.

THE INUNDATION ANALYSIS SUBSYSTEM: In this study, the inundation analysis model combined with sub-models of river, channel, inundation area and sewer is developed. This model can analyze complex water behaviors in urban area. These sub-models are shown below.

River	:1D unsteady flow model
Channel	:1D unsteady flow model without advection terms as to the rectangular cross section
Urban area	:2D model with rectangular grid based on shallow water equation
Sewerage system	:1D unsteady flow model based on slot model and continuity equation at a manhole

THE DEMONSTRATION SUBSYSTEM: This subsystem is prepared for examination and presentation of input data and analysis results. The visual figures of

various analysis results, which are distribution and temporal change of inundation water depth etc, can be drawn and presented easily by using this subsystem.

EXAMPLE OF APPLICATION: As an example of application of this inundation analysis system in urban area, the inundation due to interior runoff is calculated by analysis model considered water behaviors in urban area, sewer system and channel. Figure 1 shows the distribution of inundation water depth. From this figure, it is found that the expansion of inundation water is demonstrated. The developed analysis system successfully simulates the inundation phenomena in urban area and the hydraulic relationship of the flows in urban area, sewer system and channel are shown obviously in these figures.

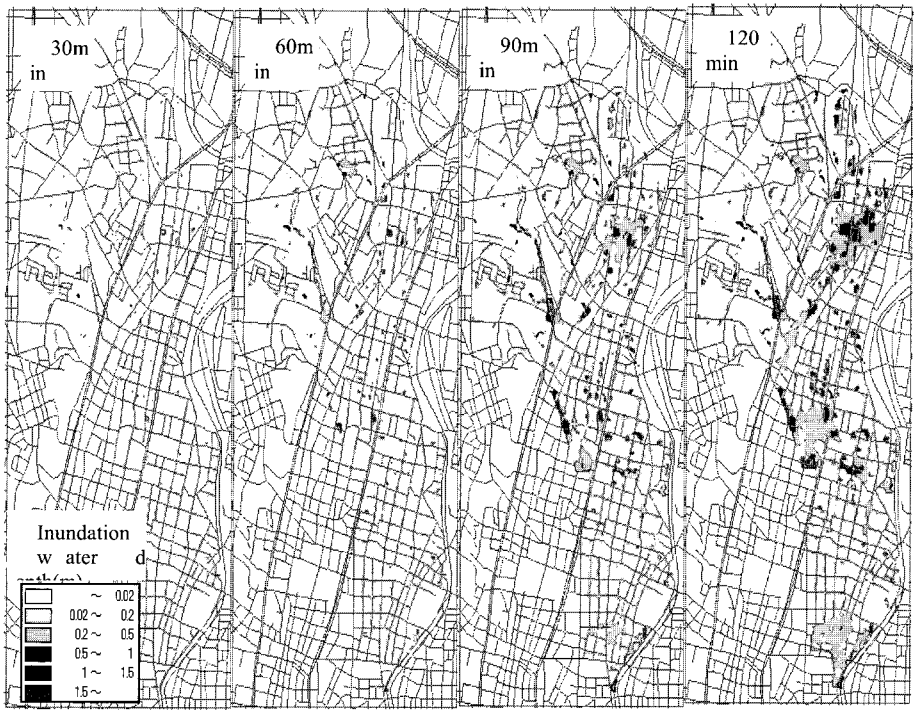

Fig. 1 The temporal change of inundation water depth

REFERENCE

Iwasa,Y., Inoue,K. & Mizutori,M.(1980): Hydraulic analysis of overland flood flows by means of numerical method. the Annuals of the Disasater prevention research institute, Kyoto University, NO,23 b-2,PP.305-317. (in japanese).

Makoto Takeda., Naoki Matsuo, Sigeru Hirashima, Yasunori Hirayama, Masahiro Tanaka and Kazuya Inoue(2005): The development of inundation analysis system in urban, MPMD2005, pp.125-130.