

Performance of levee system at flood stage

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Introduction

The extremum of a meteorological event increased, and as a result, a flood disaster has come to occur frequently in Japan. The concentrated downpour as a main cause of such flood and inundation disasters could be considered, and caused serious damage to personal and social property. It is very difficult to control perfectly unexpected flooding by disaster prevention system of river structure such as levee, and it is unrealistic in cost. Recently, the persistent levee system which reduces the affected level of river basin as much as possible is needed for. Therefore, this study attempts to clarify the mechanism of levee breaching from the particular case of Maruyama River, and detects and evaluated the section having the high risk of levee breaching from the geomorphological classification map for flooding.

Levee breaching case in Maruyama River basin

The particular study was motivated by the October 2004 levee breaching case at Tachino, on the right-hand bank of the Maruyama River. The flood-induced outbursts brought about distinct erosional features, including a plunge pool, and depositional features, is a long stretch of sand bar looking like a natural levee. We performed the digital photo-theodolite survey, analyzed in detail these topographical changes and obtained digital survey data regarding topography of sand ridge and boundaries of the plunge pool. In this section, the detailed analysis of the data set facilitates the following discussion:

(a)Volume analysis of sediment budged by levee

breaching

(b)Estimation of the flow speeds of the outbursts from the depth of plunge pool and diameter of clay lumps

(c)Formation mechanism of sand ridge leading to sediment gravity flows and reproducing by numerical model of LIQSEDFLOW

Estimation of high risk section of levee-breaching

The external factors of a levee such as height and discharge capacity of the section are considered as cause of levee breaching. However, historical performance of levee breaching is very important factor, because the section breached in the past breaches again in many cases. The geomorphological classification map for flooding is very meaningful, because the past breached section and weak point of the basin system can be read.

In this section, the downstream region of Kizu-river is made into a particular case, and considers the following discussion:

(a)Reading the topographical features by the past levee-breaching from the above classification map

(b)Exploration and identification of erosional and depositional zone in the field

These classification maps are still paper data, and so informational sharing is difficult. In view of this,

(c)Digitization of these map data

(d)Detailed analysis of digital data by using a geographical information system (GIS)

(e)Evaluation of safety degree of levee system at flood stage