Development of an Operation Rule of Irrigation Ponds for the Compatibility of Water Supply and Flood Mitigation

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1. Introduction

The operators of irrigation ponds are interested in keeping water stored as much as possible for drought of the future. On the other hand, comprehensive and basin-wide flood control such as strengthening flood mitigation function of irrigation ponds is considered to take effective measures against flooding.

The objective of this research was to develop an operation rule of irrigation ponds for the compatibility of water supply and flood mitigation and the effectiveness was illustrated by simulations on an actual irrigation ponds with historical data including several years with severe drought events and heavy rain events.

2. Methodology

2-1 data generation

Though both inflow and outflow (release) are indispensable data to develop the operation rule, most of water users' associations who manage irrigation ponds do not collect such data. A Tank Model was utilized to generate daily inflow from catchment, besides, Information with regard to actual operation policy collected from interview of water users' association were used to generate release in each day during an irrigation period.

2-2 operation rule line for flood mitigation

The *Required Storage* at t-th day($S(t)$) for irrigation was calculated by a storage sequential equation. $S(t)$ in each year was calculated cumulatively from the end of irrigation period to the beginning retroactively. The *Required Storage for Drought* at t-th day ($SD(t)$) was defined as maximum value of $S(t)$s in all of the years calculated with historical data. The operation rule line of Pond A (the capacity; 1.76 MCM) located in southern Takamatsu Plain was shown in **Fig.1**. It was given by an approximation of $SD(t)$s' time series calculated with generated data for 34 years from 1985 to 2018. The capacity to regulate inflow was indicated in a superior capacity distinguished by the operation rule line.

2-3 Simulation cases

Comparison storage fluctuations based on the operation rule line with the actual storage fluctuations were done in order to verify effectiveness of the operation rule line. On the simulation with the operation rule line, release to maintain the empty capacity is capable of doing within a release facility capacity in a no-rainfall day only.

3. Results and Discussions

By the operation with the operation rule line (the Case A), significant inflow (about 0.56MCM) due to heavy rain (79.5mm/d) in early July, 2018 was regulated fully in comparison to the Case R that storage was kept as much as possible for irrigation supply (**Fig.1**).
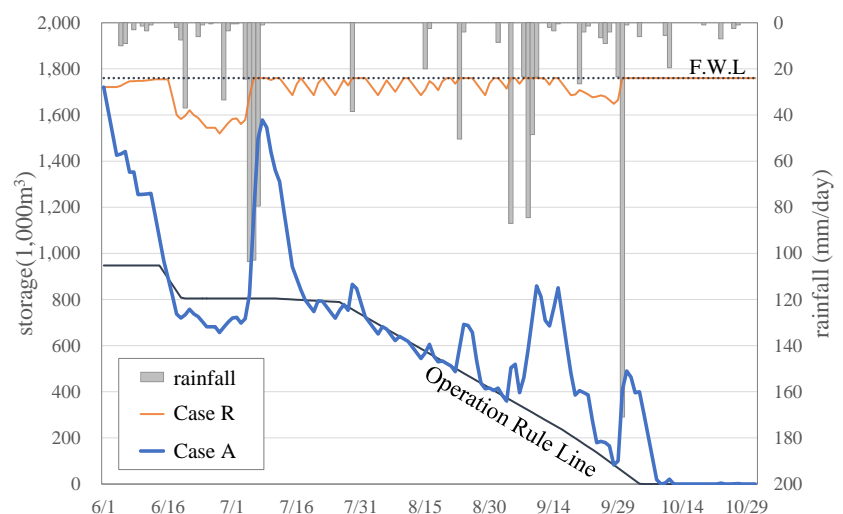

Fig.-1 storage fluctuations of 2 cases in 2018