

Research Trends and Results

Dam Flood Control based on Ensemble Rainfall Forecasting

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1. Introduction

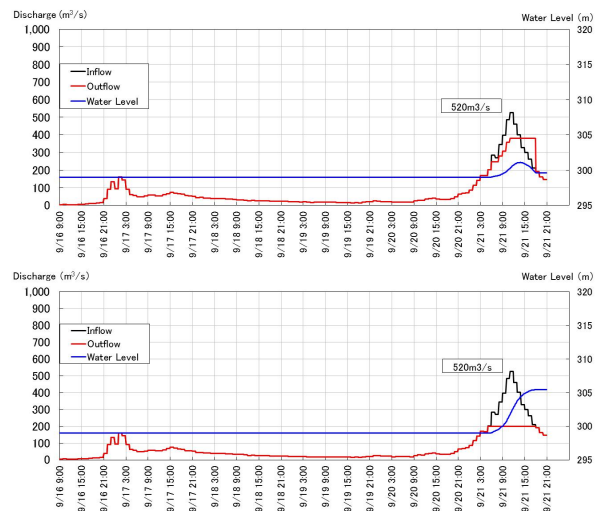
Utilization of rainfall forecasting is one strategy to enhance flood control functions of existing dams. It is true that the accuracy of rainfall forecasting improves day by day but the error has still not been zero. Accordingly, utilization of rainfall forecasting in dam flood control is still very limited. Because it seems very difficult for the error to be zero soon, it is important for us to recognize that the error is never zero and propose methodologies to utilize rainfall forecasting data which has not only error but also potential to enhance flood control functions of existing dams.

The Water Management and Dam Division has proposed the methodology which estimates the outflow discharge considering the probabilistic distribution of error in rainfall forecasting. One problem of that methodology is how to set the probability distribution. Then, we applied the ensemble rainfall forecasting (ERF) data for dam flood control operation. ERF data estimates the range of forecasting with taking into consideration meteorological conditions at that time. In addition to that, ensemble rainfall forecasting does not need accumulation of historical forecasting and observation data to determine the statistical relation between them.

2. Dam flood control based on ensemble rainfall forecasting

The figure shows the simulation result of dam flood control operation of the Hachisu Dam for Typhoon Roke in 2011. Every time the boundary condition is updated, ERF is calculated and the outflow discharge which minimizes the expected peak discharge in downstream is

estimated. That outflow discharge is released until the next update of the boundary condition. As a result, the outflow discharge based on ERF was stationary in the outflow discharge which starts flood control operation. Accordingly, the flood control based on ERF decreases the peak discharge in downstream by around 10% compared with the flood control by the regular rule.



Flood control simulation of the Hachisu Dam for Typhoon Roke (Upper: the regular rule, Bottom: Operation based on ensemble rainfall forecasting)

3. Other problems

The complementary operation rule has to be proposed to avoid increasing peak discharge in the downstream for low accuracy of ERF.

【Reference】

- 1) Mitsuishi et al.: Research on Risk Management of Dam Flood Control by Utilizing Rainfall Prediction, Journal of Japan Society of Dam Engineers, Vol.21, No.4, pp242-250, 2011