

Utilization of Ensemble Forecast Precipitation in Preliminary Release Operation in Dams

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1. Introduction

A possibility of increase in the scale of heavy rain is indicated as a result of climate changes, and importance of demonstrating the ability of existing disaster prevention facilities more efficiently is suggested as a countermeasure. As one of the measures for existing dams, flexible dam operation is expected, which aims to reduce damage in the downstream as much as possible through more effective use of the dam capacity based on the rainfall forecast information, which is remarkably progressing in technology.

Here, since forecast precipitation always accompanies an error, small or large, it is important to consider the width of forecast in order to use of forecast rainfall for dam operation. As means to express the width of forecast, NILIM has focused on "ensemble forecast precipitation" (multiple forecast precipitations outputted from forecast calculation under multiple initial / boundary conditions) and studied prior discharge operation and special operation for disaster prevention as advanced operation using "ensemble forecast precipitation." This paper introduces a method of using ensemble forecast precipitation with focus on preliminary release operation.

2. Decision making method for preliminary release operation using ensemble forecast precipitation

Preliminary release refers to an operation to reduce the reservoir level of a dam to a preliminary release level to secure the flood control capacity when a flood is expected. Since the capacity to be secured by preliminary release is also the flood control capacity in dam design, the reservoir level needs to be reduced to the preliminary release level before the dam starts a flood control, i.e., before inflow reaches the flood volume. Accordingly, it would be necessary for dams that adopted the preliminary release method to make decisions on whether preliminary release is necessary before flood or the volume of release for completing preliminary release.

As material for such decision making, this study devised two indicators, i.e. "whether inflow is expected to exceed flood volume" and "whether water level can be reduced to the preliminary release level with the set discharge." These indicators can be expressed as a ratio using ensemble forecast rainfall, which are organized as shown in Fig. 1. "The ratio of

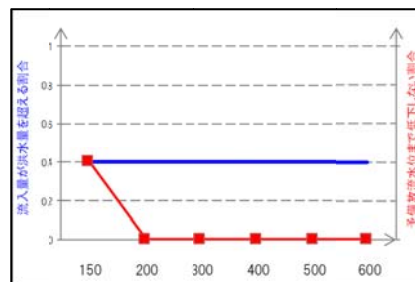


Fig. 1: Example for indicators of preliminary release operation

inflow exceeding flood volume" on the left vertical axis indicates the ratio of ensemble members that result in the forecast of inflow exceeding flood volume, and shows the necessity for preliminary release operation. "The ratio of not falling to the preliminary release level" on the right vertical axis indicates the ratio of ensemble members that result in the forecast of the reservoir level not falling to the preliminary release level against each of the release volume set on the horizontal axis, and serves as material for judging release volume for completing preliminary release. In Fig. 1, for example, since there is a ratio of inflow exceeding flood volume at this point, preliminary release operation is started or continued. For discharge in this case, other outlet structure is co-used since outflow may not reduce to the preliminary release level if it is 150 M³/s, which is maximum water use discharge, and selection of appropriate discharge is considered so that the ratio of not falling to the preliminary release level is zero.

Thus, expression of indicators as a ratio that serve as material for deciding preliminary release operation through conversion from ensemble forecast rainfall is expected to reduce the burden of decision making by dam administrator and support effective / efficient operation. We intend to verify applicability as a system supporting decision-making for a series of dam operations in close cooperation with the site, based on the study of preliminary release operation, prior discharge, and special disaster prevention operation.