

Evaluation of Precipitation Predictability in Dam Upstream Areas and Assessment of Lead Time Extension

*Yuki Saito¹, Ryo Kaneko², Atsushi Okazaki^{3,2}

1. Graduate School of Science and Engineering, Chiba University, 2. Center for Environmental Remote Sensing Chiba University, 3. Institute for Advanced Academic Research, Chiba University

In recent years, the increasing frequency of extreme rainfall events due to climate change has led to severe flood-related disasters across Japan. To mitigate flood risks, the importance of dam flood control functions has gained growing attention, with pre-release operations highlighted as an effective measure. The successful implementation of pre-release operations requires accurate precipitation forecasts to secure sufficient lead time for effective decision-making.

In Japan, pre-release decisions must currently be made at least three days before the scheduled release. These decisions rely on precipitation forecasts provided by numerical weather prediction models operated by the Japan Meteorological Agency (JMA), specifically the Global Spectral Model (GSM) and the Meso-Scale Model (MSM), which provide forecasts up to 84 hours and 39 hours in advance, respectively. However, for large-scale precipitation events such as typhoons and prolonged rainfall associated with the Baiu front, a three-day lead time may be insufficient for an effective response. Extending lead times by incorporating longer-range precipitation forecasts could enhance flood control capacity.

This study investigates the predictability of the Global Ensemble Prediction System (GEPS) and evaluates its forecast accuracy in comparison with GSM and MSM to assess the feasibility of utilizing precipitation forecasts beyond three days. Specifically, we examine how well GEPS precipitation forecasts perform relative to those of GSM and MSM and, based on these evaluations, determine whether extending the lead time allows pre-release decisions to be made earlier than three days in advance.

In the presentation, we will report the results of GEPS precipitation forecast validation against JMA precipitation analysis for dam upstream areas across Japan. We will also compare the accuracy of GEPS with that of GSM and MSM. Based on the comparisons, we will discuss the feasibility of extending lead times using GEPS.

The findings of this study will contribute to discussions on whether GEPS provides sufficient accuracy for pre-release decision-making, the potential benefits of extended lead times for enhancing decision-making flexibility, and the alignment of such an approach with existing pre-release guidelines. Ultimately, this research is expected to provide new insights for optimizing pre-release decision-making and enhancing dam flood control operations.

Keywords: flood control, pre-release operations, precipitation forecasting, ensemble prediction, forecast accuracy