A Realistic Method of Forecasting Dam Water Inflow for an Efficient Operation of Hydroelectric Power Stations including Pumped Storage

Koichiro HATA
Electric Power Research & Development Center,
Chubu Electric Power Co., Inc.
Nagoya, Japan

Session Advances in energy storage and conversion technologies

Keywords: Forecasting dam water inflow, Pumped storage facilities, Mesh type run-off model

Abstract

There are a number of hydroelectric power stations including pumped storage facilities built on different river basins in our company. For the efficient operation of these power stations, it is necessary to accurately predict the dam inflow during rain in order to make effective use of water resources. However, there are no established methods at present in place to assist the operator in forecasting such dam inflows during rainfall and as such, there is a heavy reliance on the experience of the operator. This problem has become even more acute in the view of the fact that the younger operators are replacing experienced operators, and there is an increase in the frequency of local heavy rains especially in non-gauged catchment areas. Therefore, there is a need to develop a realistic and robust forecasting method which can be able to accurately predict dam inflows during rain irrespective of the operator's experience as well as can be applied to non-gauged catchment areas.

Hence, an accurate and realistic forecasting method applying "mesh type run-off model" has been developed. This model has been originally proposed by Kyoto University disaster prevention research center, and has been improvised jointly by the Japan Weather Association and Chubu Electric Power Company. In this model, the catchment area of the target river basin is divided into uniform meshes where each mesh is of a few hundred square meters with a provision to set up the parameters relating to the easiness of water infiltration, easiness of water flow etc. By tuning these meshes according to the geography of the catchment area, it is possible to accurately simulate the direct run-off, water flow through the soil by simply inputting the mesh-wise rainfall amount.

The forecasting method of dam water inflow was applied to the Yahagi river basin by developing its "mesh type run-off model" and it was tuned for its accuracy and robustness by comparing the forecasted and observed dam inflows for 35 rainfall cases. On adjusting the parameters of each mesh for reducing the error, it was confirmed that the calculated inflow amount can be reproduced with good accuracy compared with the actual results.

In future, when this system is applied to different river basins, it is expected to accurately predict dam inflow irrespective of operator's experience. As a result, it is possible to realize more efficient operation of hydroelectric power stations by reducing the water spillage, more flexibility of pumped storage stations due to less operational restriction and better prediction in the flooding.