AOGS 2005

Use of Climate Information for Improving the Extended Streamflow Prediction

YOUNG-OH KIM[1], JAE-KYOUNG LEE[1] and DAE-IL JEONG[1]
[1]*School of Civil, Urban and Geosystem Engineering, Seoul National University, Korea*

Over the last decade, an accuracy of climate forecast information has improved due to advances in understanding climatic systems, particularly due to the better understanding of ENSO and the improvement in meteorological models like that global circulation models. Therefore, if the forecasted climate information is properly incorporated into streamflow prediction, the accuracy of the resulting streamflow forecasts can be improved. Mid- and long-term (i.e. 10-day, monthly, seasonal) climate forecast information is especially valuable for extended streamflow prediction in Korea because there exists no good predictor: for example, maximum monthly autocorrelations of streamflow are in general around 0.3, and the snowpack and ENSO information is not useful in Korea. Recently, ESP (Ensemble Streamflow Prediction) has been introduced in Korea as an alternative streamflow prediction approach that can make probabilistic streamflow forecasting. The first objective of this paper is to investigate climate forecast information available that can improve extended streamflow prediction in Korea. Such information includes the climate forecasts provided by (1) the Monthly Industrial Meteorology Information Magazine (MIMIM) of Korea Meteorological Administration; (2) the Global Data Assimilation Prediction System (GDAPS); and (3) the US National Centers for Environmental Prediction (NCEP). Each of these forecasts is issued in a unique format: (1) MIMIM is the most-probable-event forecast, (2) GDAPS in a single series of deterministic forecast, and (3) NCEP is an ensemble of deterministic forecasts. The second objective of this study, therefore, is to propose a methodology that can employ these three types of climate forecast information in the extended streamflow prediction in Korea. With MIMIM, we first selected among historical data, the meteorological scenarios that would correspond to the most probable event forecast for the month being forecasted, generated ESP scenarios by inputting only the selected meteorological scenarios to a rainfall-runoff model, and made a probabilistic streamflow forecast using the generated ESP scenarios. With GDAPS, extended streamflow prediction was straightforward: a deterministic meteorological forecast series of GDAPS was inputted to a rainfall-runoff model to generate a deterministic streamflow forecast series. Lastly, with the NCEP ensemble, the forecast were transformed into a probabilistic format, and an ensemble of historical meteorological scenarios were inputted to a rainfall-runoff model to generate a corresponding number of streamflow forecast scenarios, and the transformed probabilistic NCEP forecast was used to assign a unique weight to each streamflow scenario using the PDF-ration method. The proposed methodologies were applied to 10-day ahead inflow forecasting at the Chungju multi-purpose dam in Korea. A cross validation study identified the most valuable climate forecast information and methodology that could improve the accuracy of inflow forecasts.