

整合校正後 ECMWF 中期雨量預報與水文模式 分析水庫入流量預報效能-以石門水庫為例

Integration of Calibrated Medium-Range Rainfall Forecasts with Hydrological Modeling to Analyze Inflow Forecasting Accuracy – A Case Study for Shimen Reservoir Catchment

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摘 要

中央氣象署採用歐洲中期天氣預報中心(European Centre for Medium-Range Weather Forecasts, ECMWF)中期雨量預報產品(空間解析度 $0.1^\circ \times 0.1^\circ$)，經校正後提供全臺高解析網格(空間解析度 1.25 公里 \times 1.25 公里)未來 1-9 天逐日之 3 日累積降雨預報產品。本研究主要引進校正後 ECMWF 中期雨量預報產品建置水庫入流量預報系統，採用 ECMWF 中期雨量預報於 2013/01/02 至今校正後成果，將每次 1-9 天降雨預報資料，輸入至修正型 HBV 水文模式進行 1-9 天流量預報，並計算每次預報的流量預報誤差，進行流量預報效能分析。

流量預報誤差的計算方式為預報值減觀測值，預報值採用 1-9 天預報流量之平均值，而觀測值則採用預報同期間之 1-9 天觀測流量平均值。另採用氣候法(即以預報同期間之歷史流量平均值當作預報值)與採用校正後 ECMWF 中期(未來 1-9 天)雨量預報輸入修正型 HBV 水文模式進行流量預報之結果相互比較。以不同季節(10-4 月秋冬春季、5-6 月梅雨季與 7-9 月夏季)之流量預報誤差盒鬚圖，呈現流量預報誤差成果，以瞭解採用校正後 ECMWF 中期雨量預報進行石門水庫入流量預報之效能。分析結果顯示：相較以歷史流量平均值當作預報值，採用校正後 ECMWF 中期雨量預報產品進行石門水庫入流量預報具有更高的預報校能。

關鍵詞：ECMWF 中期雨量預報，水庫入流量預報，HBV 水文模式

Abstract

The Central Weather Administration of Taiwan calibrated the medium-range rainfall forecasts ($0.1^{\circ}\times 0.1^{\circ}$) provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) to produce the 3-day cumulative rainfalls ($1.25\text{ km}\times 1.25\text{ km}$) for 1-9 days ahead. The study integrated the calibrated medium-range rainfall forecasts with the hydrological model to build the reservoir inflow forecasting system for Shimen Reservoir in Northern Taiwan. The historical calibrated rainfall forecasts (2013/01/02~now) were inputted into the modified HBV hydrological model to simulate the reservoir inflows as forecasts. The inflow forecasting errors for all historical forecasts were calculated to investigate the reservoir inflow forecasting accuracy.

The inflow forecasting error for each historical forecast was calculated as the difference between the 9-day mean forecasted inflow and the 9-day mean observed inflow. The climatology method, which involves using the historical flow average over many years for the same forecasting date as the forecast value, was utilized and compared with the proposed forecasting method in this study. Box plots illustrating the inflow forecasting errors by the proposed forecasting method and the climatology method were presented for different seasons (Oct. - Apr., May - Jun., and Jul - Sep.). The findings indicate that the proposed method, which integrates calibrated medium-range rainfall forecasts with hydrological modeling, outperforms the climatology method.

Keywords: ECMWF medium-range rainfall forecast, reservoir inflow forecasting, HBV hydrological model