WAT-73 ORAL PRESENTATION · WATER TRACK · SURFACE WATER HYDROLOGY & BASIN MANAGEMENT

Performance Evaluation of Global Ensemble Forecast System (GEFS) Based Reservoir Inflow Forecasting for Almatti Reservoir, India

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DOI: https://doi.org/10.31705/ICEWSE.2026.67

Abstract

Accurate reservoir inflow forecasting is essential for effective reservoir operation and water resources management. This study evaluates the performance of the Global Ensemble Forecast System (GEFS) coupled with the Variable Infiltration Capacity (VIC) hydrological model for forecasting inflows to the Almatti Reservoir during a selected high-flow event from 15 to 30 June 2021. During the event, the observed reservoir inflow peaked at 4,390 m^3/s. Three inflow hydrographs were considered: observed reservoir inflow, VIC-simulated inflow using observed rainfall from the India Meteorological Department (IMD), and forecast inflow generated using GEFS rainfall. The GEFS–VIC forecasts were evaluated at a 3-day forecast lead time by comparing the forecast and observed inflows. Forecast deviation was quantified as the percentage difference between GEFS–VIC forecast and observed inflows, with positive and negative values indicating overestimation and underestimation, respectively. The results show substantial deviation during the initial forecast period, with an average deviation of about 243%. Forecast performance improved during subsequent periods, with average deviations reducing to −18% and −32%. The forecast errors also varied with the stage of the observed inflow hydrograph. Overall, the GEFS–VIC forecasts captured the general temporal pattern, including the rapid rising and subsequent recession phases, although underestimation was evident during several later forecast periods. Comparison with VIC simulations driven by observed IMD rainfall provides a reference for understanding the influence of rainfall forecast uncertainty. The results demonstrate the potential of the GEFS–VIC framework for short-range operational reservoir inflow forecasting and supporting reservoir management decisions.

Keywords: *Almatti reservoir; ensemble rainfall forecasting; GEFS; reservoir inflow forecasting; VIC model*