4 Results

4.1 Calibration

Monthly simulated and observed streamflow data for the calibration period (2001-2010) for selected control stations in the Middle Nzoia Catchment (Figure 3). The model's ability to reproduce observed values depicts the relationship between simulated and observed flows.

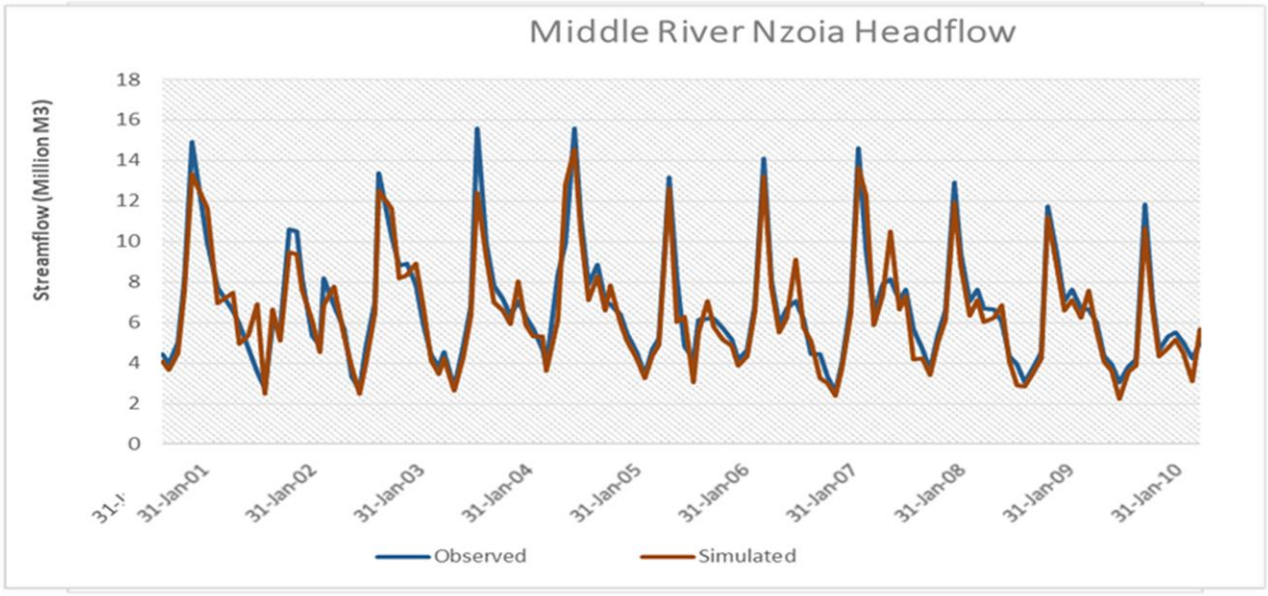

Figure 3 Calibration results showing observed and simulated monthly streamflows at selected stations in the Middle Nzoia Catchment (2001-2010) (Source: Researcher (2025))

This figure shows a time series plot of streamflow for the Middle River Nzoia Headflow. The time-series pattern for the Middle Nzoia Headflow indicates clear seasonal and interannual variability in streamflow between January 2000 and January 2010. Streamflow peaks generally occurred during the same periods each year, reflecting the influence of rainfall seasonality and catchment hydrological processes, whereas the lower flows corresponded to dry-season conditions. Overall, the simulated streamflow followed the observed pattern closely, indicating that the WEAP model was able to reproduce the temporal dynamics of streamflow reasonably well. The agreement between the two series was particularly strong during low-flow periods, where the simulated and observed values were nearly overlapping, suggesting that the model performed well under baseflow conditions. This close correspondence supports the suitability of the model for water resources assessment, planning, and forecasting in the Middle Nzoia Catchment.

The statistical fit indicators for the calibration period (2001-2010) are summarized in Table 1, which presents the performance of the WEAP model at Nzoia (IDD1) Gauging Station. The results show that the model achieved a Mean Absolute Error (MAE) of 5.552 m^3/s and a Root Mean Square Error (RMSE) of 11.921 m^3/s. In addition, the Nash–Sutcliffe Efficiency (NSE) was 0.712, the Index of Agreement (IA) was 0.913, and the Coefficient of Determination (R^2) was 0.757. These values fall within acceptable ranges for hydrological model evaluation and indicate good agreement between simulated and observed streamflow. A further comparison of observed and simulated monthly flows is presented in Figure 4, where the strong correlation between the two datasets ($r = 0.87009$) confirms that the model captured the observed streamflow trends satisfactorily.

Overall, the calibration results demonstrate that the WEAP model performed well in representing the hydrological behavior of the Middle Nzoia Catchment. The good model fit may be attributed to the ability of the model to capture the main physical characteristics of the basin, including the topographic variation between the middle and upper catchment, catchment size, and the seasonal response of runoff to rainfall. These findings provide confidence in the model's application for subsequent scenario analysis and water allocation assessment.