Hydrological Basin Analysis Report: Upper Leaf

1. Basin & Gauge Map

The Upper Leaf basin, covering an area of 4540.54 km², is analyzed using USGS gauge #02473000 located at coordinates (31.343056, -89.280278). The basin map highlights the watershed boundary with several USGS gauge stations identified. The centroid coordinates are approximately 31.8067° latitude and -89.4854° longitude. Among the gauges, 02473000 appears to be the most downstream. The geography reveals varying elevations, influencing water flow and accumulation patterns.

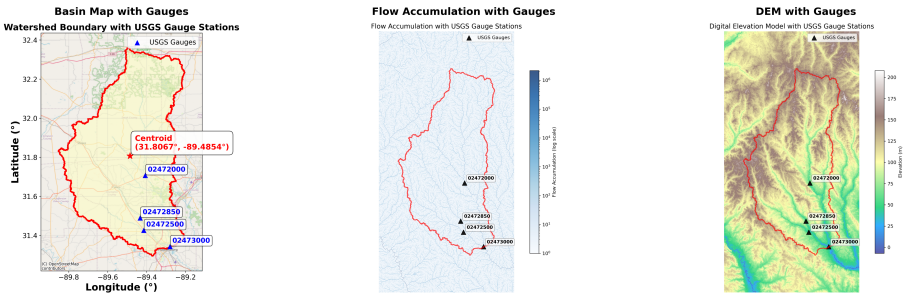

Figure 1: Basin & Gauge Map

2. Fundamental Basin Data

Digital Elevation Model (DEM)

The DEM indicates varied terrain, with elevations ranging from 0 to over 200 meters. The basin shows significant relief, which can impact surface runoff and drainage dynamics.

Flow Accumulation Map (FAM)

The flow accumulation map, presented in logarithmic scale, illustrates the convergence of flow paths towards the basin outlet. Higher accumulation areas suggest major stream networks, critical for understanding flow dynamics.

Drainage Direction Map (DDM)

The DDM reveals the drainage directions within the basin, showing a dense network that can affect flow speed and storage times. The directional color coding helps identify primary flow paths.

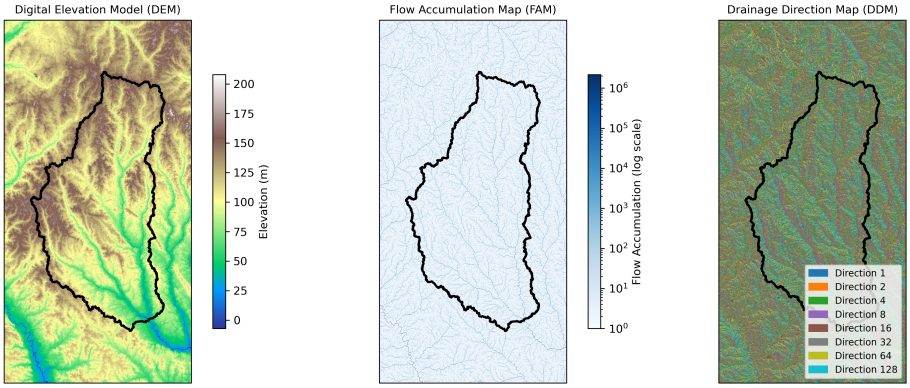

Figure 2: Fundamental Basin Data

3. Simulation vs Observation

The hydrograph shows simulated discharge (black line) and observed discharge (red dots), overlaid with precipitation data (blue bars). The simulation generally follows the observed pattern, reflecting periods of high flow and low flow. However, noticeable deviations occur at peak discharges, where the model sometimes under-predicts or over-predicts flows. Lags between precipitation events and peak flows are evident, highlighting potential model calibration needs. Overall, there's a slight bias towards underestimating flows, necessitating further adjustments for model accuracy.

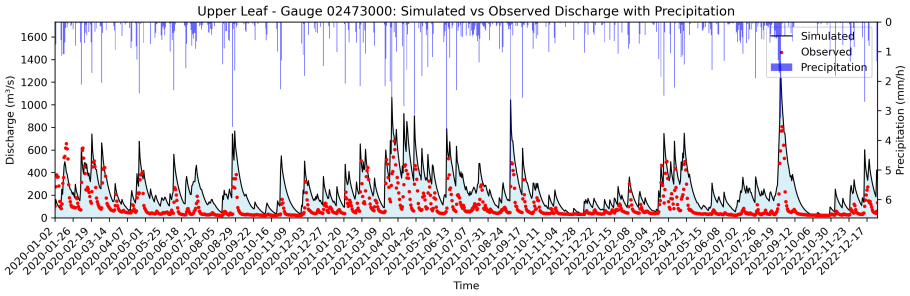

Figure 3: Simulation vs Observation

4. Model Performance Metrics

Metric	Value
Nash-Sutcliffe Coefficient of Efficiency (NSCE)	-1.367
Kling-Gupta Efficiency (KGE)	-0.513

Metric	Value
Correlation Coefficient	0.749
Bias (m^3/s)	143.43 (141.7%)
Root Mean Square Error (RMSE) (m^3/s)	185.60

5. CREST Parameters

Water Balance Parameters

Parameter	Value
Water capacity ratio (WM)	150.0
Infiltration curve exponent (B)	12.0
Impervious area ratio (IM)	0.2
PET adjustment factor (KE)	0.7
Soil saturated hydraulic conductivity (FC)	40.0
Initial soil water value (IWU)	25.0

Kinematic Wave (Routing) Parameters

Parameter	Value
Drainage threshold (TH)	150.0
Interflow speed multiplier (UNDER)	1.5
Interflow reservoir leakage coefficient (LEAKI)	0.1
Initial interflow reservoir value (ISU)	0.0
Channel flow multiplier (ALPHA)	1.2
Channel flow exponent (BETA)	0.5
Overland flow multiplier (ALPHA0)	1.0

6. Conclusion/Discussion

Model Performance Evaluation

The model performance, as indicated by the negative NSCE and KGE values, suggests that the model requires further calibration to improve its predictive accuracy. The correlation coefficient of 0.749 indicates a moderate agreement between observed and simulated streamflows, but the significant bias and RMSE highlight areas for improvement.

Warmup Period Considerations

Given the bias of 141.7%, it is crucial to consider extending the warmup period to allow the model to stabilize before the analysis period begins. This could help reduce the initial discrepancies between observed and simulated data.

Recommendations for Simulation Period and Next Steps

- **Calibration:** Refine model parameters, particularly those affecting peak flow predictions and timing, to improve accuracy.
- **Extended Warmup:** Implement a longer warmup period to ensure model stability.
- **Further Analysis:** Conduct sensitivity analysis to identify key parameters influencing model performance and focus on their optimization.
- **Validation:** Use additional data sets for validation to ensure robustness of the model across different conditions.

This report provides a comprehensive overview of the hydrological simulation conducted for the Upper Leaf basin. The insights gained will guide future model refinements and enhance the understanding of hydrological dynamics within the basin.