Assessment of Surface water yield using SWAT Hydrological model

CASE study of the Shipra Basin

Presented By: Arjit Mishra



Overview of Shipra Basin

 The Shipra, also known as the Kshipra, is a river of religious importance in Madhya Pradesh state of central India.

The river rises in the Kakri Bardi hills of Vindhya Range, north of Dhar, and flows across the Malwa Plateau to join the Chambal River.

Total length is 195km long, out of which 93km flow through Ujjain

Estimated drainage area is about 562,110 ha.



Data Used

Spatial Data

- Digital Elevation Model: SRTM 90 m resolution
- Drainage Network: Hydroshed
- Soil maps and associated soil characteristics: FAO Global soil
- Land use: Global Map of Land Use/Land Cover Areas (GMLULCA)
- IWMI's Global Map of Irrigated Areas (GMIA) (source: IWMI)



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Weather Data

IMD gridded weather data (1971–2004)

5 years of weather data was used as warmup/setup
period for the Shipra basin model thus outputs were

available from 1976 to 2004



Data Layers used for modeling of Shipra Basin



Digital Elevation Model

Parameter	Elevation (m)
Minimum Elevation	388
Maximum Elevation	831
Mean Elevation	510



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Data Layers used for modeling of

Shipra Basin



Landuse Map

Merged Landuse and Irrigation source map from IWMI





Data Layers used for modeling of

Shipra Basin



Soil Map



Sub-Basins delineated from SWAT



- Threshold Value used for delineation 5000 ha
- Number of Subbasins Delineated 41
- Total Basin Area 5621 sq km



SWAT Model Calibration

 Model had been calibrated using Observed data for the period 1976-2004 at monthly scale.

- For Model calibration data from 2 stream flow monitoring stations were made available
 - > Ujjain
 - > Mahidpur





SWAT Model Calibration

- □ SWAT cup was run to know the sensitive parameters
- Such Sensitive parameters were manually adjusted and calibrated with respect to observed data (1976-2004) using SWAT model with 5 years "warm up period"
- Manually adjusted parameter comprises mainly of Ground water components.
- Before performing statistical comparison with observed data, the reasonableness of the model for general evapotranspiration, runoff, base flow/return flow, and crop yields against district averages were analyzed and found satisfactory.



Results

- For statistical comparison two type of model efficiency parameters were used to determine the quality of match between simulated and observed data.
 - Correlation Coefficient (R2)
 - Nash-Sutcliffe coefficient (NS)

Gauge Site	Catchment Area*(Sq km)	COE (NS)	Correlation coefficient(R ²)	Flow Difference (%)	W
Ujjain	2288	0.45 cot cite	0.79	-23	
Mahidpur	4467	0.66 NOT	0.82	-2.6	elhi (
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Simulated Vs Observed flows at Ujjain Gauging site



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Coefficient of Correlation between Simulated and Observed flows at Ujjain site





Simulated Vs Observed flows at Mahidpur Gauging site





Coefficient of Correlation between Simulated and Observed flows at Mahidpur Gauging site



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