

Uncertainty in the SWAT Model Simulations due to Different Spatial Resolution of Gridded Precipitation Data

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Introduction

- Watershed scale hydrological models – important tools for impact evaluation
- Applications include: Watershed management, irrigation planning, flood forecasting, etc.
- Constraint -Uncertainty









Significance of Precipitation Data

Gauge Data	Gridded Data
Meteorological Station	Computed: Satellite Data Derived: Gauge and Satellite Data
Point measurement	Spatial measurement
Poor spatial coverage	Good spatial coverage
Long records (maximum 350 years)	Short records (maximum 25 years)
Observer errors, instrumental errors, errors due to environmental influences	Instrument calibration, changing algorithms



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Process Representation in SWAT

SWAT uses data from one precipitation gauging station that is nearest to the centroid of each sub-basin







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Basin centroid

Gridded data poin

Objective



• To assess the variability in the model output with respect to precipitation data of different spatial resolutions and watershed size



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Model Setup



Data	Resolution	Source
Digital Elevation Map	90 m	Shuttle Radar Topography Mission (SRTM)
Land use Map	500 m	WATERBASE
Soil Map	1000 m	Harmonized World Soil Database (HWSD)
Weather Data	1° x 1° 0.5° x 0.5° 0.25° x 0.25°	India Meteorological Department (IMD)



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Scenarios



- Watershed Discretization
 - □ 19 sub-watersheds (CI Threshold = 7000 km^2)
 - □ 77 sub-watersheds (2000 km²)
 - □ 129 sub-watersheds (1000 km²)

Precipitation Input

Data Set	Spatial Resolution (Lat x Long)	Data Period
IMD	1° x 1°	1971-2005
IMD	$0.5^{\circ} \ge 0.5^{\circ}$	1971-2005
IMD	$0.25^{\circ} \ge 0.25^{\circ}$	1971-2005



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Precipitation – 19 Sub-basins





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Precipitation – 77 Sub-basins





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Precipitation – 129 Sub-basins





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Evapotranspiration – 77 Sub-basins





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Evapotranspiration – 129 Sub-basins





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HMG-IITM Surface Runoff – 19 Sub-basins 10 **0.5**° **0.25**° 24 b) a) C) 501 - 1000 151 - 250 251 - 500 1001 - 2000 > 2000 Surface Runoff, Mean (mm) <= 150 d) e) f) 300 150km 51 - 75 76 - 100 101 - 150 151 - 200 > 200 <= 50 Surface Runoff, CV (%) Hydrologic Modeling Group

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Surface Runoff – 77 Sub-basins





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Surface Runoff – 129 Sub-basins



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Sediment Yield – 77 Sub-basins





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Sediment Yield – 129 Sub-basins





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PBIAS (with respect to flow from 1°)

No. of Sub- basins/Degree	0.5 °	0.25 °
19	6.07	14.97
77	-0.22	24.39
129	7.93	28.07



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Conclusions



- Uncertainty in input data needs to be considered for efficient water resources planning and management
- The uncertainty in representation of spatial variability of rainfall data is significant
- The forcing data selection needs to be done carefully

