An Assessment of Anthropogenic Impacts on a Hydrological System using SWAT Model

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Outline

- Introduction – Study Area
- Statement of the Problem
- Catchment Characteristics
- SWAT modeling
- Preliminary Results
- Conclusions
Aim:
This study aims to quantify the historic and future impacts of major anthropogenic changes on the hydrology of the upper Musi catchment, India.

Objectives:

Anthropogenic Impacts: Effects, those that are derived from human activities. Ex: Hydrological structures (Farm dams, Check dams, etc.), Groundwater extractions, Land use change, etc.,
Study Area: Himayat Sagar Catchment

Legend
- Himayat_Sagar_Catchment_Area
- HSC_Drainage
- HSC_Stream
- HSC_Big Tanks
- HSC_Small Tanks
- SWAT_19_Subbasins

Himayat Sagar Reservoir: 1340 km²

Inflows:
- AAI = 69 GL
- 1980-89 = 100 GL
- 1990-99 = 64 GL
- 2000-09 = 43 GL
Anthropogenic Impacts:
Effects, those that are derived from human activities.

Ex: Hydrological structures (Farm dams, Check dams, etc.), Groundwater extractions, Land use change, etc.,
Data collected for 25 different types of hydrological structures (storages and usage)
• Every 2 Acre Has One bore at least (Irrigated Land)

• Each Bore well is pumping 600 hrs (Per year)

• ~ 121 MCM are pumping from GW (93 mm, 12.5% Rf)
• 25% of runoff Volume is stopped by Structures (25 GL)

• 100% of recharge is pumping back to Irrigation (121 GL)
**Modelling: Land use Land cover & Groundwater Extractions**

**First Set:**
- **Warm up Period:** 1980 - 1982
- **Calibration Period:** 1983 – 1987
- **Validation Period:** 1988 – 2009

**Land use Area:** Ave (1986)
**Hydrological Structures:** 1995-2005
**GW Extractions:** Ave (2000 – 2005)

**Second Set:**
- **Warm up Period:** 1997 - 1999
- **Calibration Period:** 2000 – 2005
- **Validation Period:** 1995 – 2000

**Land use Area:** Ave (2000-2002)
**Hydrological Structures:** 1995-2005
**GW Extractions:** Ave (2000 – 2005)
Validation Period (1988-1992)

\[ y = 0.96x - 0.40 \]

\( R^2 = 0.7684 \)

\( E = 0.71 \)

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Observed Inflows
Simulated Inflows

Hydrological Structures

Runoff (13%)
Evapotranspiration
Evaporation
Land use
Percolation (16%)
Lat Q (1%)

From (1983 – 1992)

Et (71%)

Total Volume of water due to RF

First Set
Results

Analysis of residuals: 1995-2005

Wet Year: 6-8%
Normal Year: 8-25%
Dry Year: 27-36%
Conclusion

- The results to date clearly show that the impacts of Anthropogenic changes on streamflows are significantly greater during dry years.
- Model calibration for the second set of period
- Separating the individual effects of these changes and
- Quantifying the relative impacts of these changes on catchment hydrology.
Thank You