Development and Application of Urban Storm Sewer within a Watershed Model

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Status of Urban Storm Sewer Simulation

Storm Water Management Model (SWMM)

Short

Intermediate

Long

Storm Sewer

Soil and Water Assessment Tool (SWAT)
Research Objectives

- Develop a **lumped storm sewer** component within **SWAT**

- Apply **SWAT-SS** model to evaluate *land use change*
Multi-timescale Approach

Short-term response

Intermediate-term response

Long-term response
Multi-timescale Approach

- Hydraulic Length
- Average Slope
- Manning’s Roughness
- Subbasin Area

Time of concentration ($T_c$)

- Long-term response
- Short-term response

Main Channel
Study Site

Charmany Farm Station

USGS 05427965

Storm sewer and Use
Data → Evaluation of Urban Development → Validation → Calibration → SWAT-SS → Result
**Calibration**

*Original SWAT*

\[ R^2 = 0.50, \text{NSE} = 0.47 \]

**SWAT-SS**
SWAT-SS Validation

R²=0.77, NSE=0.77

R²=0.79, NSE=0.78

Observed vs. Model Rainfall and Flow Rate Comparison

- Gray dots represent observed data.
- Red dots represent model predictions.
- Blue line represents rainfall.

Research Objectives

- Develop a lumped storm sewer component within SWAT

- Apply SWAT-SS model to evaluate land use change
Application of SWAT-SS

- Pervious area
- Impervious area

Land Classification

Total Roughness

High roughness

Low roughness
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<td>Overland roughness (n)</td>
<td>0.24</td>
<td>0.24</td>
<td>0.08</td>
<td>0.02</td>
<td>0.02</td>
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**Impervious area percentage**
Summary and Conclusion

- **Storm sewer** component is added into a Watershed model **SWAT-SS**

- **SWAT-SS** can simulate *short-term sub-hourly* storm response for an urban watershed.

- **Land use development** can be estimated using **SWAT-SS**
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Questions ?