Analysis of Major Parameters in a Tropical Climate Watershed

Case Study: Tabma Sub-basin, Thailand

Orachorn Kamnoet
Ph.D Student
King Mongkut's University of Technology Thonburi, (KMUTT)

Chaiyuth Chinnarasri
Water Resources Engineering & Management Research Center (WAREE),
King Mongkut's University of Technology Thonburi,(KMUTT)
Content

Introduction and State of Problems
Objectives
Methodology
SWAT model
Result
Calibration and Validation
Conclusion
Statement of Problems

Rainfall and runoff decreasing or increasing or uncertainty

• In 2005, Drought was occurred in June and July and Flood in the last year in Rayong Province. So, both of situations occurred in the same year.

• many water used such as agriculture and industrial.
Area: 1,704 km²

8 rainfall stations
1 runoff station
Scope of Study

Section 1

- Historical Temperature Trends
  - Increase and decrease
- Historical Precipitation Data
  - Peak season

Section 2

Hydrological Model
Swat: Soil and Water Assessment Tool

Data
- Landuse
  - DEM (Digital Elevation Model)
  - Climatologically data
  - Rainfall
- Temperature
  - Relative humidity

Section 3

Simulated Runoff
Objectives

• To simulate stream flow and identify major parameters which are sensitive to a tropical climate in the Tabma Sub-basin.
## Methodology

### Input Data in SWAT model

<table>
<thead>
<tr>
<th>Data</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>calibration</td>
<td>Validation</td>
</tr>
<tr>
<td>Rainfall</td>
<td>2001-2002</td>
<td>2003</td>
</tr>
<tr>
<td>DEM</td>
<td>2001</td>
<td>2001</td>
</tr>
<tr>
<td>Land use</td>
<td>2001</td>
<td>2001</td>
</tr>
<tr>
<td>Soil series</td>
<td>2001</td>
<td>2001</td>
</tr>
<tr>
<td>Temperature (Max and Min)</td>
<td>2001-2002</td>
<td>2003</td>
</tr>
<tr>
<td>Runoff</td>
<td>2001-2002</td>
<td>2003</td>
</tr>
</tbody>
</table>

Parameter values which used in calibration can be apply to use in next year of data. Assume: Land use doesn’t change within 3-5 years. So, use these to instance values.
Relationship between rainfall and observed flow data
Rainfall map in 2001

January  
February  
March  
April  
May  
June  
July  
August  
September  
October  
November  
December  

Source: Hydro and Agro Informatics Institute (HAII)
Tabma Subbasin:
Digital Elevation Model: DEM
Resolution: 30 m
Tabma Subbasin:

Landuse

- Crop (8%)
  - Sugarcane (2%)
  - Cassava (20%)
  - Pineapple (23%)
  - Para rubber (18%)
- Forest (2%)
Tabma Subbasin: SWAT Process

DEM | Delinated Watershed | Land use | Soil Series

Input data

SWAT model

Runoff

Calibration & Validation
## Result of research

### Most sensitive parameters of SWAT model

<table>
<thead>
<tr>
<th>Sensitivity analysis</th>
<th>parameters</th>
<th>Group</th>
<th>Range of value</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ch_K2</td>
<td>rte</td>
<td>0.00 – 150.00</td>
<td>1.03</td>
</tr>
<tr>
<td>2</td>
<td>Cn2</td>
<td>mgt</td>
<td>35.00 – 98.00</td>
<td>42.35</td>
</tr>
<tr>
<td>3</td>
<td>Esco (HRU)</td>
<td></td>
<td>0.00 - 1.00</td>
<td>0.015</td>
</tr>
<tr>
<td>4</td>
<td>SOL_AW_C</td>
<td>Soil unit</td>
<td>0.00 - 1.00</td>
<td>0.65</td>
</tr>
<tr>
<td>5</td>
<td>Sol_k</td>
<td>Soil unit</td>
<td>0.00 - 150.00</td>
<td>22.32</td>
</tr>
<tr>
<td>6</td>
<td>Alpha_Bf</td>
<td>GW (Groundwater)</td>
<td>0.00 - 1.00</td>
<td>0.66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error</th>
<th>Calibration 2001-2002</th>
<th>Validation 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nash</td>
<td>0.651</td>
<td>0.312</td>
</tr>
</tbody>
</table>
Result of research

- Calibration 2001 - 2002
- Validation 2003

Graph showing daily observed and simulated runoff in m³/s over the months of January 2001 to December 2003.
Conclusion

• The most sensitive parameters were: CH_K2, CN2, Alpha BF, Sol K, and Sol AWC

• The model performs not so good to simulate flow in this sub-basin, it might be because land use has been changing every year.
Thank you for your kind attention.