Comparing SWAT and WetSpa on the river Grote Laak, Belgium

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SWAT

- SWAT 2005
- Only water quantity modeling
- AVSWAT used for delineation of catchment
  - 3 subcatchments
- Sensitivity-analysis
  - LH-OAT
- Automatic Calibration
  - SCE-UA
WetSpa

• A distributed parameter GIS-based precipitation-runoff model
  • Flood prediction
  • Scenario analysis

• Development?
  • @ Vrije Universiteit Brussel
  • Department of hydrology and hydraulic engineering

• Automatic calibration
  • PEST (Parameter Estimation)
WetSpa (2)

- **Users?**
  - Research institutes and water authorities interested in hydrological modeling/scenario analysis

- **Availability?**
  - **FREELY AVAILABLE**
    - (GUI, automated parameter estimation, theoretical & practical manual)

- **Applications?**
  - Locations: Europe, Asia, America, Africa
  - Scale: watersheds 100 km² – 10,000 km²
Concept

Q = Q_s + Q_i + Q_g

Precipitation

Evapotranspiration

Initial losses

Surface runoff Q_s

Interflow Q_i

Groundwater flow Q_g

Flow

Time

Infiltration

Impervious

Pervious

Transmission zone

Root zone

Saturated zone

Recharge

Groundwater
Input & Output

Digital Spatial Data (DEM, Landuse, Soil type)

GIS Methods

WetSpa Programs

Time Series (Precipitation, Potential EP, Temperature, Discharge)

Peak Discharges

Flow Hydrographs

Spatial Characteristics
Delineation (WetSpa)

- In order to work with same basin
  - Mask of basin delineated by AVSWAT was used
  - Burn in of streams with secondary elevation map
    - CRWR-prepro-tool (Olivera, 1998)
    - Due to small slopes
    - Due to small differences in altitude
  - Artificial wall around the area
    - To cover the same area as in SWAT
Grote Laak

- **Nete catchment**
  - Schelde catchment
  - Belgium
- **Lowland river**
  - Small slopes
  - Small differences in altitude
  - 17m - 65m
- **Area**: 56 km²
- **900mm precipitation/year**
Grote Laak

- **Landuse**
  - Corn
  - Forest
  - Pasture
  - Urban

- **Soil**
  - Clay
  - Sand (>85%)
  - Sandyloam

» 23 HRU’s in SWAT
Data & Evaluation

• Daily discharge data
  • Calibration: January 2000 – December 2003
  • Validation: 1999

• Parameters
  • SWAT: 12
  • WetSpa: 8

• Evaluation of the model performance
  • NSE
  • Log NSE (low flows)
  • Adapted NSE (high flows)
Results SWAT

4th International SWAT conference, Delft
17-7-2007    Pag.11
Results WetSpa

4th International SWAT conference, Delft
17-7-2007   Pag.12
## In numbers

### Calibration

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<th>NSE</th>
<th>LNSE</th>
<th>ANSE</th>
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<tbody>
<tr>
<td>SWAT</td>
<td>0.739</td>
<td>0.658</td>
<td>0.788</td>
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<tr>
<td>WetSpa (manual)</td>
<td>0.701</td>
<td>0.588</td>
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<td>WetSpa (automatic)</td>
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### Validation

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<td>0.690</td>
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Calculation and calibration time

• Calculation time
  • WetSpa four times higher
    • Distributed
    • Acceptable and workable because of limited area

• Calibration time
  • WetSpa: four hours
  • SWAT: four days
    • Different algorithms
    • SWAT more parameters
Conclusions

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- Both acceptable results
  - Problems with low flows (extreme dry event)!

- WetSpa more stable
  - Less calibration parameters
    - Less calibration time
  - More appropriate for predictions? (Validation)
  - Possibility for better results when changing input databases
Future work

- Similar studies on other catchments with results
  - Analyze processes of both models
- Search for advantages
- Improve model by incorporating advantages from other models
Research

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  • Department of hydrology and hydraulic engineering
  • Prof. Dr. ir. Willy Bauwens
  • PhD-research

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Questions