Assessing the Influence of Climate Datasets for Quantification of Water Balance Components in Black Sea Catchment: Case Study for Melen Watershed, Turkey

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Outline

• Introduction
• Aim and Scope
• Study Area
• Model Setup
• Results
• Conclusion
Introduction

- Melen Watershed is the integral part of the Istanbul Water Resources System
- Quantification the water quantity and quality in Melen Watershed is important.

**Watershed Model**
- Discharge
- Water Balance
- Diffuse Pollution

**River Water Quality Model**
- Point Sources
- Sediment Trans.
- Water Quality Parameters

**Reservoir Water Quality/Ecology Model**
- Bathmety,
- Hydrodynamics
- Water Quality Parameters
Aim and Scope

• Developing a hydrological model for Melen Watershed, Turkey
• Comparing of local data set with reanalysis data (CFSR)

• Precipitation is one of the predominant input uncertainty sources
• Data scarce region
• Spatial distribution, measurement quality, missing data
• Representative weather data for watershed
• Ungauged mountainous region
Study Area (Istanbul, Turkey)

Melen Watershed
Study Area (Melen Watershed)

Area = 2444 km²
Q_{ave} = 45.7 m³ sec^{-1}
Precip = 823mm ???
Model Setup (Data Sources)

- Digital Elevation Map SRTM 90m
- Land Use CORINE
- Soil FAO
- Climate Data Set
  - CFSR (1979-2014)
  - Local Climate Datasets (1960-2013)
- Discharge Data
  - DSI (6 stations)
Model Setup

- 5 years warmup
- 20 Subbasins
- Hargreaves Method

- SWAT-CUP using SUFI-2 algorithm
- 60% of streamflow used for calibration
- NSE as an objective function
- Performance criteria NSE, R2, PBIAS as well as P-factor and R-factor
Methodology

SWAT Model Setup

Preliminary Analysis

Evaluation

Elevation Band Adj.

Evaluation

Parameter Adjustment

Calibration Complete

ArcSWAT ↔ SWAT-CUP

Land Use

Climate Data

Soil

Topography

Observed Streamflow

Change Climate Data

Re-Setup Model
Elevation Band Adjustment

To consider the orographic effects on precipitation and temperature in watershed,

Five elevation bands have been applied to model developed by local data (MGM)

- **T lapse** Rate is chosen as -6.5 C / km
- **P lapse** Rate is chosen as 600mm/km
SWAT Model Parameters

<table>
<thead>
<tr>
<th>SWAT Parameters</th>
<th>Initial Range</th>
<th>CFSR</th>
<th>MGM (Elev Adj.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>r__CN2.mgt</td>
<td>-0.5 to 0.5</td>
<td>-0.92 to 0.02</td>
<td>-0.23 to 0.304</td>
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<tr>
<td>r__GWQMN.gw</td>
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<td>-0.44 to 0.18</td>
<td>-0.93 to 0.02</td>
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<td>r__GW_REVAP.gw</td>
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<td>-0.83 to 0.05</td>
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<td>r__SOL_AWC().sol</td>
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<td>-0.86 to 0.04</td>
<td>-0.71 to 0.09</td>
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<td>r__REVAPMN.gw</td>
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<td>r__ALPHA_BF.gw</td>
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<td>r__SOL_K().sol</td>
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<td>r__SOL_BD().sol</td>
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<td>-0.09 to 0.70</td>
<td>-0.68 to 0.10</td>
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</tbody>
</table>

480 simulations has been done
## Calibration Results

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Station ID</th>
<th>Elevation (m)</th>
<th>Calibration</th>
<th>Validation</th>
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<tr>
<td></td>
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<td>p-factor</td>
<td>r-factor</td>
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<td>CF SR</td>
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<td>E13A002</td>
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<td>D13A038</td>
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<td>0.85</td>
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<td>D13A033</td>
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<td>D13A032</td>
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<td>MGM (Adj. Elev)</td>
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Moriasi et al. 2007  
Krause et al. 2005  
Abbaspour et al. 2015
Water Budget Components

Water Budget Components*

*for all basin

U95ppu

L95ppu
Conclusion

- Effects of climate data input are investigated using local data (MGM) and CFSR data in Melen Watershed, Turkey.
- SWAT model has been successfully applied to quantify water budget components of Melen Watershed.
- Global freely available gridded reanalysis data (CFSR) represents watershed better than local data (directly used) in Melen Watershed.
- After using elevation band features of SWAT model for local data, findings of model results have become quite satisfactory at outlet of watershed.
- Model results for both data set in ungauged (climate stations) and mountainous region of watershed still poorly represented.
- Using different sources of model input (if possible) is very important to define and quantify unceartinty sources.
Thanks for your attention...