A comparison of stream flow prediction using station and gridded meteorological datasets in IRAN

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Background

Objectives

Methodology

Results & Outlook

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CRU climate data grid points (0.5° * 0.5°)

Observed climate stations
506 subbasin delineation

1269 subbasin delineation

Area: 1,648,000 km² (165 million hectare)
Altitude: -80 to 5670 m
Average annual precipitation: 252 mm
Precipitation range: 20-2000 mm
Temperature: -44 to 56 degree C
Main objectives:

- Compare the effect of two climate datasets (observed and gridded) on the prediction of the stream flow
- Showing the relationship between resolution of the rain gauge network and subbasin size
Model Input

**Background**

- DEM (Extracted from global USGS DEM map)
- High: 5670 m
- Low: -80 m

**Methodology**

- Landuse (Extracted from global USGS landuse/land cover)
  - Legend:
  - 1: URMD
  - 2: CRDY
  - 3: CRIR
  - 4: CRGR
  - 5: CRWO
  - 6: GRAS
  - 7: SHR
  - 8: MIGS
  - 9: FODN
  - 10: SAVA
  - 11: FODB
  - 12: FODB
  - 13: SAVA
  - 14: FOEN
  - 15: FOMI
  - 16: WATB
  - 17: WEHB
  - 18: WEWO
  - 19: BSVG
  - 20: TUWO
  - 21: TUMI
  - 22: TUMI

**Soil** (Extracted from global FAO soil map, 1995)

**Outlook**

- Soil (Extracted from global FAO soil map, 1995)
- High: 5670 m
- Low: -80 m
Model Setup

**Scenario 1:** 506 subbasins using observed climate dataset of WSIMO

**Scenario 2:** 1269 subbasins using observed climate dataset of WSIMO

**Scenario 3:** 506 subbasins using CRU gridded climate dataset

**Scenario 4:** 1269 subbasins using CRU gridded climate dataset

**Simulation Setup**

<table>
<thead>
<tr>
<th>Simulation Setup</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Simulation time</td>
<td>1987-2002</td>
</tr>
<tr>
<td>Warm-up period</td>
<td>3 years</td>
</tr>
<tr>
<td>Number of observed stations</td>
<td>150</td>
</tr>
<tr>
<td>Number of gridded points(CRU)</td>
<td>1200</td>
</tr>
<tr>
<td>ET calculation method</td>
<td>Hargreaves</td>
</tr>
</tbody>
</table>
Nash-Sutcliffe Efficiency (NSE)

\[ NS = 1 - \frac{\sum_{i=1}^{n} (O_i - P_i)^2}{\sum_{i=1}^{n} (O_i - \bar{O})^2} \]

• Evaluates the model performance with reference to the mean of the observed data
• Its value can vary from 1 to \(-\infty\)
506 subbasins delineation

NSE
(station climate data)

NSE
(CRU)
1269 subbasins delineation

NSE (station climate data)

NSE (CRU)
### Performance of the SWAT prediction when...

<table>
<thead>
<tr>
<th>Subbasin</th>
<th>NSE (station climate data)</th>
<th>NSE (CRU)</th>
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</thead>
<tbody>
<tr>
<td>HR1</td>
<td>-1.97</td>
<td>-0.68</td>
</tr>
<tr>
<td>HR2</td>
<td>-0.40</td>
<td>-0.90</td>
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<td>HR3</td>
<td>-1.69</td>
<td>-1.34</td>
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<tr>
<td>HR4</td>
<td>-29.25</td>
<td>-5.68</td>
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<tr>
<td>HR5</td>
<td>-87.25</td>
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<tr>
<td>HR6</td>
<td>-53.33</td>
<td>-16.64</td>
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<tr>
<td>HR7</td>
<td>-19.83</td>
<td>-41.01</td>
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<tr>
<td>HR8</td>
<td>-5.76</td>
<td>-2.00</td>
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</table>

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<tr>
<th>Subbasin</th>
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<th>NSE (CRU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR1</td>
<td>-1.52</td>
<td>-0.76</td>
</tr>
<tr>
<td>HR2</td>
<td>-0.36</td>
<td>-0.50</td>
</tr>
<tr>
<td>HR3</td>
<td>-0.53</td>
<td>-0.22</td>
</tr>
<tr>
<td>HR4</td>
<td>-8.34</td>
<td>-3.52</td>
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<tr>
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<td>-10.40</td>
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<tr>
<td>HR6</td>
<td>-116.46</td>
<td>-18.17</td>
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<tr>
<td>HR7</td>
<td>-7.46</td>
<td>-25.26</td>
</tr>
<tr>
<td>HR8</td>
<td>-2.11</td>
<td>-1.36</td>
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</tbody>
</table>
Results

• CRU high resolution grid dataset is useful for the hydrological simulation

• Improvement was significant in more subbasin delineation

• Global CRU climate dataset can be used in regions of climate data scarcity with high confidence
outlook

- Using elevation band
- Calibration, Validation and Uncertainty analysis
- Using more Efficiency criteria like:
  - Coefficient of determination ($R^2$)
  - Root Mean Square Error (RMSE)
  - $br^2$
  - Percent Bias (PBIAS)
Thank you for your attention. Your comments are most welcome!