MyWater - Merging hydrological models and EO data for reliable information on Water

A flow forecast system for hydroelectric production

Carina Almeida, Pedro Chambel-Leitao - IST - Portugal
Waldenio Almeida - CPTEC/INPE - Brazil
Summary

• MyWater Project
• SWAT model watershed implementation: the Queimado case study
• Model flow calibration
• CPTEC Weather forecast
• Precipitation uncertainty and bias removal in Queimado
• Mohid Land application in Tamega
• Conclusions
GIS-Tool

EO Data

Hydrologic Models

Meteo Data

data integration and visualization (time and space)
Study sites, Partners and Users
SWAT model watershed implementation:
the Queimado case study
SWAT model implementation

Area: 3900 km²
SWAT model implementation: Inputs

- **Topography** Shuttle Radar Topography Mission
- Land Use
- Soil type
- Meteorological data
SWAT model implementation:

- Topography
- Land Use (Regional map)
- Soil type
- Meteorological data
SWAT model implementation: Inputs

- Topography
- Land Use
- **Soil type** Joint Research Centre
- Meteorological data
SWAT model implementation: Inputs

- Topography
- Land Use
- Soil type
- Meteorological data

Data source:
ANA (Agência Nacional de Águas)

Barreiro: 1985-2008
Rio preto: 1985-2007
Fazenda limeira: 1985-2013
Model flow Calibration
## Model flow calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default value</th>
<th>Final value</th>
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<tbody>
<tr>
<td>GW_Delay (days)</td>
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<td>300</td>
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<tr>
<td>Alpha_BF</td>
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<td>1</td>
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<td>Soil depth (mm)</td>
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<td>3000</td>
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<tr>
<td>CN2</td>
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<td>-30%</td>
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<tr>
<td>CH_N2</td>
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<td>0.15</td>
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<td>CH_K2</td>
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<td>100</td>
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<tr>
<td>Alpha_BNK</td>
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Model flow calibration

- Queimado – Annual flow: 1985 – 2012 hydrological years
Model flow calibration

- Queimado – Monthly flow: 1985 – 2012 hydrological years

<table>
<thead>
<tr>
<th></th>
<th>Observed Average</th>
<th>Modeled Average</th>
<th>Bias</th>
<th>RMSE</th>
<th>R2</th>
<th>Model Efficiency</th>
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<tbody>
<tr>
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<td>6,16</td>
<td>18,94</td>
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Model flow calibration

- Queimado – Daily flow: 1985 – 2012 hydrological years

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<tr>
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<td>49,15</td>
<td>55,2</td>
<td>6,12</td>
<td>29,09</td>
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<td>0,37</td>
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A flow forecast system for hydroelectric production - Queimado
CPTEC Weather forecast models
CPTEC ETA model for MyWater

- For MyWater CPTEC was running ETA model
- 5km horizontal resolution
- CPTEC’s global model for boundary conditions
- Model runs every 12h for 3 day forecasts.
Monthly Mean Precipitation

RMSE

For the 5 test areas, the monthly mean value for the RMSE – The expected error

July 2012 to June 2013
Precipitation uncertainty and bias removal
Precipitation uncertainty

- Flow obtained with different precipitation data:
  - ANA (data used in calibrated run)
  - TRMM (2011-2013 years)
  - CPTEC (2013 year)
Precipitation bias removal

• CPTEC tests
Mohid Land application in Tamega
Tamega

• Tamega watershed in Portugal using CPTEC model generated good results with 24h forecast and the MM5 24h forecast

![Graph showing Tamega results comparison between measurements, Mohid-Land with MM5, and Mohid-Land with CPTEC.](image_url)
A flow forecast system for hydroelectric production - Tamega
Conclusions
Conclusions

- SWAT is useful to predict flows
- In the case of Queimados to apply a bias correction to precipitation is needed to improve SWAT flow results.
- Precipitation from ETA CPTEC/INPE model needs a bias removal of more than 50% to get reasonable forecast flows in Queimado.
- For Tamega watershed an average bias removal in the precipitation of 10% would be sufficient (in this case using Mohid Land, but SWAT expected to be similar).
- Modeling results of Queimados an Tamega were shown to the local power production companies and they were interested on the results.