Use of SWAT for optimizing irrigation strategies for sugarcane production on the Island of Maui, Hawaii.

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- Sugarcane - 184.3 km²
- Average yield: 159.9 t ha⁻¹
- Irrigation: 760,000 m³ d⁻¹ (drip irrigation)
• Climatic characteristics
• Water diversion & transport
• Water usage concerns
- SWAT model
- Landuse:
  - 701 Sugarcane
- Soils data:
  - SSURGO
- HC&S Climate data:
  - 16 Weather stations
  - 40 Rain gauges
- Simulation period 2003-2013
  - 1 year spin up
- Crop parameters
- Irrigation DB
- Penman-Monteith method

Model setup
Methods
• Climatic variables
  • Precipitation (mm)
  • Temperature (°C)
  • Solar Radiation (MJm\(^{-2}\))
  • Wind Velocity (m/s)
  • Relative Humidity (%)

• Time period 1997-2013

• Data processing:
  • Historical extreme events
  • Missing data
### Water budget (mm)

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff</td>
<td>2.8</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>1604.9</td>
</tr>
<tr>
<td>Lateral flow</td>
<td>19.2</td>
</tr>
<tr>
<td>Percolation</td>
<td>325.4</td>
</tr>
<tr>
<td>Soil Water Content</td>
<td>-8.4</td>
</tr>
<tr>
<td>Precipitation</td>
<td>65.0</td>
</tr>
<tr>
<td>Irrigation</td>
<td>1895.8</td>
</tr>
<tr>
<td>PET</td>
<td>1851.9</td>
</tr>
</tbody>
</table>
To perform a sensitivity assessment of sugarcane yields to various irrigation schemes.
• Treatments:
  • Historical Irrigation dataset (100%)
  • Treatments (+25, -25, -50, -75%)
  • Automatic irrigation
• Response variables:
  • Crop yield
  • WUE
Results

LAI (Obs : Sim)
Crop growth (Obs : Sim)

Results
LAI (Obs : Sim) Results
Crop growth (Obs : Sim)

Results
Crop Yield Results
Water Use Efficiency

Results
Auto Irrigation Results
Auto Irrigation
Results
Crop Yield Results
Water Use Efficiency

Results
• Lessons learned
  • SWAT can adequately estimate sugarcane growth under different water management
  • Sugarcane yield and growth rate highly sensitive to water reductions.
  • Timing of irrigation is as important as volume applied

• Future work
  • WUE analysis entire plantation
  • Plant/Crop algorithm
  • Alternative biofuel crops

Lessons learned & Future work

Conclusions
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