Application of SWAT Model to Evaluate the Impacts on Water Resources of Some Climatic Scenarios in a Catchment of the Basque Country

Maite Meaurio\textsuperscript{(1)}, Ane Zabaleta\textsuperscript{(1)}, Iñaki Antiguedad\textsuperscript{(1)}, Laurie Boithias\textsuperscript{(2,3)}, Sabine Sauvage\textsuperscript{(2,3)}, José-Miguel Sánchez-Pérez\textsuperscript{(2,3)},

\textsuperscript{(1)} University of the Basque Country - Euskal Herriko Unibertsitatea, Department of Geodynamics, Leioa, Basque Country (Spain).
\textsuperscript{(2)} CNRS; Castanet-Tolosan, France.
\textsuperscript{(3)} University of Toulouse; INPT; UPS; ENSAT; Laboratoire d’Ecologie Fonctionnelle, Castanet-Tolosan, France.

maite.meaurio@ehu.es
K-EGOKITZEN

• ETORTEK strategic research program of the Basque Government.

• Objectives:
  • Development of knowledge about the impacts of global change.
  • Research about possible ways of adapting to cope with these impacts.

• Four study sections:
  • Urban Environment and Infrastructure
  • Coastal Environment
  • Terrestrial ecosystems
  • Marine ecosystems
PCP average = 800-1000 mm
T average = 12-13 °C
Watershed: 180 km²
• 4 pcp stations:
  • 2001-2006 calibration
  • 1 meteorological station
  • 2006-2010 validation
Calibration

<table>
<thead>
<tr>
<th></th>
<th>NASH</th>
<th>r²</th>
<th>PBIAS</th>
<th>RSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAILY</td>
<td>0.68</td>
<td>0.68</td>
<td>13.87</td>
<td>0.56</td>
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<tr>
<td>MONTHLY</td>
<td>0.85</td>
<td>0.87</td>
<td>14.1</td>
<td>0.38</td>
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<td>YEARLY</td>
<td>0.94</td>
<td>0.77</td>
<td>16.04</td>
<td>0.94</td>
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</table>

DAILY ➔ NSE > 0.65 very good. *Saleh et al. (2000)*
PBIAS < 10% to < 15% good. *Van Liew et al. (2007)*

MONTHLY ➔ 0.75 ≤ NSE ≤ 1 very good
10% ≤ PBIAS ≤ 15% good
0 ≤ RSR ≤ 0.5 very good
*Moriasi et al. (2007)*
**MONTHLY FLOW CALIBRATION-VALIDATION**

<table>
<thead>
<tr>
<th></th>
<th>Calibration</th>
<th>Validation</th>
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<tbody>
<tr>
<td><strong>DAILY</strong></td>
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</tr>
<tr>
<td>$r^2$</td>
<td>0.63</td>
<td>0.68</td>
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<tr>
<td>PBIAS%</td>
<td>0.70</td>
<td>1.35</td>
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<tr>
<td>RSR</td>
<td>24.62</td>
<td>0.56</td>
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<tr>
<td><strong>MONTHLY</strong></td>
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<tr>
<td>$r^2$</td>
<td>0.84</td>
<td>0.94</td>
</tr>
<tr>
<td>PBIAS%</td>
<td>0.88</td>
<td>0.77</td>
</tr>
<tr>
<td>RSR</td>
<td>23.45</td>
<td>0.52</td>
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<tr>
<td><strong>YEARLY</strong></td>
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<tr>
<td>$r^2$</td>
<td>0.89</td>
<td>0.89</td>
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<tr>
<td>PBIAS%</td>
<td>0.30</td>
<td>0.30</td>
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<tr>
<td>RSR</td>
<td>20.01</td>
<td>1.35</td>
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</table>

Santhi et al. (2001); adapted by Bracmort et al. (2006)

PBIAS <15% to <25% satisfactory

Van Liew et al. (2007)

$\text{NSE} > 0.5$ satisfactory.

$0 \leq \text{RSR} \leq 0.5$ very good

$0 \leq \text{PBIAS} \leq 15$ satisfactory

Moriasi et al. (2007)
CLIMATIC SCENARIOS
2000-2050

• Methodology:
  – Precipitation: Two climatic models.
    • KNMI-RAKMO [–0.7 ± 0.3% decade]
    • METNO-HIRHAM
      Maddalen Mendizabal (Tecnalia R&I), Roberto Moncho (Azti) y Guillem Chust (Azti).

  – Temperature: IPCC B2 scenario
    
    | AUTUMN | WINTER | SPRING | SUMMER |
    |--------|--------|--------|--------|
    | +2     | +1     | +1     | +2     |
CONCLUSIONS

HYDROLOGIC MODEL:
- Best results: monthly simulation.
- Statistical analysis ➔ good results
- Accumulated flow in validation 23 % error

CLIMATIC SCENARIOS (2000-2050):
- Depending on the climatic model different results.
- No clear trends in the hydrologic results.

FUTURE PROJECTS:
- Analyse the differences for the accumulated flow.
- More simulation with the results of temperature models.
- Take into account future land uses.
THANK YOU
PARAMETERS:
*bsn
-ESCO: 0.75
-SMTMPO: 1.5
-SURLAG:0.3
*gw
-RCHRG: 0
-SHALLST: 1000
-GW_DELAY:10
-ALPHA_BF: 0.04
-GWQMIN: 850
-REVAPMN: 900
*sol
-RANKER → SOL_AWC: 0.2