Water Balance Estimation in Rio Negrinho Basin, Southern Brazil.

T.M. Brighenti
Ms. Student, Environmental Engineering graduate program, Federal University of Santa Catarina, Brazil, tassiabrighenti@hotmail.com

N.B. Bonumá
Department of Sanitary and Environmental Engineering, Federal University of Santa Catarina, Brazil, nadia.bonuma@ufsc.br

S. Malutta
Águas de Joinville Company, Brazil simonemalutta@gmail.com
In recent years, the Rio Negrinho basin has **suffered from intense hydrological events**: accelerated urbanization, soil sealing and occupation of risk areas.

According to the ANA (National Water Agency) The Rio Negrinho river has a **high degree of vulnerability to the floods occurrence**.

Consequently the quantity of water is a region concern. Making it important to **quantify each process involved in water balance**.

Some papers has been developed in place to assess the basin behavior, such as: **GOERL, 2011; GIGLIO, 2011; MALUTTA, 2012 and BRIGHENTI, 2013.**
September flood in 2009, in Rio Negrinho Basin. The lines marks the floods in 1992 (above) and 1983 (below). The longest line represents the river left bank of normal conditions.
The marks above are for the years 1983 and 1992, and the mark below is for 2010.
Introduction

- The knowledge of the various processes that compose the hydrological cycle is important to estimate the water balance in different scenarios;

- The processes of water balance are directly influenced by the geomorphology, soil composition, climate and vegetation.

- Some hydrological processes considerate that are mainly:
  
  - Precipitation
  - Runoff
  - Evapotranspiration
  - Soil-water storage
• The Rio Negrinho Basin have a drainage area of **200km²** (inside two cities: Rio Negrinho e São Bento do Sul).

• The regional climate type is **temperate without dry season, with cool summer**.

• The annual temperature ranges from **11°C to 27 °C**
• Annual rainfall is **1720mm**.

• Cambissolos
• **Mixed Ombrophilous Forest; pine reforestation and agriculture.**
Data from three rainfall station in a period from 1990 to 2013 was used for simulation; and one station for meteorological data.

The stations are respectively: 6km, 19km and 25km at the basin.
Methodology

- The evapotranspiration method: Penman/Monteith;
- **Manning** Number was automatically determined;
- The runoff process made by *SCS curve number*.

THE WATER BALANCE:

\[
SW_e = SW_o + \sum_{i=1}^{t} (R_{day} - Q_{surf} - E_a - W_{seep} - Q_{gw})
\]
RESULTS

- The basin have altitudes varying from 1000m to 800m
- Cambissolo (clay texture): 99%

<table>
<thead>
<tr>
<th>Land Use</th>
<th>% of Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAST</td>
<td>8.96</td>
</tr>
<tr>
<td>AGRC</td>
<td>4.31</td>
</tr>
<tr>
<td>WATR</td>
<td>0.27</td>
</tr>
<tr>
<td>AGRL</td>
<td>4.47</td>
</tr>
<tr>
<td>URBN</td>
<td>4.39</td>
</tr>
<tr>
<td>FRST</td>
<td>58.00</td>
</tr>
<tr>
<td>PINE</td>
<td>19.60</td>
</tr>
</tbody>
</table>

PAST: Pasture
AGRC: Agricultural Land-Close-grown
WATR: Water
AGRL: Agricultural Land-Generic
URBN: Residential
FRST: Forest-mixed
PINE: Pinus
**Results**

- The results presented in this study are **monthly** of 24 years simulation.

<table>
<thead>
<tr>
<th>Water Balance Ratios</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream Flow/Precip</td>
<td>0.83</td>
</tr>
<tr>
<td>Base Flow/ Total Flow</td>
<td>0.60</td>
</tr>
<tr>
<td>Surface Runoff/ Total Flow</td>
<td>0.40</td>
</tr>
<tr>
<td>Perc/ Precip</td>
<td>0.52</td>
</tr>
<tr>
<td>Deep Recharge/Precip</td>
<td>0.03</td>
</tr>
<tr>
<td>ET/Precipitation</td>
<td>0.13</td>
</tr>
</tbody>
</table>
Results

It is also possible to obtain the simulation values of some parameters for each land use. (1710mm of rain)
CONCLUSIONS

• The **SWAT** model is a **promising tool** to assess the effects of land use changes in the **water balance in Brazilian watersheds**;

• Realized the importance of SWAT model **calibration and validation** to give consistency to the results.
Thanks!
tassiabrighenti@hotmail.com