SHORT TERM WATER CONSUMPTION FORECASTING IN THE METROPOLITAN AREA OF SAO PAULO

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WSN12 - Bolsa de Valores
Rio de Janeiro, Brazil ,06 to 10 August 2012
• Water supply and water distribution are two main components of water consumption system.

• It requires adjustments in response to variations in demand to reduce costs.

• Water consumption is a function of time (hour, day, month, season); weather and climate conditions; activities (work, holiday; special events); use (domestic and industrial) (Mukhopadyay et al., 2001).
WATER DISTRIBUTION SYSTEM IN THE MASP

Data and Methodology

Introduce

Results

Conclusion

Legend

Guarapiranga 20.7%
Canareira 50.2%
Rio Grande 6.5%
Alto Cotia 1.5%
Baixo Cotia 1.4%
Alto Tietê 13.7%
Rio Claro e R. da Estiva 6.8%
Water treatment stations (8)

Average consumption: 63 m³/s (2005)

Variables: Water Consumption, Temperature, Humidity, Pressure, Wind direction and speed, anthropic variables
Average water consumption for WTS Alto Tietê in 2005.
Heat Wave

GOES-8 IR for RMSP (right) - 1539 UTC 8/10/2002.
(Pereira Filho et al, 2004)
Weather Impact

Daily water consumption and air temperature in MASP - 24/09 to 23/10/002.
(Pereira Filho et al, 2004)
Monthyly consumption x weather variables for 2000.

(Pereira Filho et al, 2004)
Study Areas

Cantareira WTS

Itaim Paulista Area

Data and Methodology

Introduce

Results

Conclusion
Artificial Neural Network

Connections

Input layer

Hidden layers

Output layer
Cantareira Results

**Training - ANN-C8**

- Observed
- Forecasted

**Forecasting - ANN-C8**

- Observed
- Forecasted
Artificial Neural Network Model Performance

<table>
<thead>
<tr>
<th></th>
<th>TRAINING</th>
<th>VERIFICATION</th>
<th>FORECASTING</th>
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<tbody>
<tr>
<td>POD</td>
<td>76%</td>
<td>67%</td>
<td>62%</td>
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<tr>
<td>FAR</td>
<td>24%</td>
<td>41%</td>
<td>19%</td>
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<tr>
<td>CSI</td>
<td>65%</td>
<td>42%</td>
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<td>POFD</td>
<td>17%</td>
<td>22%</td>
<td>14%</td>
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Itaim Paulista Results

Training

Forecasting

Observed
ANN-IP-9 to 32
ANN-IP-33 to 55
# Artificial Neural Network Model Performance

## Itaim Paulista

<table>
<thead>
<tr>
<th></th>
<th>ANN-IP-9 - 32</th>
<th>ANN-IP-33 - 55</th>
<th>RNA-IP-56 - 57</th>
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<tr>
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<td>8,7%</td>
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<tr>
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<td>7,3%</td>
<td>17%</td>
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</table>
ANN model for the Cantareira system (large system)

1-hour average – poor results;

12-hour average – good results;

Consumption memory - best results.
ANN model for the Itam Paulista system (small system)

1-hour average – good results;

 Longer leading time possible.
Thank you