



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

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- 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).

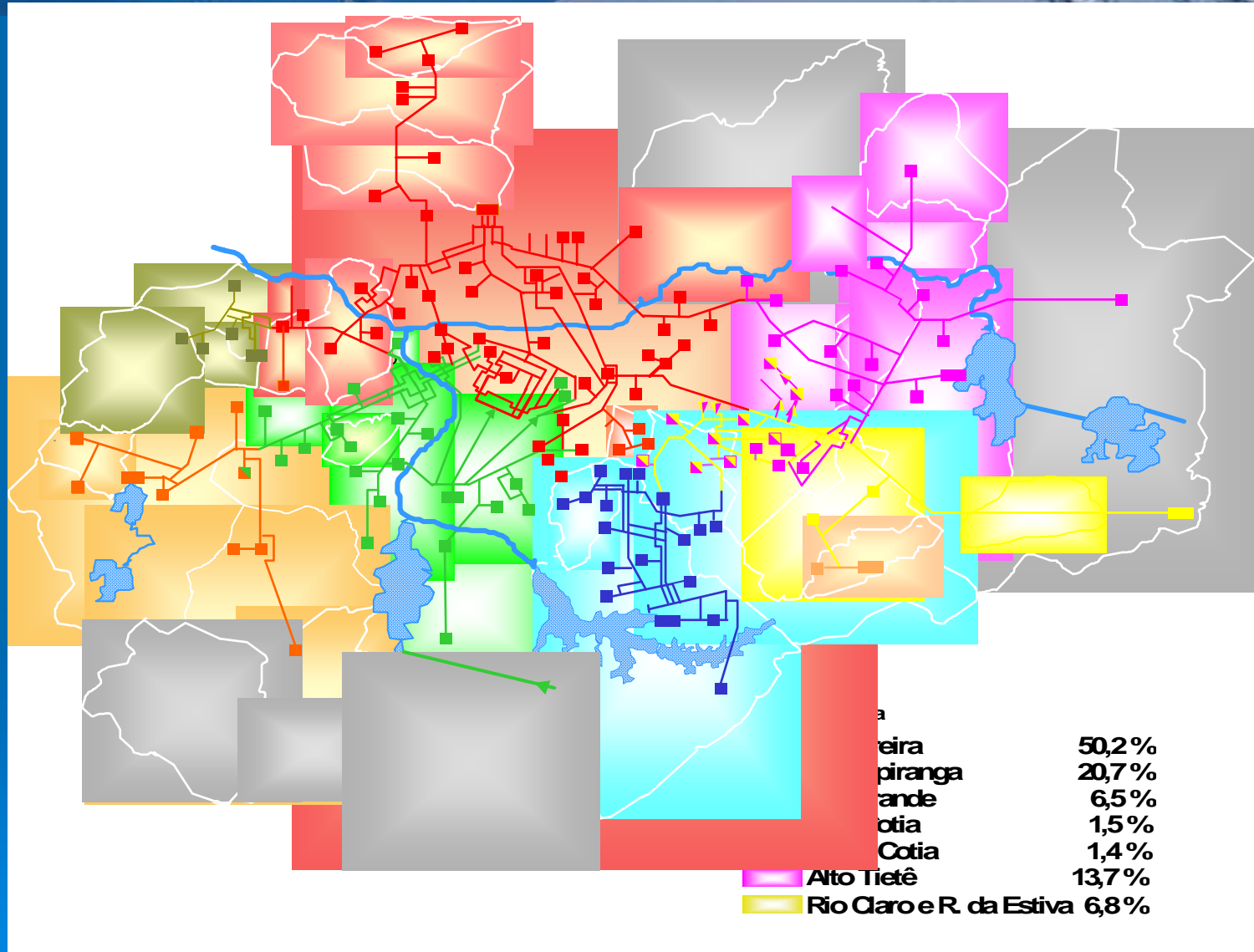
Introduce

Data and Methodology

Results

Conclusion

# WATER DISTRIBUTION SYSTEM IN THE MASP



Introduce

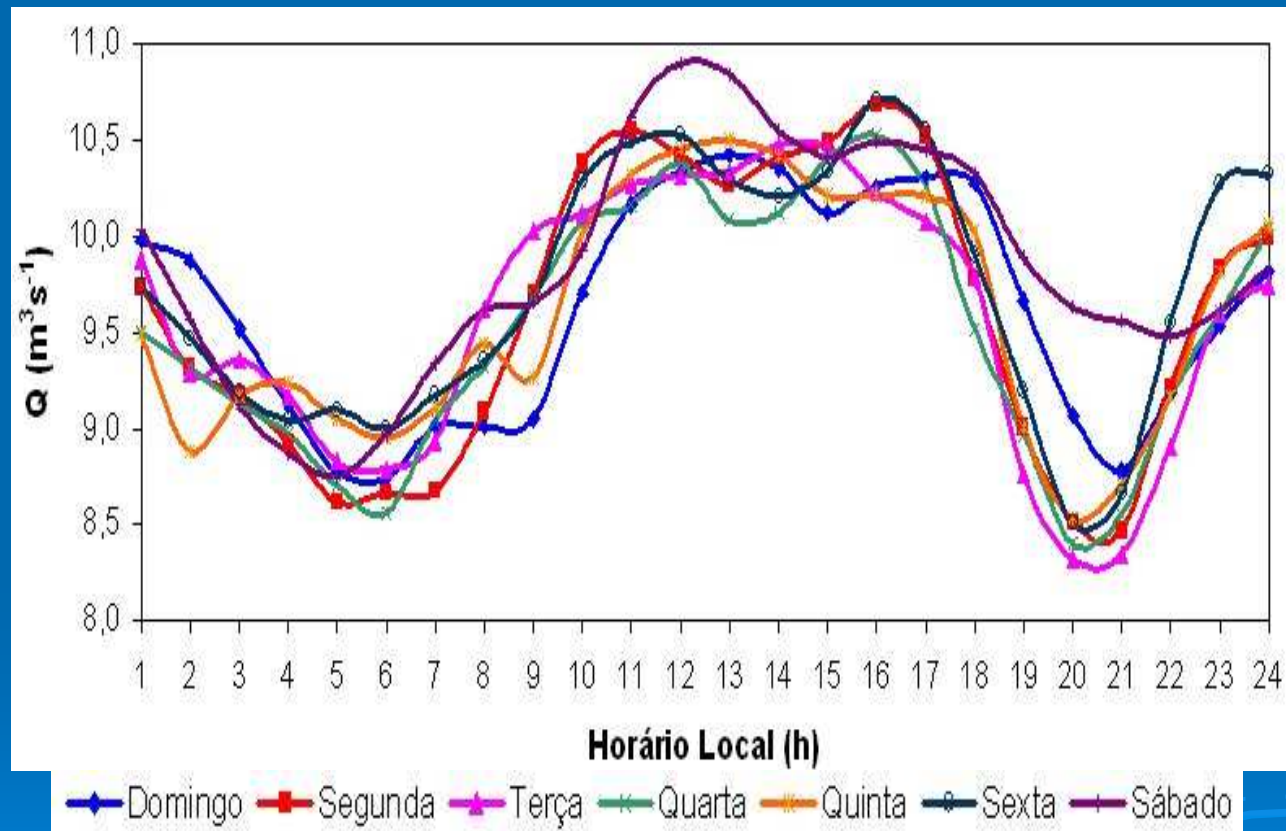
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- ✓ *Water treatment stations (8)*
- ✓ *Average consumption: 63 m<sup>3</sup>/s (2005)*
- ✓ *Variables: Water Consumption, Temperature, Humidity, Pressure, Wind direction and speed, anthropic variables*



Average water consumption for WTS Alto Tietê in 2005.





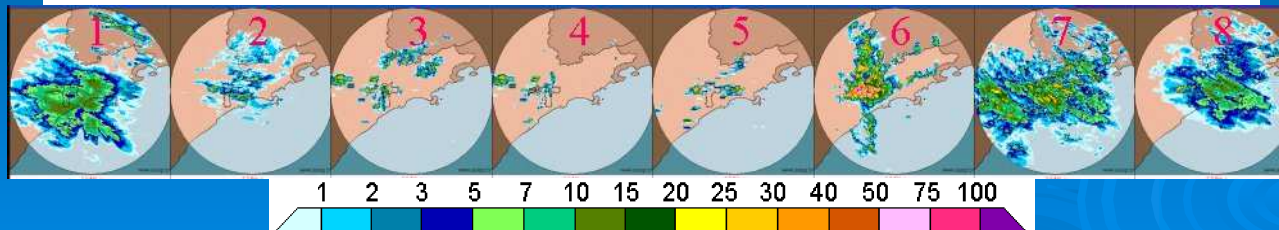
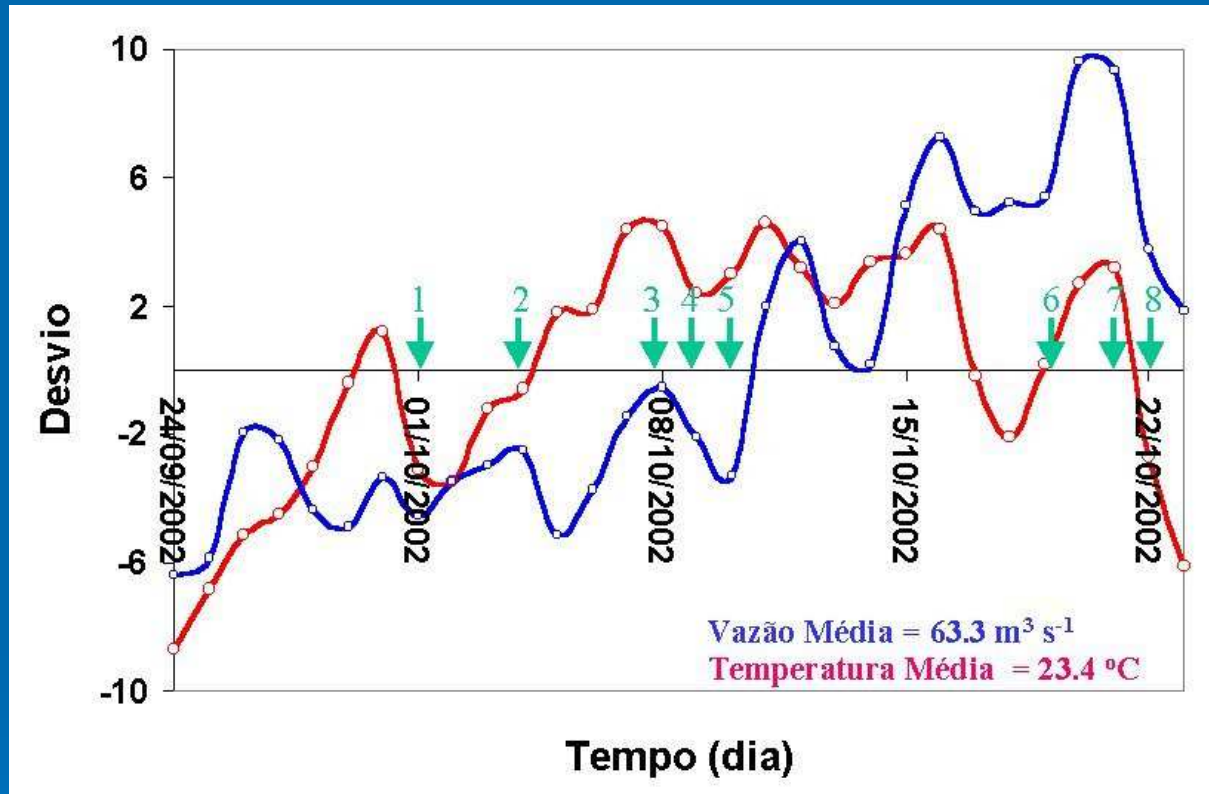
# Heat Wave



GOES-8 IR for RMSP (right) - 1539 UTC 8/10/2002.

(Pereira Filho et al, 2004)

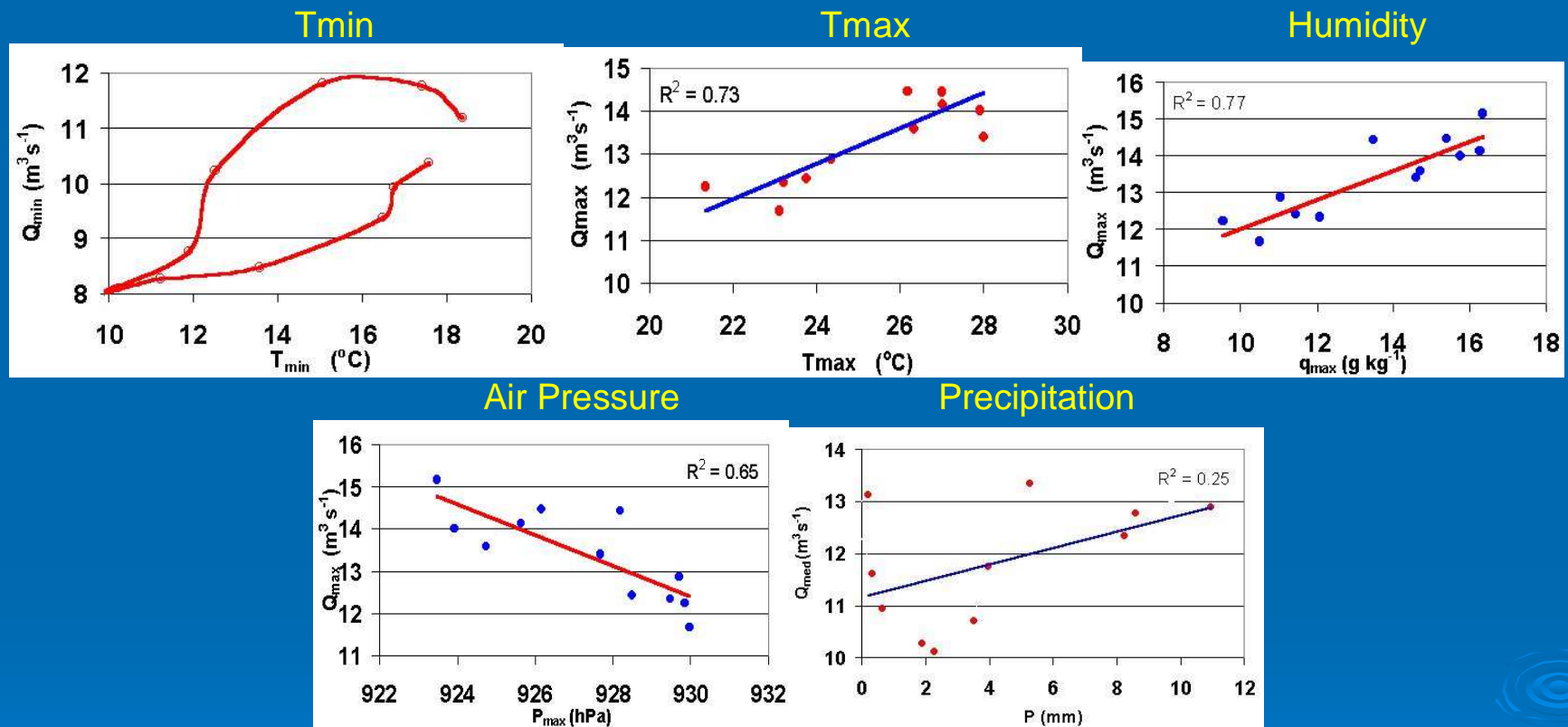
# Weather Impact



Daily water consumption and air temperature in MASP - 24/09 to 23/10/002.

(Pereira Filho et al, 2004)

# Statistics



Monthly consumption x weather variables for 2000.

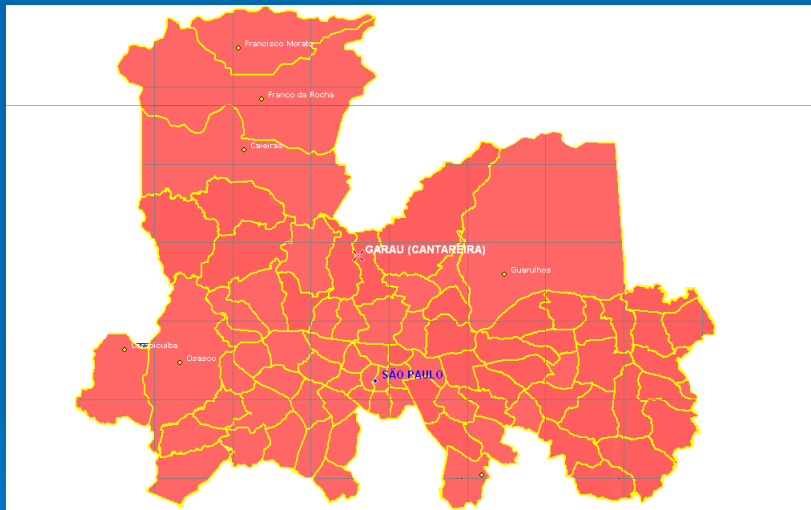
(Pereira Filho et al, 2004)



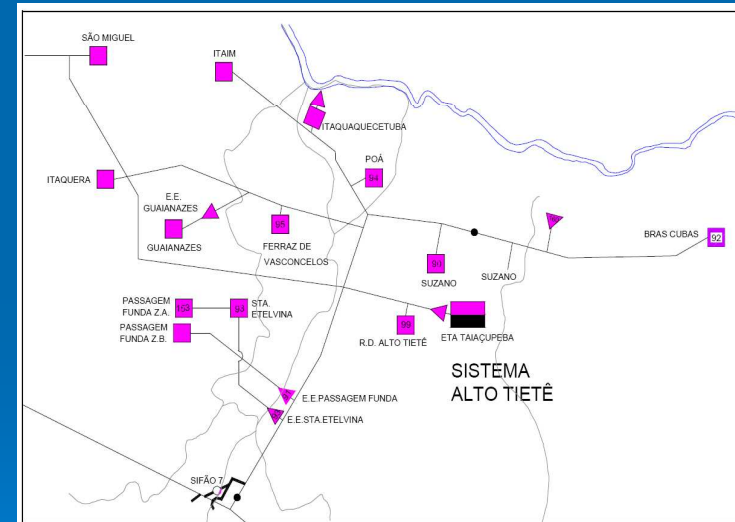


## Study Areas

### Cantareira WTS



### Itaim Paulista Area



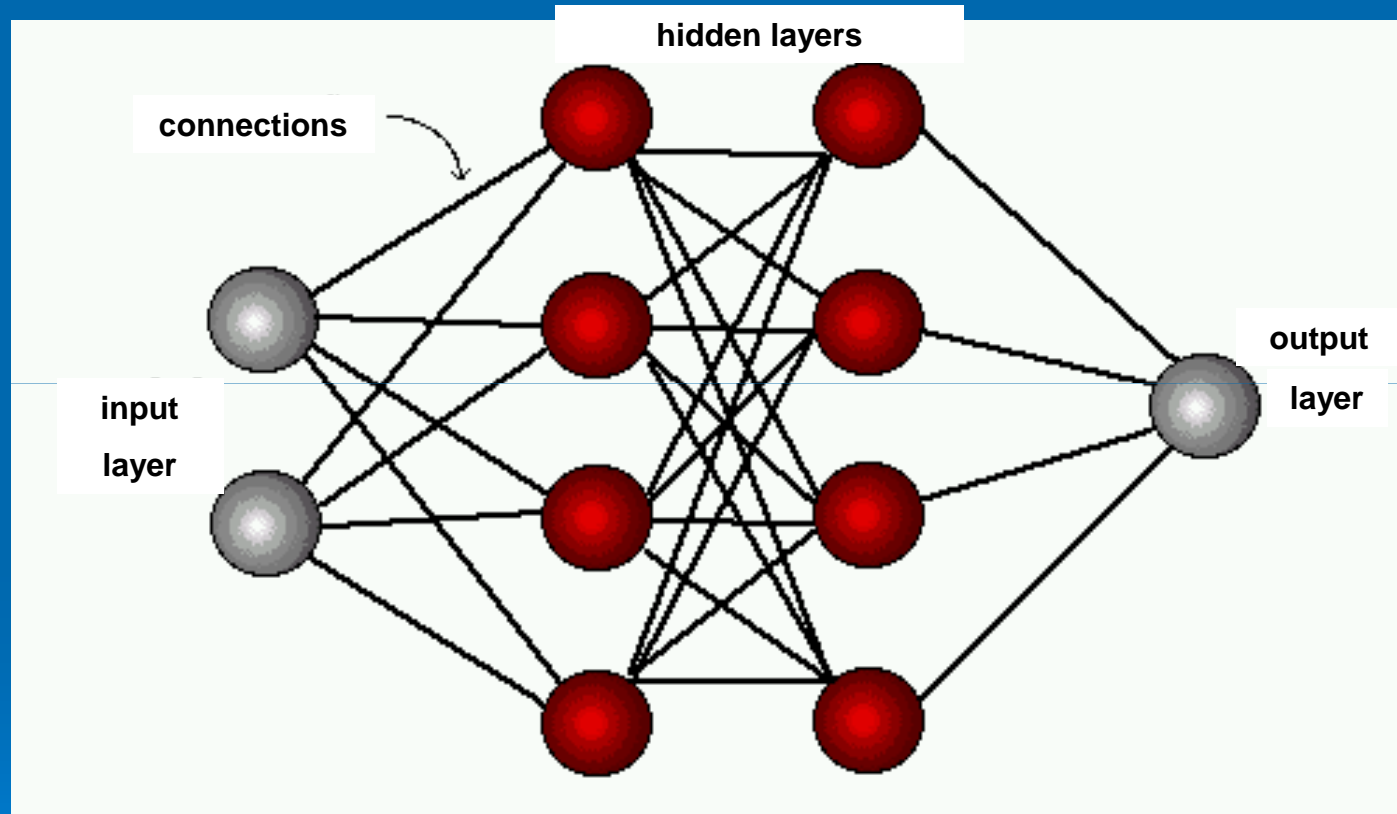
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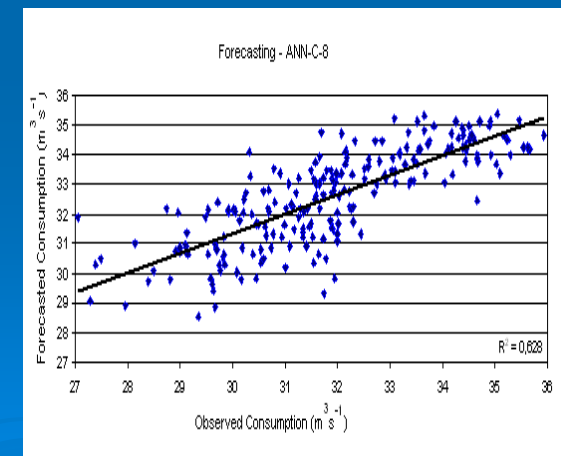
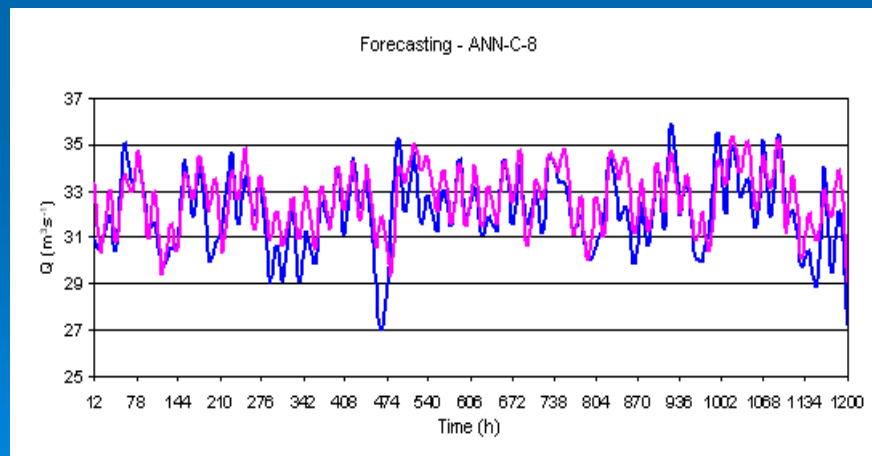
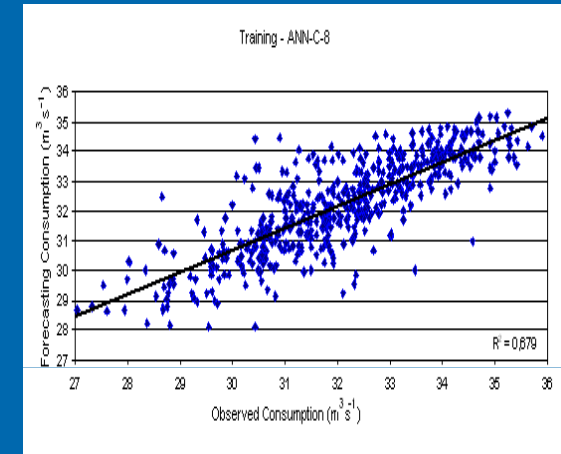
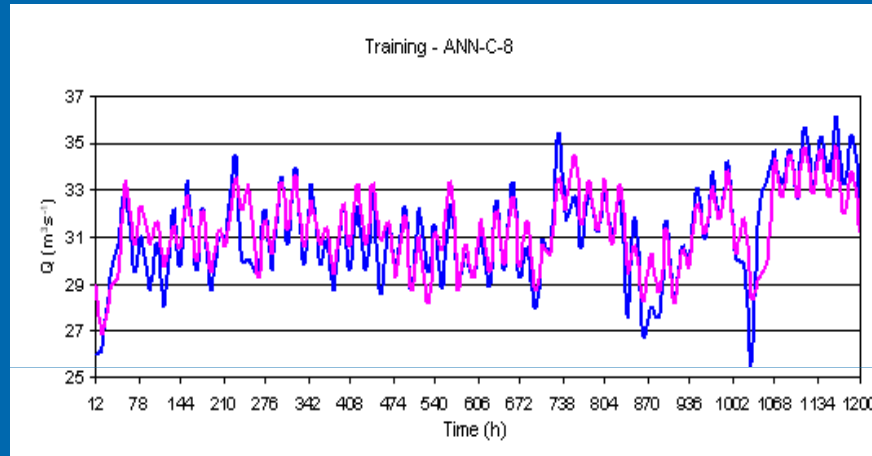
# Artificial Neural Network





# Cantareira Results

— Observed  
— Forecasted



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## *Artificial Neural Network Model Performance*

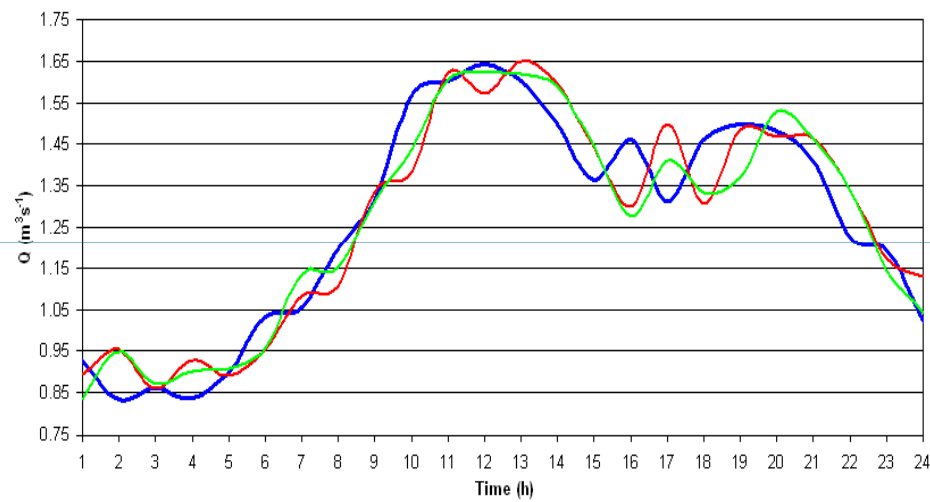
	TRAINING	VERIFICATION	FORECASTING
POD	76%	67%	62%
FAR	24%	41%	19%
CSI	65%	42%	53%
POFD	17%	22%	14%





# Itaim Paulista Results

Training

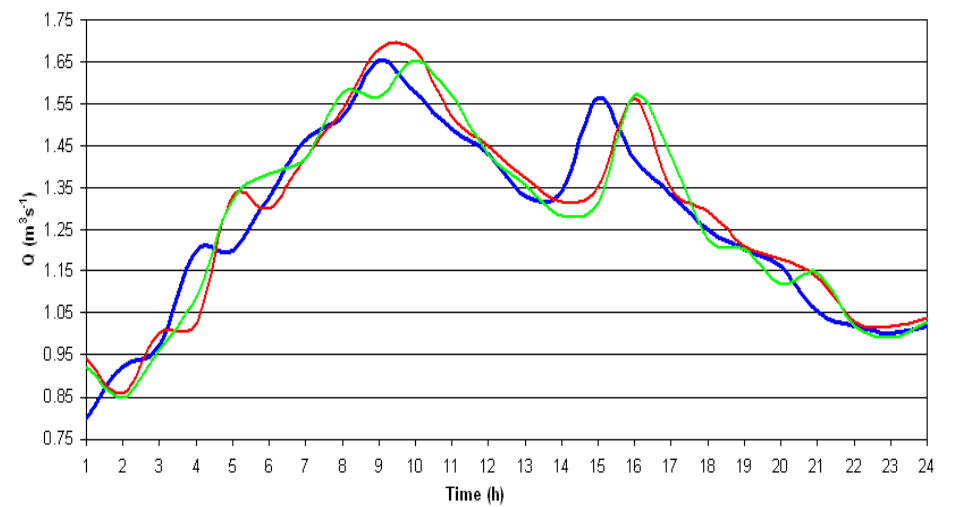


Observed

ANN-IP-9 to 32

ANN-IP-33 to 55

Forecasting



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# Artificial Neural Network Model Performance

Itaim Paulista

		ANN-IP-9 - 32	ANN-IP-33 - 55	RNA-IP-56 - 57
POD	Training	76,7%	73,6%	82,7%
	Forecasting	80,7%	81%	76,6%
FAR	Training	11,9%	10,4%	13,4%
	Forecasting	8,2%	8%	21,1%
CSI	Training	75,8%	56,5%	75%
	Forecasting	76,2%	77%	67%
POFD	Training	10,5%	8,7%	14,5%
	Forecasting	8,7%	7,3%	17%

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## ANN model for the Cantareira system (large system)

1-hour average – poor results;

12-hour average – good results;

Consumption memory - best results.

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ANN model for the Itam Paulista system (small system)

1-hour average – good results;

Longer leading time possible.





# Thank you

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