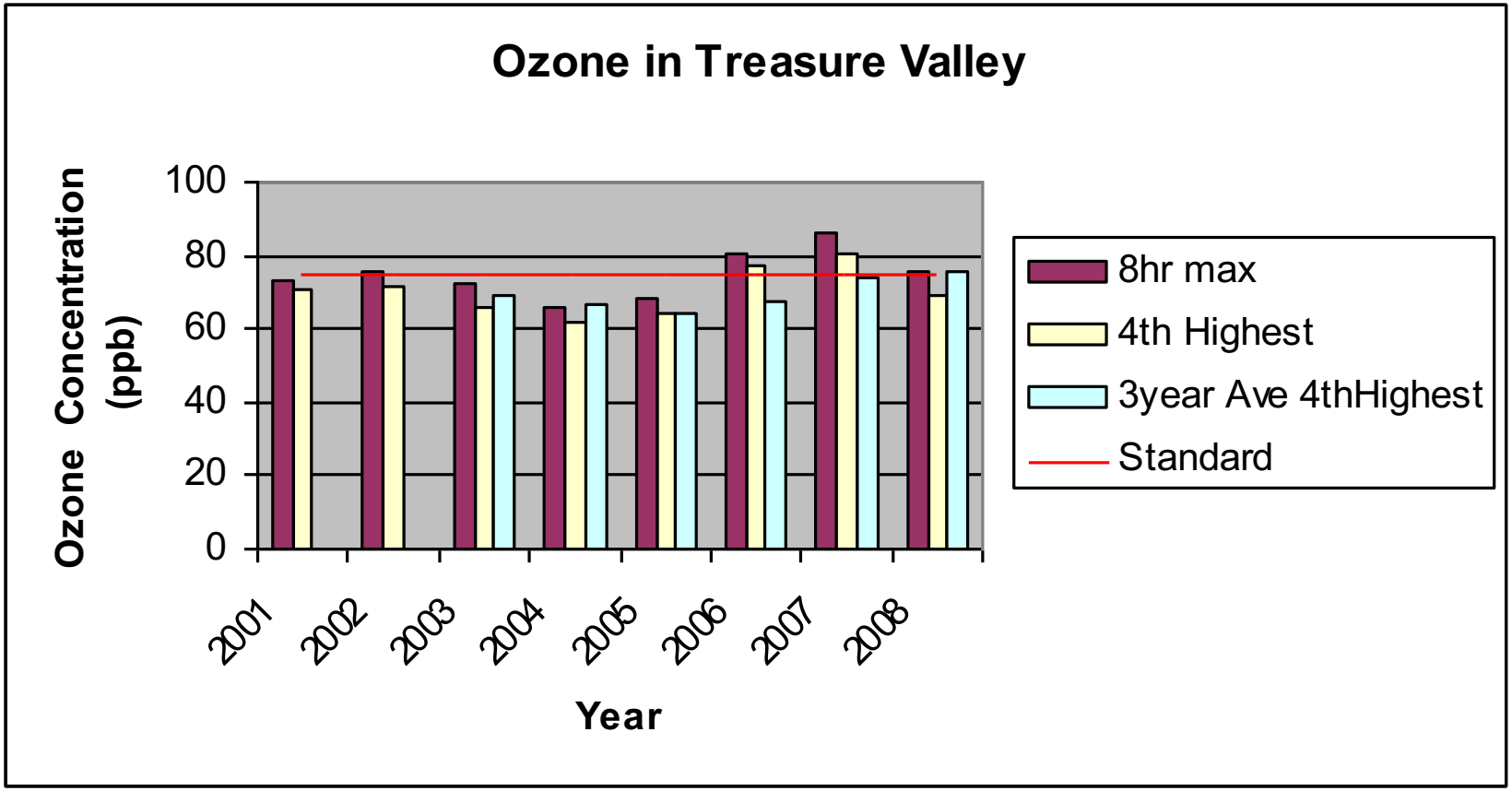
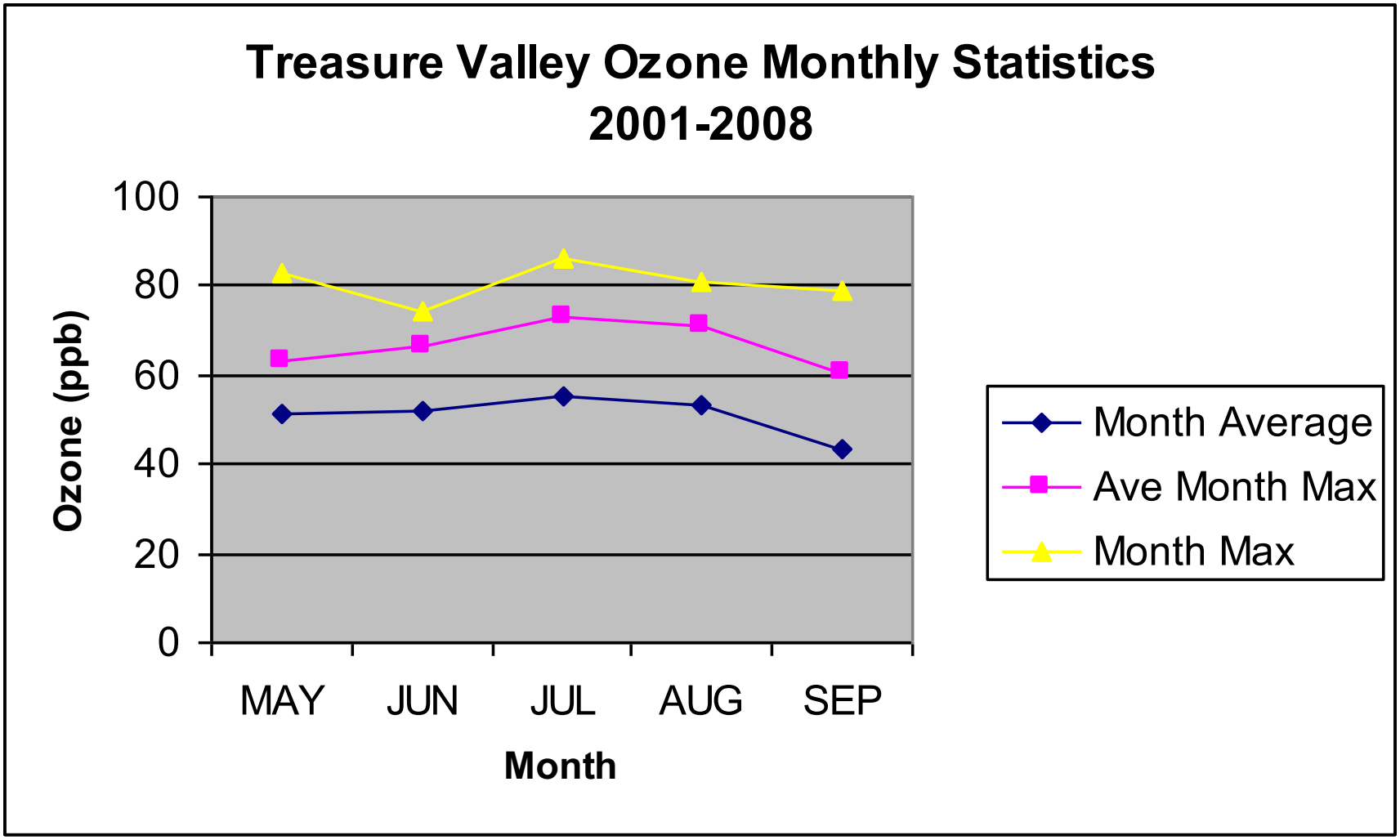
Forecasting Ozone in Treasure Valley using CART

Idaho DEQ

June 3, 2011

Ozone in Treasure Valley




Treasure Valley Ozone Monthly Statistics
2001-2008
Ozone (ppb)
100
80
60
40
20
0
MAY
JUN
JUL
AUG
SEP
Month
Month Average
Ave Month Max
Month Max

Forecasting for AQI and CRB

- Daily AQI forecast for public
- Daily AQI forecast for residential burning bans (AQI<60 outdoor, AQI <74 all burns)
- Forecast for Crop Residual Burning
- Regional offices utilize AIRPACT, WRF data, apply various methods for the forecasting
- Need more reliable, easy to use tools

CART Model

- Classification And Regression Tree (CART) is a statistical procedure designed to classify data into dissimilar groups.
- CART helps to develop a decision tree to predict pollutant concentrations based predictor variables that are well correlated with pollutant concentrations.

Forecasting Methods

Methods	Development Effort	Operational Effort	Accuracy
Persistency	Low	Low	Low
Climatology	Low-Moderate	Low	Low
Criteria	Low-Moderate	Low	Low-Moderate
CART	Moderate	Low	Moderate-high
Regression	Moderate	Moderate	Moderate-high
Neural Networks	Moderate-high	Moderate	Moderate-high
3-D Air Quality Models	Very High	Moderate-high	Moderate-high
Phenomenological /Intuition	High	Moderate	High

From Guidelines for Developing an Air Quality (Ozone and PM2.5) Forecasting Program. EPA-456/R-03-002 June 2003

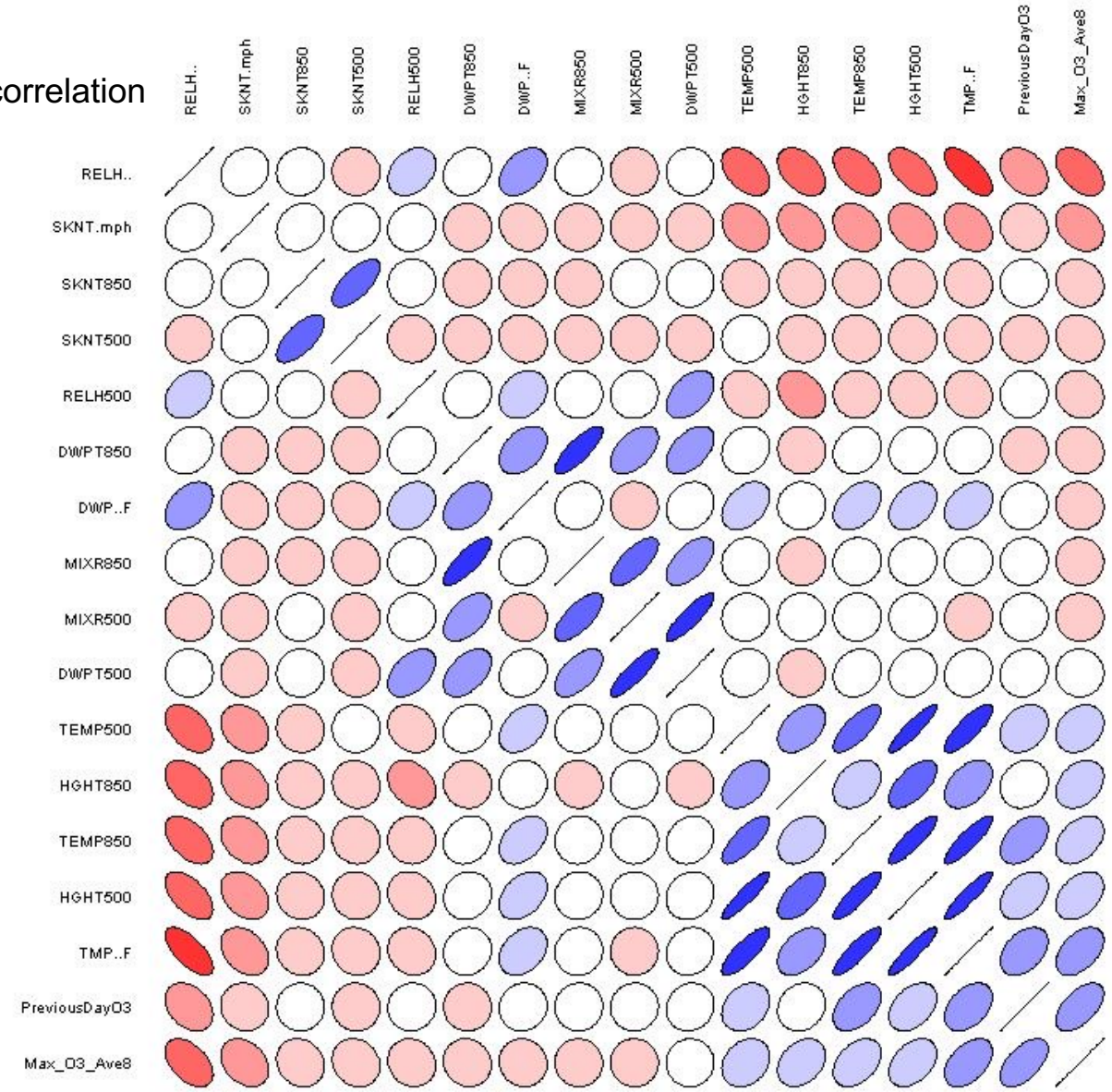
Data

- Eight year ozone data (2001-2008)
- Eight year meteorological data including surface data and upper air data: temperature, wind, humidity, pressure, etc.
- WRF forecasting data

Positive correlation

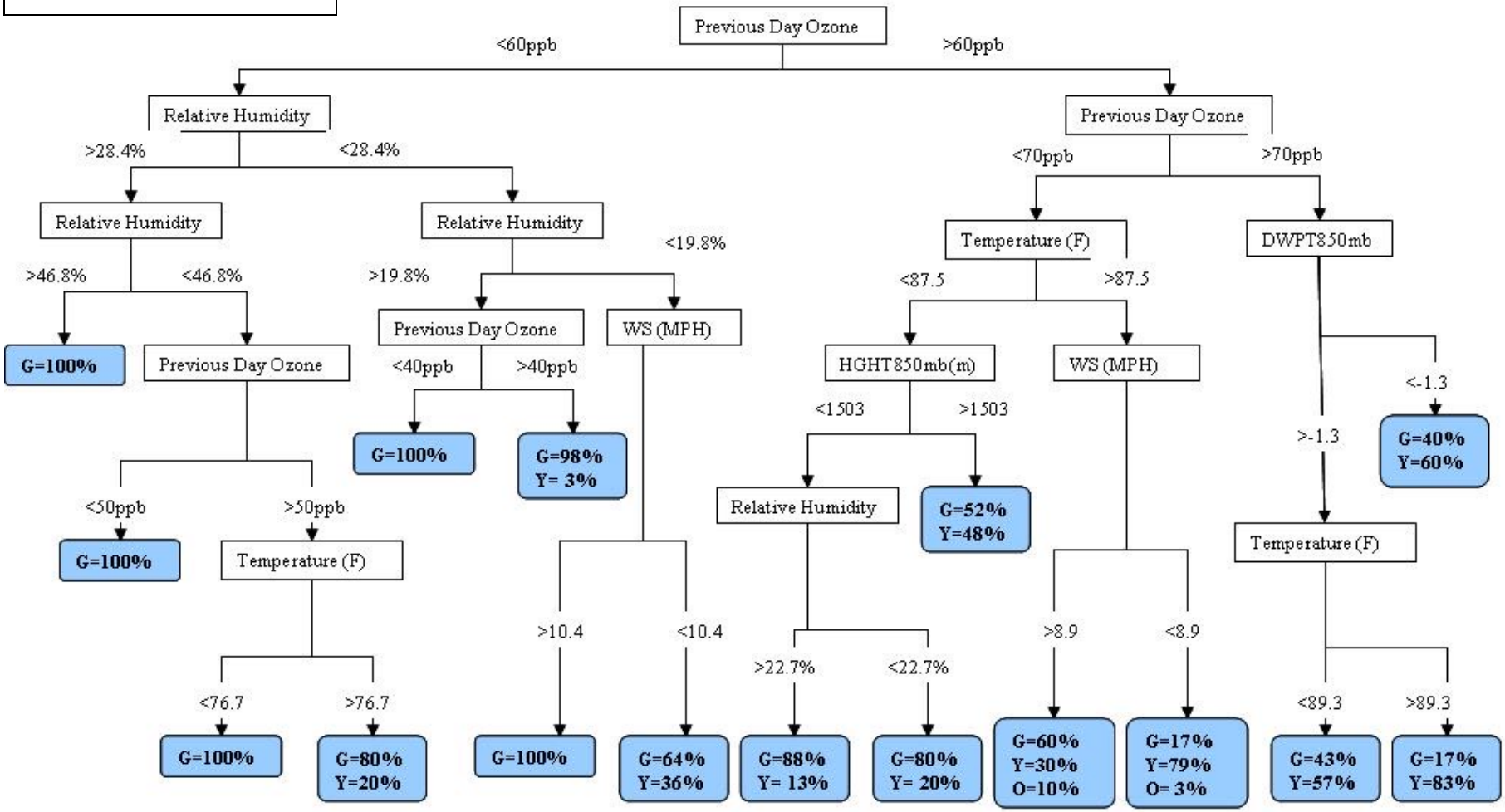
No correlation

Negative correlation



G=Green	0-59ppb
Y=Yellow	60-75 ppb
O=Orange	76-95ppb
R=Red	96-115ppb
P-Purple	116-374ppb

CART tree for Treasure Valley Ozone Forecasting (1)
Observation Data: Year 2001-2008, May-Aug



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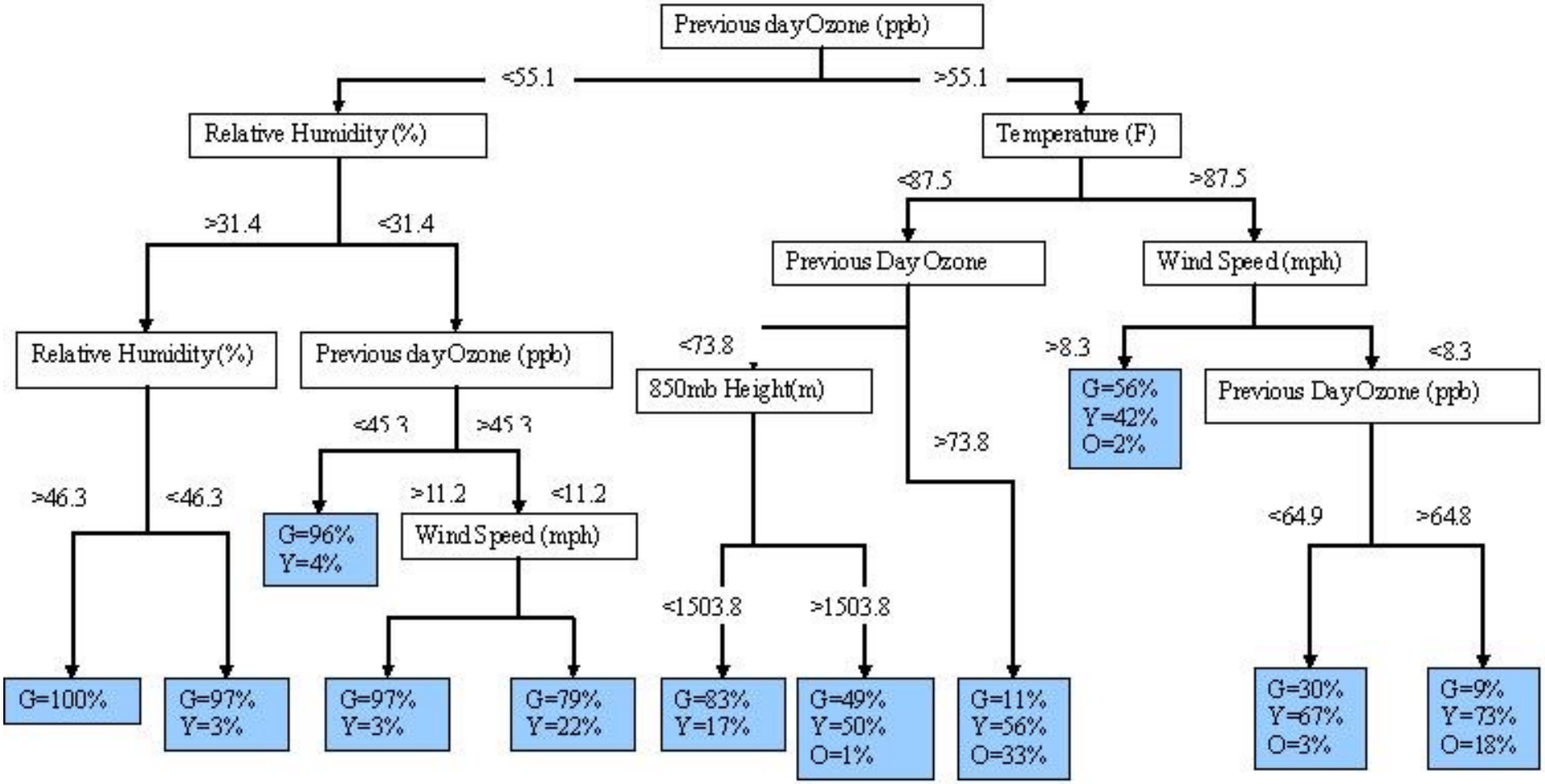
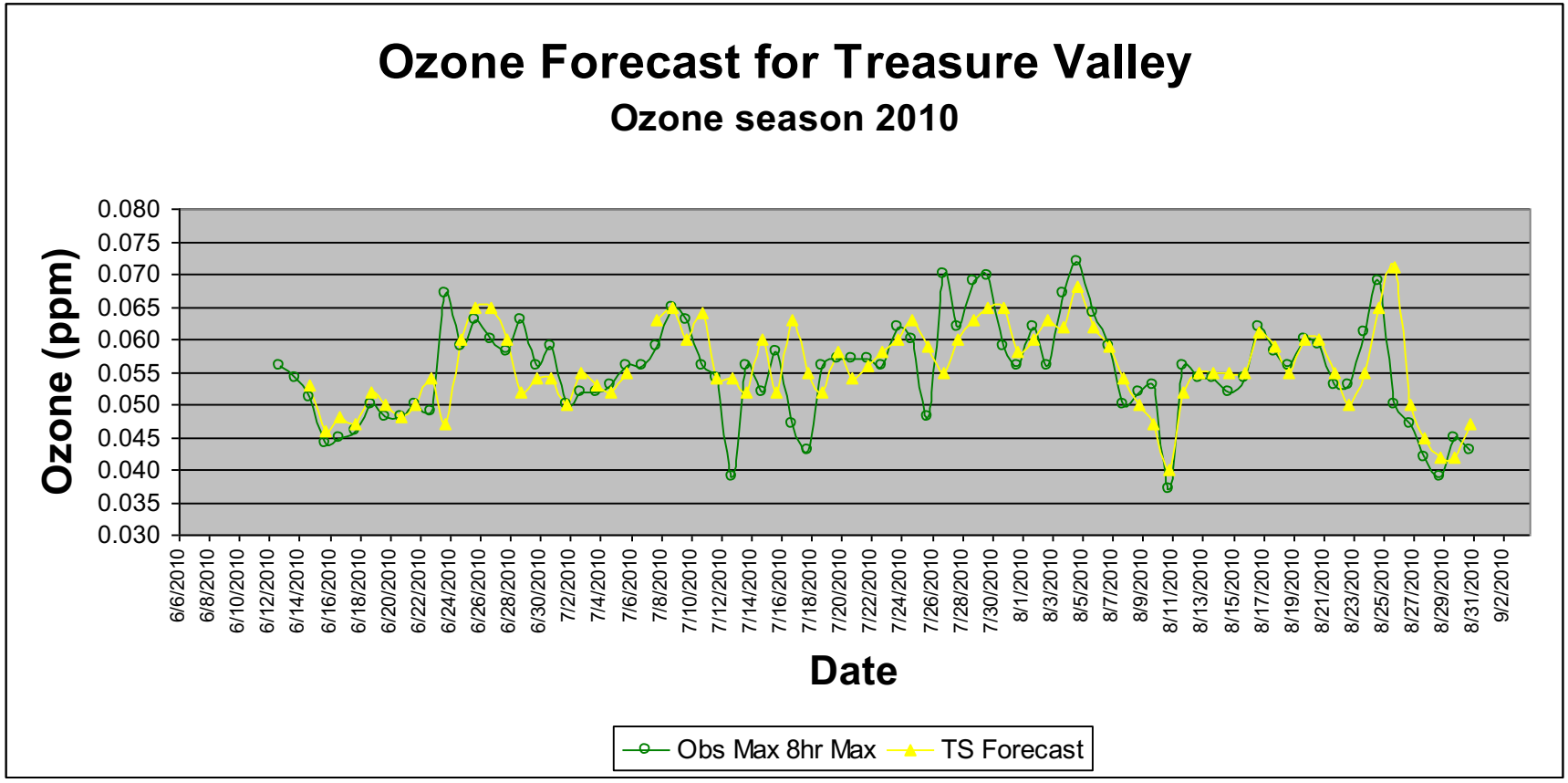
CART tree for Treasure Valley Ozone Forecasting (2)
Observation Data: Year 2001-2008, May-Aug



Performance Evaluation

TS Performance	
Total days	79
Observed Green Days	59
Observed Yellow Days	20
forecasted Green	52
Forecasted G for G	48
Forecasted Yellow	21
Forecasted Y for G	4
Forecasted G for Y	4
Forecasted Y for Y	17
Accuracy of Green	81%
Accuracy for Yellow	85%
Over forecasting	7%
Under forecasting	20%

Performance

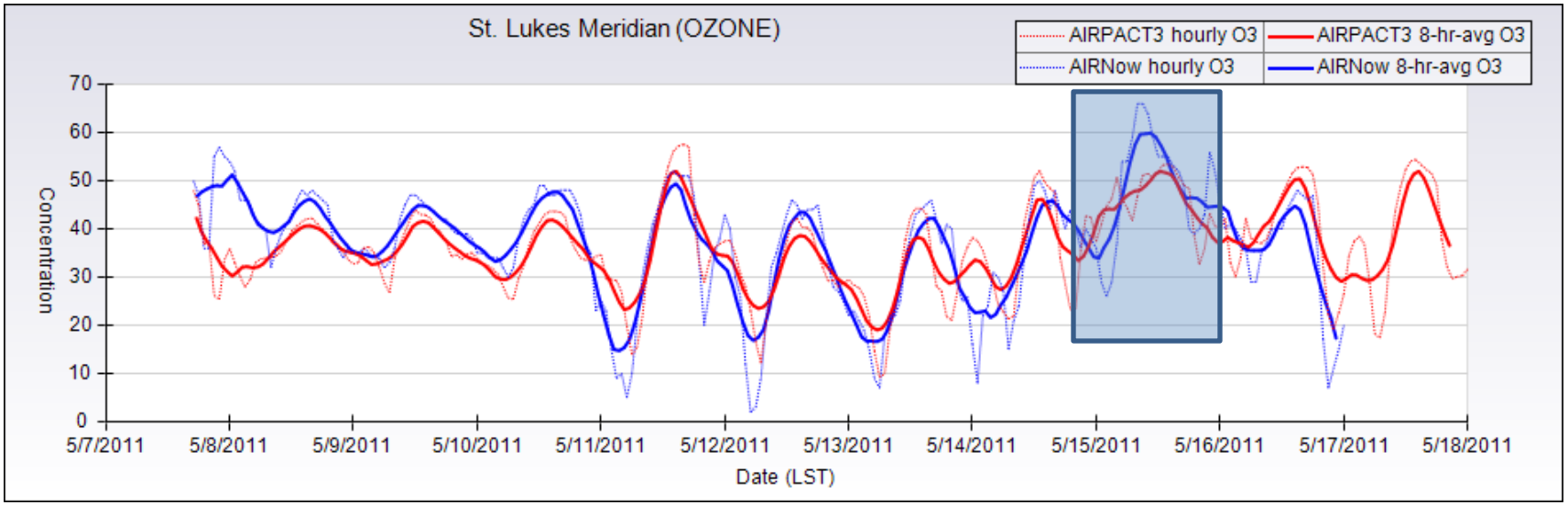


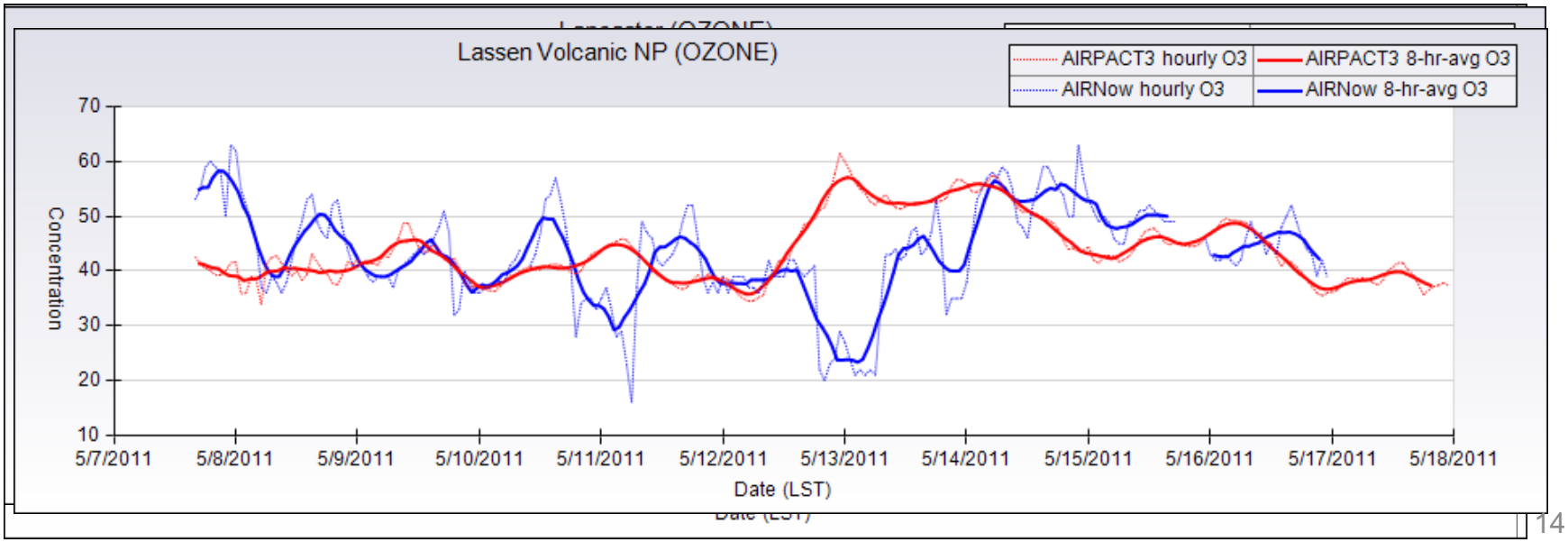
Source of Errors

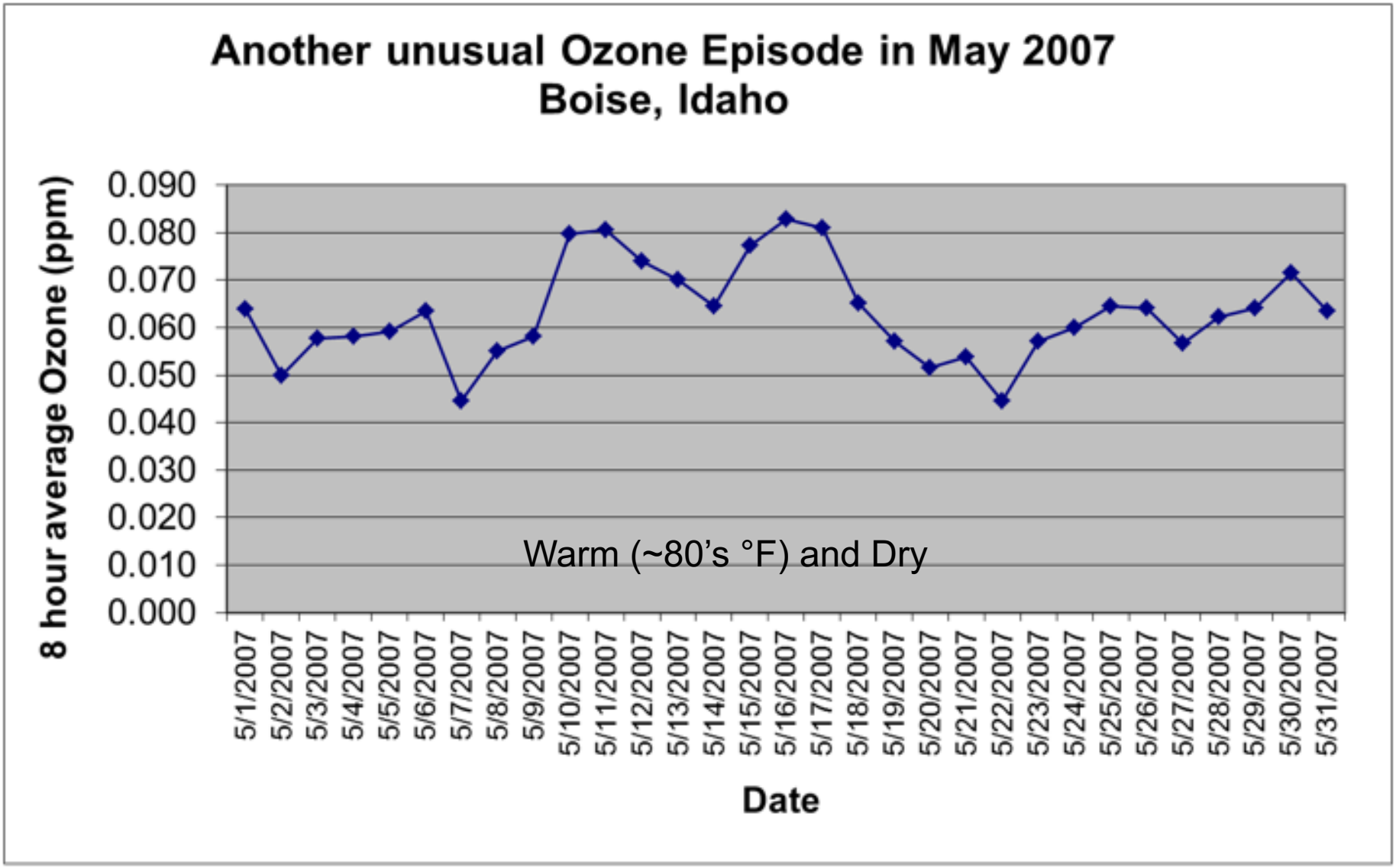
- Small changes near the split point may end larger errors.
- Bias in the meteorological forecast.
- Emission changes. e.g. Holidays, economy driven sources.
- Boundary conditions. e.g. Stratosphere intrusion (ST) due to stratosphere-troposphere exchange (STE); long range transport.

An unusual Ozone Episode in May 2011

Graphs From AIRPACT

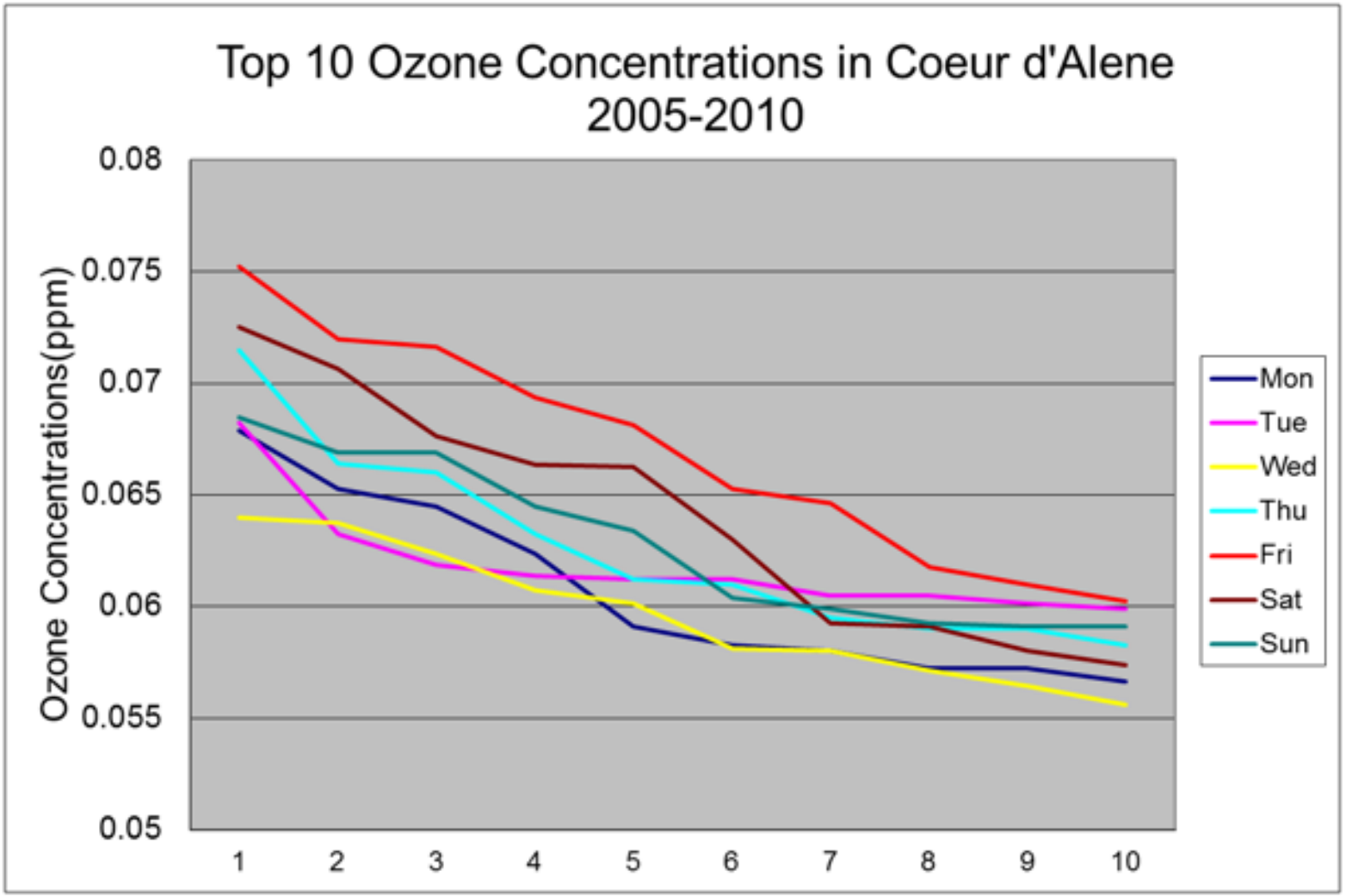






Monthly average relative humidity was 26.7%
Average 6 year Relative humidity in May is 38.4%.
(average from 10:00am-6:00pm)

Weekend Effect



CART- Limitations

- Requires large set of data, a modest amount of expertise and effort to develop.
- Small changes in predictor variables may produce large changes in the predictions.
- Does not predict unusual events.
- Requires periodic updates due to emission and land use changes.

Future Work

- Improve the model for Boise
- Experiment for Coeur d'Alene
- Explore more parameters
- Study for unusual events.