

# Modeling the Effects of Plug in Hybrid Electric Vehicle's (PHEV) on Air Pollution

Anna Edwards

Advisors: Jana Milford and  
Greg Brinkman

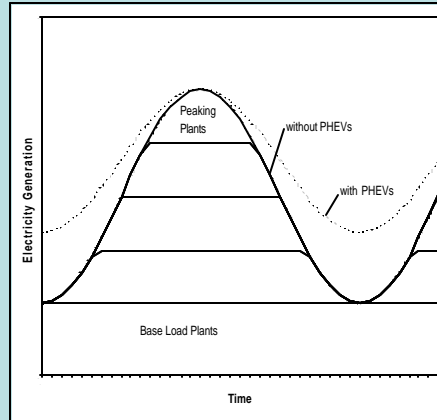
University of Colorado at Boulder REU 2008

## Project GOALS

- To understand the effects of switching to PHEV's on Ozone.
- Better understand the reactions between NO<sub>x</sub> and VOC.
- To make sure that the base case scenario is running with enough accuracy for the project.

## PHEV's

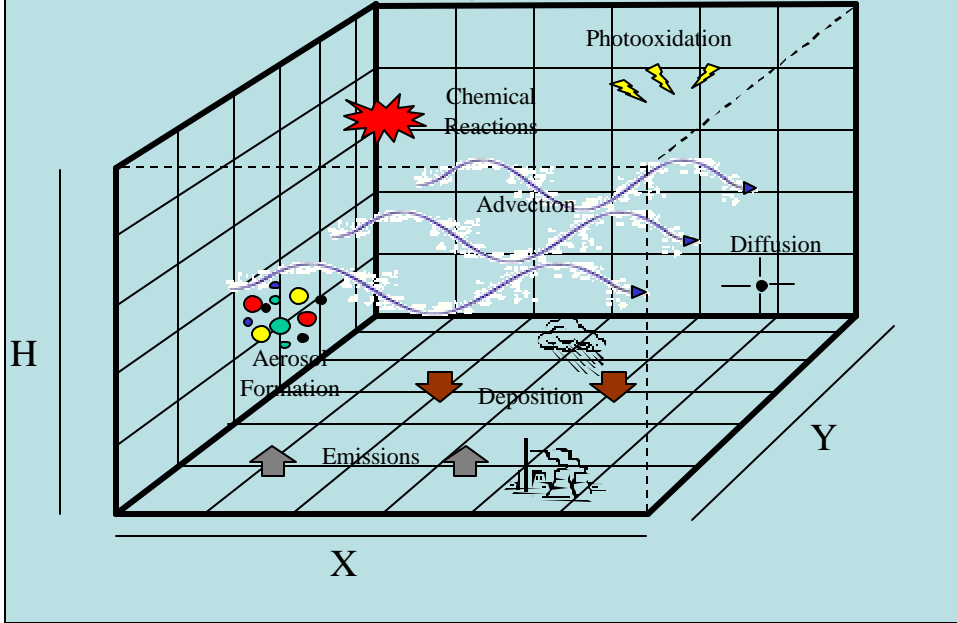
- Change the source of emission from the tailpipe to the utilities
- Reduce the total amount of VOC
- NO<sub>x</sub> shifted spatially and temporally



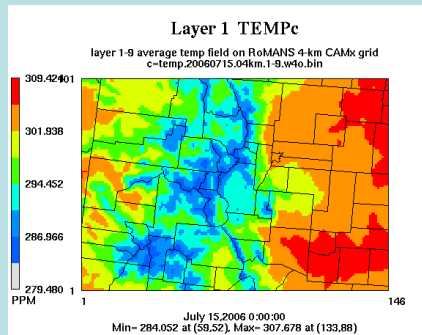
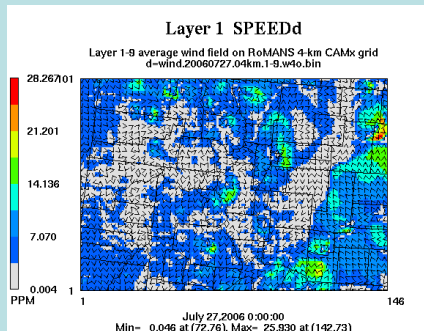
## Methods

- CAMx Chemistry and Transport Model
  - Base Case
  - PHEV cases
- Plume -in-Grid
- 4km grid
- 16 day spinup period during June
- Focus on two episodes in July

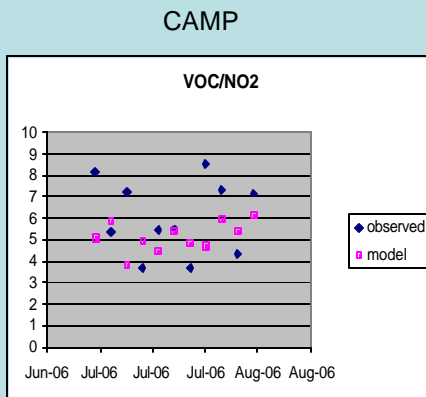
## Schematic of Chemistry and Transport Model



## WIND and TEMPERATURE

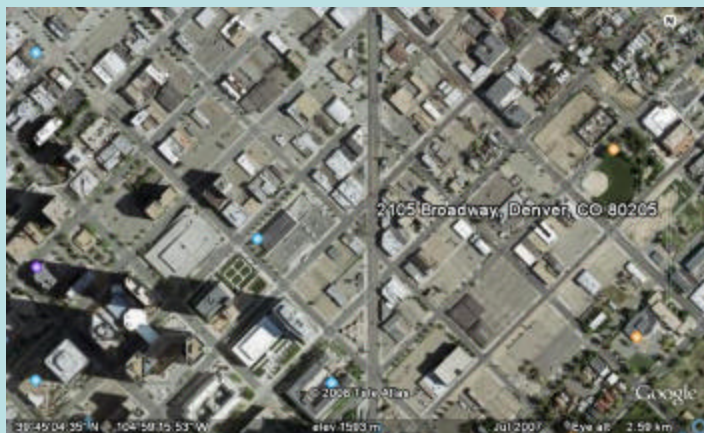


# VOC to NOx

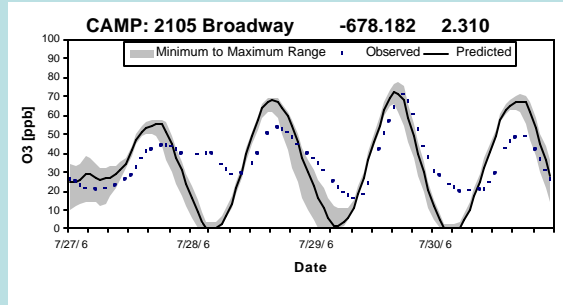


- Non linear reaction between VOC and NOx.
- See how the model is performing with respect to ozone.

# CAMP

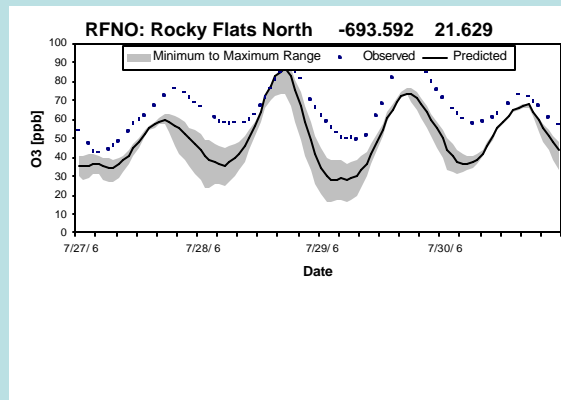


# Model Evaluation

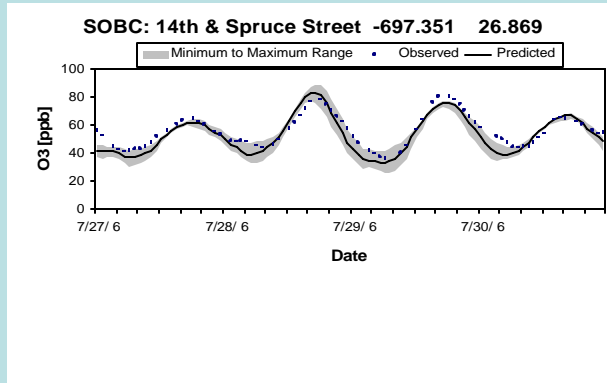


- Under prediction
- Model going to zero at night

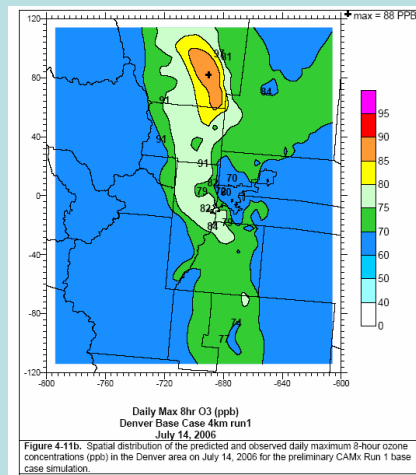
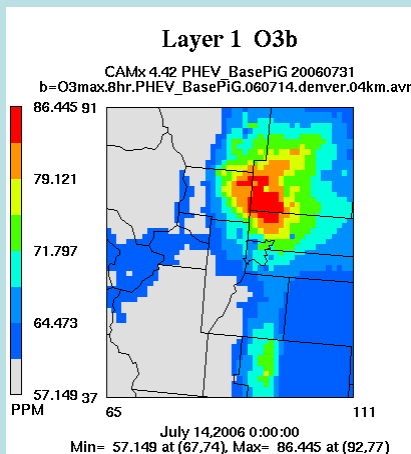
# Model Evaluation



# Model Evaluation

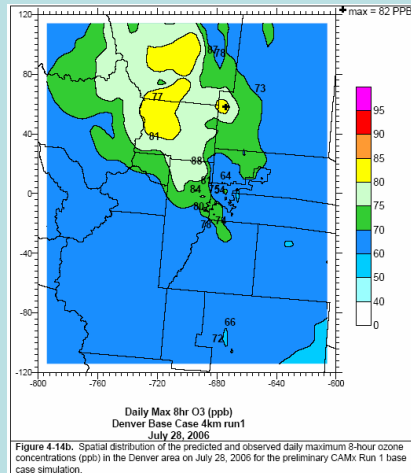
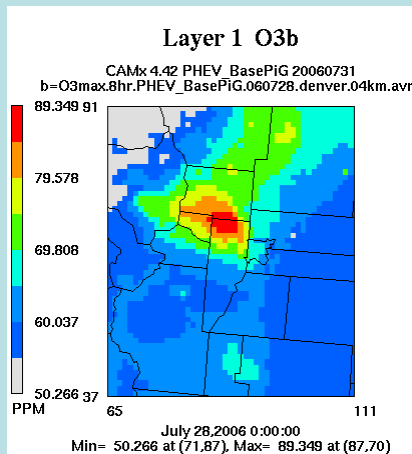


# OZONE



(Morris, 2008)

# OZONE



(Morris, 2008)

## Where To Go From Here

- Update point source emissions in the base case
  - Don't expect much difference
- Perform different scenarios
  - 100% night
  - 100% night and day
  - 30% night
  - Renewable
  - Renewables +100% night PHEV
  - Double VOC Base
  - Double VOC +100% night PHEV

# Pueblo School Buses

Anna Edwards

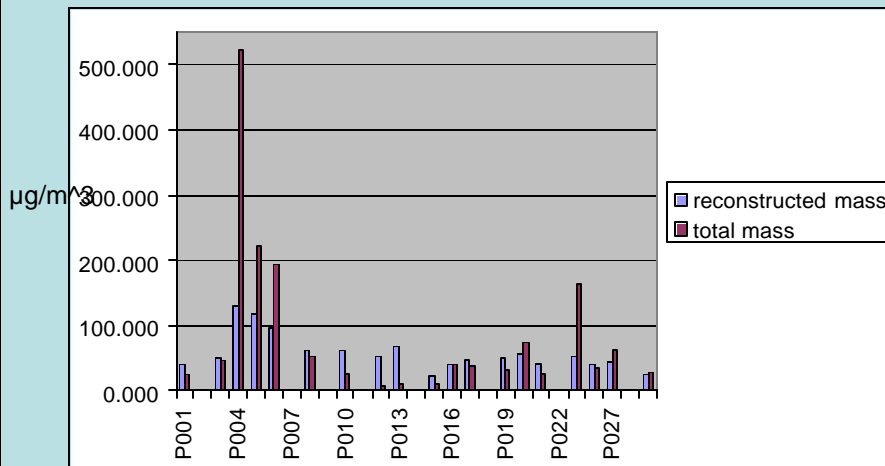
Advisors: Mike Hannigan and  
Jana Milford

## Background

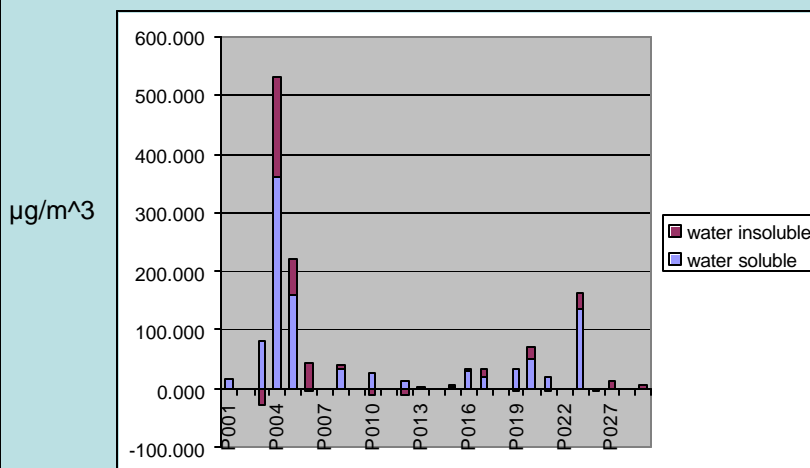
- Placed filters on a bus to sample the PM<sub>2.5</sub> in the air
- Find the effectiveness of crankcase filters and the diesel oxidation catalyst
- Found that it reduced the mean concentrations of all air pollutant with the exception of carbon monoxide and acetone



# Mass Comparison



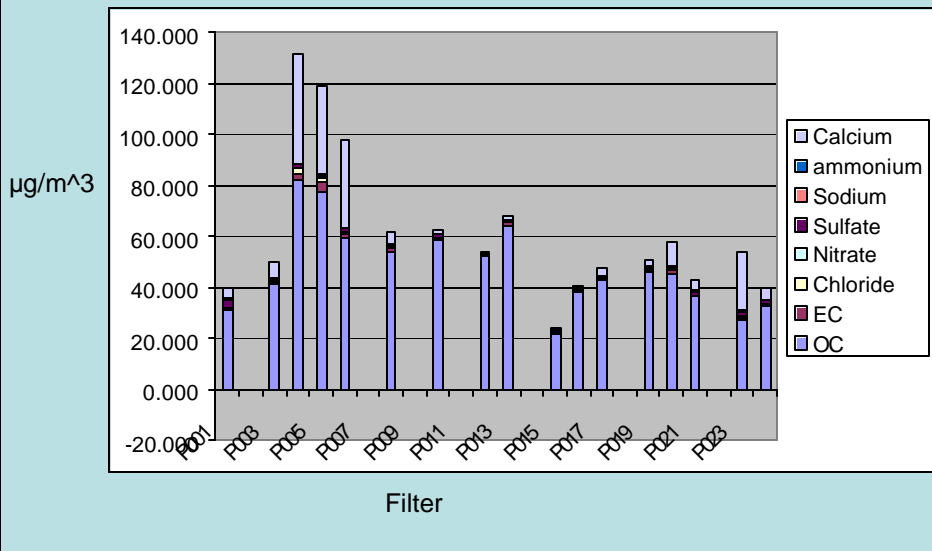
# Total Mass



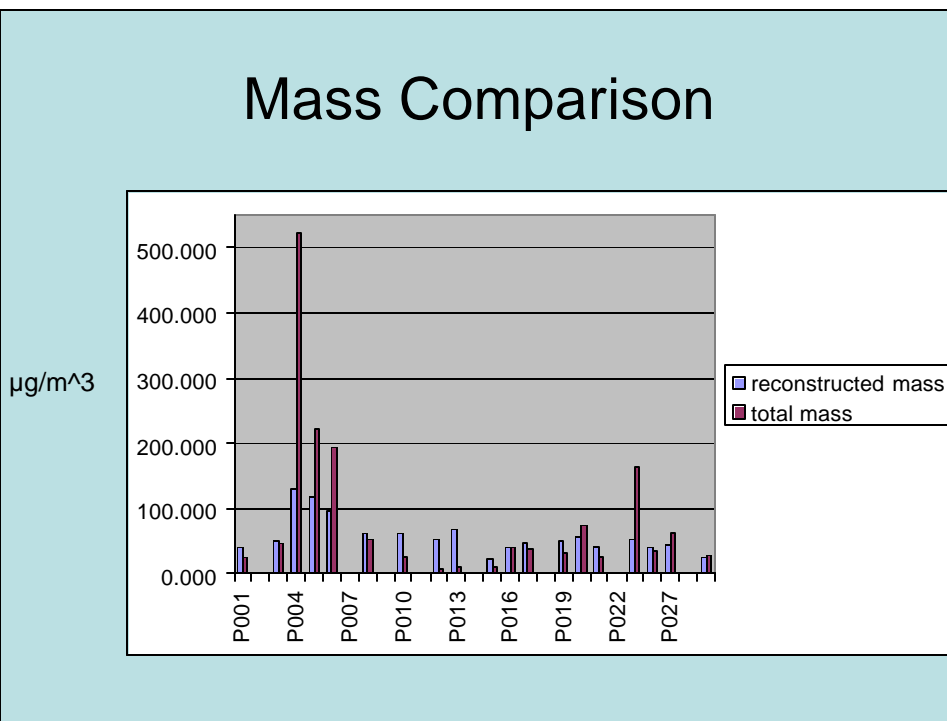
Post Run – Post Extraction = Water Soluble Mass

Post Extraction – Pre Run = Water Insoluble Mass

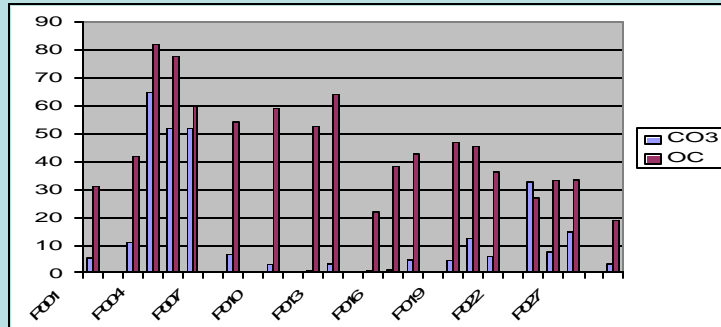
# Reconstructive Mass



# Mass Comparison



# Carbonate



$\mu\text{g}/\text{m}^3$  calcium?  $\mu\text{g}/\text{m}^3$  carbonate

## What it all Means

- Waiting to see how much carbonate is in the filters
  - May be the source of the extra mass
- There could also have been a problem with the pre weighs
  - Higher post weighs than pre weighs

Questions?