Understanding Relationships Between Changes in Ambient Ozone and Precursor Concentrations and Changes in VOC and NOx Emissions from 1990 to 2004 in Central California

Envair

DRI

Alpine Geophysics

January 18, 2006

Today's Meeting

- Schedule
- Draft work plan ➔ *feedback*
- Preliminary data assessment

Schedule –

- *Startup meeting – November 18, 2005*
- Phase I draft work plan – December 16, 2005
- *Task 1 meeting – early January 2006*
- Phase I final work plan – February 1, 2006
- Draft Phase I report & Phase II plan – May 1, 2006
- *Task 4 meeting – mid-May 2006*
- Final Phase I report & Phase II plan – June 30, 2006
- Draft final report & manuscript – October 2006
- *Task 7 meeting – November 2006*
- Final report & manuscript – December 31, 2006

Phase I Work Plan

Task 1a – Emissions Estimates *(Alpine Geophysics, DRI)*

Coordinate w. ARB & focus on unique project needs

- Obtain ARB monthly historical emissions
- Historical v. new surrogates for gridding?
- Hybrids of 1990 and 2000 census data?
- Changes in historical point source locations?
- Need for historical temporal profiles?
- Identify changes needed for our project
- Make changes in county-level inventories *(may defer to Task 5)*

Tasks 1b and c – Ambient AQ Data *(Envair, DRI)*

- Update AQ data bases, 1990 – 2004
- Hourly gas-phase (O_3, NO, NOx, CO, HC)
- VOC: PAMS, ARB, SJVAQS (1990)
- Utilize previous VOC validation?
- Flag suspect data
- Create daily averages – identify artifacts
- Compile completeness statistics & criteria

Tasks 1b and c – Met Data *(DRI, Envair)*

- Compile surface met data 1990-2004
- Create integrated surface met data base
- Consult ARB and district staff on QA issues
- Obtain aloft data

Surface Met Data

Period	ARB	BAAQMD	Other Bay Area	CIMIS	NWS - NCDC	PG&E	West-side
1988-1993	x	x		x	x	x	x
1994-1996		x		x		x	
1997-2004		x		x			
2005							

Task 2 – Ambient Trends *(Envair, DRI)*

- Subregions
- Species
- Metrics
- Met classification
- Statistical model
- Trend tests

Subregions and Sites

- Bay Area
  - Southern (Fremont, Gilroy, Los Gatos, SJ 4th, SJ Pied, San M)
  - Northeastern (Concord, Pittsburg, Vallejo, Bethel Island)
  - Eastern (Livermore Old First and Rincon)
- Sacramento (Folsom [2], N High, Rock, Rose, Sac[3], Slough)
- Sierra Foothills
  - Northern (Auburn, Cool, Grass Valley, Placerville)
  - Southern (Five Mile, Jackson, J-dale, San Andr, Sonora, Yos)
- San Joaquin Valley
  - Northern (Merced, Modesto, Sto-Haz, Sto-Mar, Tracy, Turlock)
  - Central (Fr-1st, Fr-Dr, Fr-SS, Madera, Clovis, Parlier, Visalia)
  - Southern (Arvin, Bak-Cal, Bak-GS, Edison, Maricopa, Oildale)

Species

- Ozone, NO, NO_x, CO, CoH, total PAMS NMOC, sum of PAMS NMOC, alkanes, alkenes, aromatics, ethylene, isoprene, acetylene, benzene, toluene
- Ratios of species (VOC/NO_x, CO/NO_x, and reactive-to-nonreactive hydrocarbons)

Metrics

- Precursors and ratios
  - Morning and midday means
  - Match with ozone days? – (OK for CO, NO_x, not NMOC?)
- Ozone
  - Top 60 subregion peak 8-hour ozone days per year
  - 8 hour ozone DV – site, subregion, basin
- Details
  - Split days by met classes
  - Compute means by site, year, and met class

Meteorological Classification

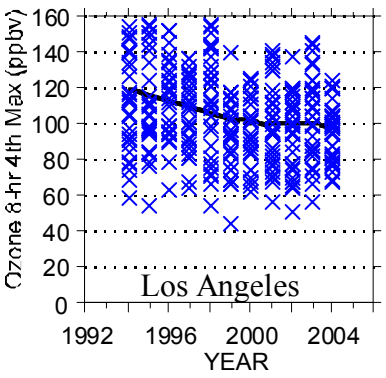
- Goal is to stratify days, not to adjust ozone
- Stratifications related to transport directions
- Use all days May through October each year
- Clustering methods
  - Clustering based on met variables related to wind directions and transport (pressure & T gradients)
  - Spatial correlation of peak ozone (e.g., DRI CCOS clustering algorithm, BAAQMD analysis)

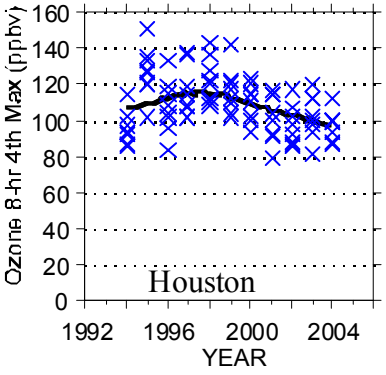
Statistical Models

- Precursors – trends over time
- Ozone – trends and/or relation to precursors (additive model with met, precursors)
- Apply separate trend tests to each set of days and/or use weighted frequency reaggregation
- From site to subregion to basin:
  - Summary of site results
  - Subregion and basin maxima

Trend Tests

- Site, subregion, basin
- Graphical analysis – check for nonlinearity
- Linear trends if justifiable
- Standard statistical tests





Task 3 – Expected Relationships for Emissions & Ambient Trends

- What have we learned in related studies?
- What have we learned in the present study?
- What could we learn in Phase 2?

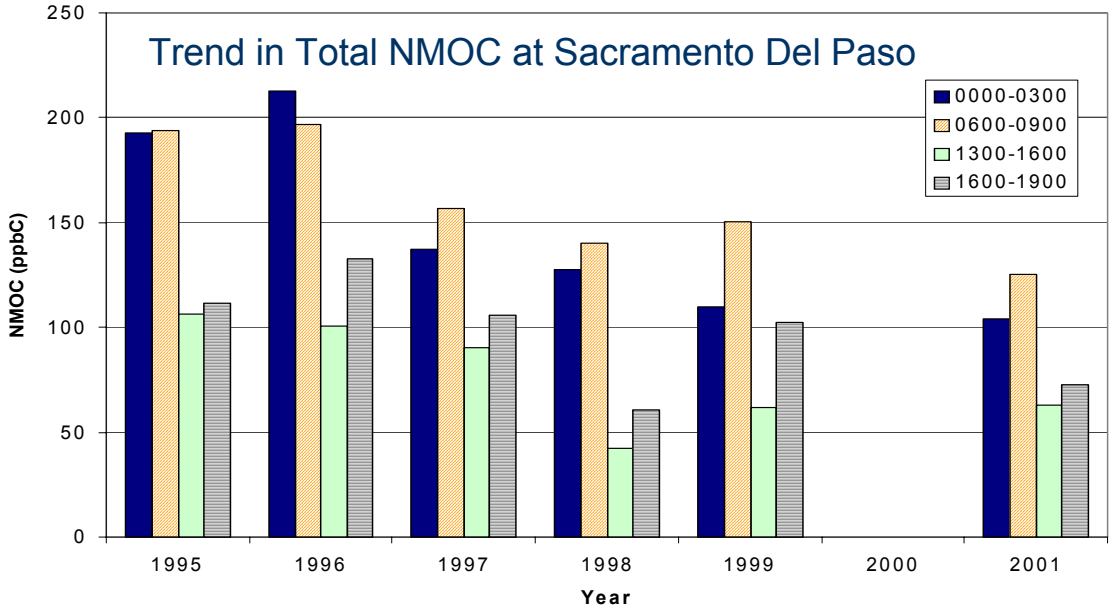
Task 3 (continued)
(Envair, DRI)

- Review results of ongoing STI study
- Summarize county-level emission trends
- Compare trends: emissions, ambient precursor (regional vs. local-scale precursor trends?)
- Compare trends: ozone, ambient precursors
- Compare to DRI Sacramento Valley analysis
- Formulate questions & hypotheses for Phase 2

Trends in Ozone Precursors in the Sacramento Area and Regional Variations in Ozone Levels

Preliminary Findings and Conclusions by Desert Research Institute

Significant reductions in VOC concentrations have occurred during 1995 to 2000, while NOx levels show no significant trend during this period. Reductions of VOC are in the range of 30 to 50% during 6-9 am and 40 to 50% during 1-4 pm. Ambient VOC/NOx ratios have trended downward.



Task 3 and 4 – What Might We Learn by Going On to Phase 2?

- What are the limitations of Phase 1 and the potential improvements expected from Phase 2 spatial gridding approach?
- Are Phase 2 efforts capable of generating useful results: potential findings of policy relevance that might be addressed in Phase 2 but could not be answered in Phase 1?
- What are potential uncertainties with Phase 2?

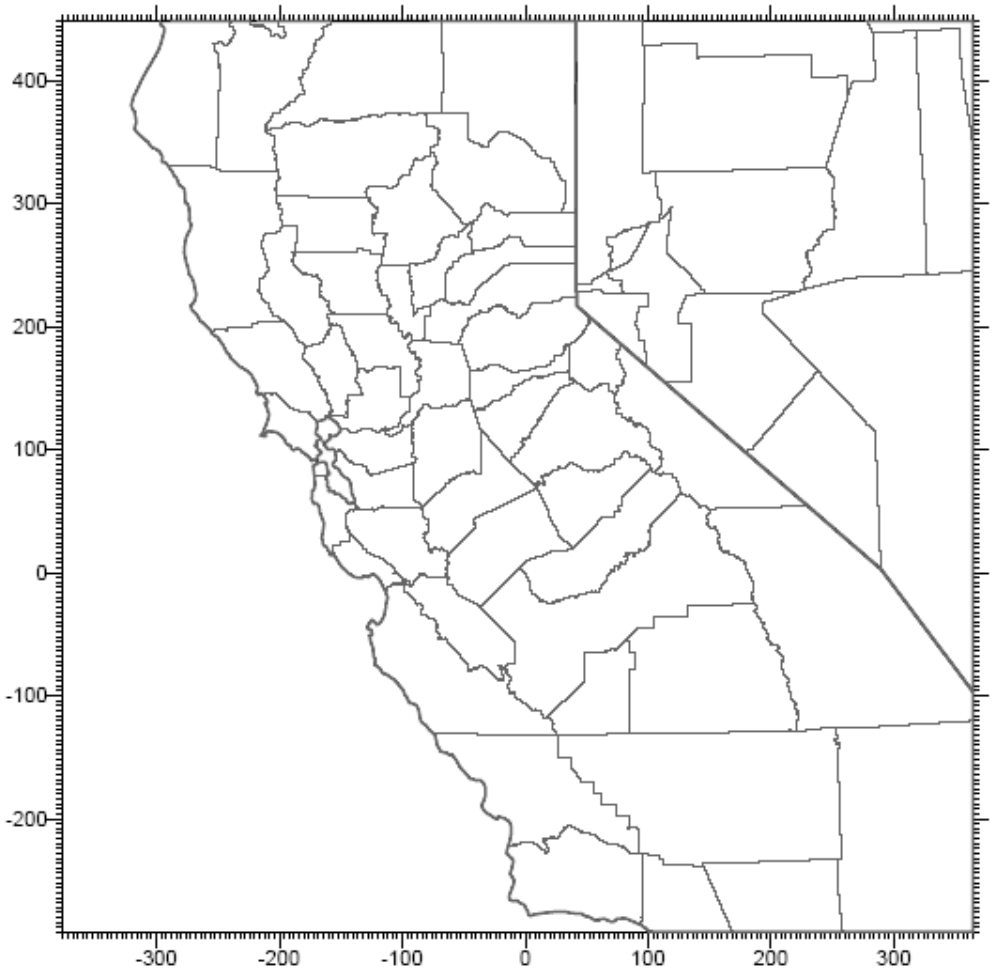
Task 4
Decision Point for Phase II

Preliminary Data Assessment

Current Emissions Data

- Represents 1990 through 2030
- Pending ARB updates
  - Update livestock waste emissions
  - Estimate missing emissions for landfills
  - Update auto refinishing
  - Update industrial solvent use
  - Update industrial coatings
  - Update agricultural irrigation engines
  - Continued updates due to goods movement plan
  - Continued updates to railroad emissions
  - Correct UTM coordinates in stationary sources
  - Are we concerned about the lack of Nevada emissions?
- Project team desires a code definition manifest for the emissions data

CCOS Air Quality Modeling Domain



Surface Met Data
QA Issues Identified by BAAQMD

- Site locations
- Time zone
- Zero values vs. missing data
- Sudden increases or decreases in WS, T
- Long periods of constant WS, WD, or T
- Incorrect flag values
- Redundant data