$PM_{2.5}$ Precursor Emissions Trading Ratio

STMPR meeting

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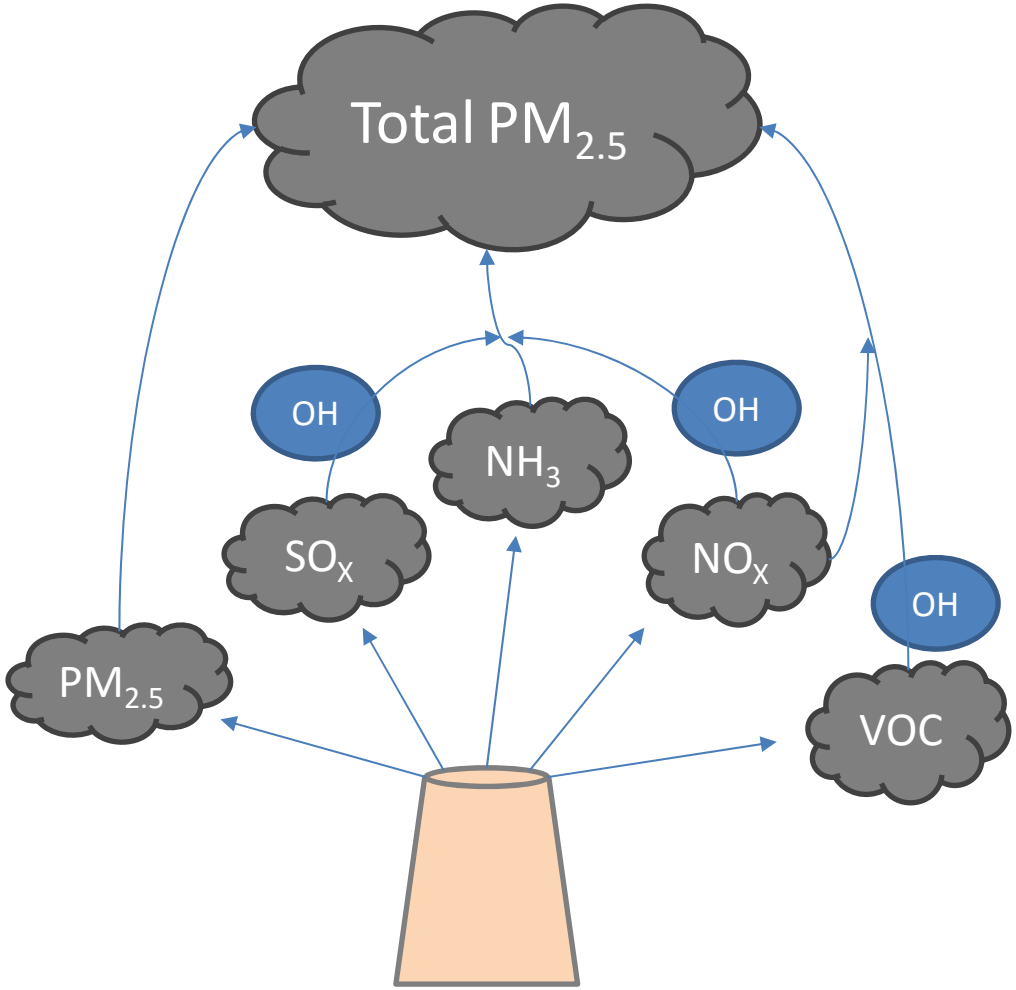
South Coast
Air Quality Management District

$PM_{2.5}$ Precursors

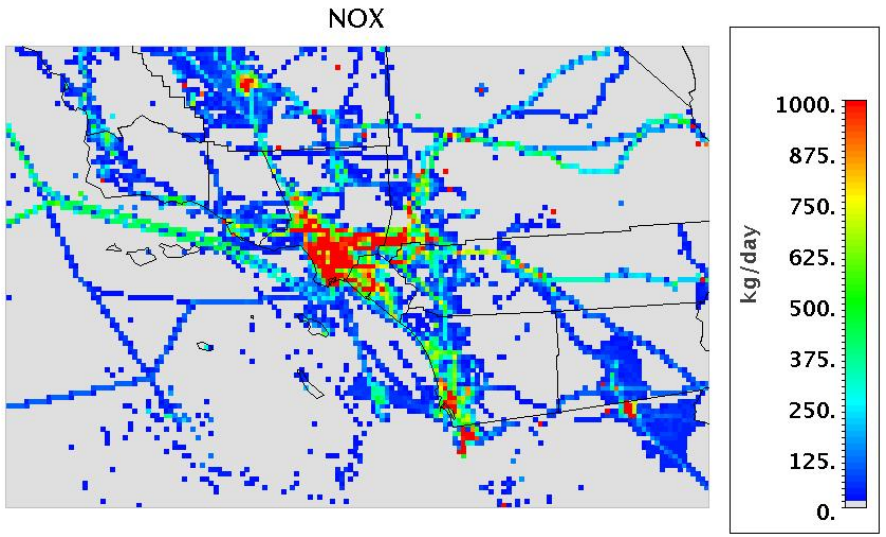
- What is the contribution of precursors to total $PM_{2.5}$?
- How do precursor emission reductions affect PM2.5 design values?

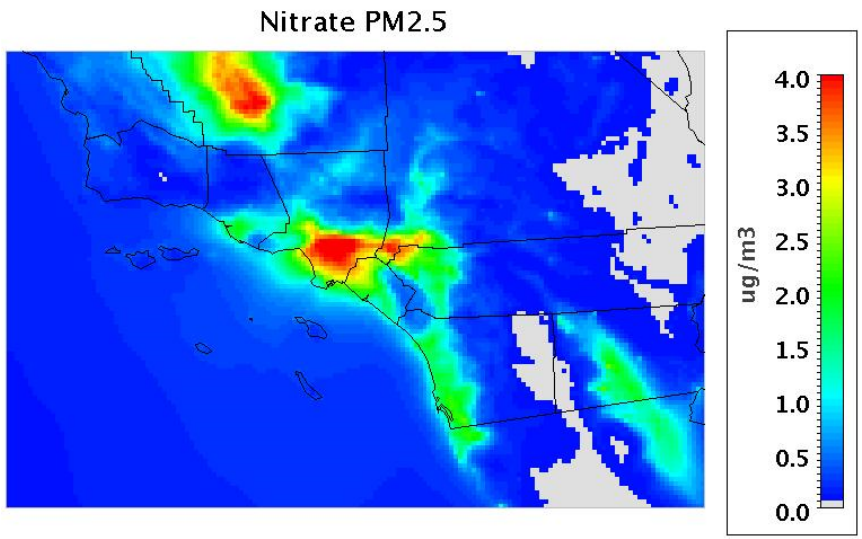


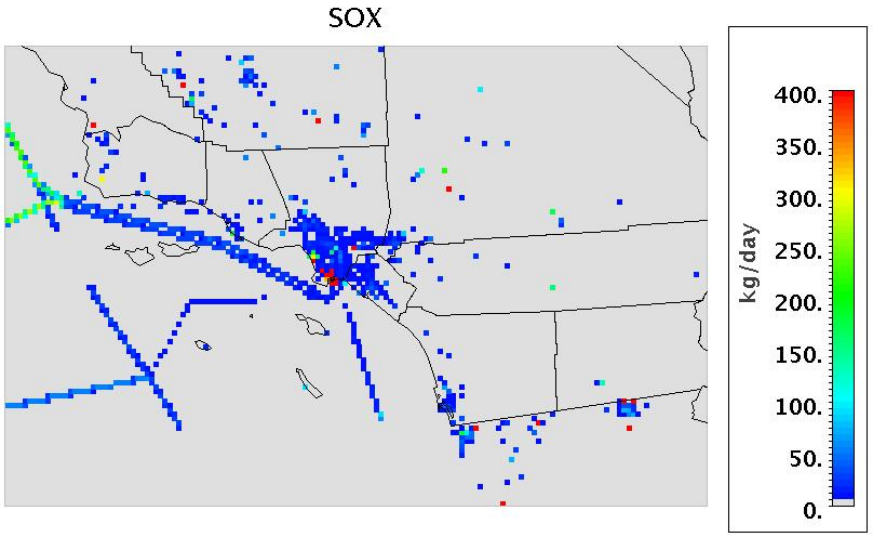
Use of Trading Ratios

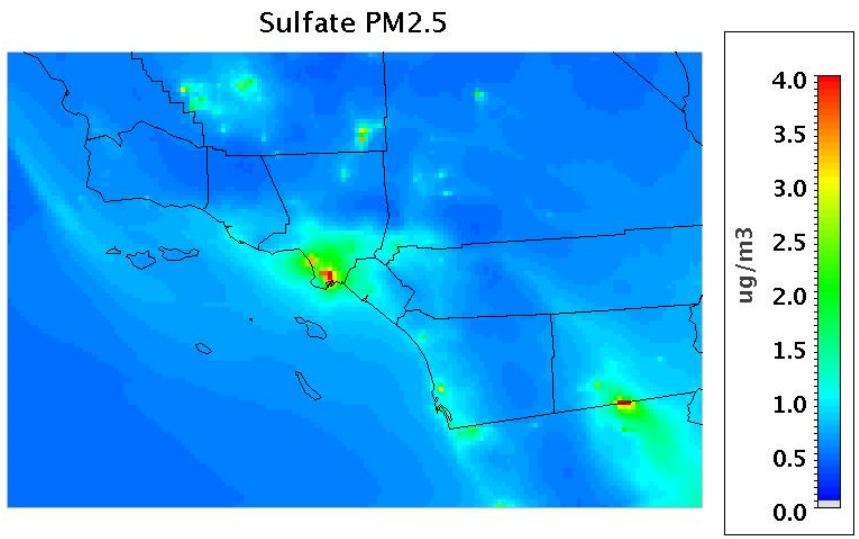
- Used:
  - For illustrative purposes
  - As first approximation of PM precursors to identify significant PM sources
  - For qualitative comparison

Emissions vs Concentrations

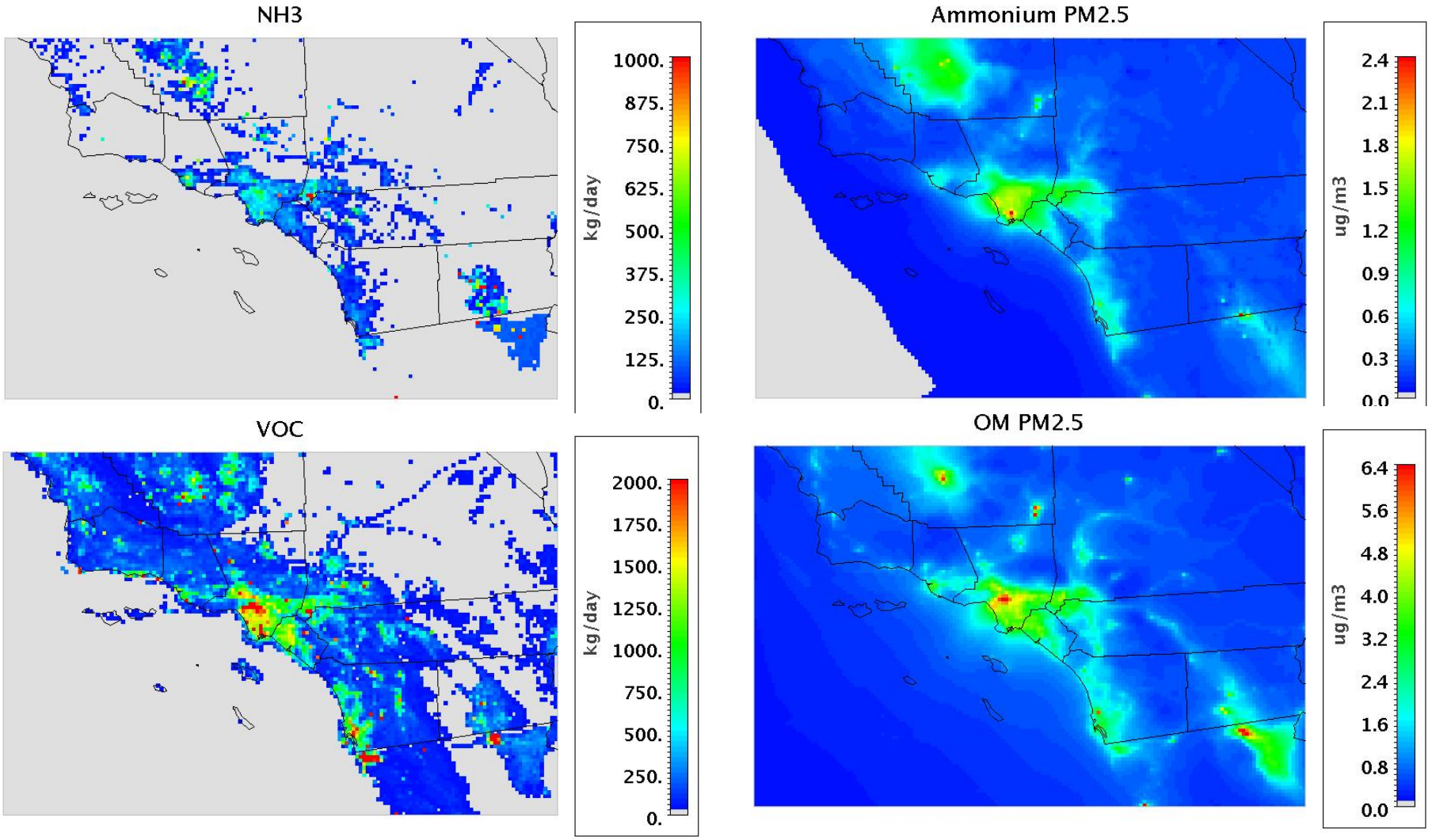








Emissions vs Concentrations



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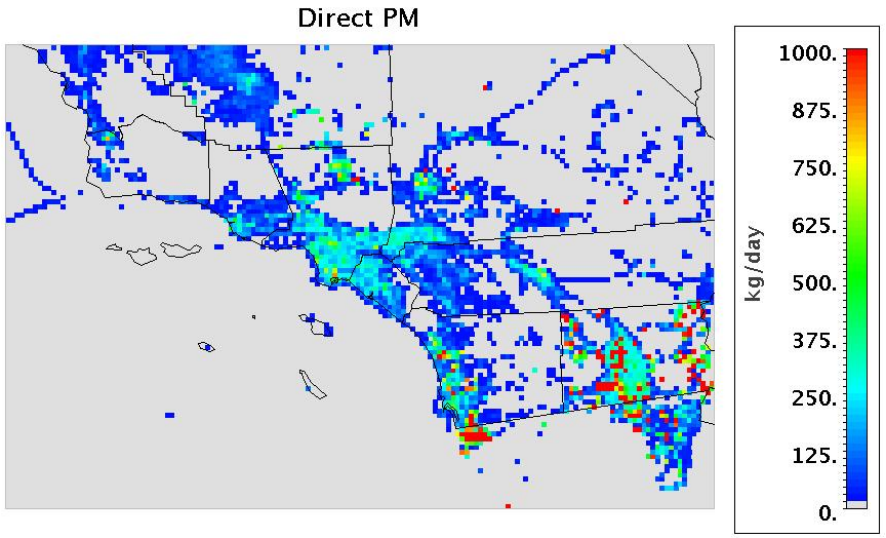
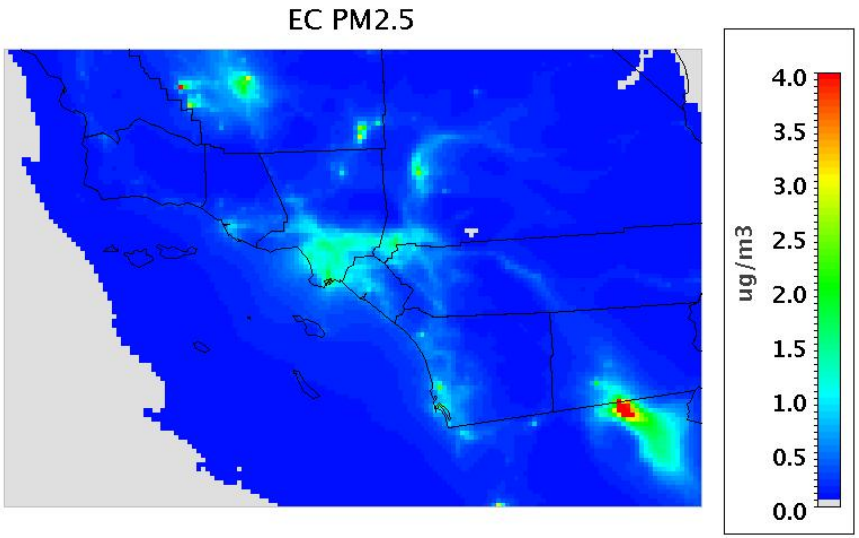
Emissions vs Concentrations





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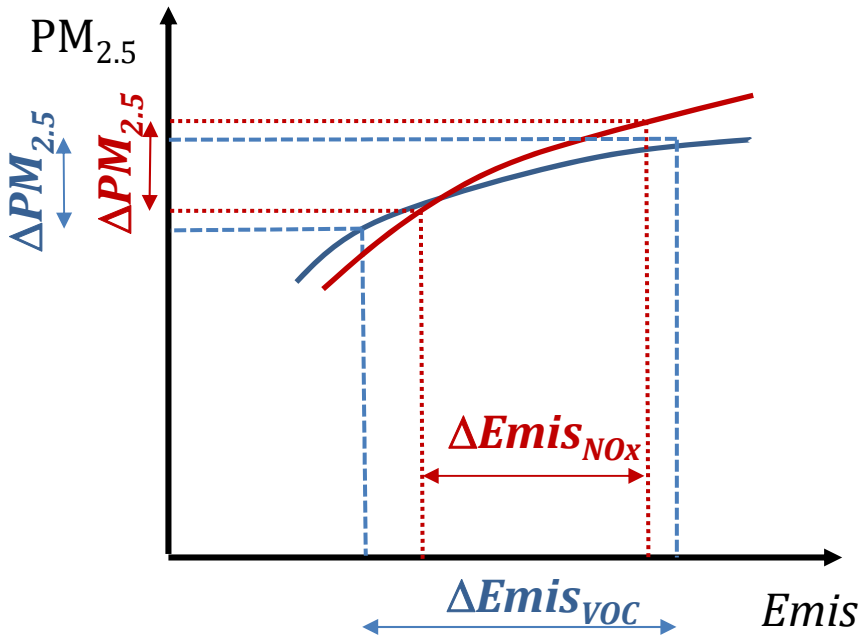
Precursor Trading Determination



This requires 2×(Number of pollutants) annual simulations

$$\beta_{PM_{2.5}} = \frac{\Delta PM_{2.5}}{\Delta Emis_{PM_{2.5}}}$$

$$\beta_{NOx} = \frac{\Delta PM_{2.5}}{\Delta Emis_{NOx}}$$

$$\beta_{SOx} = \frac{\Delta PM_{2.5}}{\Delta Emis_{SOx}}$$

$$\beta_{VOC} = \frac{\Delta PM_{2.5}}{\Delta Emis_{VOC}}$$

$$\beta_{NH_3} = \frac{\Delta PM_{2.5}}{\Delta Emis_{NH_3}}$$

Methodology

- Simple Linear Regression
  - Consider each pollutant separately
- Multiple Linear Regression
  - Consider all pollutants together
- Incorporation of Monitoring Data
  - To bound β values

Preliminary Determination

- Use annual simulations already finished (~30)
  - Baseline and attainment demonstration simulations
  - $PM_{2.5}$ isopleth runs

- Use multiple linear regression:

$$\Delta PM_{2.5} = \beta_0 + \beta_{NOx} \cdot \Delta Emis_{NOx} + \beta_{SOx} \cdot \Delta Emis_{SOx} + \ \ldots + error$$

Preliminary Annual $PM_{2.5}$ Trading Ratios

	$\Delta Emis$ range	Absolute β ($\mu g/m^3$)*/ton	Relative β with respect to NO_X
NO_X	0 – 75 %	0.0061	1.0
VOC	0 – 25 %	0.0072	1.2
$PM_{2.5}$	-7 – 0.2 %	0.0886	14.6
SO_2	0 – 9 %	1.0041	165.1
NH_3	-3 – 49 %	0.0168	2.76

*** Based on $PM_{2.5}$ values at Mira Loma**

Summary & Next Step

- Preliminary results differ from previous AQMPs
  - Specially for precursors with projected small changes in emissions (SO_X)
- Need to conduct sensitivity simulations perturbing emissions of individual precursors
  - Need consistent emission perturbation ranges
- To add multiplicative term in MLR

$$\Delta PM_{2.5} = \beta_0 + \beta_{NOx} \cdot \Delta Emis_{NOx} + \beta_{SOx} \cdot \Delta Emis_{SOx} + \beta_{SOx-NH3} \cdot \Delta Emis_{SOx-NH3} \ldots + error$$