Question D: What distribution of anthropogenic and biogenic emissions of ozone and aerosol precursors can be inferred from observations?

Mobile emission CO/NO\textsubscript{x} ratio evolution in Texas and implications for emission inventories

This Presentation:

• Investigate CO/NO\textsubscript{x} ratio in routine monitoring data: Texas vs. other U.S. locations

• Compare to emission inventories

• Suggest needed improvements to inventories
Temporal trends in CO to NO\textsubscript{x} ratios in U.S. urban areas

CO/NO\textsubscript{x} emission ratio in on-road mobile emissions have decreased dramatically.

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VOC/NO\textsubscript{x} emission ratio has decreased similarly

CO/NO\textsubscript{x} emission ratio in on-road mobile emissions have decreased dramatically.

VOC/NO\textsubscript{x} emission ratio has decreased similarly

MOBILE6 CO/NO\textsubscript{x} emission ratios have not decreased fast enough and are too high now.

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What about Texas?

CO to $NO_x$ Molar Ratio

Morning rush hour data
Urban sites

NEI 1999

Expanded axes, AIRS data as reference
What about Texas?

CO/NO$_x$ emission ratio in on-road mobile emissions have decreased dramatically.

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NEI 1999 emission ratios estimates are too high and are worse now than in 2000

VOC/NO\textsubscript{x} emission ratio has decreased similarly - likely not reflected in inventories

What about Texas?

Morning rush hour data
Urban sites
What drives the CO/NOx decrease?

Ambient urban CO levels have decreased: 4.6%/yr, but less rapidly than CO/NO\textsubscript{x} emission ratio: 6.6%/yr

NO\textsubscript{x} emissions must have increased!

What drives the CO/NOx decrease?

Ambient urban CO levels have decreased: 4.6%/yr, but less rapidly than CO/NO\textsubscript{x} emission ratio: 6.6%/yr

NOx emissions must have increased! Not captured by MOBILE6

MOBILE6 CO emissions about factor of 2 high, although rate of decrease well fit.

MOBILE6 VOC emissions have rate of decrease similar to CO, and are much more accurate

SIP Relevant Findings

**Question D:** What distribution of anthropogenic and biogenic emissions of ozone and aerosol precursors can be inferred from observations?

**On-road Vehicle Emissions:** Temporal trends from ambient measurements.

MOBILE6 has significant shortcomings as well as strengths:

- 1994 VOC emissions were accurate while CO emissions were overestimated by about a factor of two.
- Temporal trends of CO and VOC emissions are similar and accurate.
- NO$_x$ emissions increased, not decreased, through the 1990’s. For 2006, NO$_x$ emissions may be significantly underestimated.

Mobile emissions dominate ozone precursors in many urban areas. The VOC/NO$_x$ emission ratio varies significantly over years, and may be significantly overestimated by MOBILE6 in recent years.
Low ratio likely reflects large contribution from diesel engines in Barbour’s Cut area
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What about Texas?

CO/NO$_x$ emission ratio in on-road mobile emissions have decreased dramatically.

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Expanded axes, AIRS data as reference
Compare with Fuel-based Inventory

Fuel-based emissions agree with ambient CO/NO$_x$

MOBILE 5B emissions vs. Fuel-based in 1995:
- VOC agree well.
- NO$_x$ agree well, but not partitioning
- CO $\approx$ 40% high

MOBILE 6 emissions would degrade CO comparison

(Harley et al., *J. Geophys. Res.*, 106, 3559-3567, 2001)