Temporal trends in ozone, its precursors, and other secondary pollutants in Los Angeles and Atlanta

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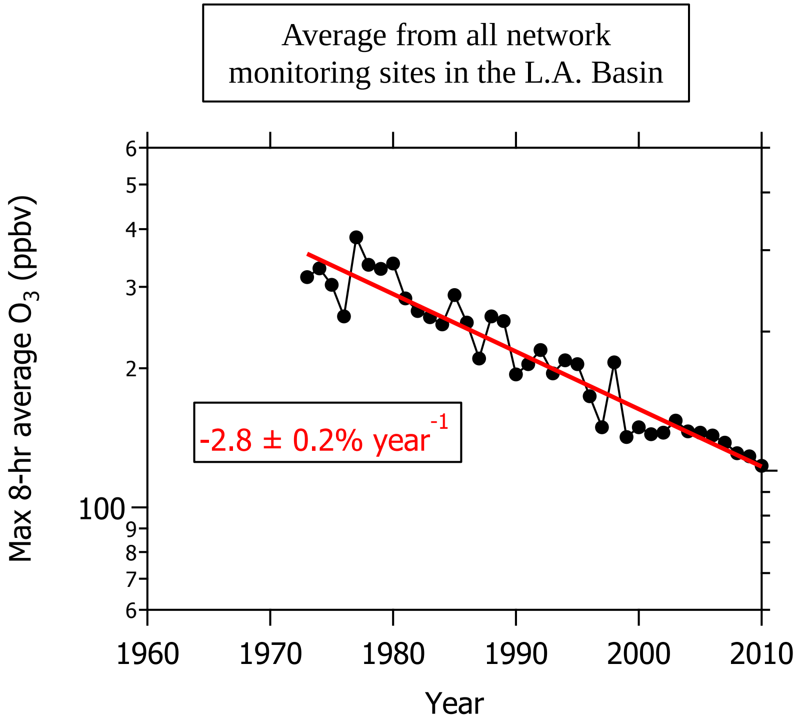
Conclusions

- Ambient observations from various platforms in L.A. show exponential decreases over 50 years
- Vehicle emissions controls reduced VOCs and CO faster than NO_x
- Changes in VOC/NO_x ratio changed PAN/HNO_3 ratio by a factor of 40
- Inventory emissions trends different than those inferred from observations
- Contrast L.A. and Atlanta

Primary Reference: Pollack et al. (2013), *JGR.*, doi:10.1002/jgrd.50472.

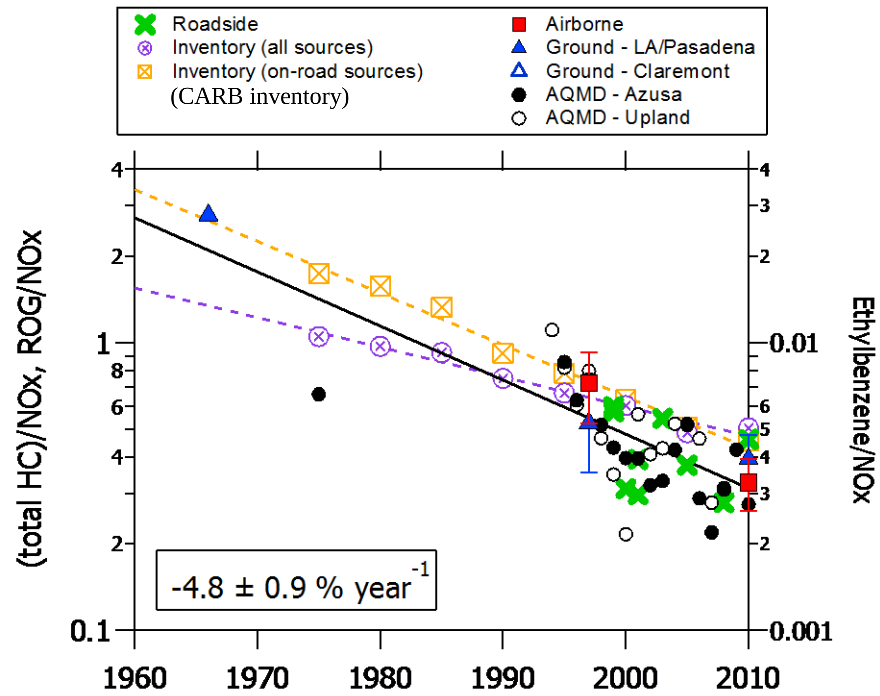
L.A. emissions controls successful in decreasing O_3 and its precursors

O_3



Factor of 3 change over 50 years

VOC/NO_x ratio

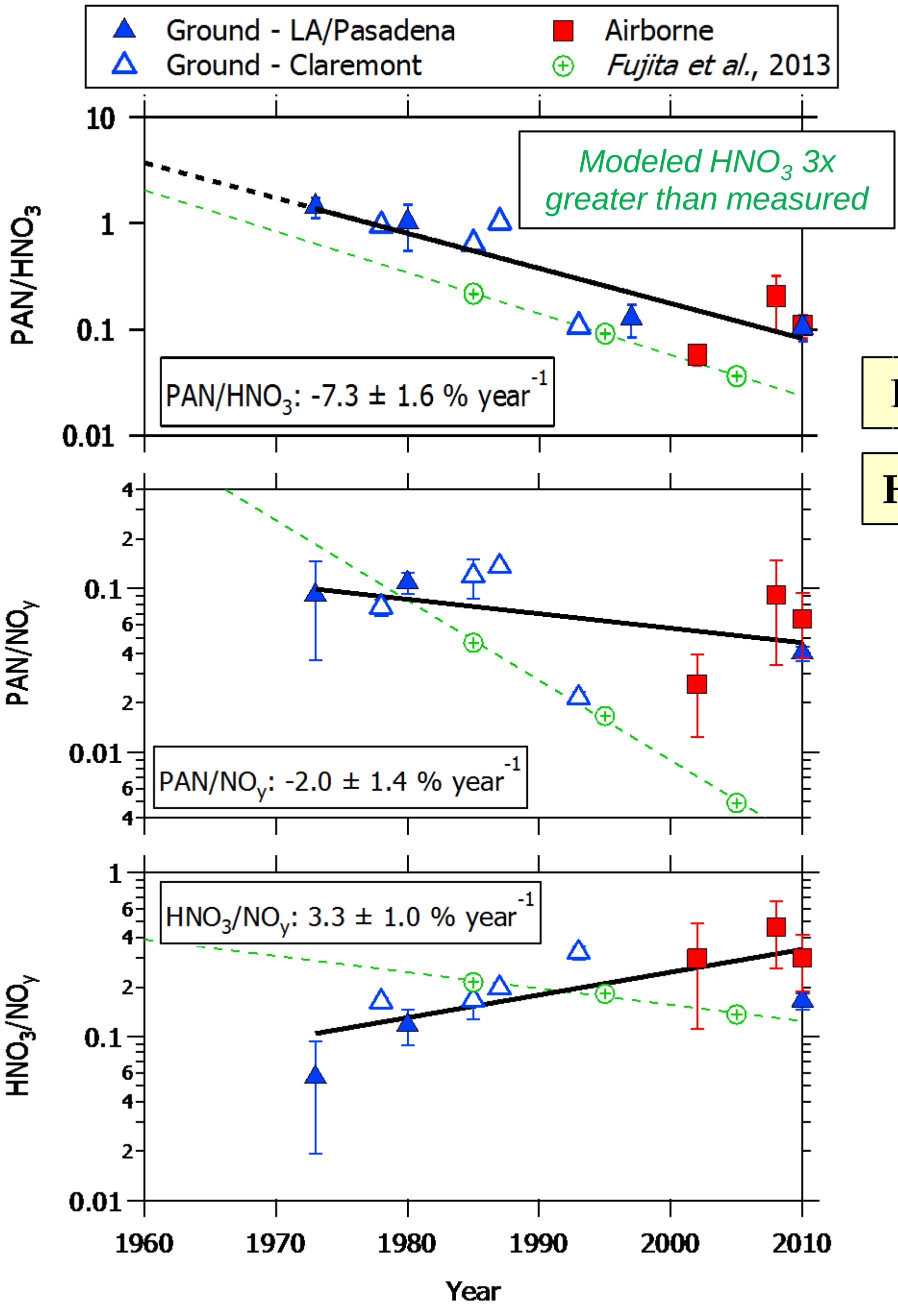


Factor of 10 change over 50 years

- Ambient observations from different measurement platforms (symbols) show decreasing trends since the 1960s
- Vehicle emissions controls reduced VOCs and CO faster than NO_x resulting in decreasing VOC/NO_x ratios

Pollack et al., JGR, 2013

L.A. controls also successful in reducing other secondary pollutants



Factor of 10 decrease in VOC/NO_x ratio resulted in *factor of 40 decrease in PAN/HNO_3 ratio* over 50 years

PAN formation associated w/ radical chain **propagation**

HNO_3 formation associated w/ radical chain **termination**

L.A. pollutant formation chemistry now favors termination over propagation

Model shows opposite trends (Fujita et al., JAWMA, 2013)

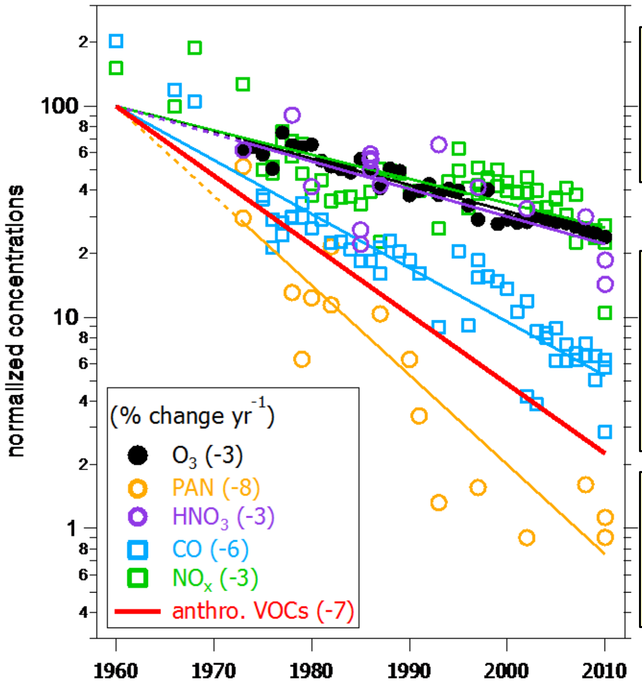
Model – measurement differences ascribed to inventory issues

Pollack et al., JGR, 2013

Regional pollutant chemistry driven by local emissions sources and controls

L.A. - Minimal BVOCs; Reduce anthro. VOCs vs. **Atlanta - Abundant BVOCs; Reduce NO_x**

50 yrs of CARB data
(*Pollack et al.*, JGR, 2013)

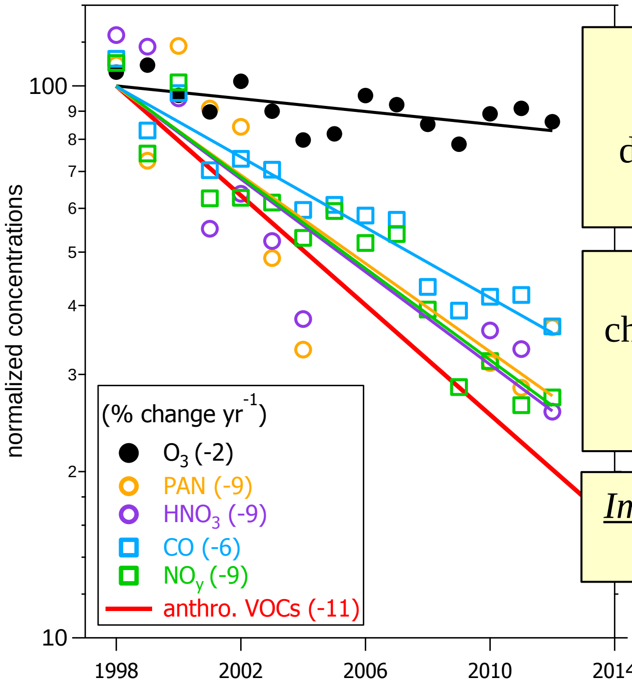


Result: Anthro. VOCs decrease faster than NO_x

Impact 1: Decreasing VOC/NO_x and PAN/HNO_3 ratios

Impact 2: Little change in $O_3/(NO_y-NO_x)$

13 yrs of SEARCH data
(*Blanchard et al.*, JAWMA, 2013)



Result: Anthro. VOCs and NO_x decrease at similar rates

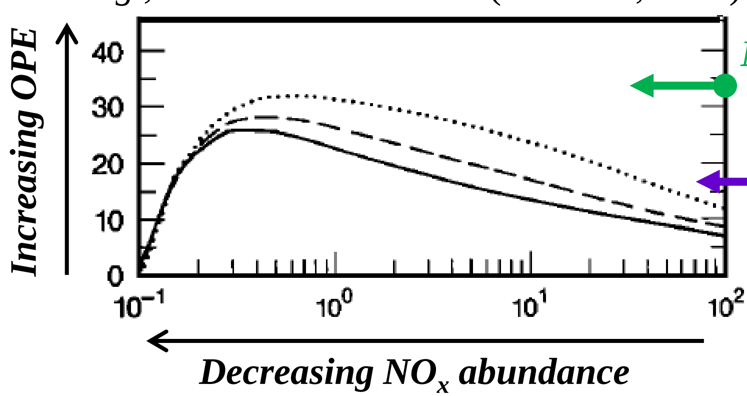
Impact 1: Little change in VOC/NO_x and PAN/HNO_3 ratios

Impact 2: Increasing $O_3/(NO_y-NO_x)$

$O_3/(NO_y-NO_x)$ used as approximation for OPE (*Trainer et al.*, JGR, 1993)

Less decrease in Atlanta O_3 – decreasing NO_x abundance offset by increasing OPE

e.g., modeled curves from (*Lin et al.*, 1988)



NO_x decrease in Atlanta between 1999 and 2013

NO_x decrease in L.A. between 1960 and 2010

Less present-day NO_x abundance in Atlanta compared to L.A.