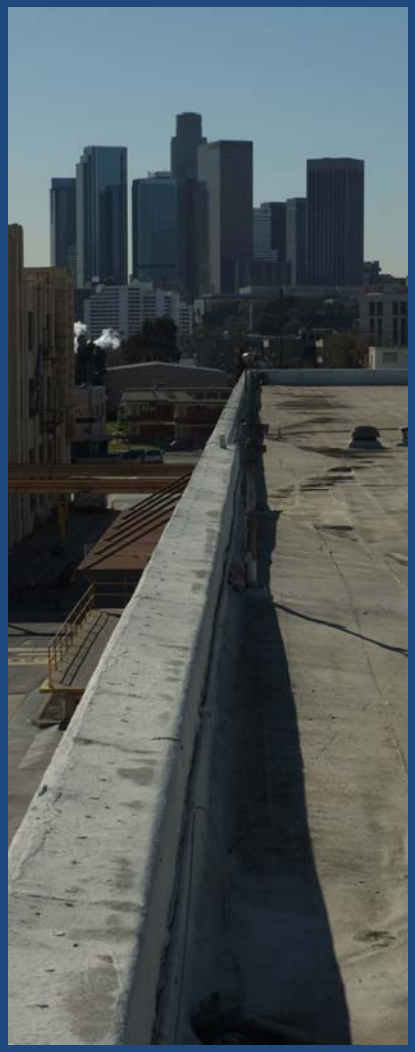
Los Angeles Supersite

Jochen Stutz, Jose Jimenez and Joost de Gouw



Outline

Joost 1. Introduction of science goals
2. Proposed site: LA North Main
3. Secondary organic aerosol formation

Jochen 4. Nocturnal chemistry
5. Logistics + additional research opportunities
6. Potential measurements at Mt. Wilson

1. Introduction of Science Goals

Secondary Organic Aerosol (SOA) Formation

Aerosol downwind from LA is largely organic and secondary

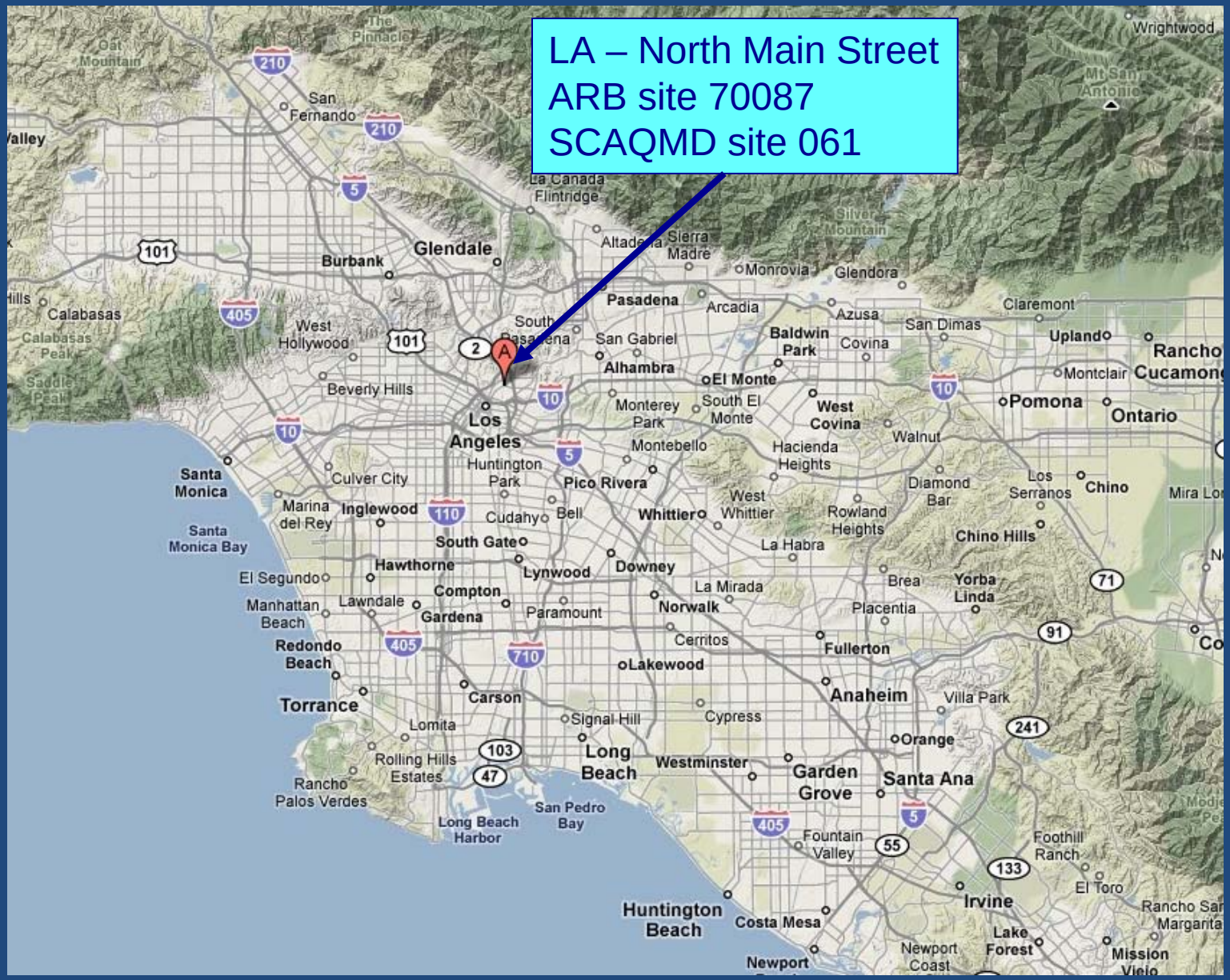
Is this also true in LA?
What are the precursors?
What is the chemistry of formation?

Nocturnal Chemistry

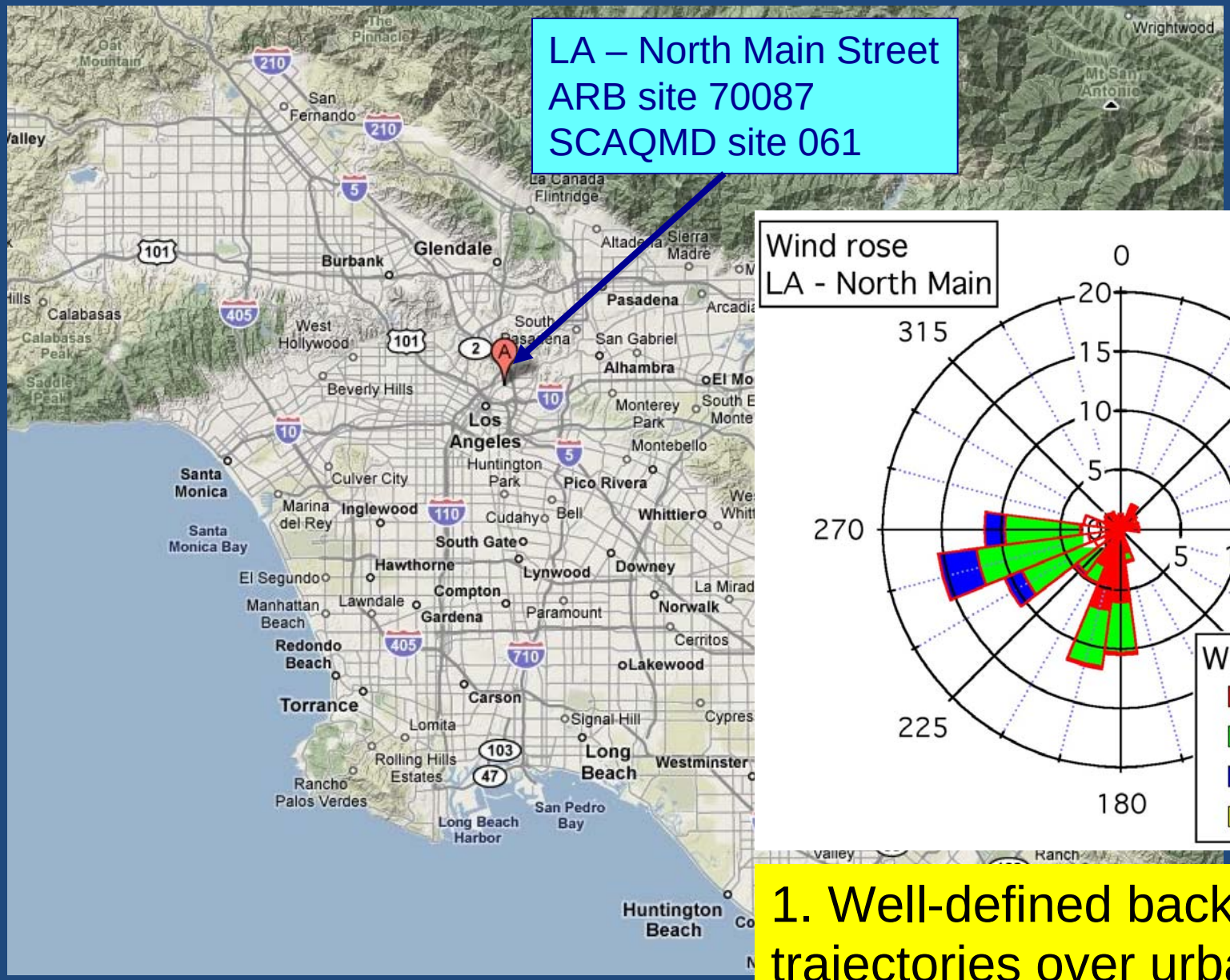
Atmospheric chemistry does not stop at night

What is the fate of NO_3 radicals?
What fraction of NOx is removed at night?
How is HONO formed and what is its role?

2. Proposed Site: LA North Main

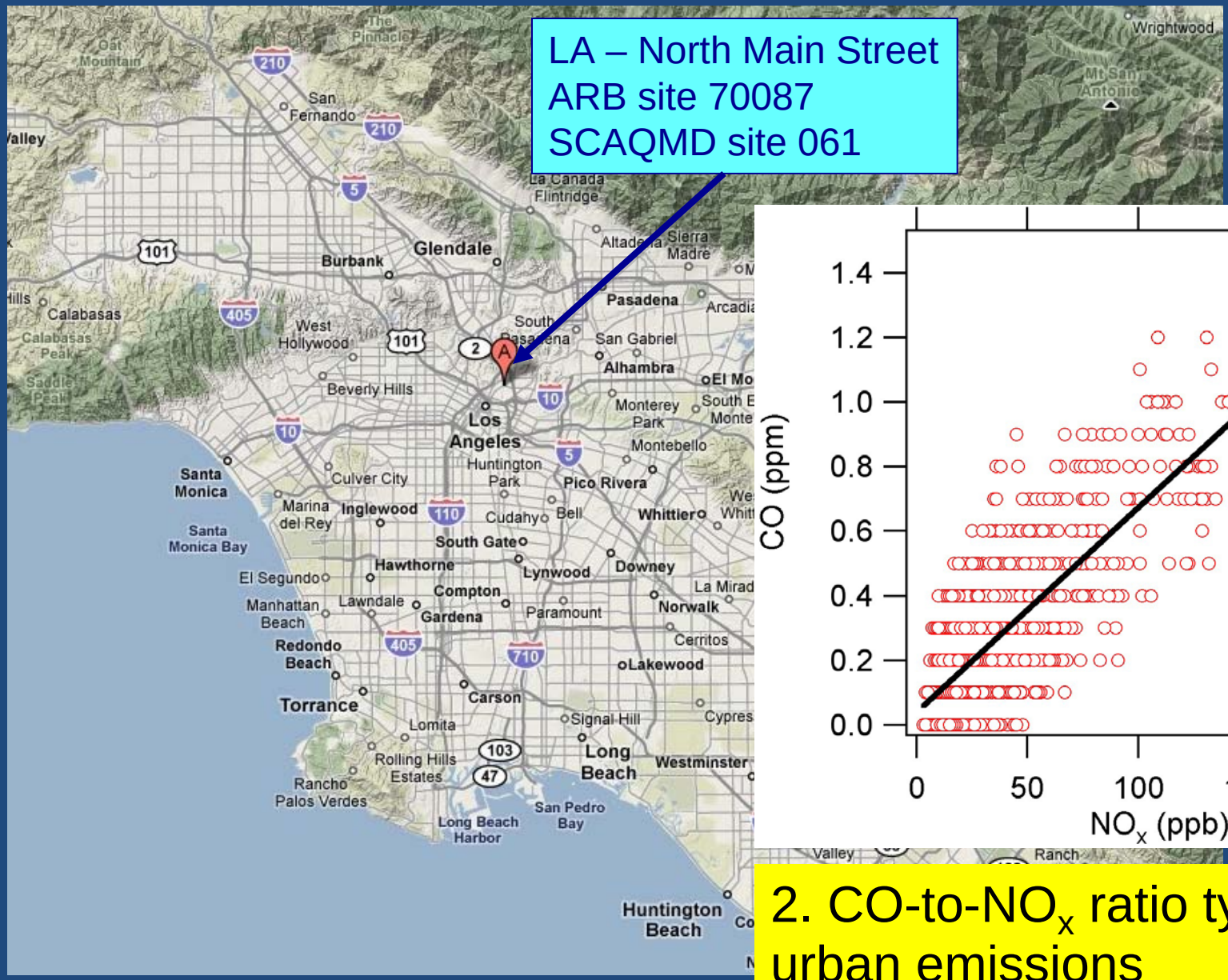


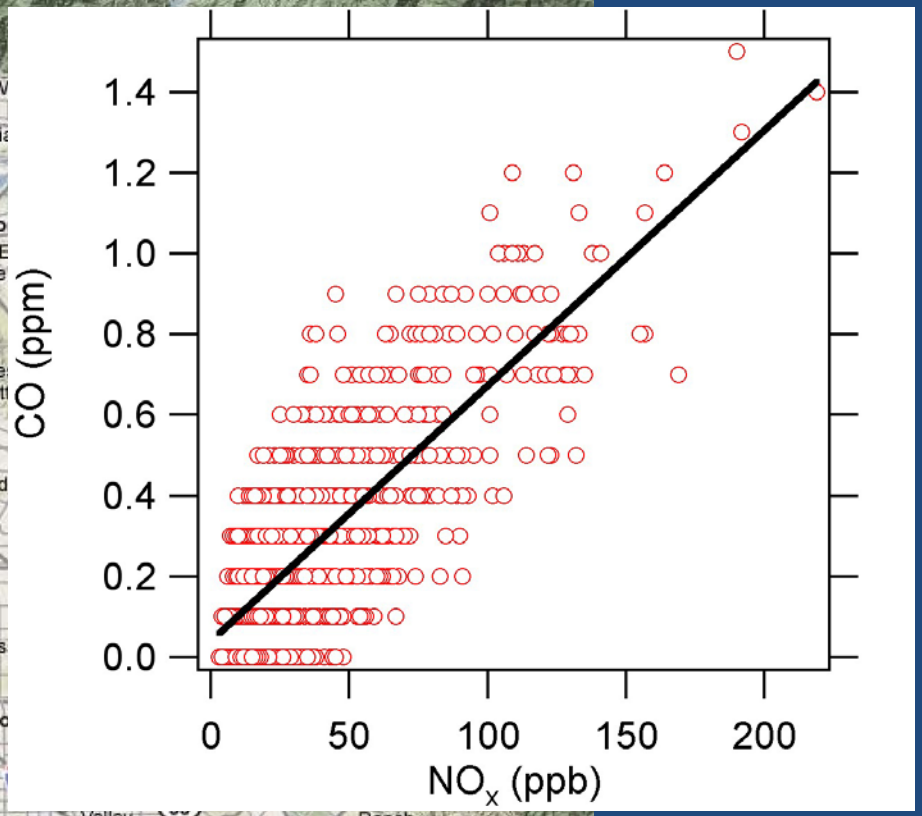
2. Proposed Site: LA North Main



1. Well-defined back-trajectories over urban area

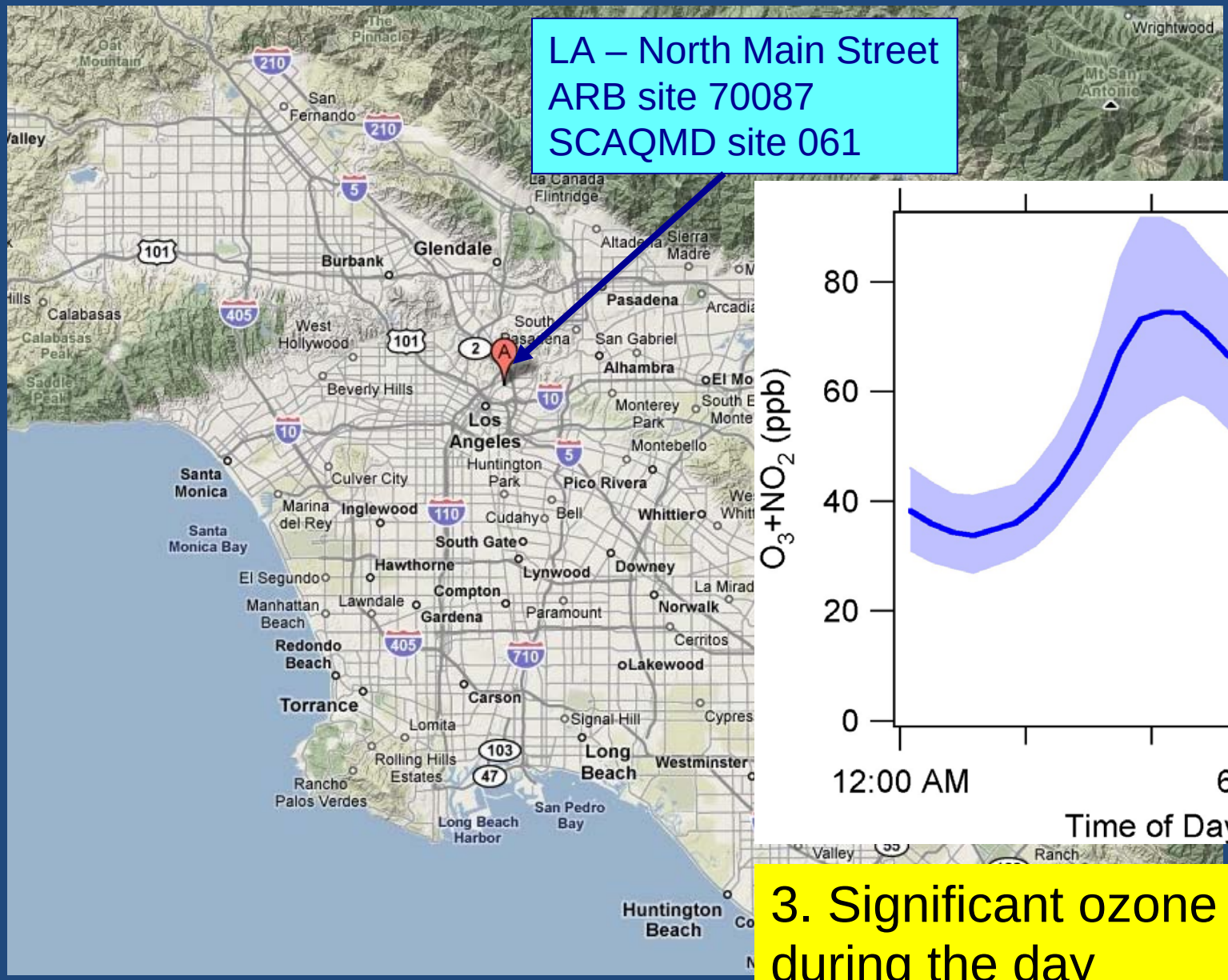
2. Proposed Site: LA North Main

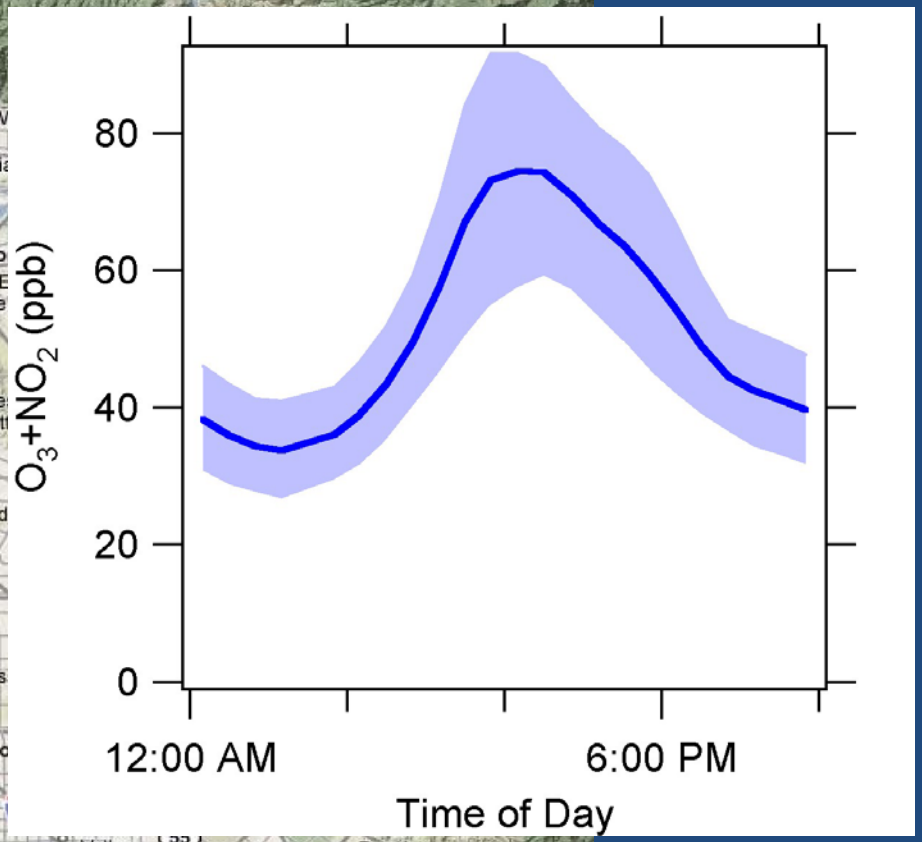




2. CO-to-NO_x ratio typical of urban emissions

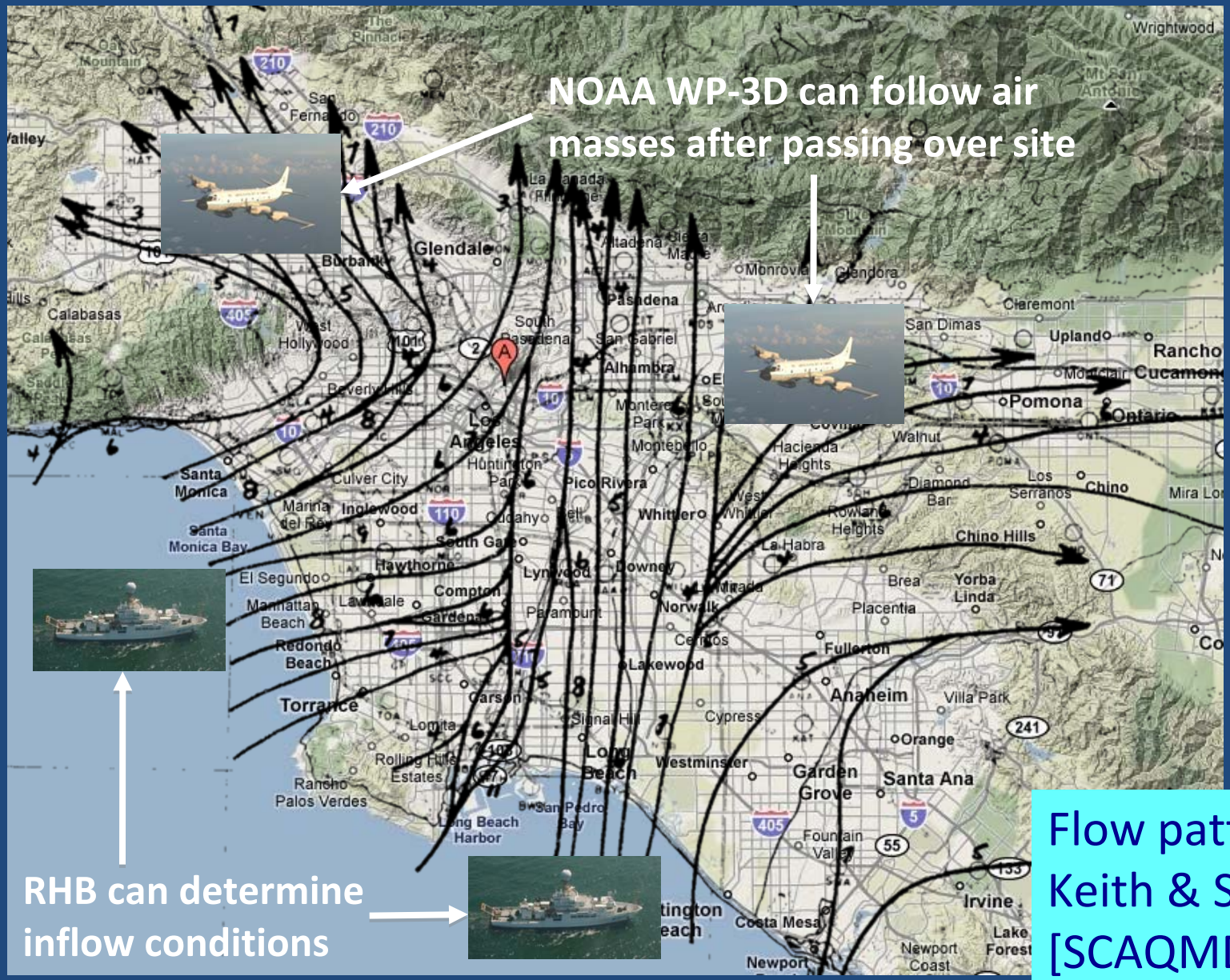
2. Proposed Site: LA North Main





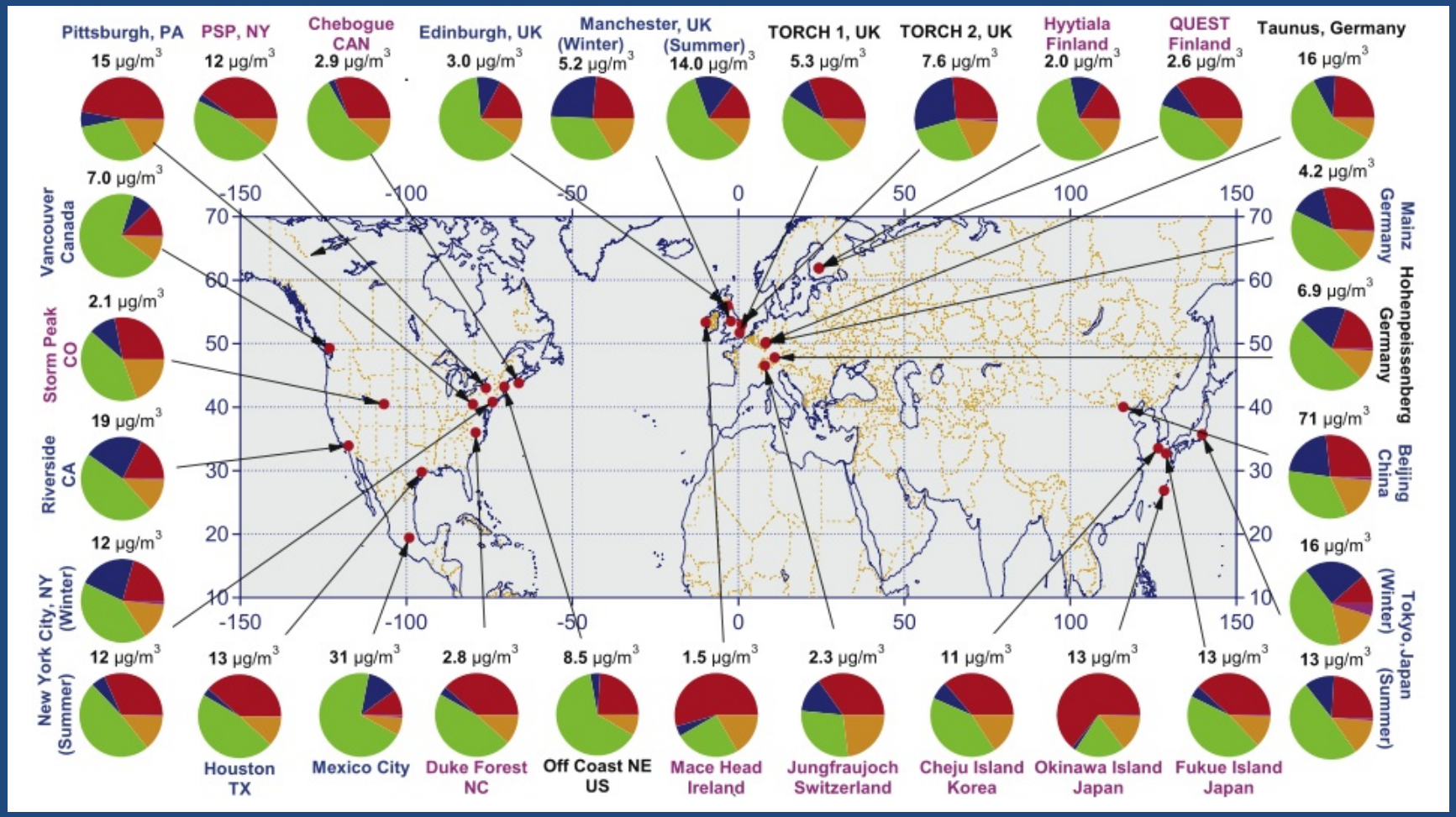
3. Significant ozone chemistry during the day

2. Proposed Site: LA North Main



Flow patterns after Keith & Selik [SCAQMD, 1977]

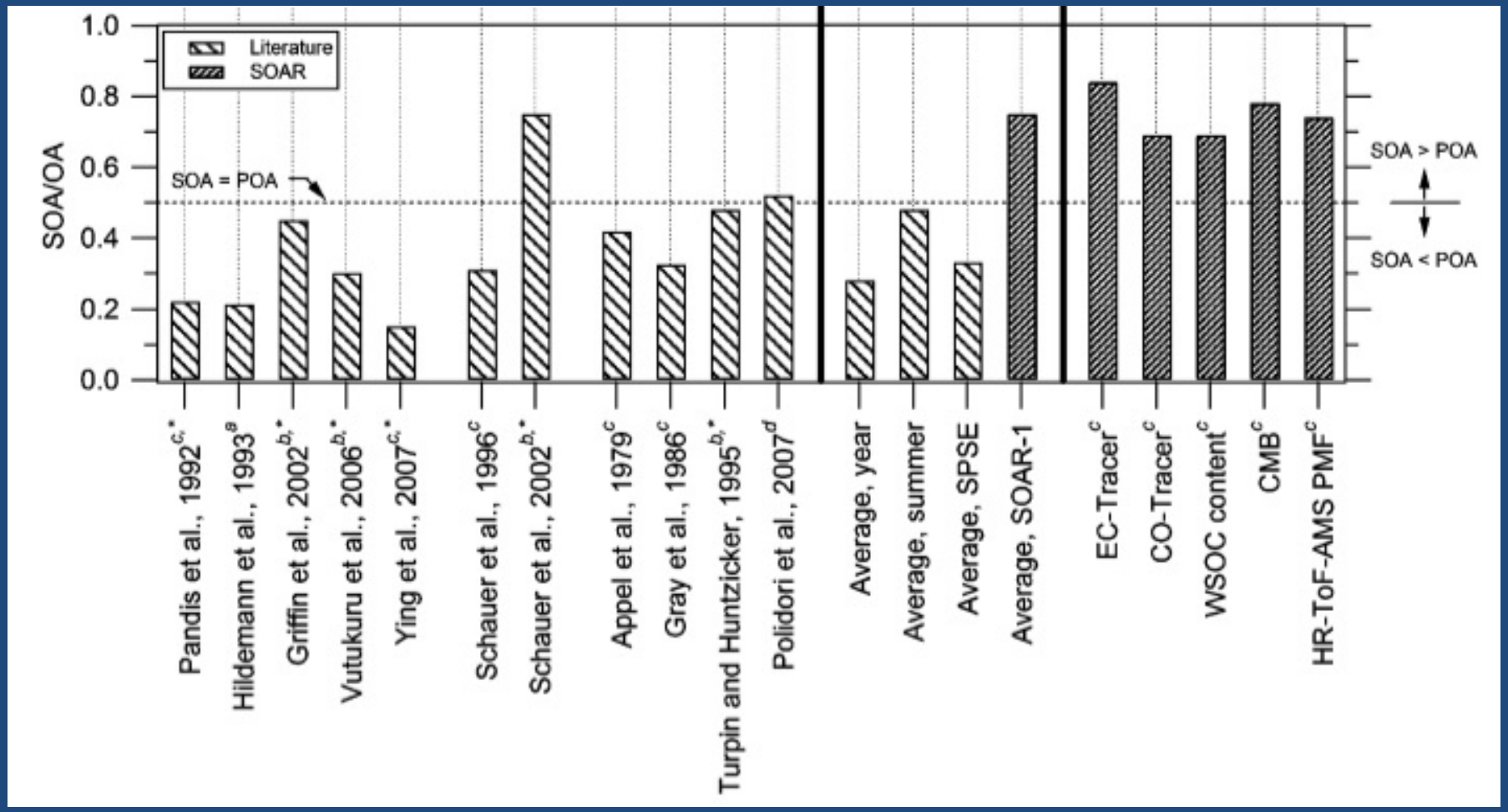
3. Secondary Organic Aerosol Formation



Global aerosol measurements using AMS *Zhang* [GRL 2007]

A large fraction of aerosol is <u>organic</u> in urban and remote locations

3. Secondary Organic Aerosol Formation

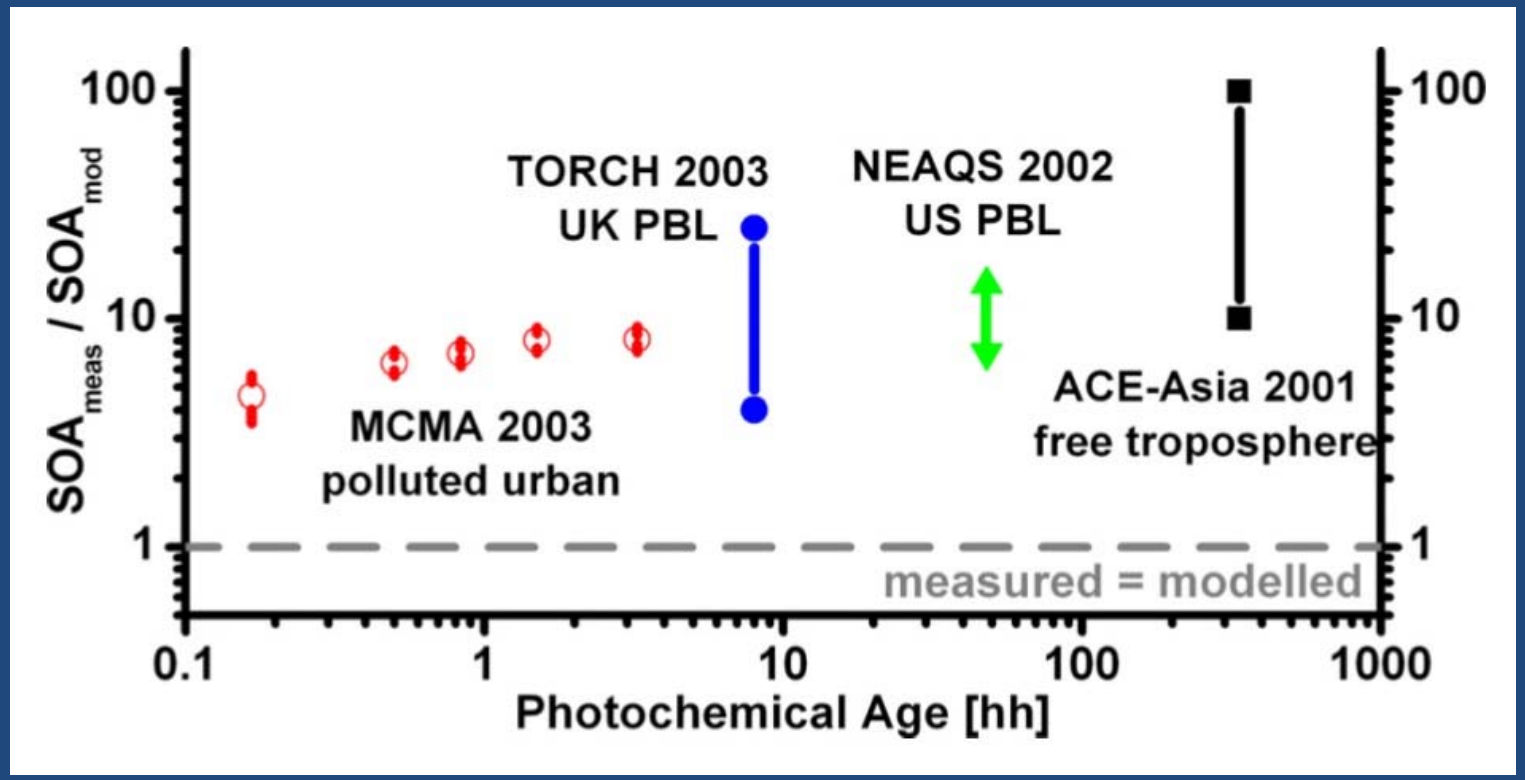


Aerosol apportionment at Riverside

Docherty [ES&T 2008]

A large fraction of urban aerosol is <u>secondary</u>

3. Secondary Organic Aerosol Formation



Summary of 4 field studies in Mexico City, U.K., eastern U.S. and east Asia

Volkamer [GRL 2006]

Urban SOA formation is <u>rapid</u> and much <u>higher than modeled</u>

Study in LA: focus on the <u>earliest</u> stages of SOA formation

3. Secondary Organic Aerosol Formation

Why is SOA higher than modeled?

- Biogenic SOA formation is enhanced in polluted air?
- Emissions of semi-volatile organic compounds (SVOCs)?
- Aqueous-phase chemistry?
- Yields from smog chamber underestimate atmospheric processes?

What will CalNex do to answer these questions?

- LA: biogenic VOCs << anthropogenic VOCs
- Measure emissions of SVOCs
- Measure glyoxal
- Potential Aerosol Mass (PAM) method vs. measured precursors
- Measure partitioning of SVOCs and organic acids

3. Secondary Organic Aerosol Formation

Planned measurements specific for the SOA goals:

<u>Aerosol-Phase:</u>

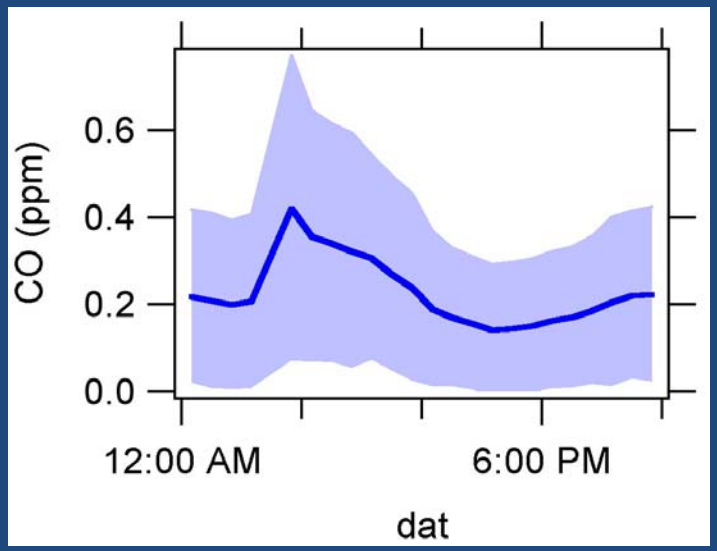
Organic aerosol	HR-ToF-AMS	*Jimenez*, CU Boulder
Aerosol volatility	thermal denuder	*Jimenez*, CU Boulder
Potential aerosol mass	PAM	*Jimenez & Brune*, CU & Penn State
BC cores	SP2-AMS	*Worsnop*, Aerodyne
Aerosol speciation	TAG-AMS	*Worsnop*, Aerodyne
Aerosol speciation	TAG	*Goldstein*, UC Berkeley
OC, EC	1-hour Sunset	*Weber*, GA Tech
WSOC	PILS-TOC	*Weber*, GA Tech
WSOC & WSON	PILS-MS	*Laskin*, PNNL
C-14	accelerator MS	*Prevot*, PSI

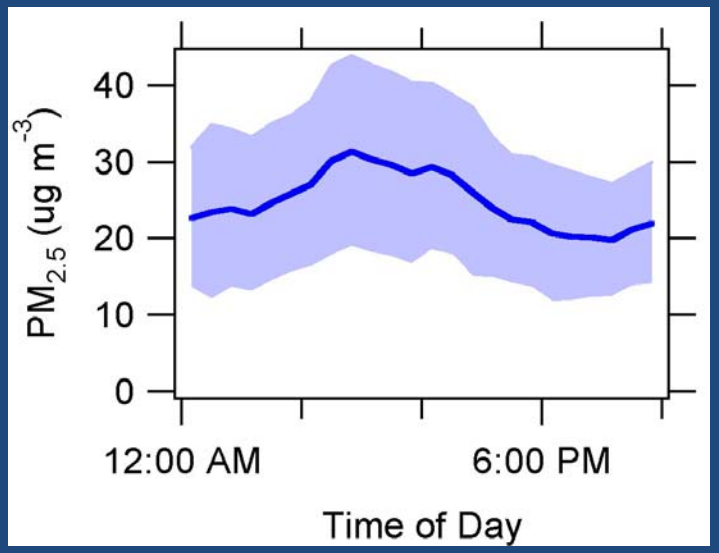
<u>Gas-Phase:</u>

VOCs	GC-MS	*de Gouw*, NOAA
VOCs	PTR-ToF-MS	*Holzinger*, Utrecht Univ.
Organic acids	CIMS	*Roberts & de Gouw*, NOAA
Glyoxal	Light absorption	*Brown*, NOAA
SVOCs	EI-MS	*Kroll*, MIT

3. Secondary Organic Aerosol Formation

What to expect from the LA supersite results?





Early morning:

- Primary species, e.g. CO and hydrocarbons, peak
- Determine emissions of SOA precursors

Later during day:

- Secondary species, e.g. $PM_{2.5}$, O_3, oxygenated VOCs peak are formed
- How much is formed relative to removal of VOCs and SVOCs

How well can we account for all the organic carbon?

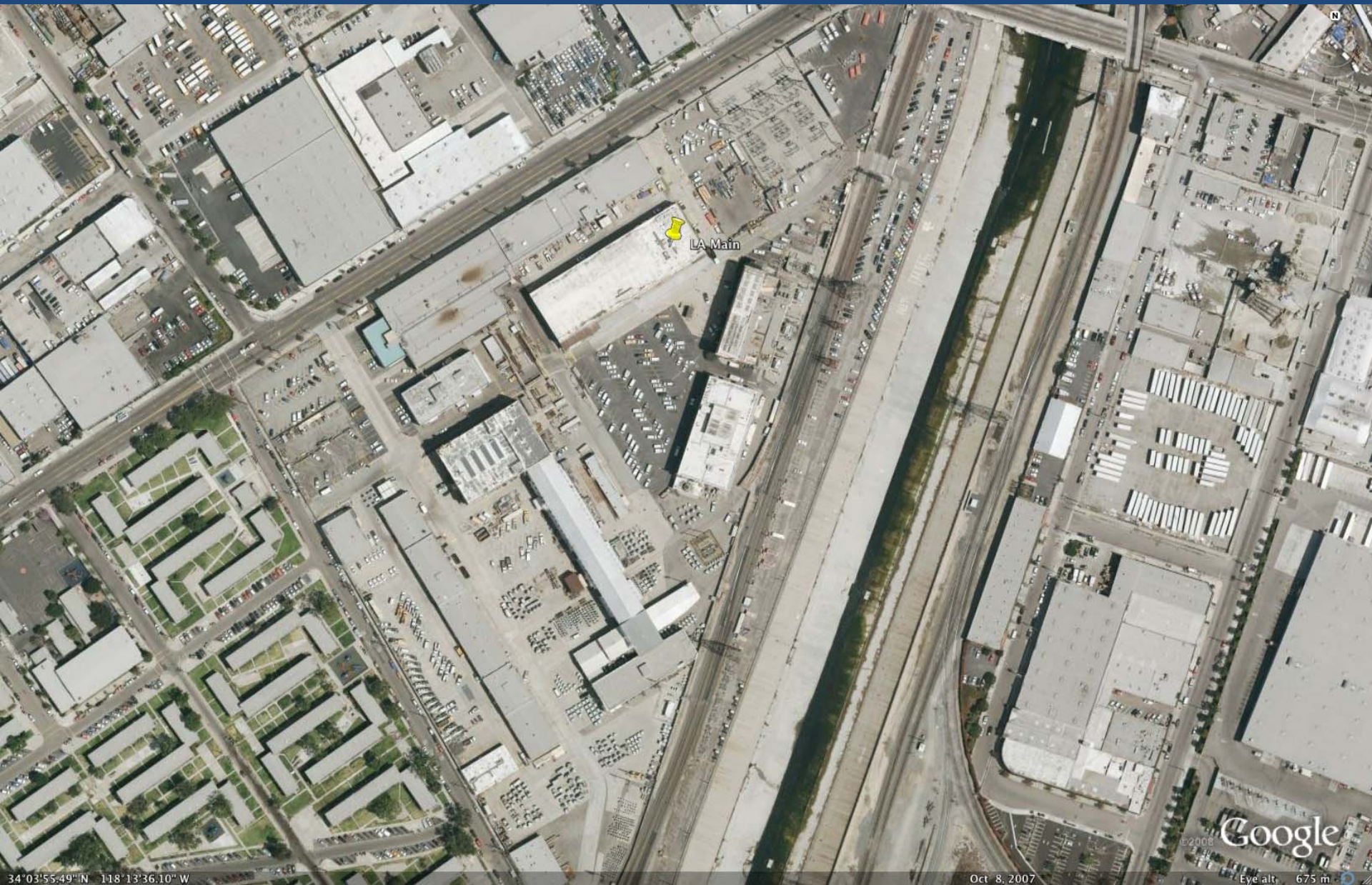
Up Next

Jochen

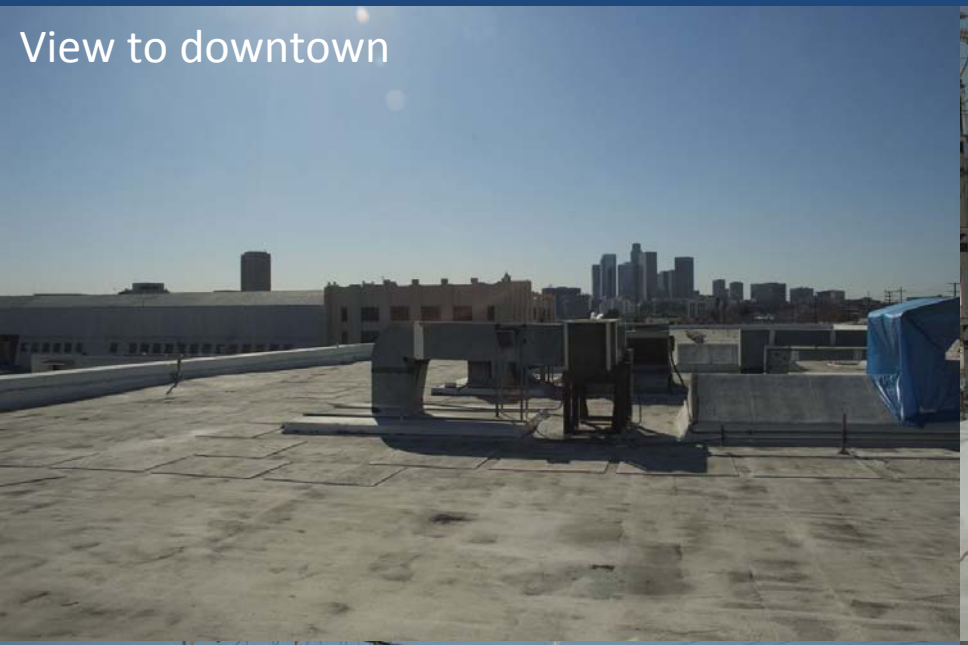
4. Nocturnal chemistry
5. Logistics + additional research opportunities
6. Potential measurements at Mt. Wilson

Back-Up Slides

LA North Main



LA North Main


View to downtown

SCAQMD samplers

View to the East: chemical storage

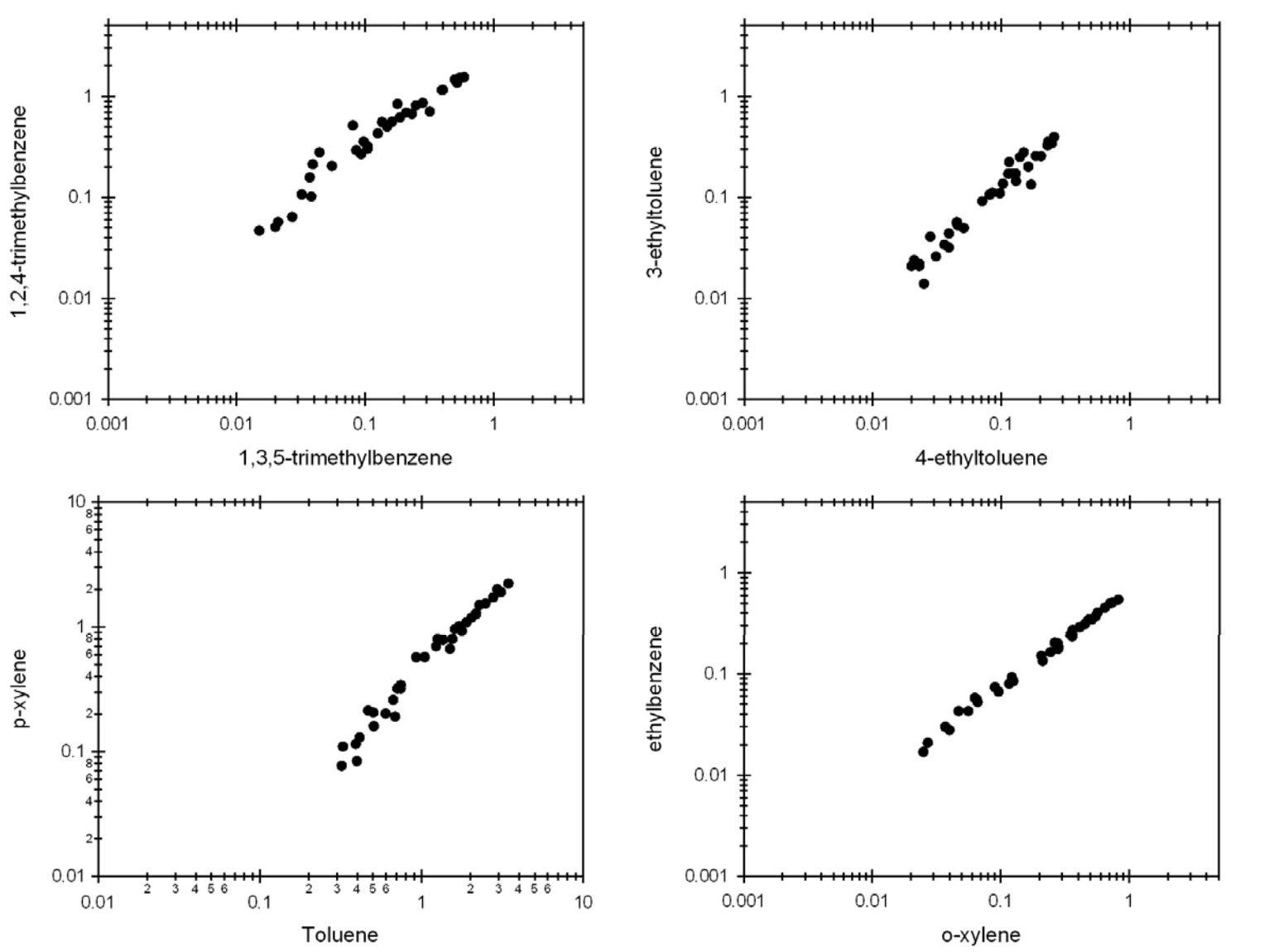
Division of Water & Power Training Room

LA North Main

Site belongs to LA Division of Water & Power (DWP)
SCAQMD rents space from DWP
Aerosol samplers on the roof
Gas samplers in training room on the top floor?

<u>Pros</u>
Good fetch towards downtown LA during day
Existing data suggest that site is good for our purposes
Secure, guarded site
Tall buildings downtown for DOAS retro-reflectors

<u>Cons</u>
Local activities include paint shop and chemical storage

LA North Main

Canister data from Tom Jobson do not point at large contamination