CARB Greenhouse Gas Measurement Program and The Megacities Carbon Project

July 24, 2014
ARB’s greenhouse gas measurement program is designed to support California’s GHG reduction efforts.
Current Progress

Identify Specific Sources → Evaluate Source Emissions → Identify GHG Reduction Opportunities → Track Emission Reductions

- Carbon Dioxide (CO₂)
- Black Carbon (BC)
- Hydrofluorocarbons (HFC)
- Methane (CH₄)
- Nitrous Oxide (N₂O)
California’s GHG Network
Tower Measurements
Additional Tools

- Mobile measurements
- Flux chambers
- Tracer-release studies
- Aircraft measurements
- Remote sensing
Research Collaborators

Satellite Measurements (700 km)

Aerial Measurements (<1 km)

Ground-level Measurements

NASA

CIRPAS
JPL
NOAA

CEC

Towers
ARB, Caltech
LBNL, LLNL
Scripps

Mobile
LBNL
Picarro
UC Irvine

Field Studies
UC Berkeley
UC Davis
Other UCs

Remote Sensing
Caltech
JPL

Laboratory
Caltech
NOAA
UC Irvine
Statewide Black Carbon Reduction

Reference: Ramanathan et al. (2013) Black Carbon and the Regional Climate of California, CARB Contract No. 08-323
Aircraft and GHG Network studies suggest statewide methane emissions greater than previously known.

Central Valley has majority of emissions.

Additional measurements expected to provide new information.

Mt. Wilson Observatory Station
Los Angeles County

Prevailing Wind Direction

Atmospheric mixing

GHG Emissions
Methane Findings

Los Angeles County

- 2007 Mt. Wilson study suggested methane emissions were underestimated
- 2014 methane emissions inventory and ambient measurements now well correlated

Hydrofluorocarbon Findings

Los Angeles County

• Results from national EPA-based method differed significantly from 2007 Mt. Wilson measurements

• New California-specific emissions inventory is consistent with 2007 Mt. Wilson measurements

Nitrous Oxide (N$_2$O) Findings

Los Angeles County

- 2014 Mt. Wilson study suggests N$_2$O emissions may be significantly underestimated
- Source attribution research in early stages
Near-term Priorities

- Statewide \( \text{N}_2\text{O} \) analysis due in 2015
- Add HFC capability to track emission reductions
- Expand VOC measurements to improve source attribution
- Switch sites to taller towers to increase footprint
- Add boundary layer measurements to improve accuracy
Longer-term Goals

- Expand measurement capabilities to quantify source-specific emissions
- Continue research collaborations to increase understanding of California’s GHG sources and emissions
Summary

- GHG measurements support multiple AB 32 programs
- ARB monitoring network helps improve emission inventories and source attribution for important greenhouse gases
- Research collaborations will continue to provide new information to help California meet long-term climate goals