Informational Report on Air Quality Field Studies

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California Environmental Protection Agency
Air Resources Board

Introduction

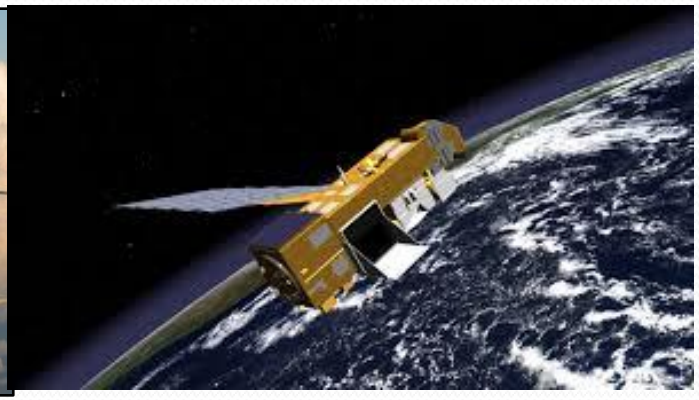
- California's field studies have provided scientific information to help design effective air quality programs for over three decades
- Field studies have examined atmospheric processes, emissions, and air quality at statewide, regional, and local levels
- Recent studies support efforts to meet both air quality standards and climate goals

Key Goals of Field Studies

- Improve understanding of:
  - the sources and atmospheric processes that form air pollution
  - the nature of local, regional, and statewide air pollution problems
  - the relative effectiveness of air pollution reduction strategies
  - the magnitude of emission reductions needed to meet air quality standards

History of California Field Studies

- Early focus on ozone in 1980s and 1990s
- Particulate matter studies initiated in 1990s
- Recent studies added climate component



Agency Partnerships

- Leverage State, local, and federal resources
  - SCAQMD, SJVAPCD, and other local districts
  - NOAA, NASA, U.S. EPA, and U.S. Navy
  - University of California, and other universities

Field Study Elements

- Radar, tower, and airplane measurements to characterize influence of air pollution aloft on surface air quality
- Expanded network of monitoring and meteorology stations to characterize spatial variability
- Special measurements to understand atmospheric chemistry
- Daily source activity data to describe variations in emissions

Regional Nature of Field Studies

- Studies are designed to understand how the mix of sources, meteorology, and geography contribute to air pollution problems
- Two distinct study regions are Central California and Southern California
- Studies have included evaluation of “upwind” and “downwind” relationships

Regional Air Quality Study Areas

Support Air Quality Plans ("SIPs")

- Regional field study results have been used to develop State Implementation Plans for ozone and particulate matter
- Successive studies address changes in emissions and atmospheric chemistry as air pollution is reduced and new measurement technologies become available
- Findings have improved air quality modeling and supported SIP strategy development

Ozone Key Findings

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- Multiple decades of ozone studies have provided an understanding of the effectiveness of VOC and NO_X reductions over time
- Large NO_X reductions will be essential to meet stringent ozone standards
- Ongoing VOC reductions also needed
- Nighttime chemistry and the role of pollutants aloft are important factors influencing regional ozone

Central CA Ozone

- Complex wind patterns provide a mechanism for circulating pollutants throughout the Valley
- The magnitude of biogenic VOCs in the Valley temper the impact of anthropogenic VOC controls
- Transport: Ozone reductions in the Valley key to reducing ozone in downwind mountain counties

Southern CA Ozone

- Recirculation of pollution in the air basin contributes to episode buildup
- VOC reductions are relatively more effective in the South Coast due to lower biogenic emissions
- Transport: Ozone reductions in the South Coast are beneficial for San Diego, Ventura and desert areas

PM2.5 Key Findings

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- Stagnant days favor regional formation of ammonium nitrate, the largest component of PM2.5
- Controlling NO_X is important for reducing PM2.5 on a regional basis
- Reductions in directly emitted PM2.5 and other precursors beneficial to address targeted attainment needs

Central CA PM2.5

- Multi-day to multi-week winter episodes lead to high levels in both urban and rural areas
- Residential wood smoke and commercial cooking activities add to regional PM2.5 in urban areas
- Residential wood burning controls have been an important element of PM2.5 control strategies



Southern CA PM2.5

- Ammonium sulfate was a significant contributor to PM2.5 in coastal areas
- Marine vessel fuel and speed controls have resulted in significant reductions in ammonium sulfate concentrations
- Targeted diesel PM reductions have also significantly reduced PM2.5 levels near ports

Upcoming SIP Development

- Past field studies provided data to:
  - Support air quality modeling
  - Provide supplemental monitoring data & speciation
  - Help improve emission inventories
- 2015-2016 SIP development process will build on past work
- Scientific “weight-of-evidence” assessment includes air quality data analysis, new air quality modeling, emissions inventory and forecasting updates

CalNex & Other Climate Studies

CalNex Study

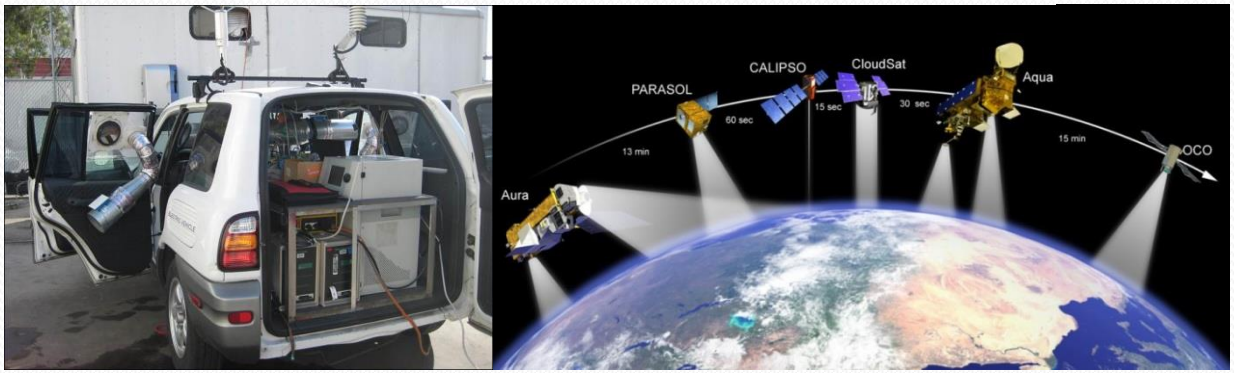
- 2010 CalNex study was first to address both air quality and climate issues, including short-lived climate pollutants
- Ambient measurements helped to inform emissions inventories for methane and fluorine-containing gases
- Documented increase in background ozone

Other Climate Field Studies

- Studies conducted by Scripps have examined black carbon and brown carbon
- Four decades of PM2.5 controls have reduced black carbon by 90 percent, with large climate and air quality co-benefits
- Current research is investigating sources of brown carbon, a recently recognized short-lived climate pollutant

Current Field Studies

- Targeted studies are tracking the benefits of diesel rules on reducing localized exposure
- ARB-NASA partnerships are using satellite data to track NO_X and methane emission sources
- An ARB-NOAA-NASA collaboration will look at the contribution of Asian transport to ozone levels in California



Summary

- The success of our programs rests on a strong scientific foundation
- Field studies provide essential scientific data for development of SIPs, climate policies, and local community strategies
- Partnerships and leveraging are critical to doing these studies in the future