Impacts of Ship Emissions on California

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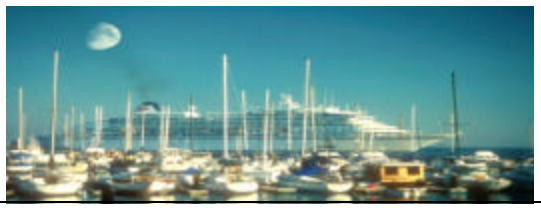


Sulfur Emission Control Area (SECA)

Overview
Technical Assessments:
- Emission Inventory
- Air Quality Modeling
- Air Quality Data Analysis
- Health and Ecological Impact

Timeline

SECA: Emission Inventory Efforts

Geographic Coverage
Data Sources
Updating Marine Vessel Inventory
Biogenic Emissions
Reconciliation with Other Port Estimates
West Coast Emission Inventory (Corbett)

Estimation, Validation, and Forecasts of Regional Commercial Marine Vessel Inventories (Corbett, 2005)

- Objectives:
  - Provide spatially resolved baseline CMV inventory of emissions at regional scale
  - Evaluate port-based inventories for potential agreement, validation
  - Spatially forecast future CMV emissions
  - Forecast future-year ship emissions under potential SECA designation
- Methodologies:

  Global ship emissions inventories, ICOADS marine vessel observations, and Lloyd's ship dataset.

SECA: Air Quality Modeling Efforts

- Modeling Approaches
  - Base case simulations
  - Additional simulations with artificial ship emissions
  - SECA emission scenarios
- Modeling Domains
  - Southern California
  - Northern California
- Reconcile with U.S. EPA's Regional Modeling

SECA: Air Quality Data Analysis

- Air Quality Data Sets
  - PM2.5 STN network
  - IMPROVE network
  - PTEP data
- Approaches:
  - Source apportionment (Hopke)
  - Isotope measurements (Thiemens)
  - Time series analysis

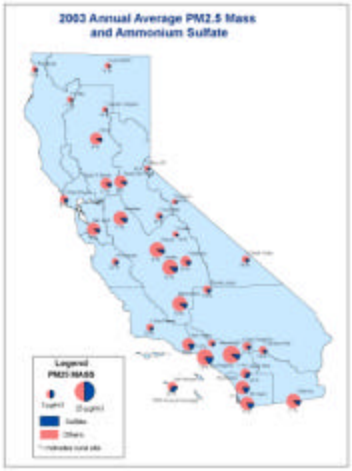
Analysis of PM-Related Measurements for the Impacts of Ships (Hopke, 2005)

- Objective: To resolve the sources of PM2.5 with a particular emphasis on impacts of ship emissions.
- Methodology: Positive matrix factorization
- Data sets: IMPROVE, STN, and PTEP (West Coast), IMPROVE and STN (East Coast)

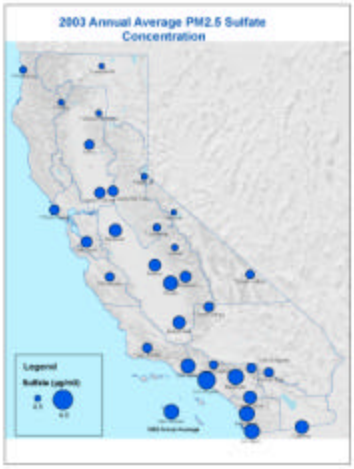
The Novel Use of Stable and Radiogenic Isotope in Aerosol Sulfates and Nitrates to Resolve Ship Track Emissions and Their Transport (Thiemens, 2005)

- Objective: To determine if multi-stable isotope ratio measurements can be used to identify the magnitude of ship emissions.
- Methodology: All sulfur, nitrogen, and oxygen isotopes will be employed.
- Samples: Isotope measurements will be collected at two sites in the San Diego area (one with ship emissions and other with multiple sources). Archived filters from selected sites will be used to determine the seasonal variability of the region.

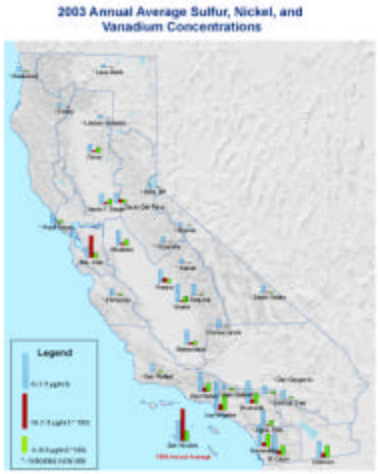
PM2.5 Mass and Ammonium Sulfate



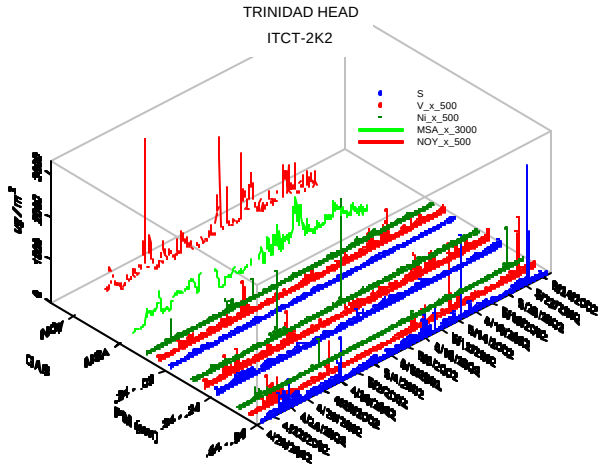
PM2.5 Sulfate Concentration



Average S, Ni, and V Concentrations



ITCT-2K2: Trinidad Head, CA



Proposed Timeline

U.S. EPA's timeline

- Technical work completed by Spring 2006
- Application completed by June 2006
- Application submitted by Spring 2007

ARB's timeline

- Emission Inventory (Fall 2005)
- Air Quality Modeling (Spring 2006)
- Air Quality Data Analysis (Winter 2005)
- Health and Ecological Impact (Spring 2006)