CalNex 2010:

An Ozone & PM Air Quality and Climate Change Field Study Planned for California May-June, 2010

One Focus:

Investigation of Longer-Range Transport

More Info:

David Parrish

Tom Ryerson

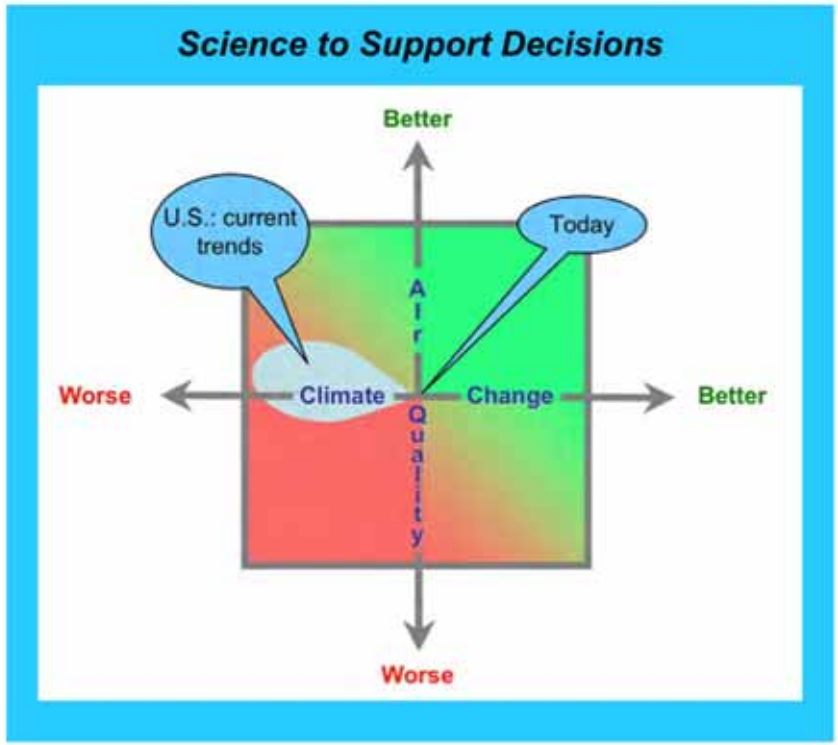
NOAA/ESRL

Chemical Sciences Division

noaaresearch

2010 CalNex

Science and Implementation Plan



Research at the Nexus of Air Quality and Climate Change

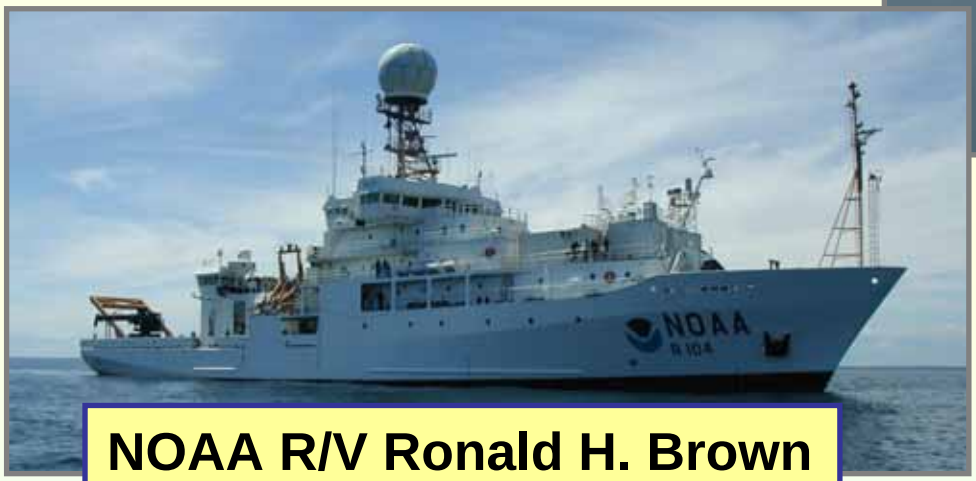
6 October 2008

http://esrl.noaa.gov/csd/calnex/scienceplan.pdf

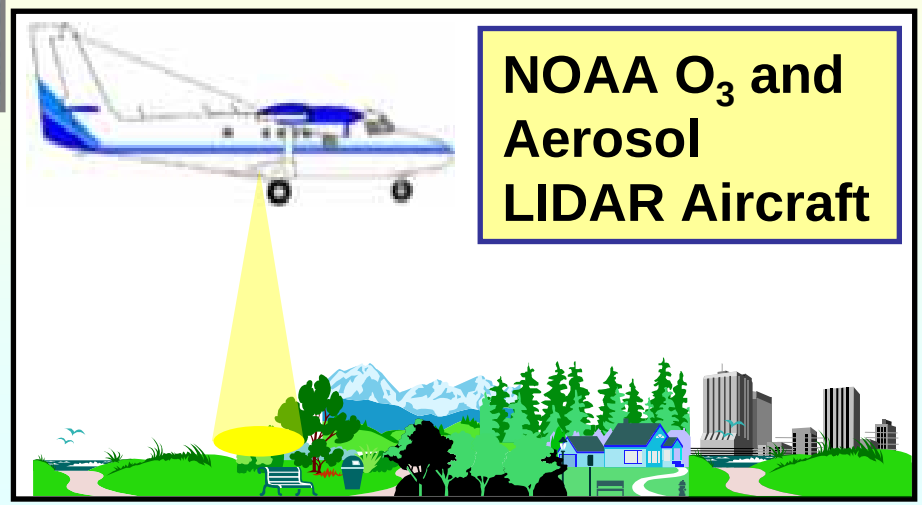
Technical Oversight Committee effort to expand CalNex 2010 Field Study to the "Downwind WRAP Region"

- Early 2008 – TOC briefed on CARB/NOAA/CEC 2010 Field Study
- July 2008
  - WRAP staff meets with CARB on their goals for & needs from the Study
  - NOAA presents study design and analysis capabilities at WRAP Workshop on Regional Emissions & Air Quality Modeling Studies (**http://www.wrapair.org/forums/toc/meetings/080729m/WRAPCalNexPres.pdf**)
- January 2009 – TOC reviews WRAP white paper
  - (**http://www.wrapair.org/forums/toc/meetings/090108c/Draft_WRAP_Regional_Field_Study_White_Paper1_7_09.pdf**)
- March 31st – Included in WRAP 2010-11 Workplan as collaborative project
  - TOC members (Steve Arnold, David Jones, John Vimont, and Marc Pitchford) helping steer Study development
- Summer 2009 - hold Field Study organizational meeting for WRAP states, feds, and tribes

NOAA's Assets



NOAA R/V Ronald H. Brown



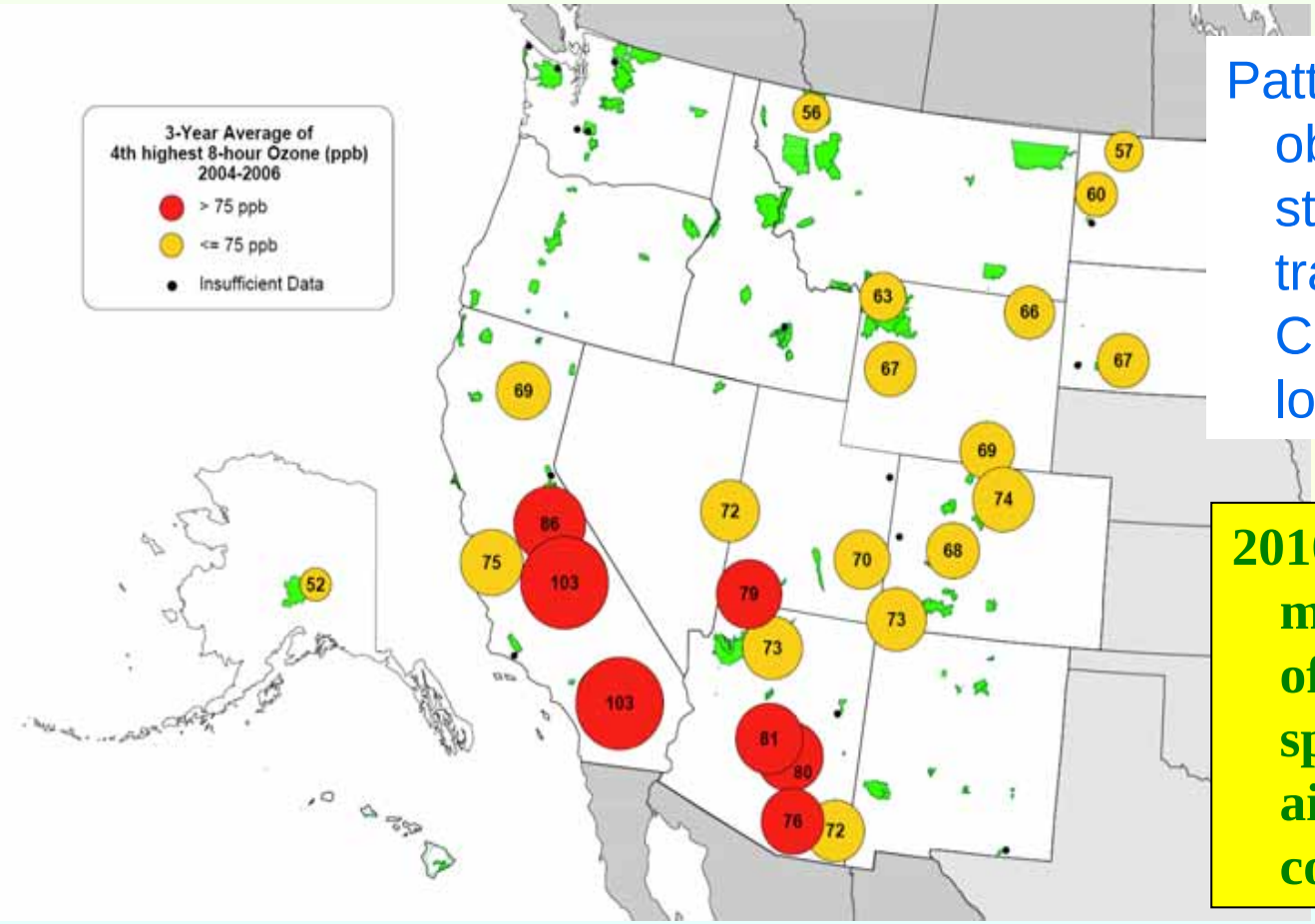
Collaborate with Others on fielding Ground-based Remote and In Situ Instrumentation, and Ozone Sondes

Transport and Meteorology

Understanding is critical for characterizing O_3 and PM levels

Transport of O_3, PM and precursors into, within, and out of California

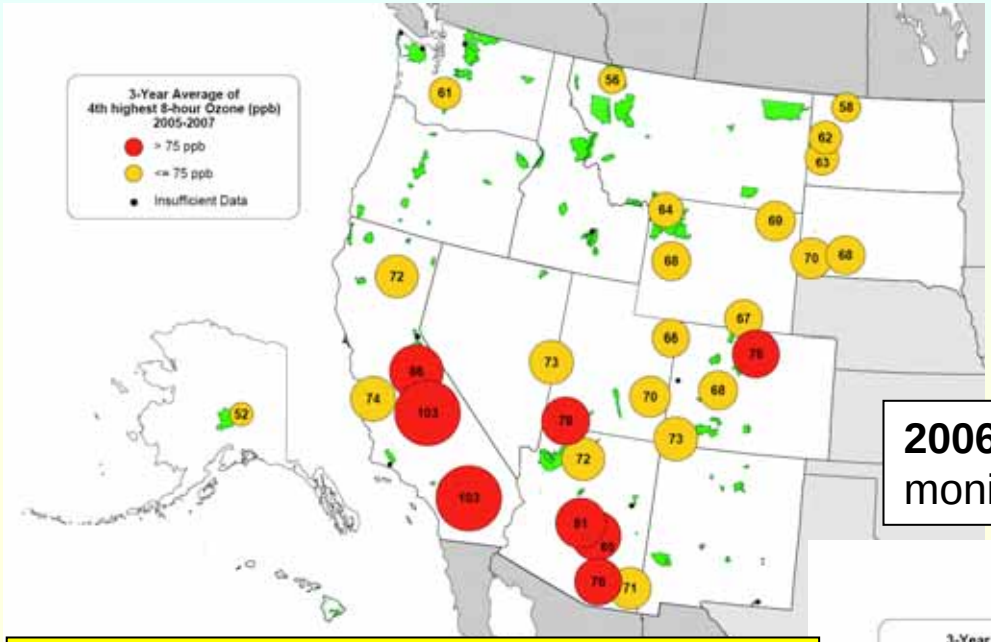
2004-06 3-year average of 4th highest daily monitored max 8-hr average at rural & Class I sites



Patterns of rural O_3 observed in downwind states, suggest that transport of Southern California emissions has long-range effects

2010 Study: Investigate mechanisms and effects of pollution transport on spatial scales from inter-air basin to inter-continental.

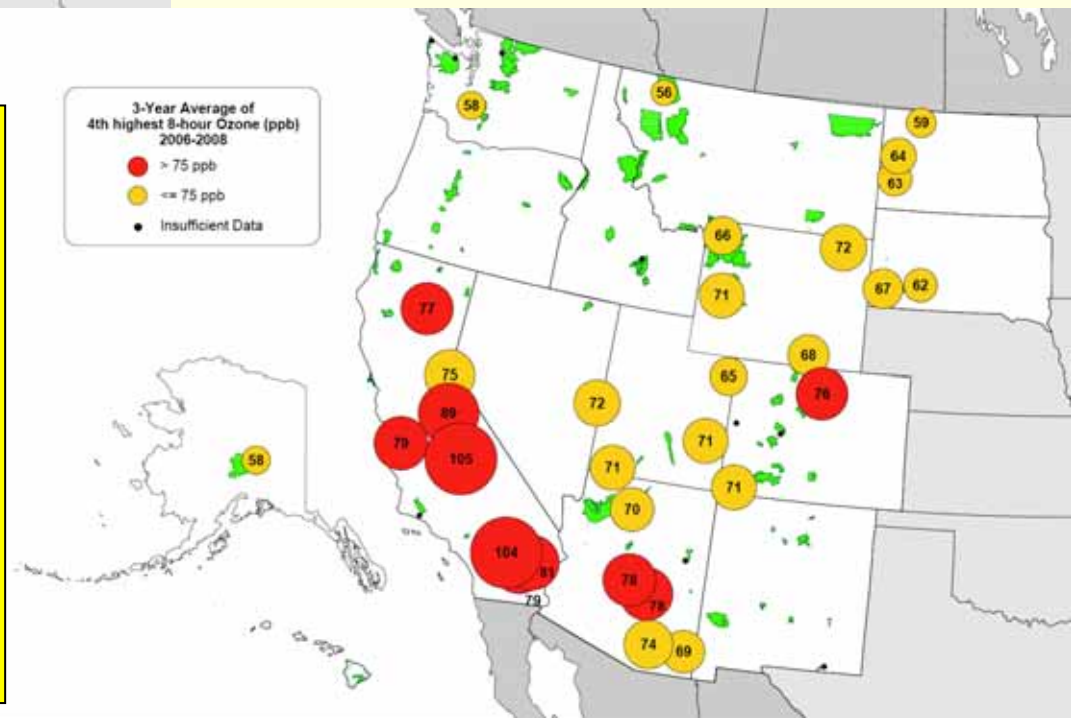
2005-07 3-year average of 4th highest daily monitored max 8-hr average at rural/Class I sites



Are impacts of regional O_3 & PM transport to rural & Class I sites caused by the same or similar sources & source regions?

How do intervening source areas affect O_3 & PM formation, titration, & transport?

2006-08 3-year average of 4th highest daily monitored max 8-hr average at rural/Class I sites



2010 Study:

- **Fill spatial gaps with monitors**
- **Add monitoring - meteorology, ozone & PM precursors**
- **Add 3-d measurements**
- **Leverage WRAP emissions tracking systems**
- **Test and improve model performance for O3 and PM**

Transport of O_3 into California

Marine O_3 has a spring maximum and a summer minimum at the surface,

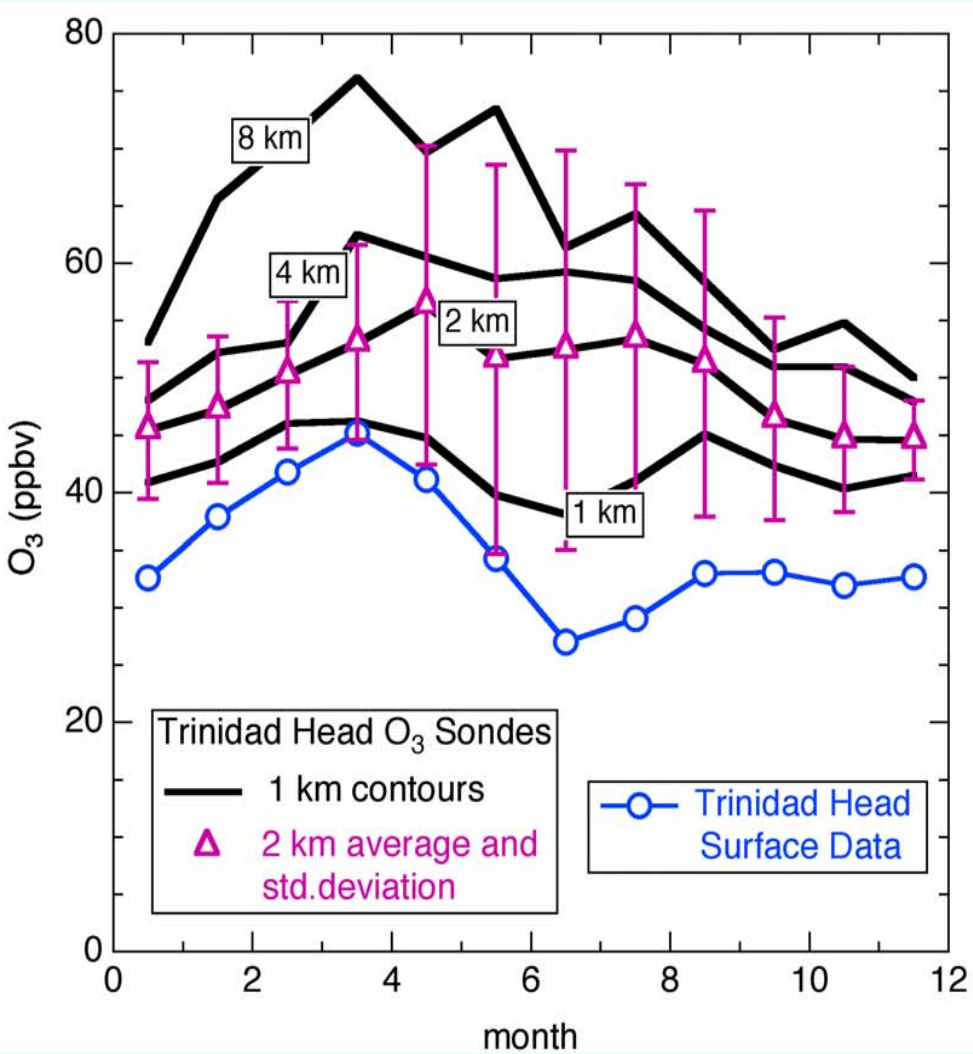
But a broad spring-summer maximum at 2 km altitude

Marine O_3 at 2 km altitude can violate 75 ppbv 8-hr average O_3 NAAQS

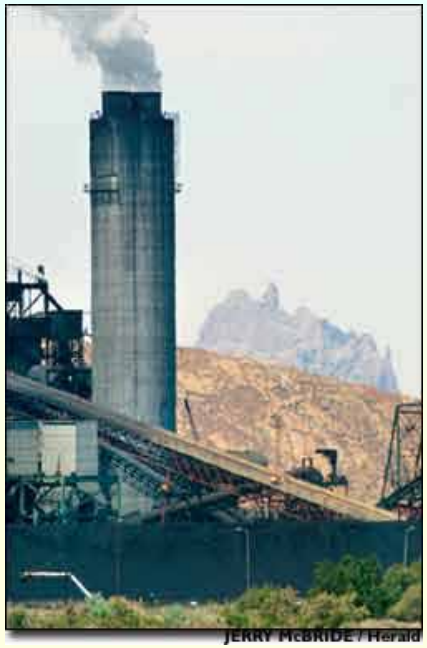
Correlations indicate that air enters Central Valley from 1 to 2.5 km altitude

High marine O_3 from aloft makes substantial (maybe dominant, maybe total) contribution to inland rural exceedances.

How does it evolve and mix to the surface?



Case Study: NO_x Emissions from Western US Power Plants and Cities



Use discrete satellite signals in Western US to evaluate NO_x emissions from individual power plants and urban areas

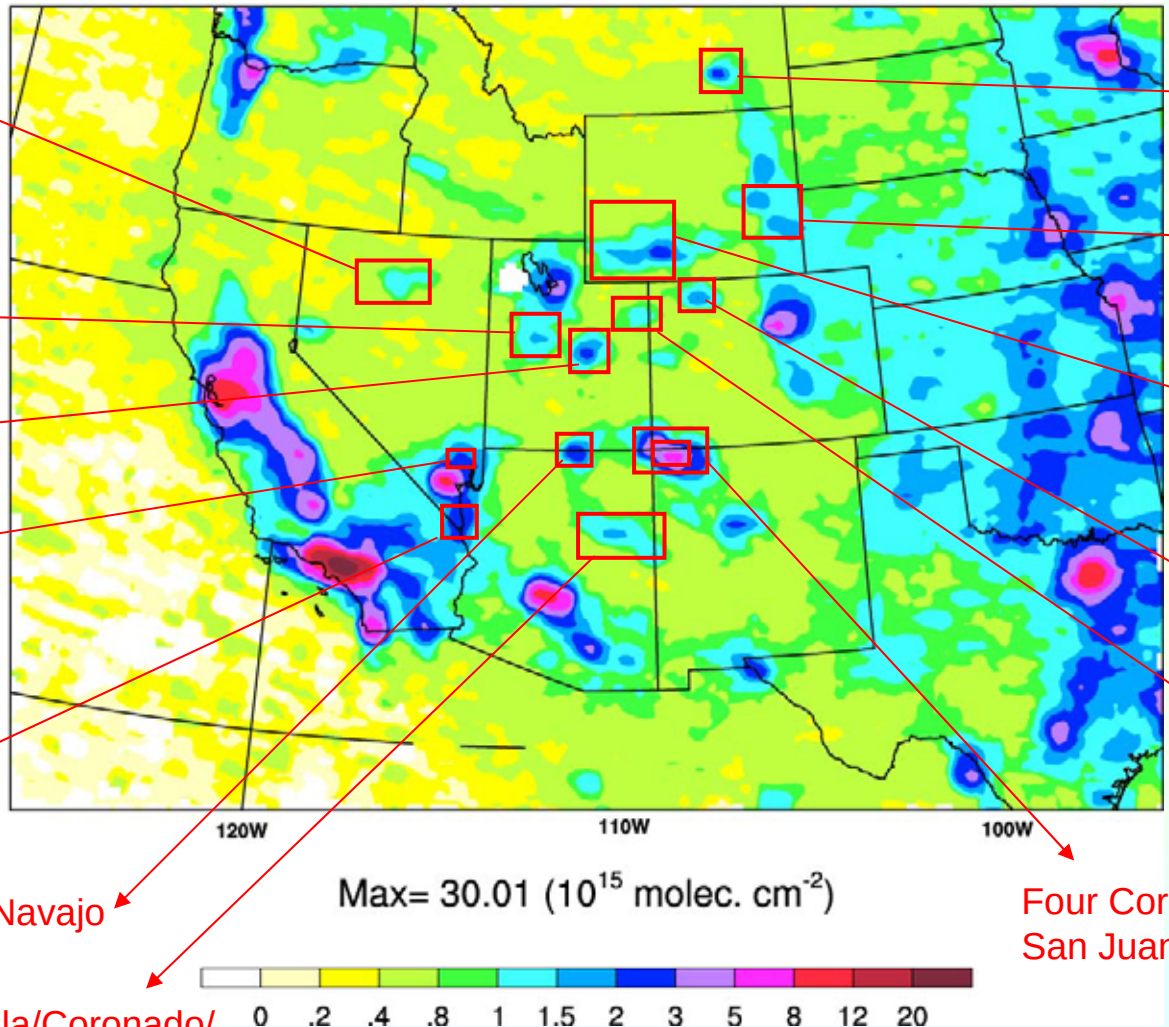
- Steady, well-known power plant emissions
  - "Calibrate" satellite and model algorithms
- Rapidly growing urban areas with lots of motor vehicles
  - How well are mobile source NO_x emissions understood?
  - Are overall NO_x emissions declining?

S.-W. Kim et al., manuscript to be submitted (2008)

Kim, Frost et al.

NO_x Emissions from Western US Power Plants

- *Isolated plants have discrete signatures in satellite retrievals*
- *Power plant emissions are measured continuously at each stack*
- *Currently no NO_x pollution controls on large coal-burning plants*
- ➢ *"Calibration" for satellite-model comparison*



North Valmy

Intermountain

Hunter / Huntington

Reid Gardener

Mohave

Navajo

Cholla/Coronado/ Springerville

Colstrip

Dave Johnston/ Laramie River

Jim Bridger/ Naughton

Craig/Hayden

Bonanza

Four Corners/ San Juan

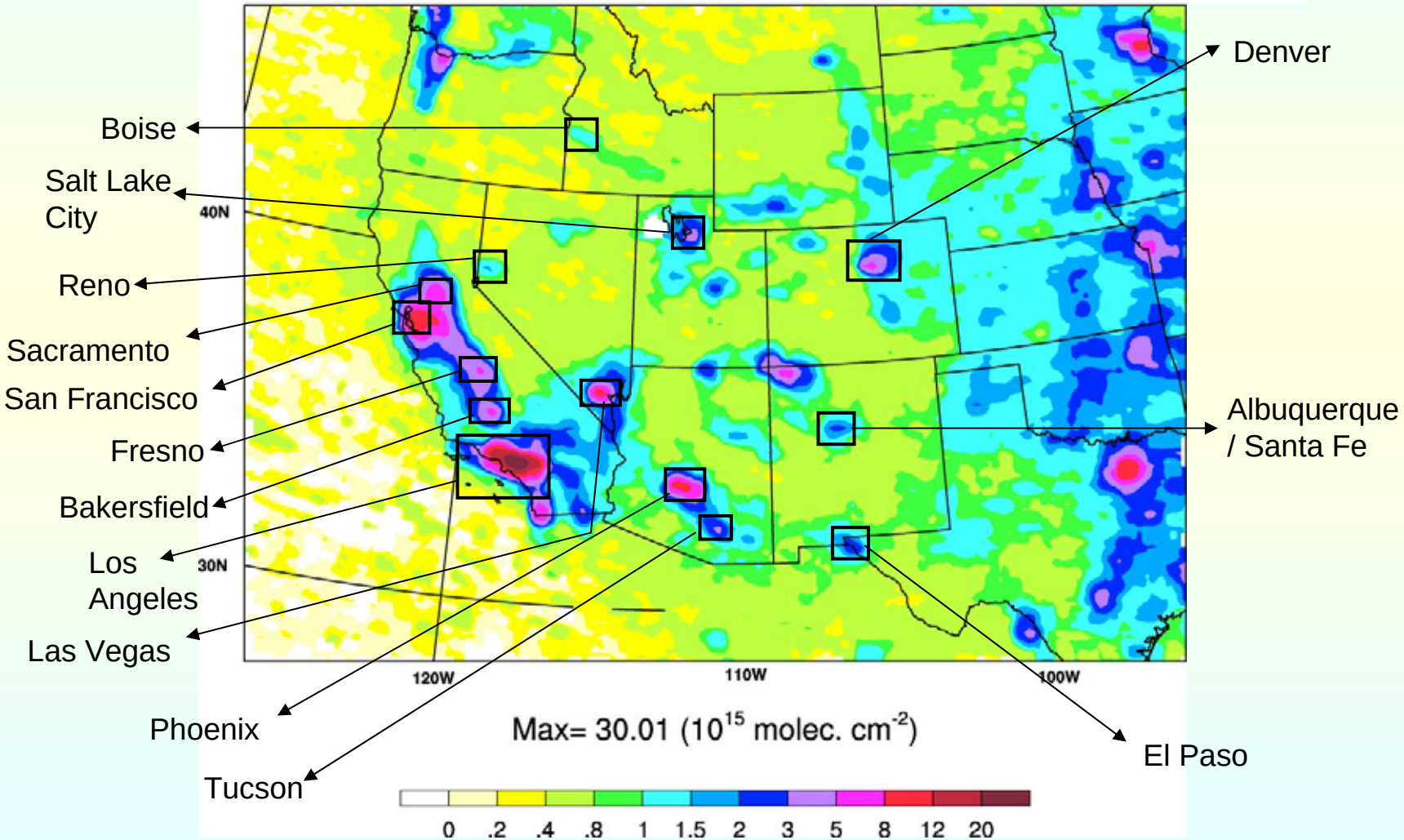
SCIAMACHY, Summer 2005

Kim, Frost et al.

NO_x Emissions from Western US Urban Areas

Build on satellite-model comparisons for power plants

➢*Evaluate urban area emission inventories and monitor changes*



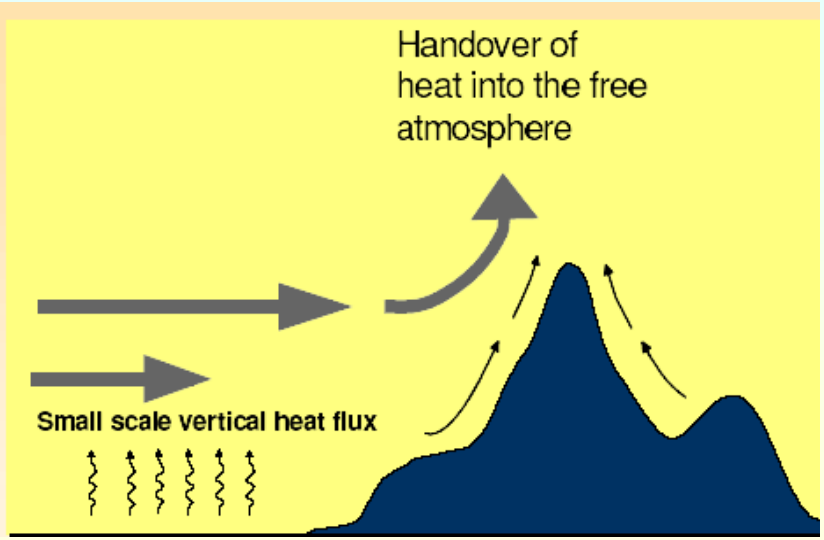
SCIAMACHY, Summer 2005

Kim, Frost et al.

Transport of pollution downwind from California

Marine O_3 is transported further downwind. How does it evolve and mix to the surface?

California O_3, PM and precursors are added to marine inflow. How does this pollution escape from California and mix to the surface downwind?



4 Questions for CalNex 2010:

Is transport out of California slow, relatively constant leakage, or intermittent, rapid surges?

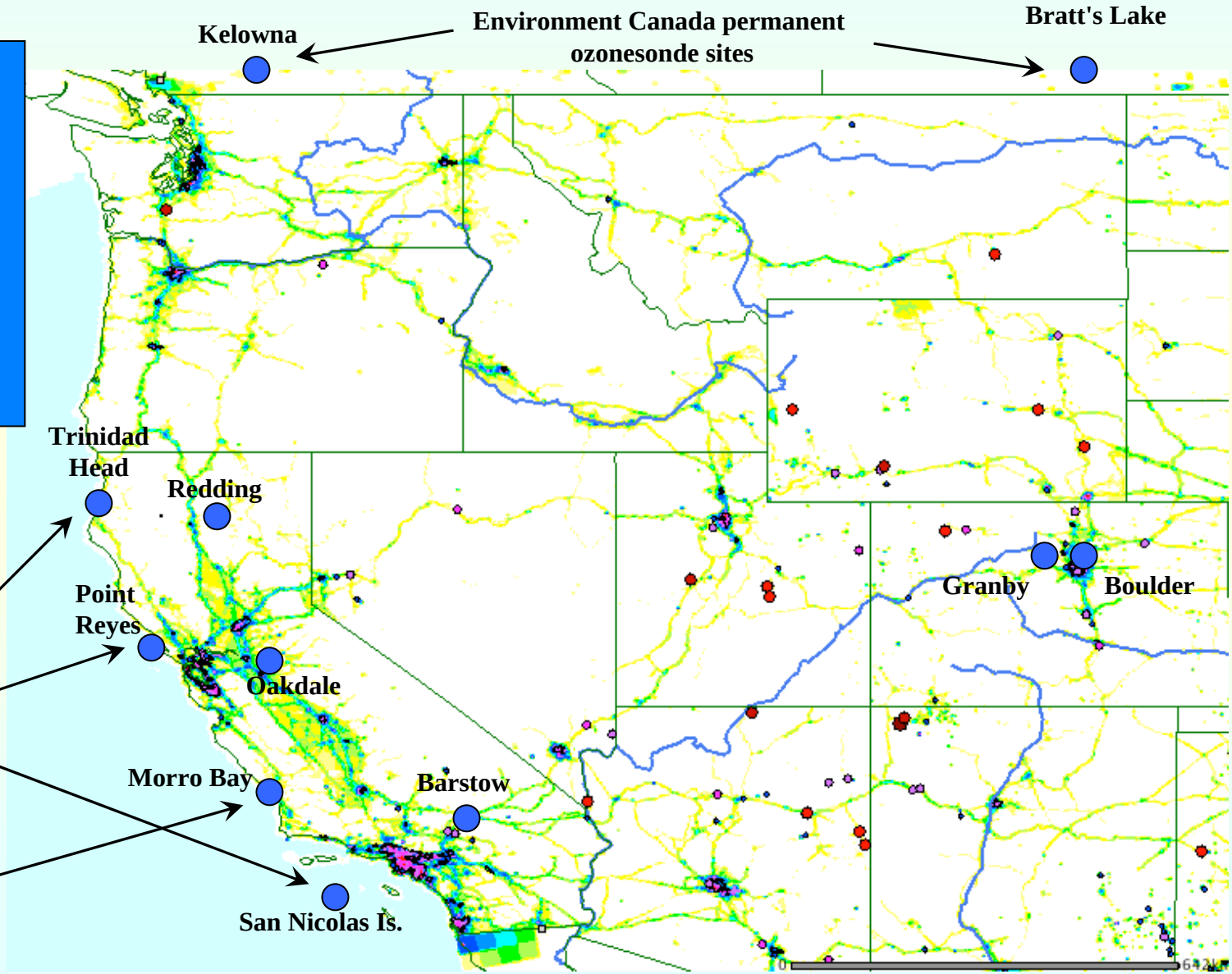
Do the Sierras and other mountain ranges represent transport barriers, or a transport mechanism?

Do California emissions leak around the mountains through lower elevations?

Can California emissions be directly observed at surface sites in or aloft over downwind states?

A Network of O_3 sondes combined with aircraft could greatly help to answer these questions

Planned CalNex O_3 sonde network, additional sites would be desirable



2010 Field Study Contacts

David Parrish

NOAA/ESRL/Chemical Sciences Division
303-497-5274

David.D.Parrish@noaa.gov

Tom Moore

WRAP

970-491-8837

mooret@cira.colostate.edu

Rationale for this suggested network configuration

Trinidad Head: A background site, where sondes are already launched, and upwind of the ozone non-attainment region of northern California.

Point Reyes: A background site upwind of Sacramento and San Francisco. A portable ground station would have to be deployed here.

San Nicolas Island: A background site upwind of LA and San Diego. The Navy has indicated that they would be interested in operating this site and already have the necessary equipment plus 24 sondes. NOAA could supplement this site with additional sondes.

Morro Bay: A background site roughly halfway between Point Reyes and San Nicolas Island, upwind of the southern San Joaquin Valley. Portable ground station required.

Barstow: Downwind of LA. A portable ground station would be required.

Oakdale: A small town downwind of San Francisco and Point Reyes and upwind of Yosemite National Park where ozone has been increasing. A portable ground station would be required. No information on a launch facility, it's just a town in the right place.

Redding: Downwind of Trinidad Head and within an ozone nonattainment region even though it has a fairly low population. Upwind of Mt. Lassen ozone monitor. Portable ground station required.

Boulder: There has been some interest from western air quality managers in participating in CALNEX and looking at downwind air pollution. Boulder would be an easy site for monitoring downwind ozone. Has an existing launch facility.

Granby: This site is directly upwind of Boulder but west of the Continental Divide, so it's as close as you can get to the Front Range and still measure upwind ozone. Portable ground station required.

Kelowna and Bratt's Lake: If the Canadians are interested in looking at long range ozone transport to eastern Canada then these permanent sites could be activated.