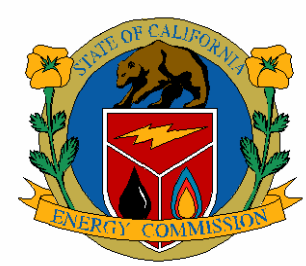


# Translating Climate Change Research Results into Resource Plans at the State Level

Guido Franco  
Public Interest Energy Research (PIER) Program  
California Energy Commission

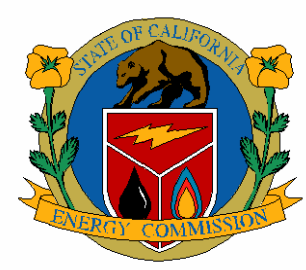
CCSP Workshop  
Climate Science in Support of Decision Making  
Breakout - Energy Systems Management: Application of Climate Science  
November 15, 2005



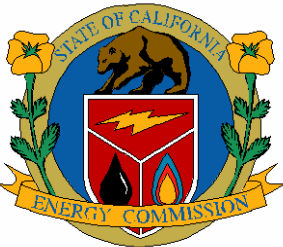


# Outline

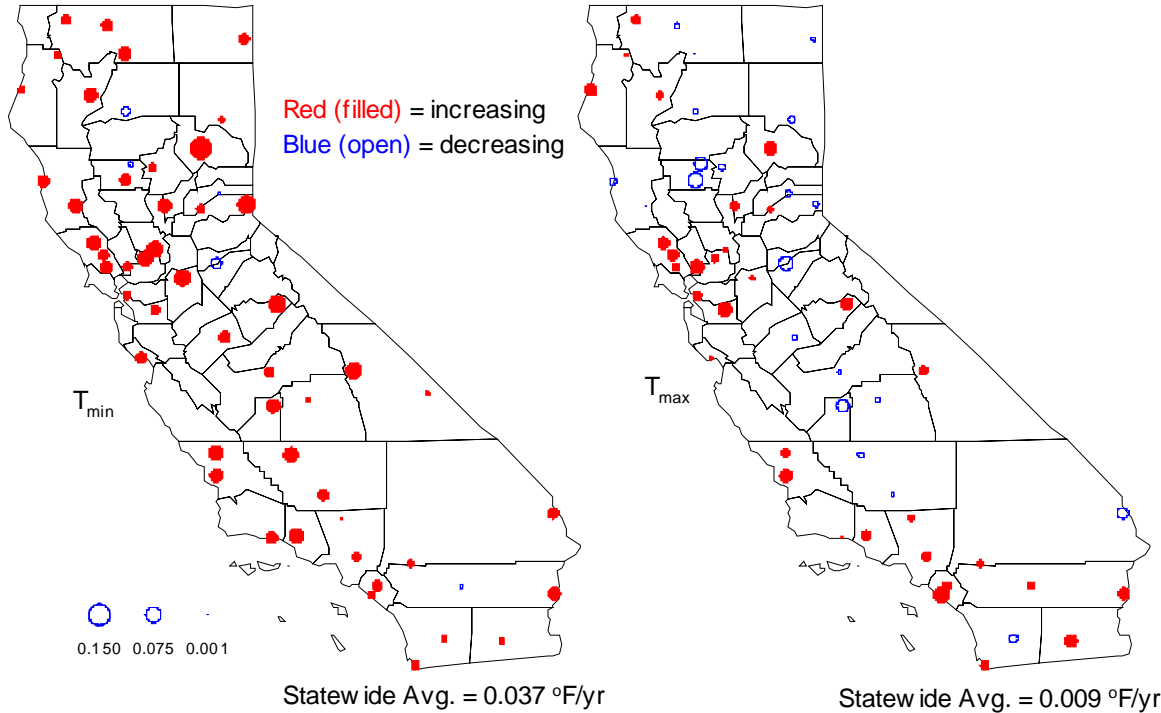
- A Changing Climate: some examples
- State of California's Responses
- Adaptation to Climate Variability
  - Energy and Temperature+
  - Management of Water Reservoirs
  - Aerosols and Precipitation
- CC Research and Long-term Plans in California



# A Changing Climate: Some Examples

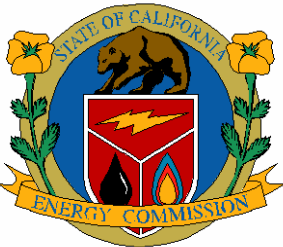


# Temperature Trends in California

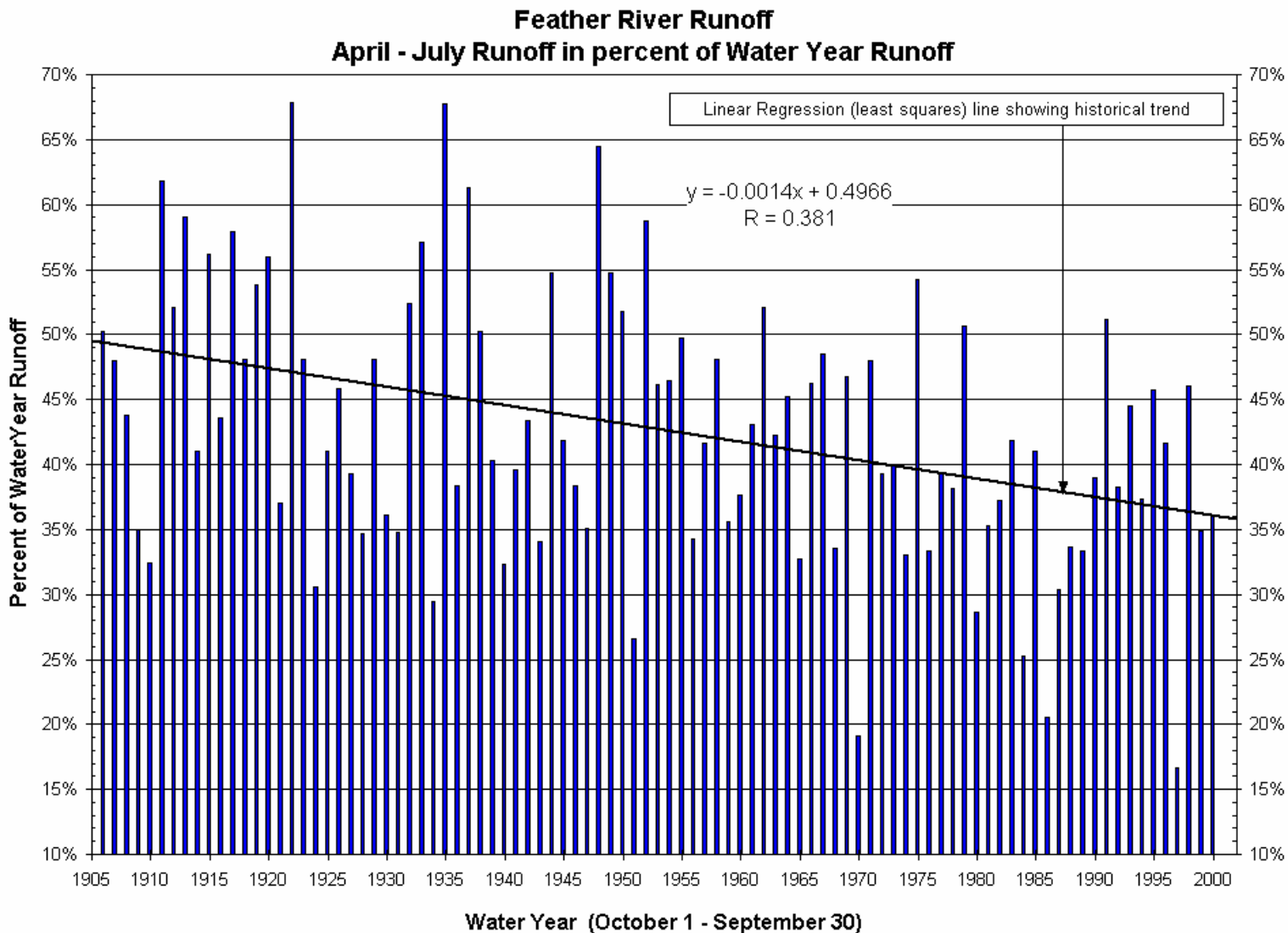


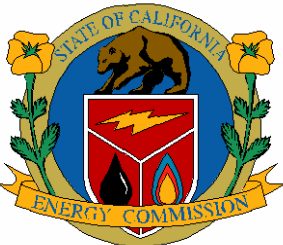
Data Source: U.S Historical Climatology Network

## Summer

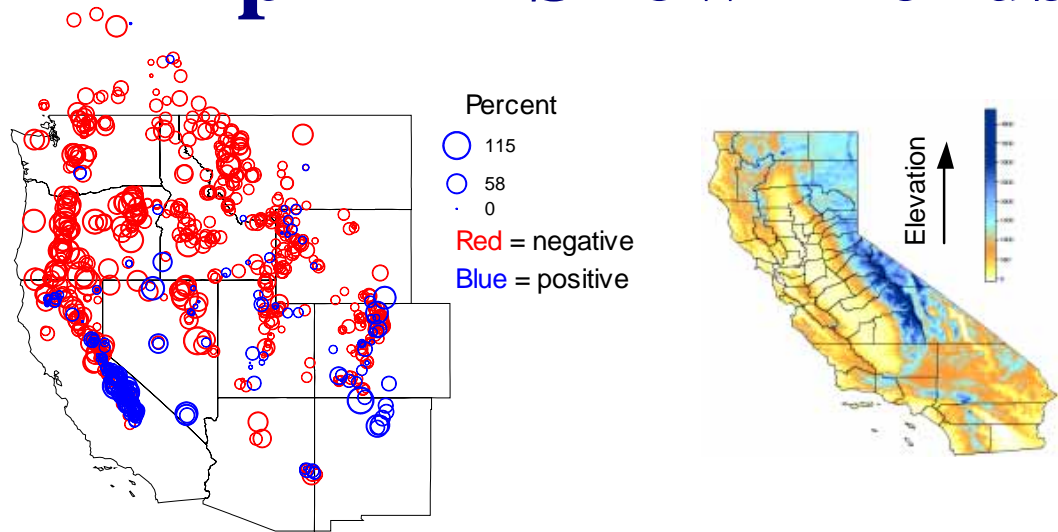


# More Runoff Early in the Year

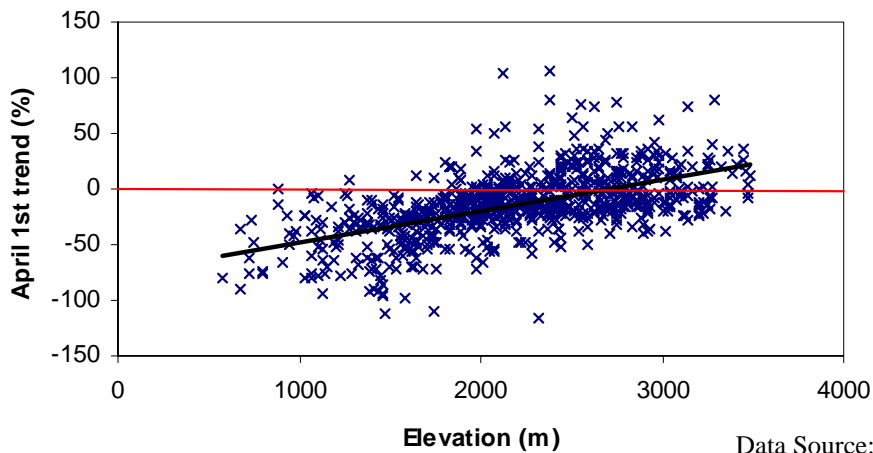




# April 1<sup>st</sup> Snow Trends

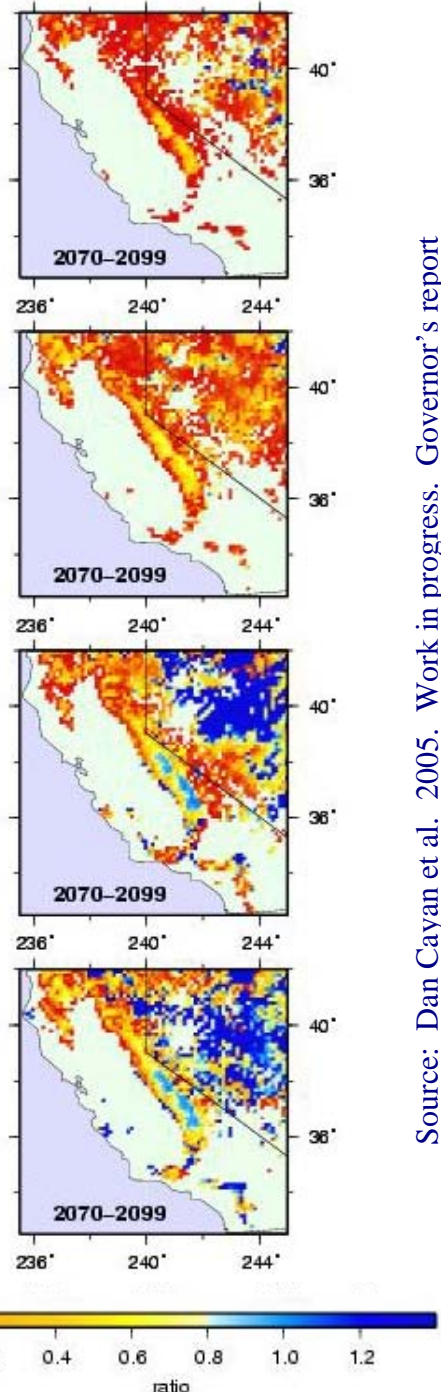


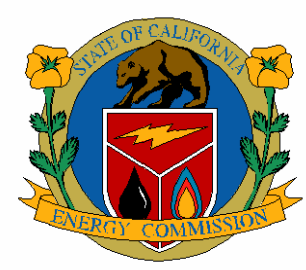
Adapted from Mote et al. 2005



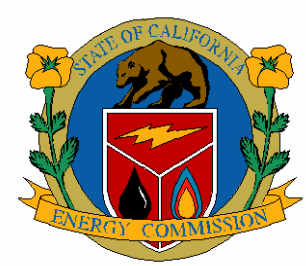
Data Source: Mote 2005

# Projections





# California's Responses to this Threat



# State of California's Responses

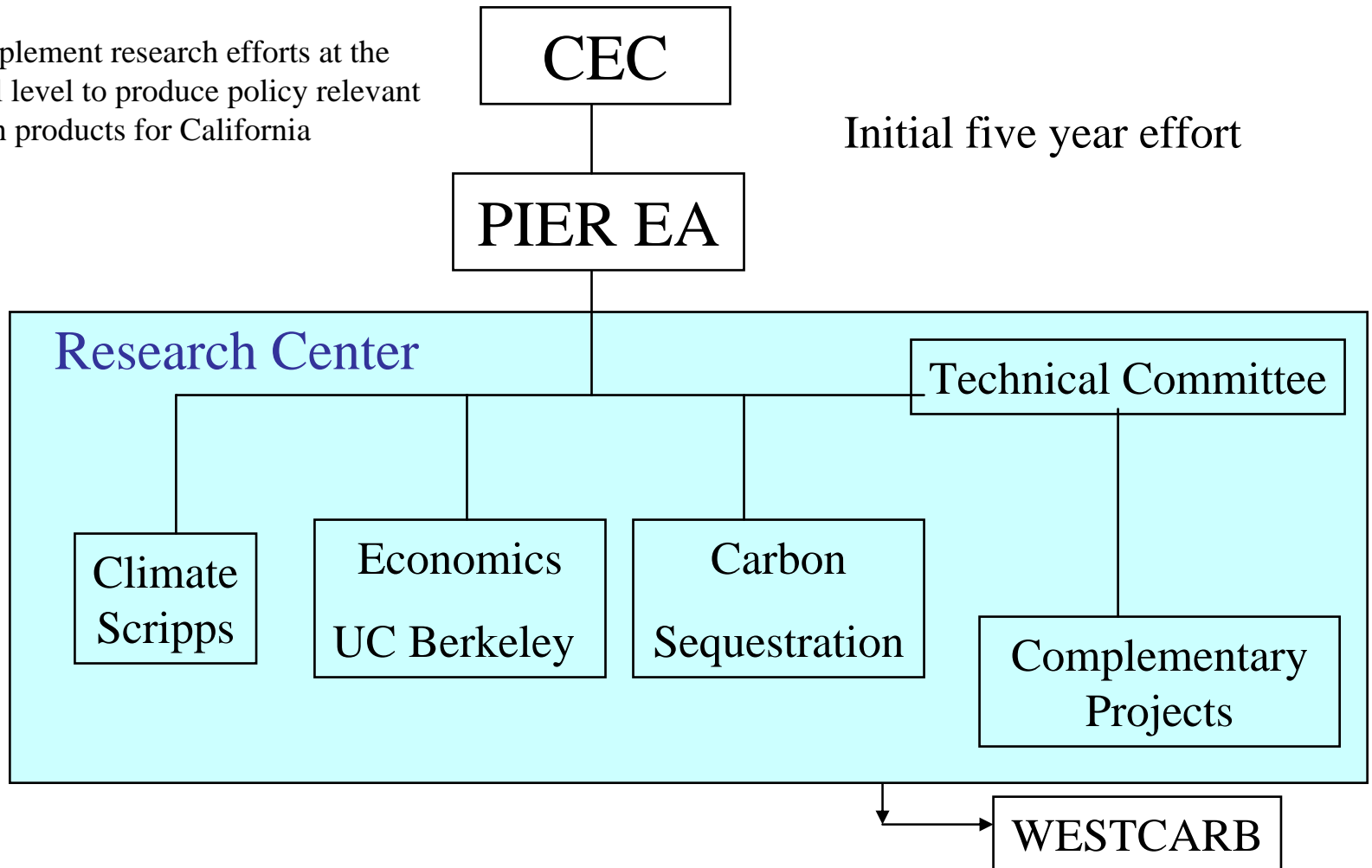
- Resource Managers are extremely concerned about observed trends and by the climatic/hydrologic projections
- Policy Responses
  - Adoption of GHG standards for motor vehicles
  - June 1<sup>st</sup> 2005 Executive Order
- Research Responses
  - Creation of a state-sponsored research program

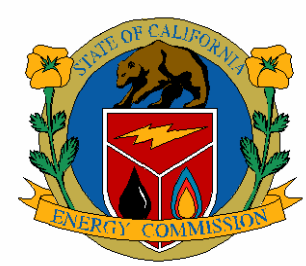


# CA Climate Change Center

To complement research efforts at the national level to produce policy relevant research products for California

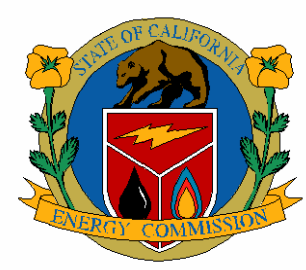
Initial five year effort



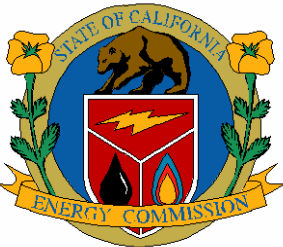


# Relevant Partners: partial list

- California Resources Agency
- California Environmental Protection Agency
- California Department of Water Resources
- California Department of Forestry and Fire Protection
- Air Resources Board
- California Department of Food and Agriculture
- California Department of Fish and Game
- Kearney Foundation
- California Coastal Commission
- CA Climate Action Registry
- Federal Agencies: NOAA, DOE

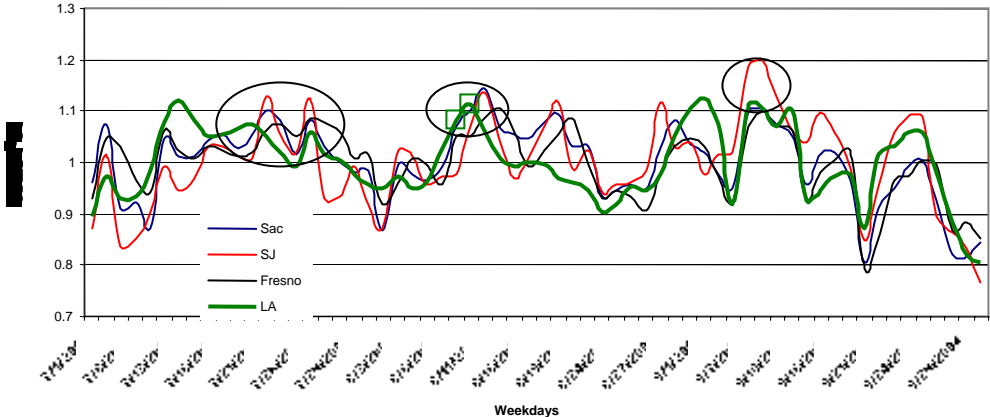


# **Adaptation to Climate Variability as a Tool to Learn How to Adapt to Climate Change: some examples**

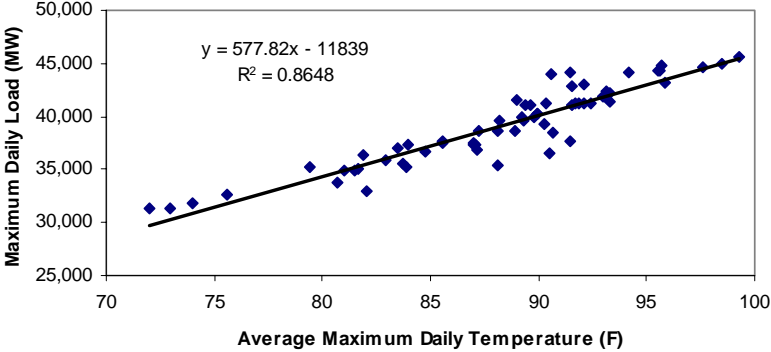
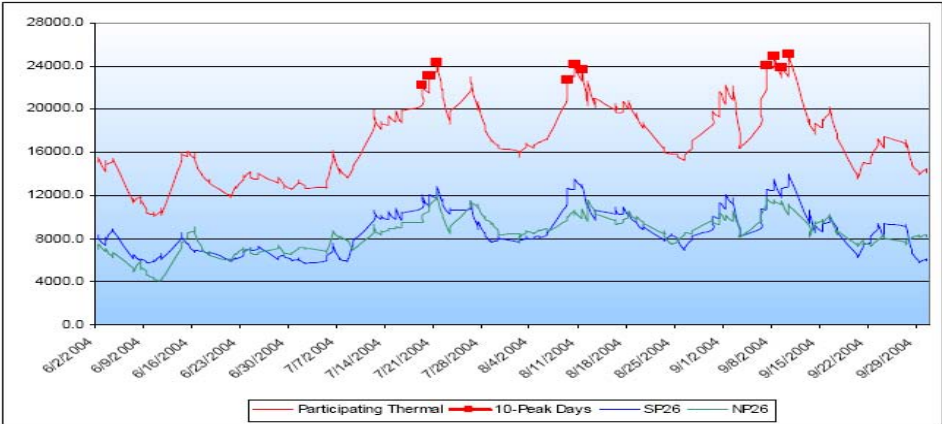


# Energy and Temperature

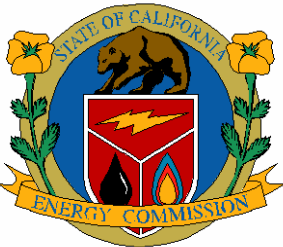
Daily Max Temperatures/Avg Temp for 2004 (July-September)



Participating Thermal Generation - 2004 Summer Months  
Weekdays 2:00 p.m. through 6:00 p.m.

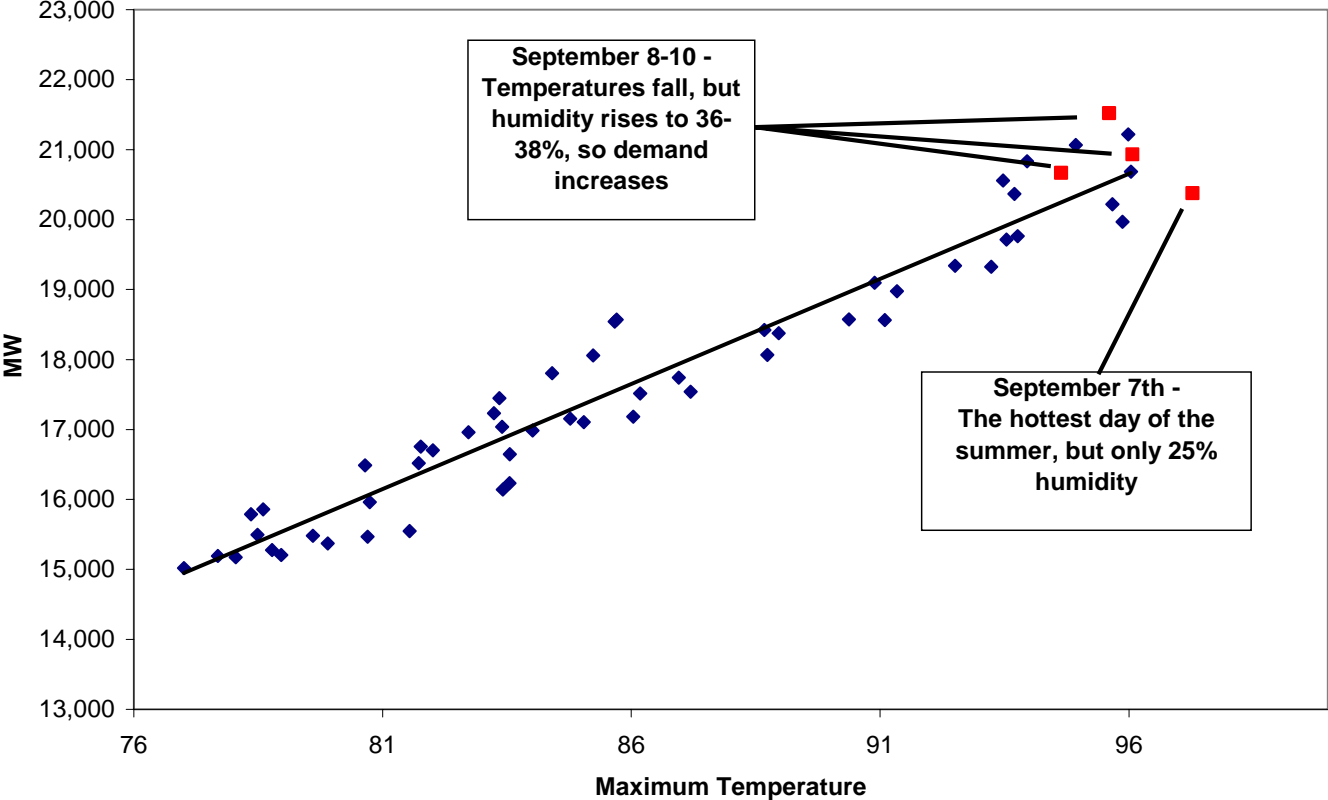


Source: 2005 Summer Operations Assessment  
California ISO

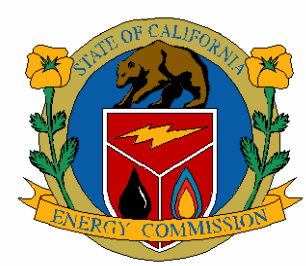


# But it is not only Temperature that Matters

Peak Loads for Southern California Edison in Summer 2004

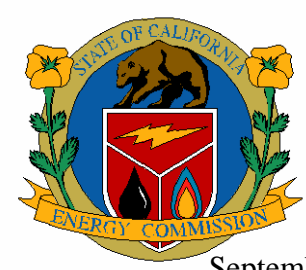


Source: David Vidaver. California Energy Commission



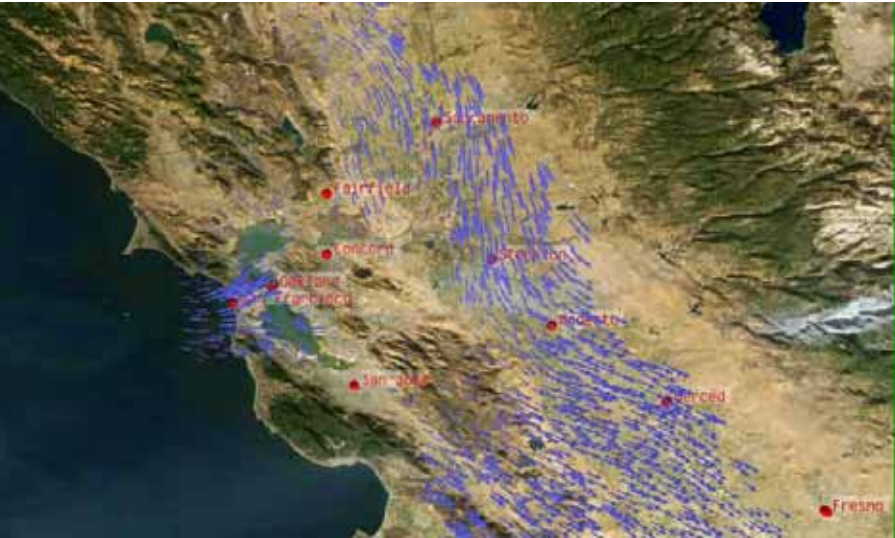
# CalEnergy Project

- Funded by NOAA with support from the California Climate Change Center
- Strong participation of Stakeholders



September 25, 2002

# CalEnergy: Delta Breeze



September 26, 2002



Sep 25, 2002: No delta breeze; winds carrying hot air down California Central valley. Power consumption high.

Sep 26, 2002: Delta breeze starts up; power consumption drops >500 MW compared to the day before

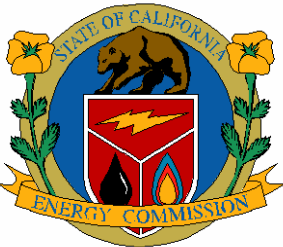
Under forecast on May 28, 2003 of 4,700 MW

Outcome: Scripps developed a relatively simple statistical technique that outperforms dynamic weather models

## Non Delta Breeze Forecast Accuracy

	Scripps	NWS GFS MOS
Tomorrow	70%	67%
Today	97%	73%

Sources: David Pierce et al. Scripps Inst. Of Oceanography  
 Guessing Mother Nature's Next Move. What can be done to improve  
 weather prediction and load forecast. Electric Utilities Fortnightly. August 2005.



# Summer CDD when PDO is above normal in spring



## CalEnergy Project

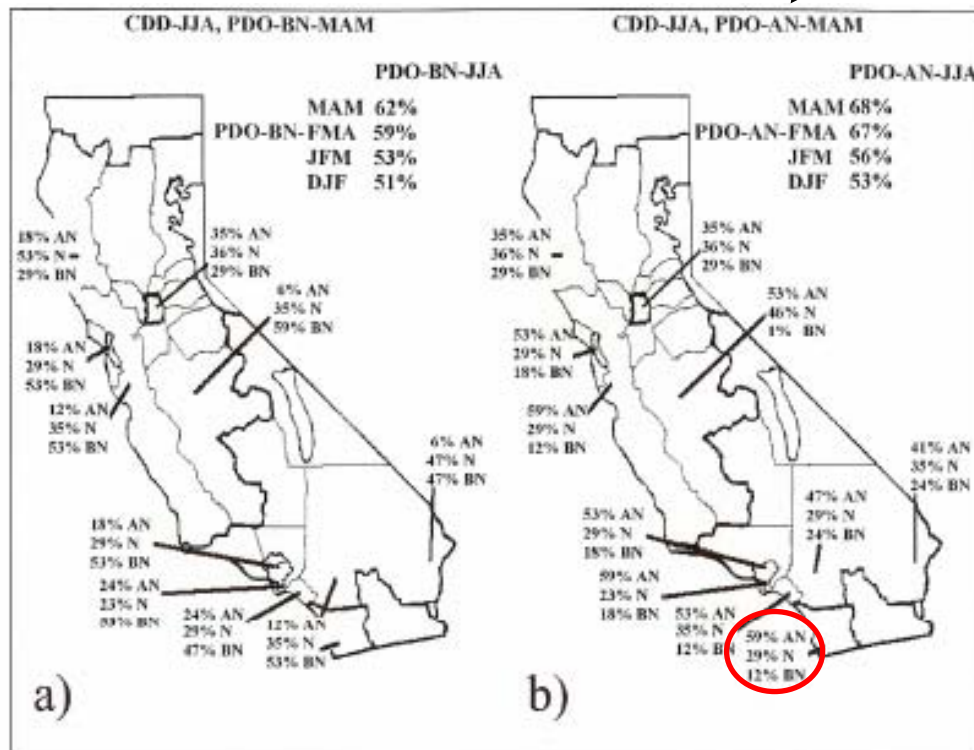
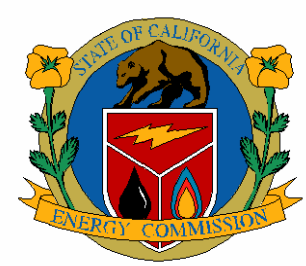


Fig. 3. Map of conditional JJA-CDD probabilities for a MAM-PDO scenario (a) below normal and (b) above normal. These values are expressed as percentages and are for the stations that the California Energy Commission has already defined as representative of the different California climate zones (see article). The conditional probabilities between persistent previous winter-spring seasons and summer PDO are also included in the upper right. Percentage values greater (lower) than 45, 51, and 57 (24, 18, and 13) are significant at the 0.10, 0.05, and 0.01 levels, respectively for high (low) count bins in the contingency analysis.

Source: A Method for Prediction of California Summer Air Surface Temperature. Alfaro et al. EOS. 21 December 2004

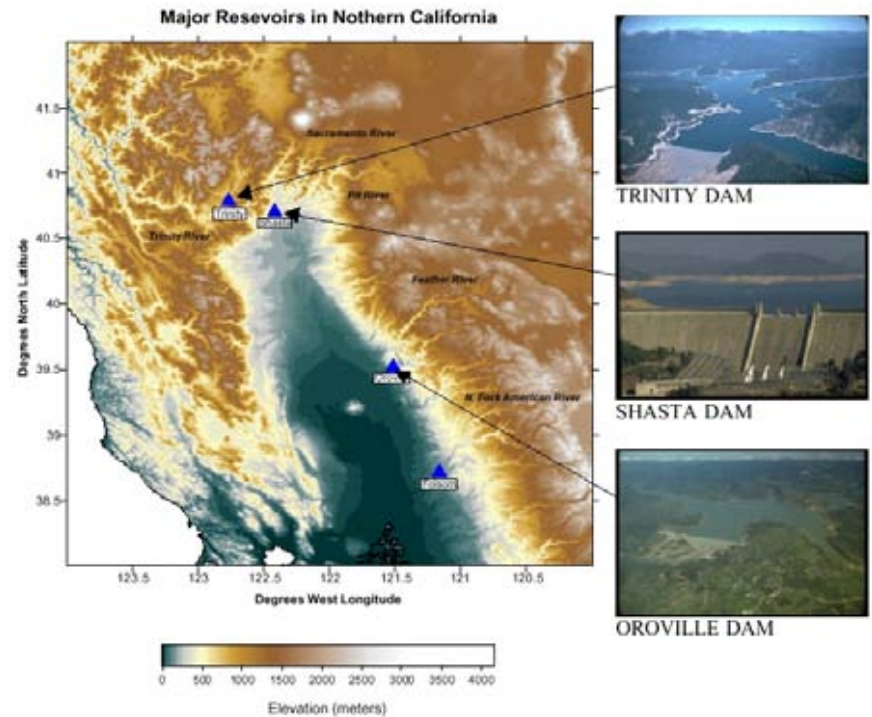
For more information about the CalEnergy Project, please visit the following site <http://cirrus.ucsd.edu/~pierce/calenergy/>



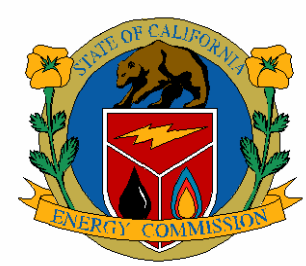


# Management of Water Reservoirs: INFORM

- Funded by NOAA, CALFED, PIER/CEC
- Demonstration of the use of modern probabilistic forecasts and decision tools
- Preliminary results suggest that our ability to cope with climate change would be substantially enhanced

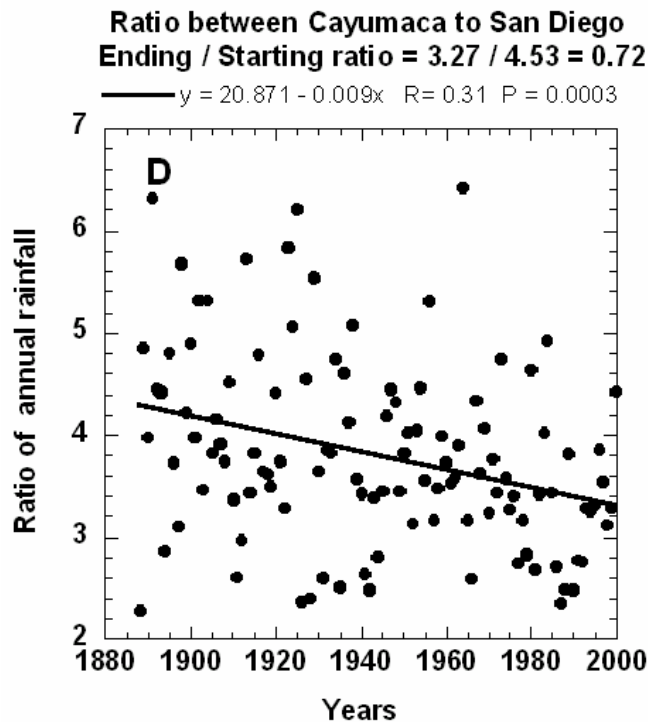


Source: K. Georgakakos. Hydrologic Research Center



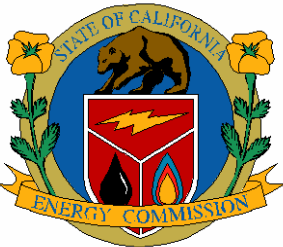
# Aerosols and Precipitation

- Funded by PIER
- Prof. D. Rosenfeld and Dr. W. Woodley

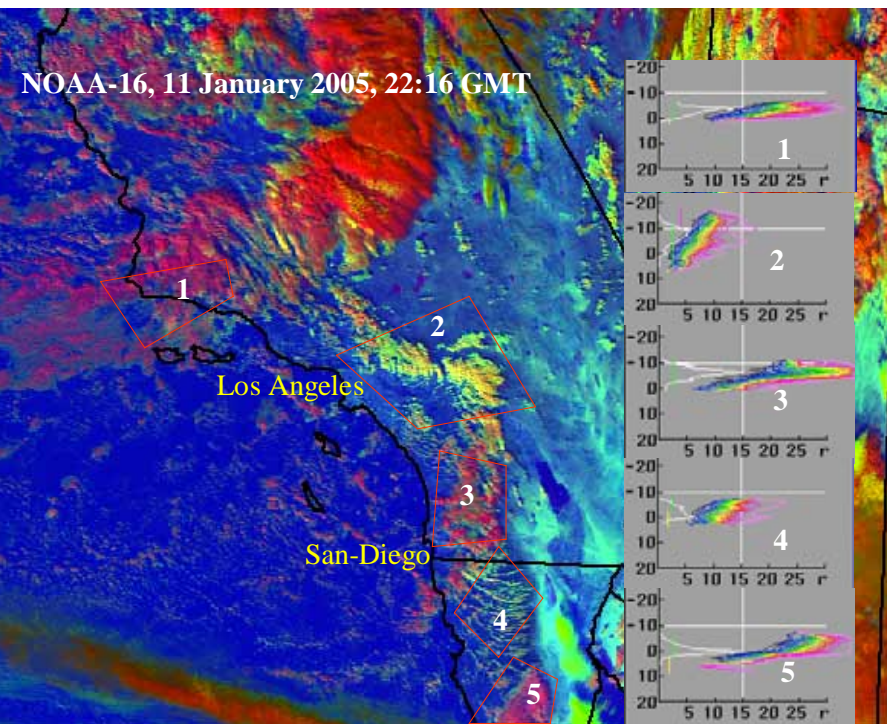


Preliminary studies suggest that aerosols are inhibiting precipitation levels in the Sierra Nevada and other high elevations sites downwind of urban areas

Source: Rosenfeld et al. 2004



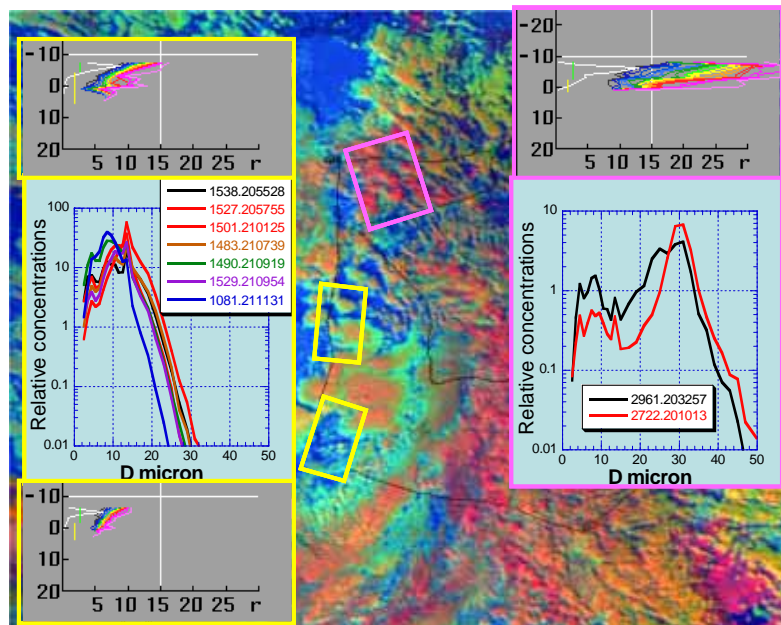
# Second Field Campaign in February/March 2006

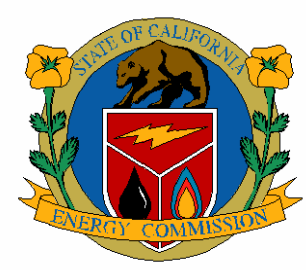


## Satellite Analyses

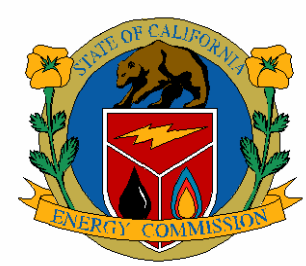
Source: On-going PIER Project  
Rosenfeld et al. 2005

## Research Aircraft February 2005 Field Campaign



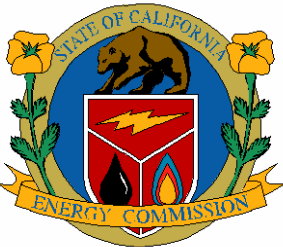


# **Climate Change Research and Long-Term Plans in California**



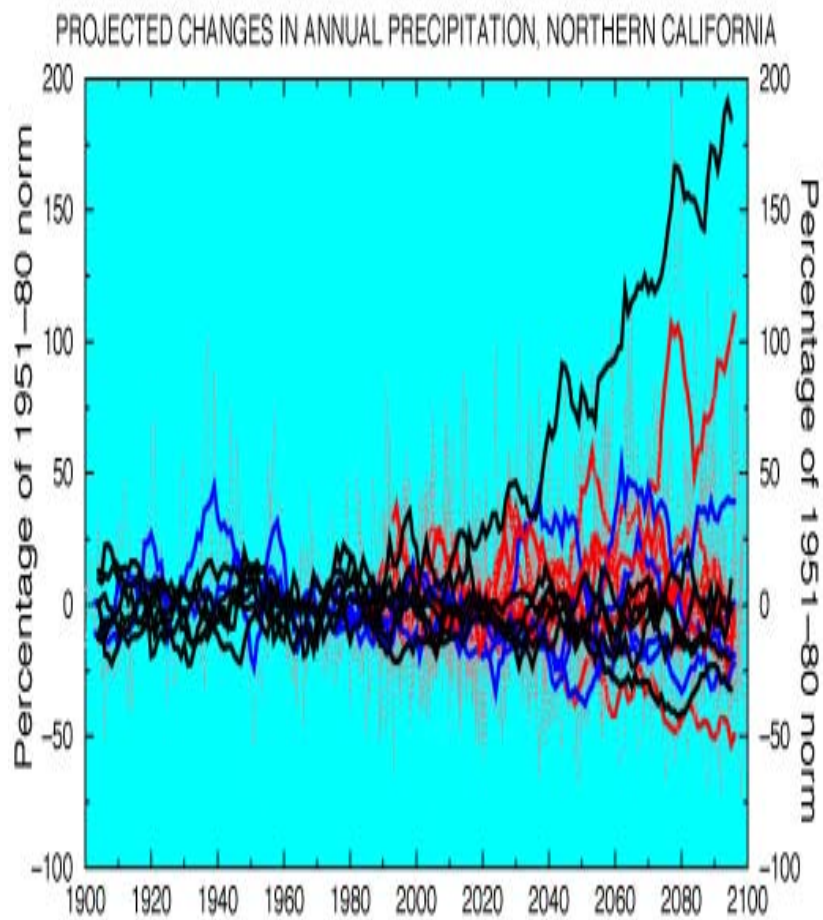
# CC research results are of direct relevance to long-term planning in California

- Examples: State Water Plan (2010);  
Integrated Energy Policy Report (2008)
- Technical staff from the relevant agencies are directly involved in the research projects to make sure we produce results that can be used directly in the preparation of long-term resource plans in California.



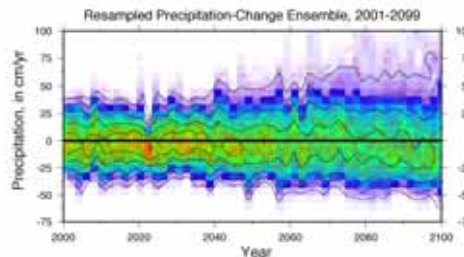
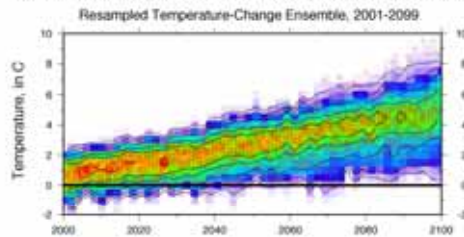
# Use of Common Climate Projections for California for Research and Planning

Heavy reliance on federal research efforts for global simulations and, perhaps, emission scenarios



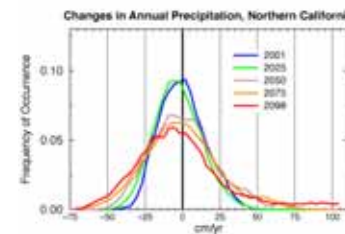
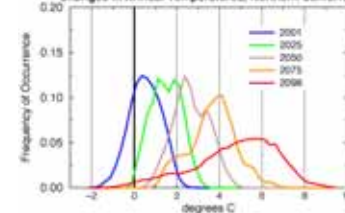
Source: M. Dettinger. Scripps.

IPCC/SRES Projections: JOINT Probabilities  
PRECIPITATION & TEMPERATURE CHANGES, NORTHERN CALIFORNIA

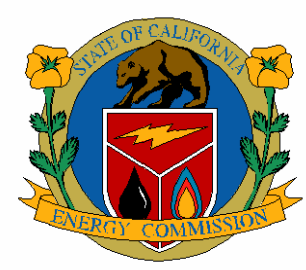


[Red dots, 18-member IPCC-ensemble projections; contours and shading, 20,000-member resampled probabilities; contours at 0.006, 0.0125, 0.025, 0.05, 0.075, 0.125, 0.175]

RESAMPLED PROBABILITY DISTRIBUTIONS  
(from 6 GCMs, 3 SCENARIOS)



Scenarios will be developed using statistical and dynamic downscaling methods (10 Km x 10 Km)



# Thank you!

Guido Franco

[gfranco@energy.state.ca.us](mailto:gfranco@energy.state.ca.us)

(916) 654 3940

For more information about our projects, please go to  
[http://www.climatechange.ca.gov/events/2005\\_conference/index.html](http://www.climatechange.ca.gov/events/2005_conference/index.html)  
and for PIER reports  
[http://www.climatechange.ca.gov/documents/pier\\_gcc\\_reports.html](http://www.climatechange.ca.gov/documents/pier_gcc_reports.html)