An Interagency Work Team's Plan for Assessing Risks of Climate Change on Management of California's Water Resources

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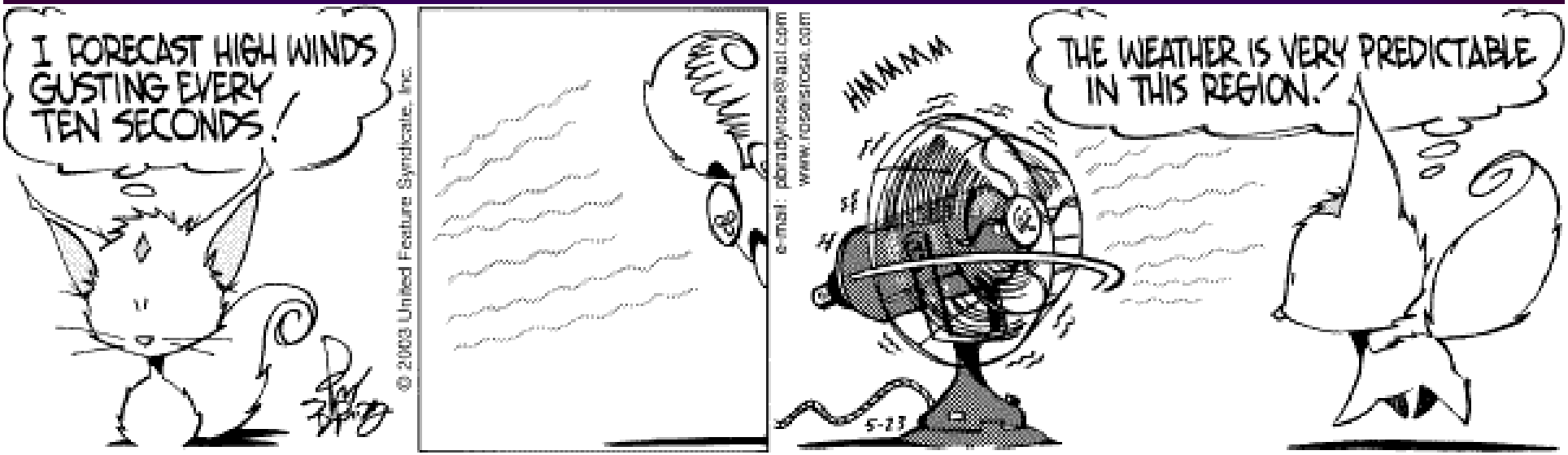
Federal Interagency Hydrologic Modeling Conference

April 5, 2006

Reno, NV

Modeling Support Branch
Bay Delta Office



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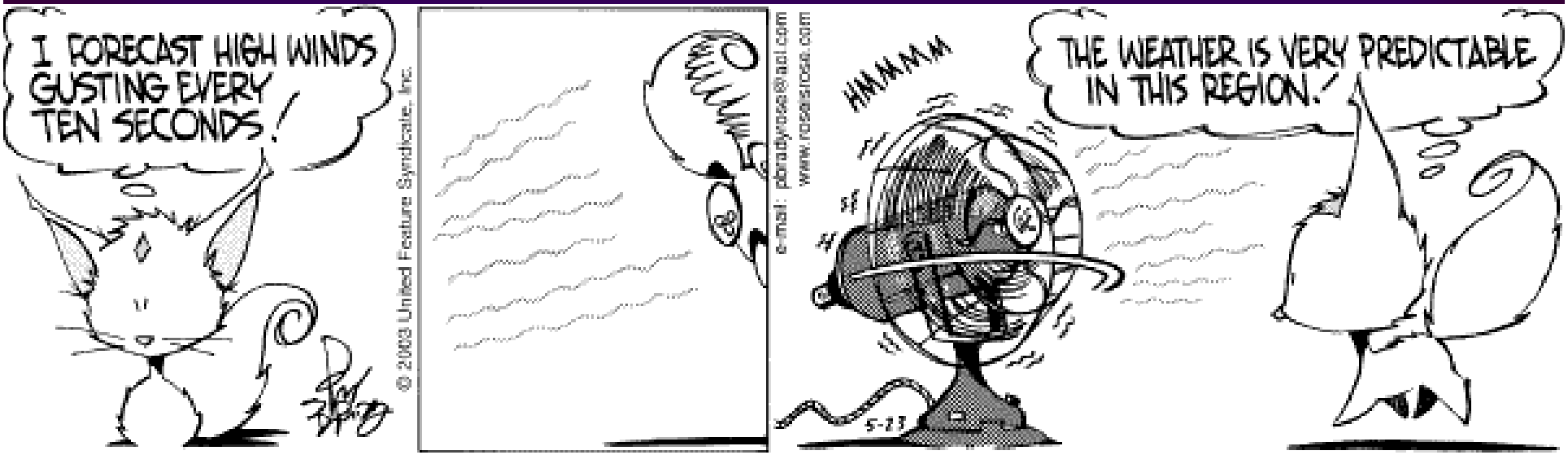

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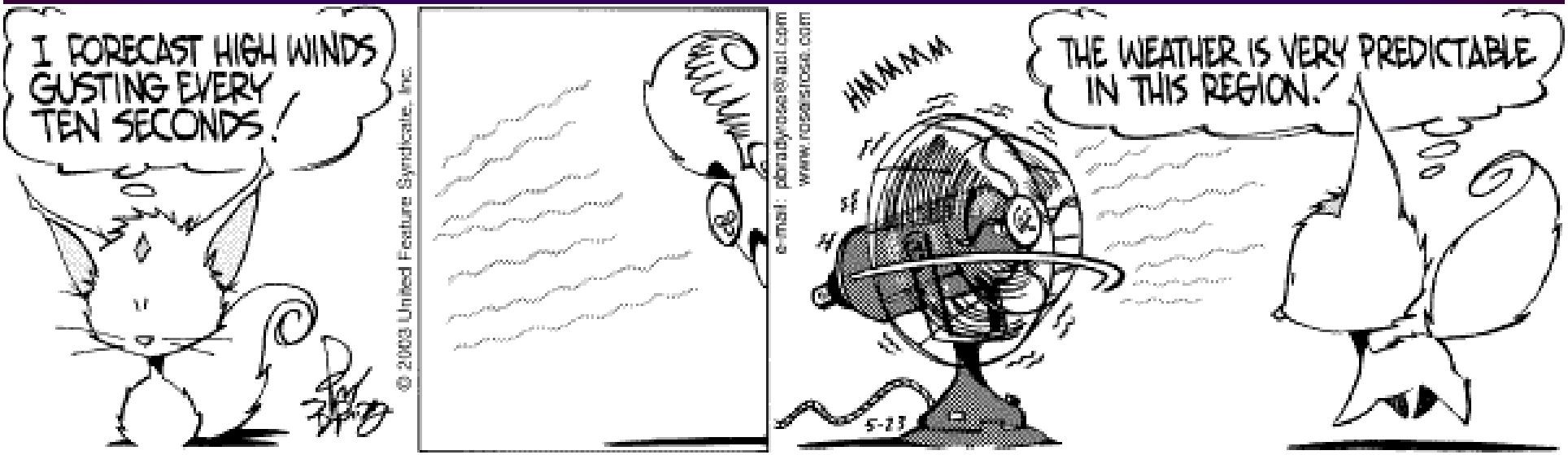
What might happen?



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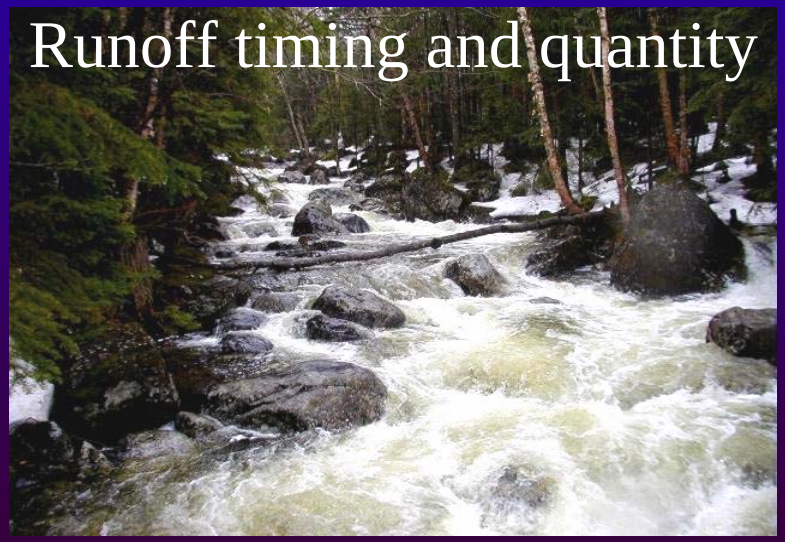
What might happen?

How likely is it to happen?

Potential Impacts of Climate Change



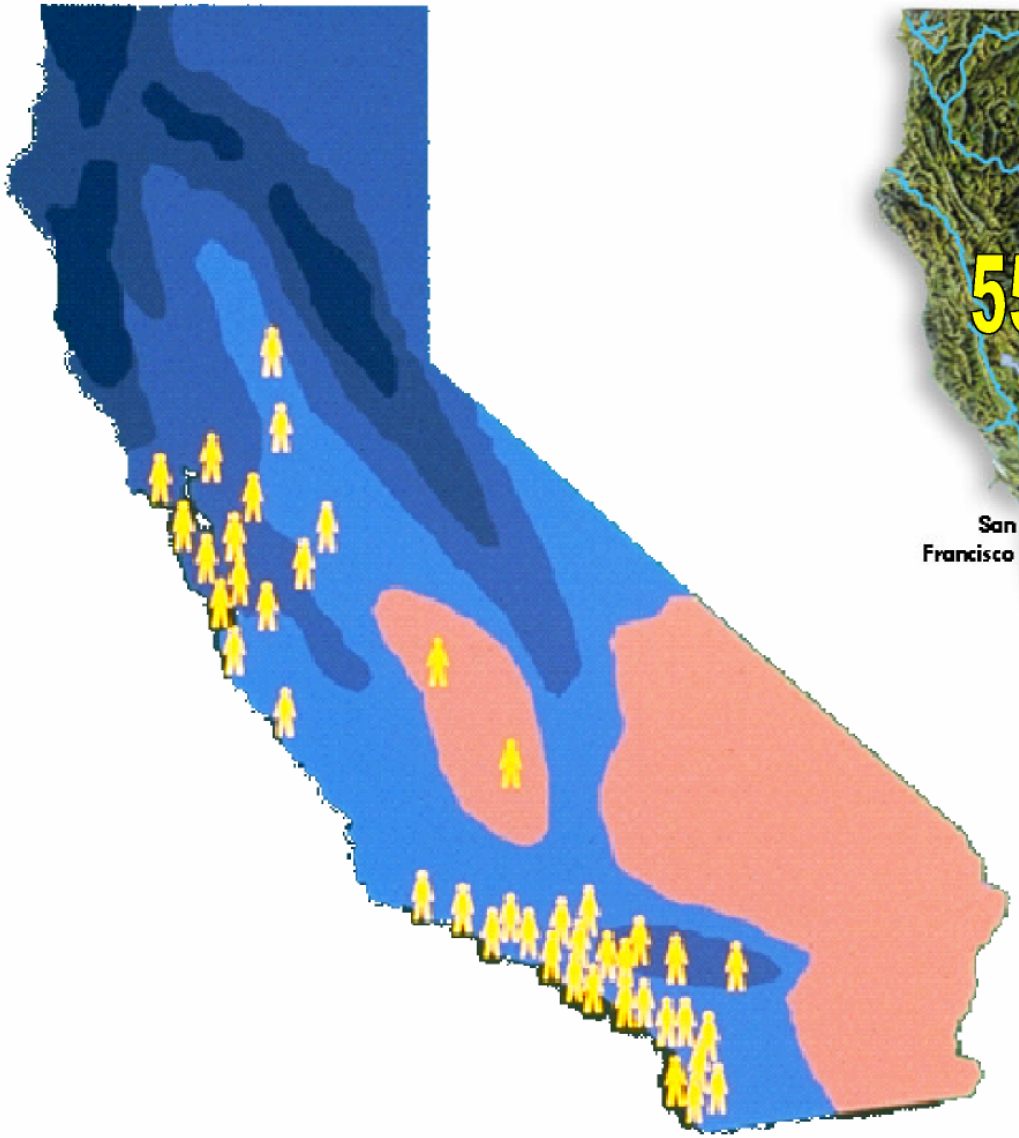
Potential Water Resources Impacts

- Water Supplies
- Water Demands
- Water Quality
- Ecosystems
- System Operations
- Flood Management

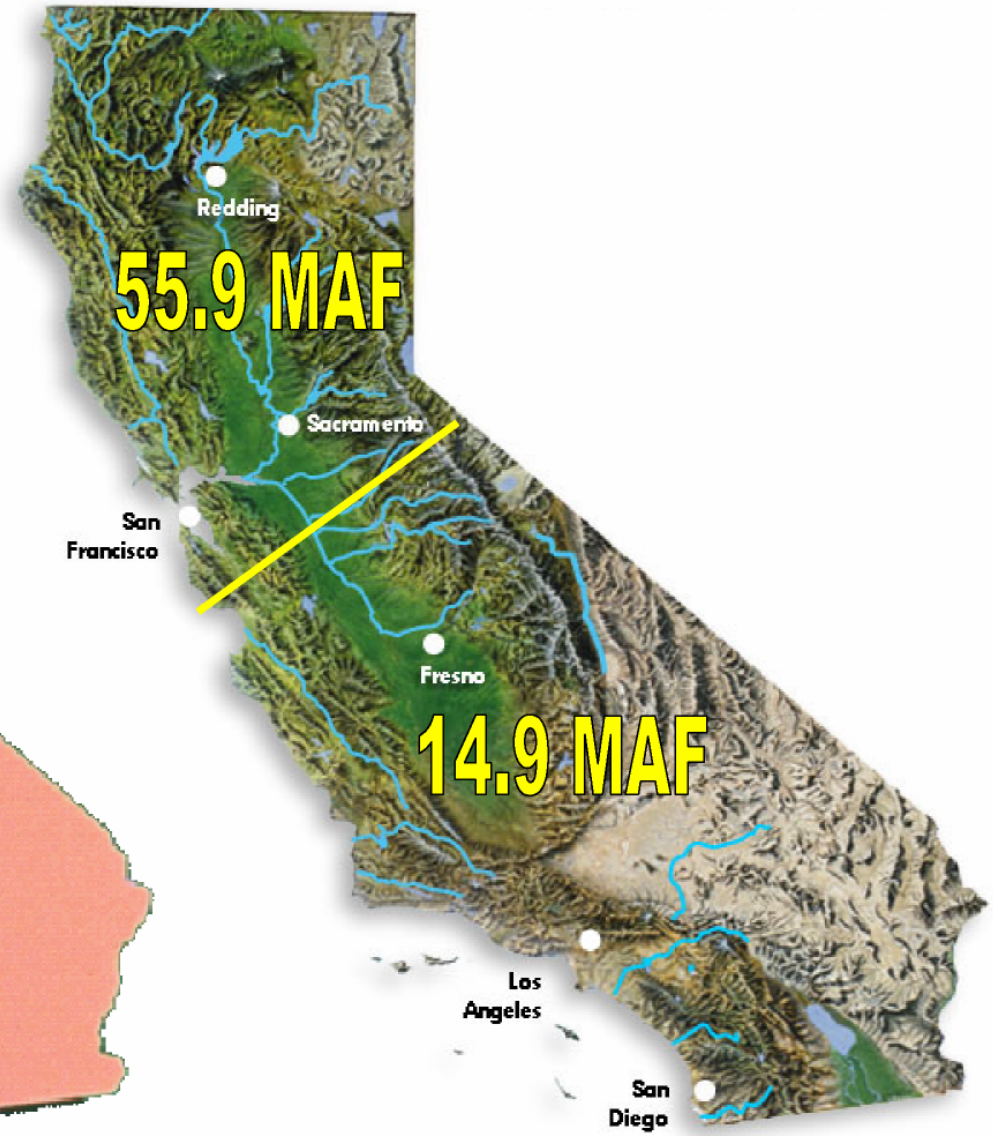
Overview of California's Water Resources

California's Water Resources

Precipitation (blue contours)
vs Population (yellow icons)

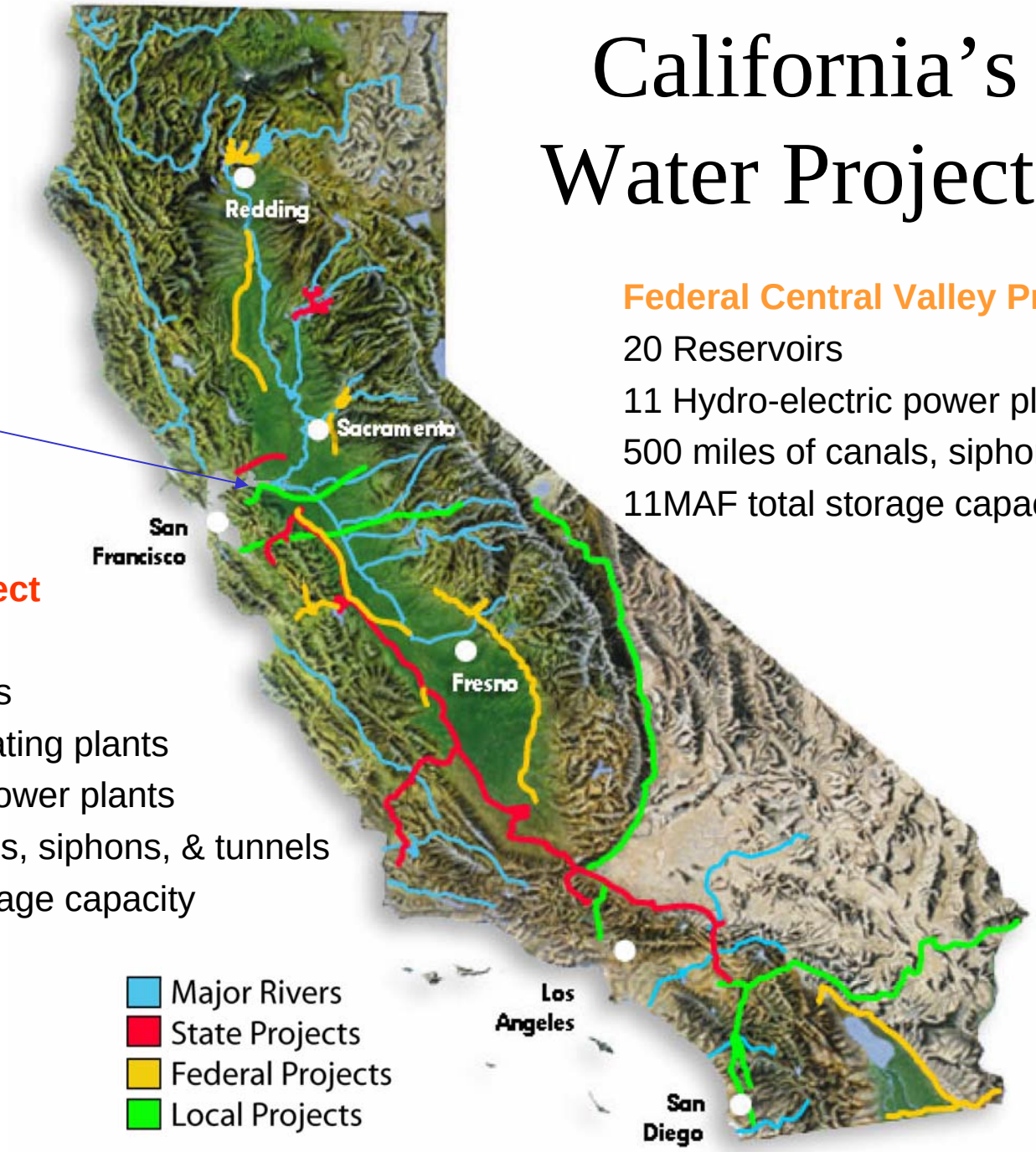


Total Annual
Runoff = 70.8 MAF



California's Water Projects

Sacramento-San Joaquin Delta



Federal Central Valley Project

20 Reservoirs

11 Hydro-electric power plants

500 miles of canals, siphons, & tunnels

11MAF total storage capacity

State Water Project

21 Reservoirs

17 Pumping Plants

3 Pumping-generating plants

5 Hydro-electric power plants

660 miles of canals, siphons, & tunnels

5.8 MAF total storage capacity

What risks does climate change pose for the management of California's water resources?

Climate Change Work Team

Jamie Anderson

Sanjaya Seneviratne

Francis Chung

Levi Brekke

Messele Ejeta

Dan Easton

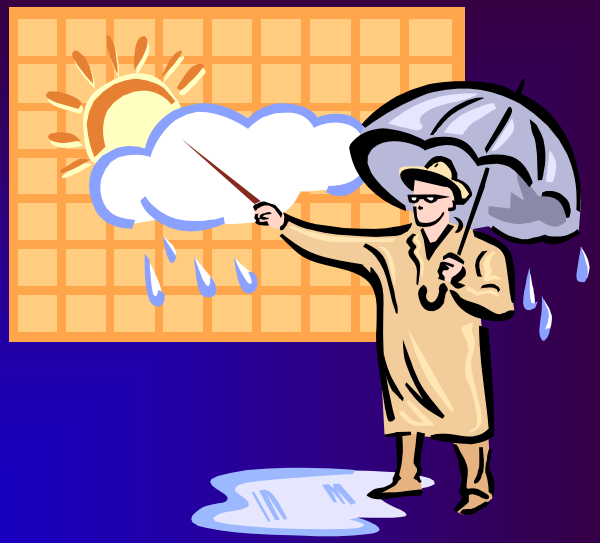
Hongbing Yin

Mike Floyd

Roy Peterson

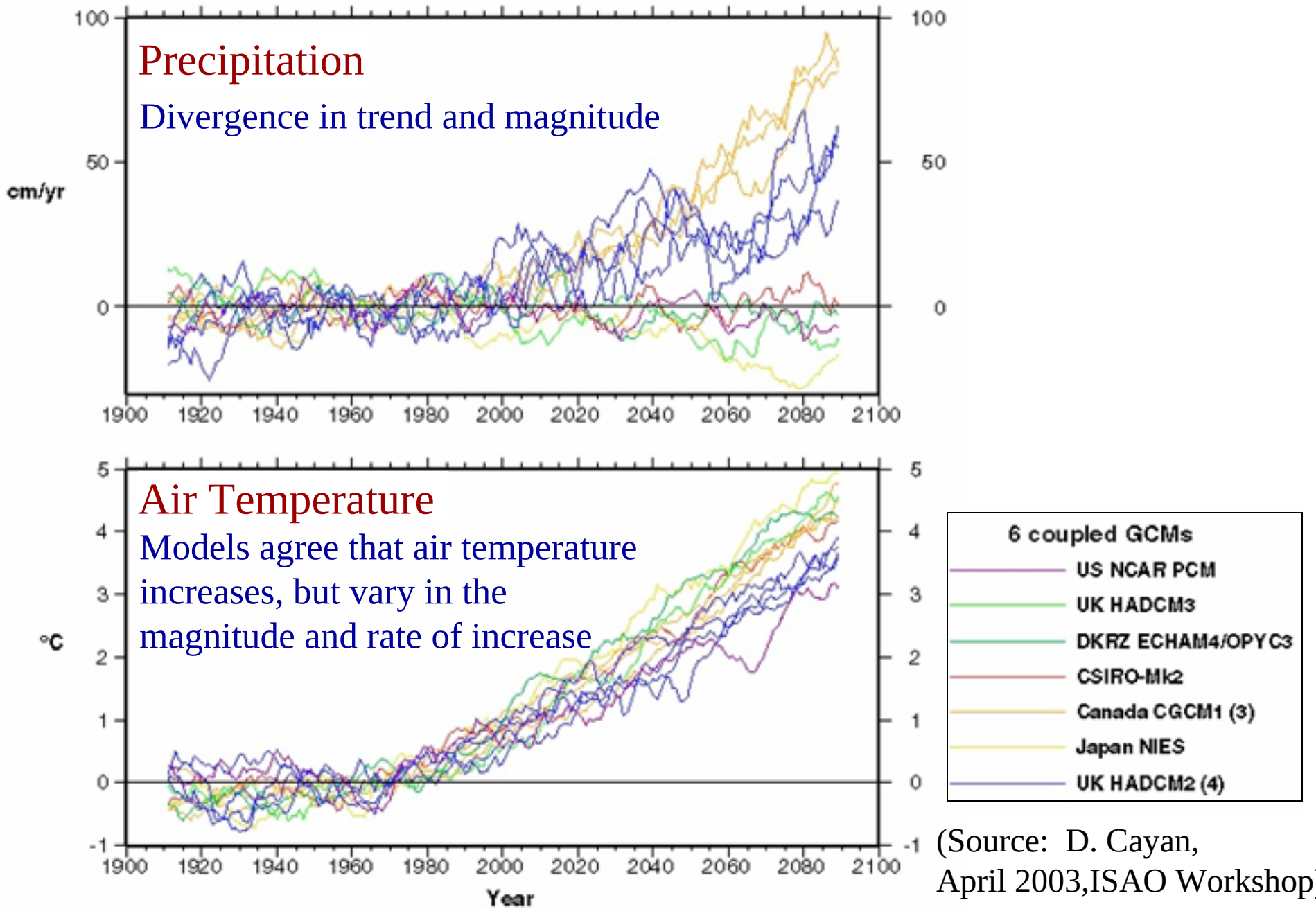
Mike Anderson

Climate modelers forecast possible future climate conditions



Our climate change team assesses potential impacts and likelihoods of those climate change scenarios related to California's water resources

Climate Change Predictions for Northern California Differ

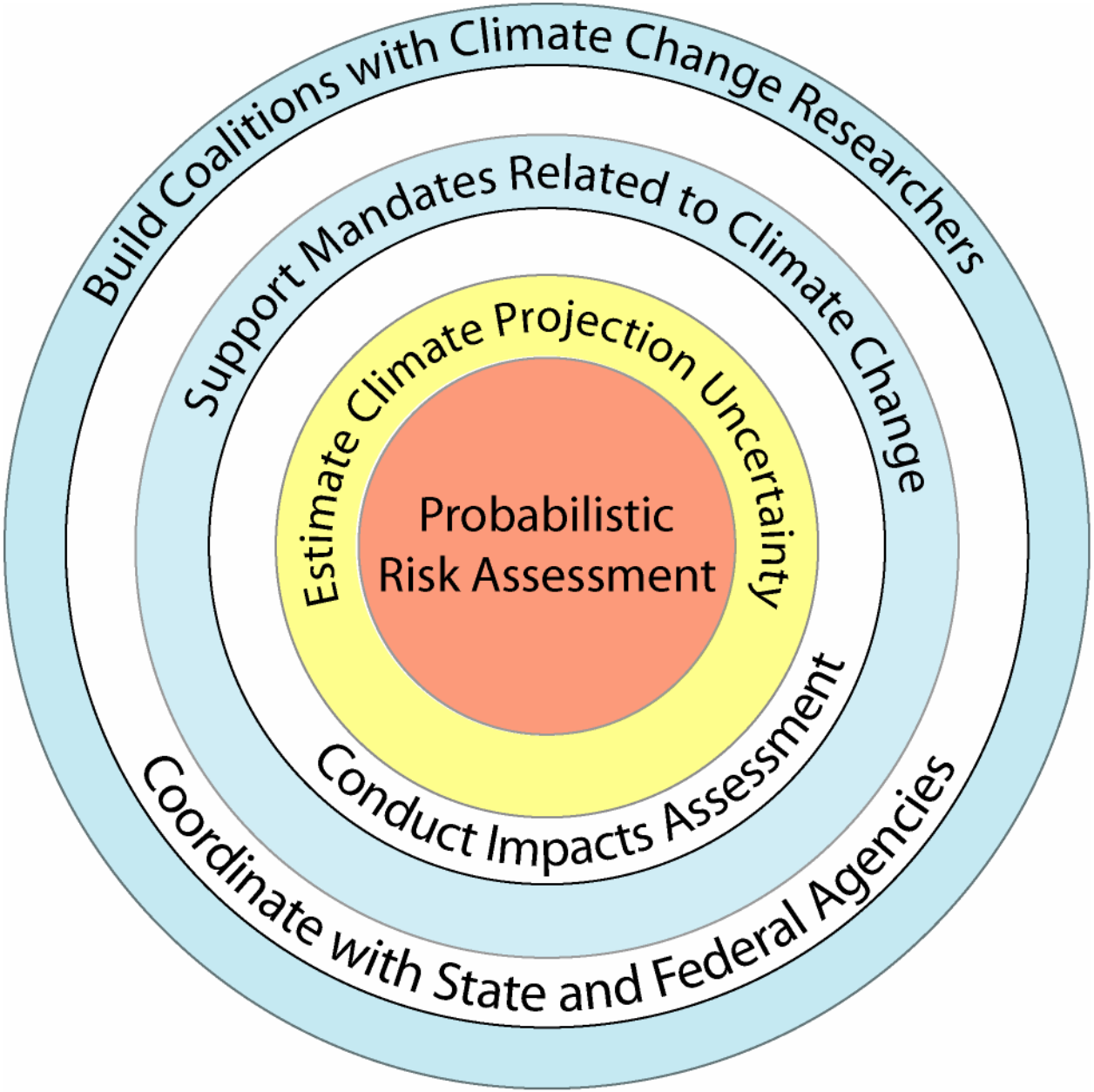


(Source: D. Cayan, April 2003,ISAO Workshop)

GOALS

Provide qualitative and quantitative estimates of impacts and likelihoods of climate change on California's water resources

Provide information that is relevant to water resources decision makers



Climate Change Work Team Goals

Building Coalitions

SCRIPPS Institute of Oceanography

U.S. Geological Survey

Lawrence Livermore Lab

Santa Clara University

Lawrence Berkeley Lab

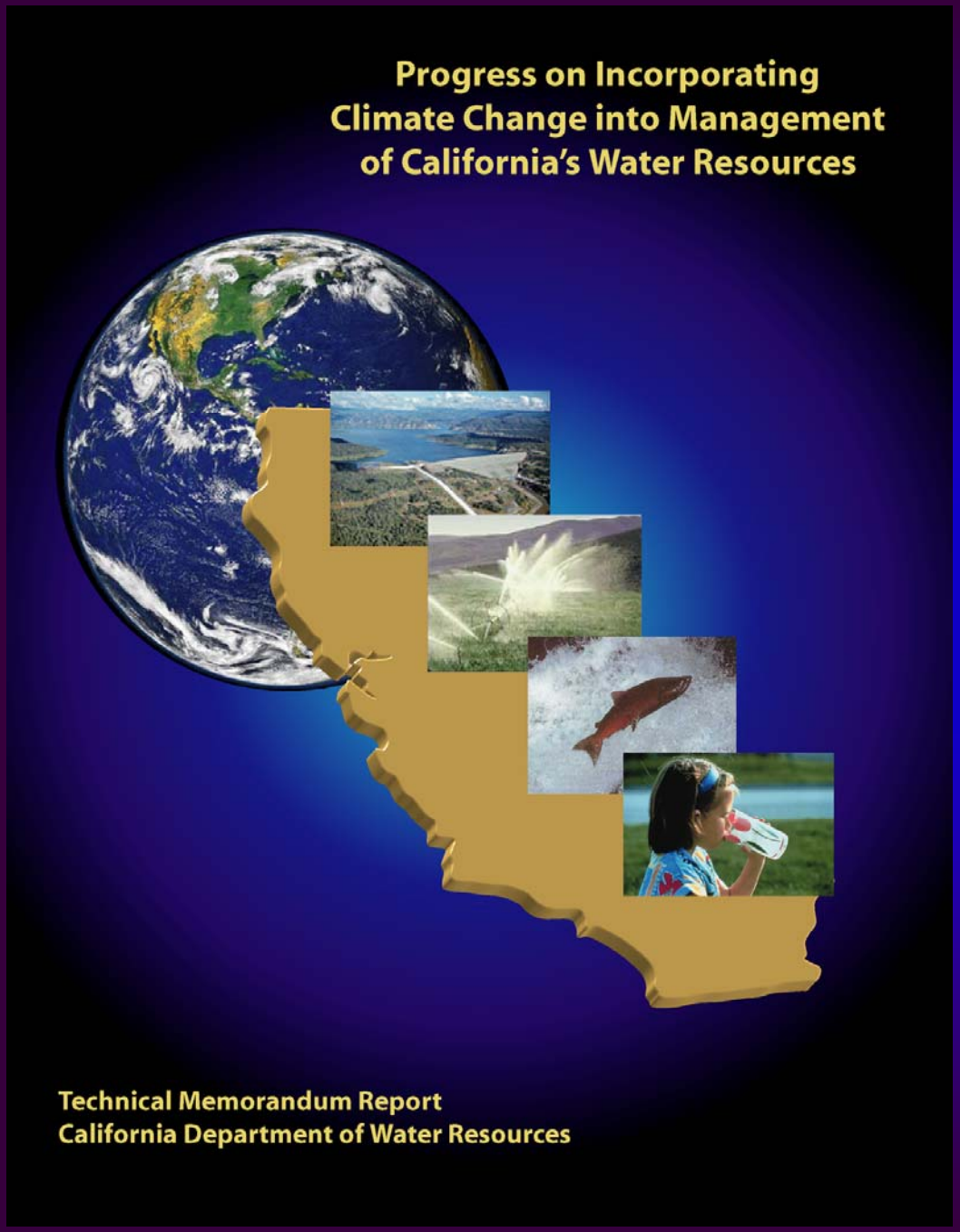
UC Davis

California Energy Commission

UC Berkeley

Support Mandates

- California Executive Order S-3-05
  - Set greenhouse gas emissions targets
  - Requires biennial reports of climate change impacts
- California Water Plan Updates
- 1990 Global Change Research Act
  - Requires federal agencies to periodically assess potential impacts



CH1 Introduction

CH2 Background

CH3 DWR Studies

CH4 SWP-CVP Impacts

CH5 Delta Impacts

CH6 Flood Management

CH7 Evapotranspiration

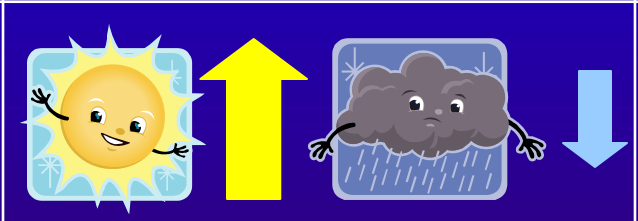
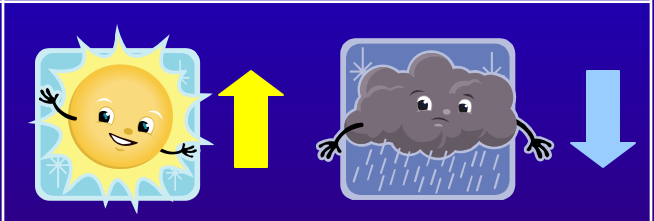
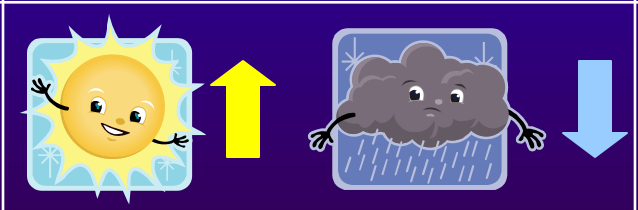
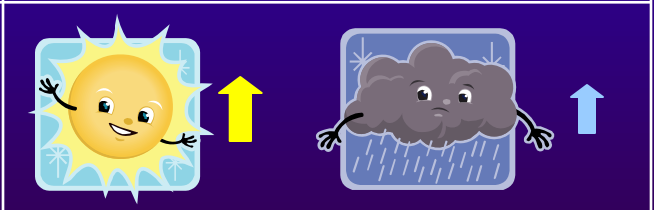
CH8 Future Directions

Peer reviewed chapters

Preliminary Impacts Assessment

- In response to Executive Order S-3-05

  2 GHG emissions scenarios x 2 GCM models

Scenario/ Model	A2	B1
GFDL		
PCM		

Analysis Process

Global Modeling	Regional Downscaling	SWP & CVP Operations	Delta Flow & Water Quality
GFDL or PCM	VIC	CALSIM	DSM2
Air Temperature Precipitation Humidity Radiation	Streamflow Snowpack Snow melt Soil Moisture	Reservoir Ops Deliveries Storage Delta Outflow	Flow Salinity

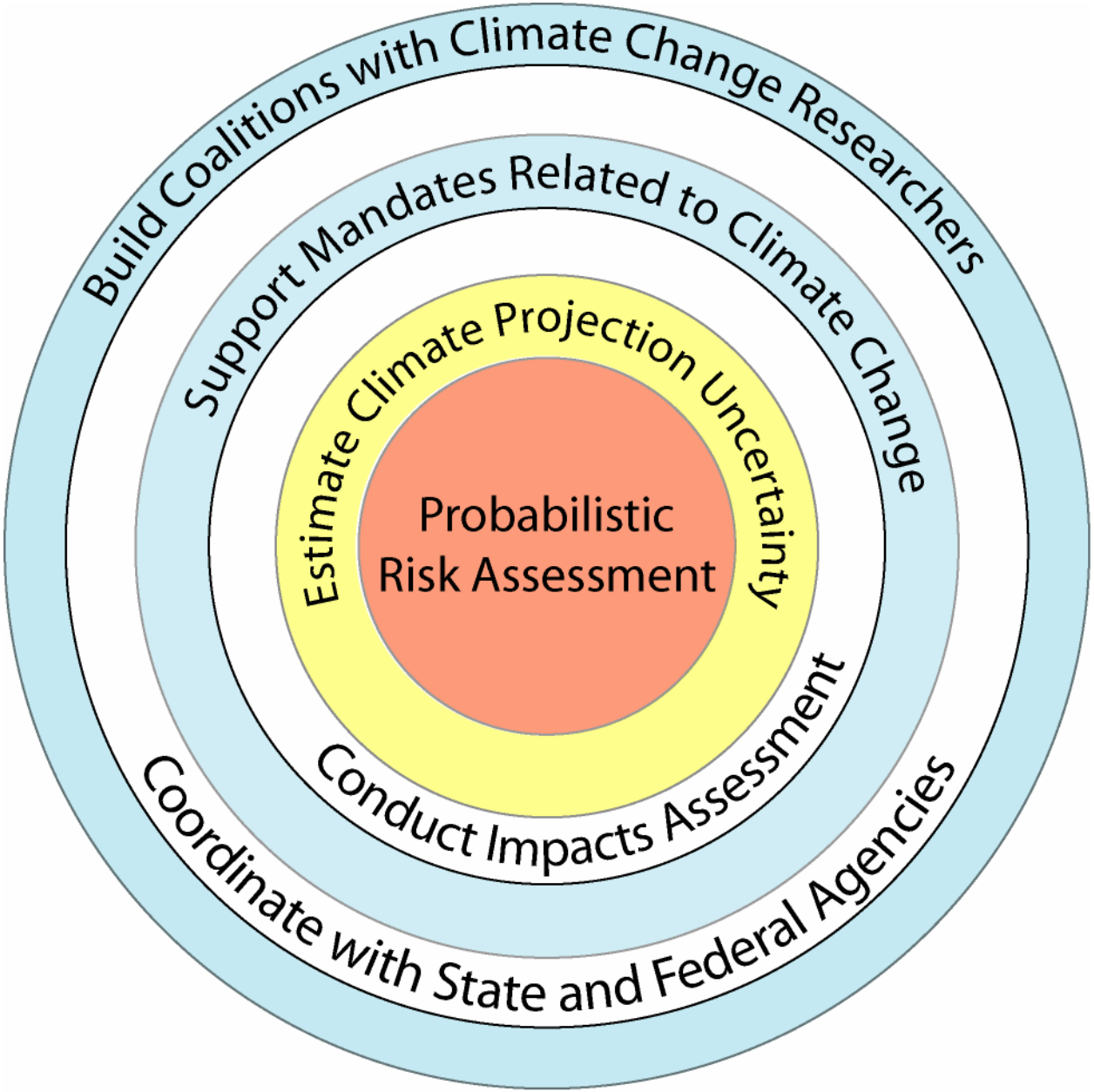
Conducted by work team

Preliminary Operations Impacts
2050 Runoff Projections, No Sea Level Rise

- Upstream reservoir shortages during droughts
- Deliveries
  - Decreased for the dry scenarios
  - Increased slightly for wet scenario
- Carryover storage
  - Reduced for drier scenarios
  - Increased in dry years for wet scenario
- Power generation was negatively impacted for drier scenarios
- Stream temperature changes were examined

Preliminary Delta Impacts

- **2050 runoff projections, no sea level rise**
  - **System flexibility maintained compliance levels with Delta water quality standards**
- **2050 runoff projections with 1ft sea level rise with no changes in system operations**
  - **Changes to operations would be required to maintain standard compliance**
  - **Increased potential to overtop Delta levees**



Climate Change Work Team Goals

Risk Assessment Project

- Assess climate change risks to SWP/CVP operations
- Reclamation funding
  - Research Office, FY2006 funding for project #X6253
  - Mid-Pacific Region Division of Planning
- Collaborators
  - CA DWR (Climate Change Work Team)
  - Ed Maurer (Santa Clara University)
  - Mike Dettinger (USGS/SCRIPPS)

SWP/CVP Risk Assessment Project

- 2-year project
- Develop and demonstrate a risk assessment methodology
- Examine 20-30 climate change scenarios
- Determine impacts for each scenario
- Assess relative likelihoods of scenarios
- Evaluate risk mitigation options
- Share results

Future Directions

- Likelihoods associated with climate change scenarios
- Sea level rise affects on system operations
- Regular updates
- Evolve to meet needs of water resources managers

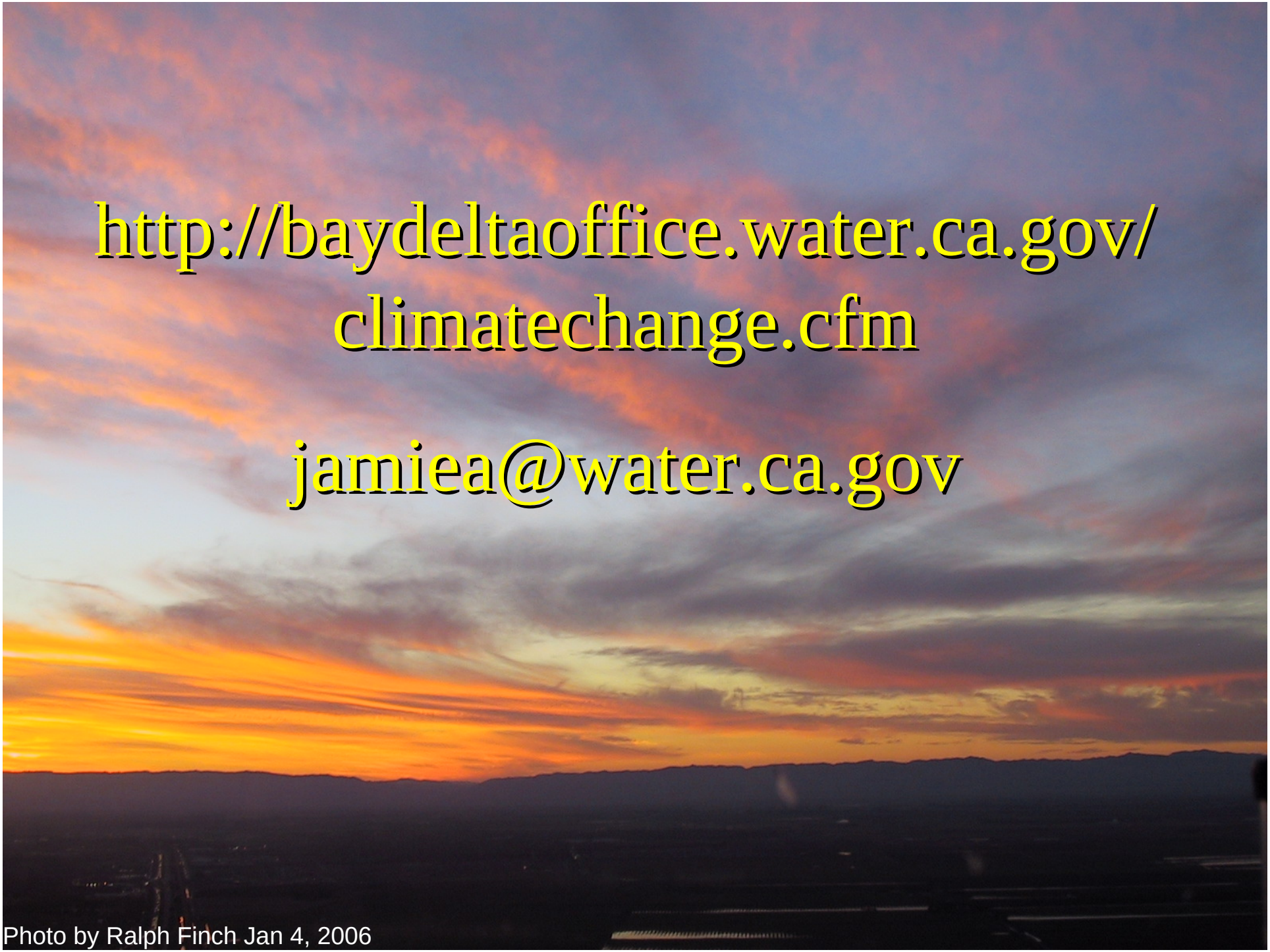


Photo by Ralph Finch Jan 4, 2006