Western Regional
Climate Center

California Climate Activities at the Western Regional Climate Center

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Western Regional Climate Center

Desert Research Institute

In coordination with

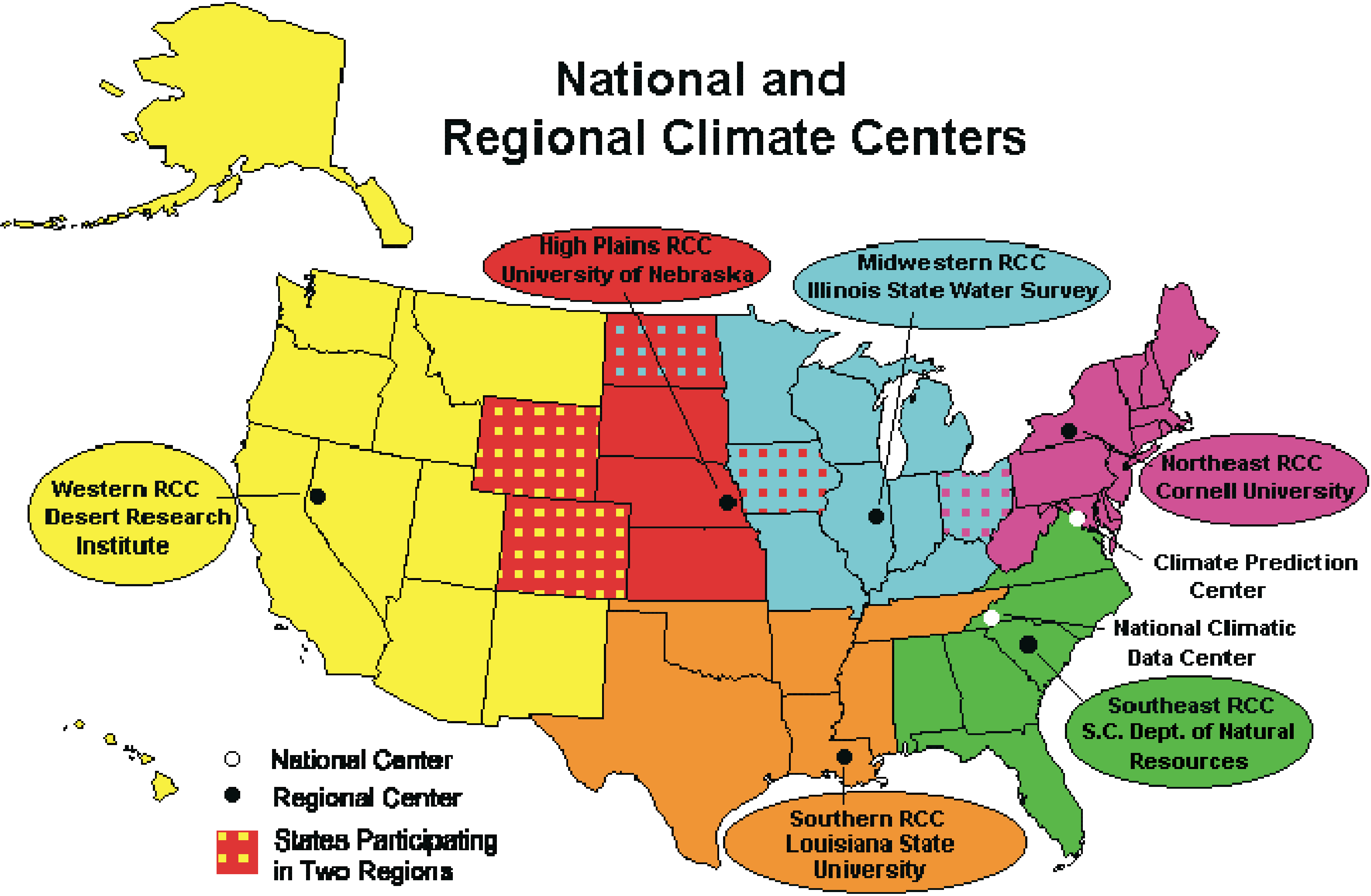
Scripps California Climate Change Center

Supported by

California Energy Commission

California Air Resources Board, April 19, 2005

National and Regional Climate Centers



Mission of Western Regional Climate Center

Act as a repository of historical weather and climate data for the western United States

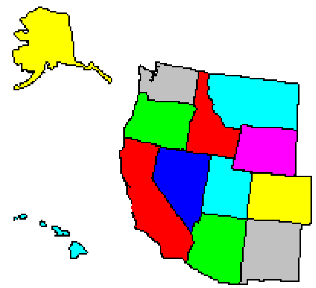
Disseminate climate data and information to the private sector, the public, federal and state agencies, and academic and research institutions

Conduct research useful for applications of climate information

Serve as a focal point for coordination of climate service activities in the western United States

Maintain strong links to other elements of the climate services sector in the United States, at all levels:

- National
- Regional
- State
- Local



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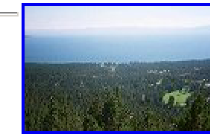


Site Map

Historical Climate Information
Western U.S. Historical Summaries; Precipitation Maps; Station Inventories; Wind and Evaporation Data; Coastal Water Table; etc.

Current Observations and Forecasts
Nat'l Weather Service Current and Past 24-hour Reports; Snotel; Climate Prediction Center Outlooks; Satellite and Radar Imagery; etc.

WRCC Projects
El Nino & La Nina; CEMP; WET; BLM RAWS; Current Weather Plots; Photo Gallery; Webcam; etc.

Climate Monitoring
Anomalies (Snotel & Airports); SPI; Product List; WGA data and information; etc.

More Climate Information
Pricing and Formats; Solar Radiation (U of Oregon); Sunrise/Sunset Information (USNO); Divisional Climate Plots; etc.

Educational and Travel Pages
Terms; More about Weather and Climate - for teachers and kids! Climate for resorts and Nat'l parks around the West.

Non-WRCC Climate Resources
National Climatic Data Center; Climate Prediction Center; National Drought Mitigation Center; CEFA; etc.

About the WRCC
Staff; Funding; Overview of WRCC; DRI Home Page; INTERNAL; etc.

WRCC Supports a Three-Partner National Climate Services Program - the Partners Include:
National Climatic Data Center (NCDC), Regional Climate Centers (RCC's), and State Climate Offices.

This is the new WRCC web page, you can still go to the old WRCC home page.

A busy web site … 87000 accesses per day in March 2005, and 1032 Mb / day of data & products. Content based on user requests.

Partners

In-state, so far we are working with:

California Climate Change Center
- **Scripps Climate Research Division**

California Department of Water Resources
- **Division of Flood Management**
- **California Snow Survey**
- **California Data Exchange Center**
- **State Climatologist**

National Weather Service
- **Weather Forecast Offices**
- **River Forecast Center**

California Energy Commission

Ocean Observing System (CeNCOOS, SCCOOS, PACOOS)

California Air Resources Board (exploratory)

UC Reserve System (Snow Lab, Sagehen, White Mtns, Santa Margarita)

UC System (San Diego, Berkeley, Los Angeles, Merced, Davis?)

CalFed

WRCC - California projects in a nutshell

- Baseline activities (NOAA, WRCC)
- California Applications Program (NOAA, Scripps)
- California Climate Data Archive (CEC, Scripps)
- California Coastal Climate Data Archive (CEC, Scripps)
- Enhanced California Climate Monitoring (CEC)
- Sierra Nevada Climate Monitoring (CEC, Scripps)
- Blue Oaks Paleoclimate (Calfed, U AR / U AZ / Scripps)
- Climate Reference Network (NOAA)
- Yosemite Wireless (NSF, Scripps, NPS)
- RAWS QC (NIFC Boise)
- Channel Islands (USGS / NPS)
- Caljet/Pacjet program successor – SHARE (NOAA, __?)

WRCC – National projects with California connections

- Climate Reference Network Western US (NOAA)
- National snow data set (NOAA, Rutgers, UNL, ISWS)
- Hydroclimatic extremes (NSF, Scripps, UNR)
- National historical/current radiosonde database (NOAA)
- RAWS, and thus any network with subdaily data (BLM)
- Soil moisture estimation for rangelands (BLM)
- Westmap: time series, spatial PRISM data (NOAA, UAZ, OSU)
- CUAHSI Sierra Nevada Hydrologic Observatory (in prog)
- Visualization of climate anomalies (NOAA, U AZ)

"Regular" WRCC web pages:

NOAA Sites: 184 north + 26 SFO + 110 south + 26 LAX = 362

Northern California Climate Summaries

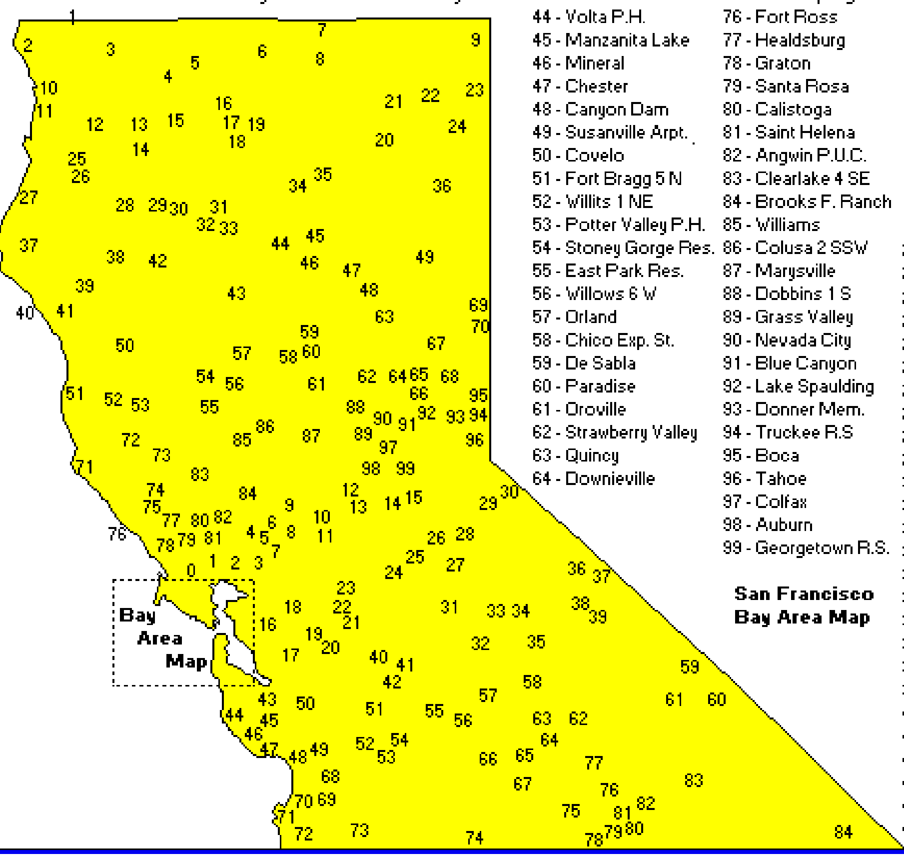
Back to: Western U.S. map | Home Page

Alphabetical Station List

- Adin Ranger Station
- Alderpoint
- Alturas Ranger Station
- Angwin Pac Union Col
- Antioch Pump Plant 3
- Ash Mountain
- Auberry 1 NW
- Auburn
- Balch Power House
- Ben Lomond 4
- Big Bar Ranger Station
- Bishop WSO
- Blue Canyon
- Boca
- Bodie
- Bowman Dam
- Bridgeport
- Brooks Farnham Ranch
- Burney
- Calaveras Big Trees
- Calistoga
- Callahan
- Camp Pardee
- Canby Ranger Station
- Canyon Dam
- Carmel Valley
- Cathay Bull Run Ranch
- Cecilville 1 SE
- Cedarville
- Cherry Valley Dam
- Chester
- Chico Experiment Station
- Clearlake 4 SE

Northern

1 - Elk Valley
2 - Crescent City
3 - Happy Camp R.S.
4 - Fort Jones R.S.
5 - Yreka
6 - Mount Hebron R.S.
7 - Tulelake
8 - Lava Beds N.M.
9 - Fort Bidwell
10 - Klamath
11 - Orick Prairie Cr.
12 - Orleans
13 - Sawyers Bar R.S.
14 - Cecilville 1 SE
15 - Callahan
16 - Weed F. D.
17 - Mount Shasta
18 - Dunsmuir T. P.
19 - Mc Cloud
20 - Adin R.S.
21 - Canby R.S.
22 - Alturas R.S.
23 - Cedarville
24 - Jess Valley
25 - Hoopa
26 - Willow Creek
27 - Eureka
28 - Big Bar R.S.
29 - Weaverville R.S.
30 - Trinity River H.
31 - Shasta Dam
32 - Whiskeytown R.
33 - Redding
34 - Burney
35 - Hat Creek P.H.
36 - Termo 1 E
37 - Scotia
38 - Forest Glen
39 - Alderpoint
40 - Shelter Cove A.
41 - Richardson Gr.
42 - Harrison G. R.S.
43 - Red Bluff
44 - Volta P.H.
45 - Manzanita Lake
46 - Mineral
47 - Chester
48 - Canyon Dam
49 - Susanville Arpt.
50 - Covelo
51 - Fort Bragg 5 N
52 - Willits 1 NE
53 - Potter Valley P.H.
54 - Stoney Gorge Res.
55 - East Park Res.
56 - Willows 6 W
57 - Orland
58 - Chico Exp. St.
59 - De Sabla
60 - Paradise
61 - Oroville
62 - Strawberry Valley
63 - Quincy
64 - Downieville
65 - Sierra City
66 - Bowman Dam
67 - Portola
68 - Sierraville R.S.
69 - Doyle
70 - Doyle 4 SSE
71 - Point Arena
72 - Ukiah
73 - Lakeport
74 - Cloverdale 3 S
75 - Warm Springs
76 - Fort Ross
77 - Healdsburg
78 - Graton
79 - Santa Rosa
80 - Calistoga
81 - Saint Helena
82 - Angwin P.U.C.
83 - Clearlake 4 SE
84 - Brooks F. Ranch
85 - Williams
86 - Colusa 2 SSW
87 - Marysville
88 - Dobbins 1 S
89 - Grass Valley
90 - Nevada City
91 - Blue Canyon
92 - Lake Spaulding
93 - Donner Mem.
94 - Truckee R.S
95 - Boca
96 - Tahoe
97 - Colfax
98 - Auburn
99 - Georgetown R.S.



San Francisco Bay Area Map

Southern

0 - Petaluma F.S.
1 - Sonoma
2 - Napa State H.
3 - Fairfield
4 - Markley Cove
5 - Lake Solano
6 - Winters
7 - Vacaville
8 - Davis 1 WSW
9 - Woodland
10 - Sacramento WSO
11 - Sacramento Arpt
12 - Rocklin
13 - Folsom Dam
14 - Placerville
15 - Placerville IFG
16 - Mount Diablo Jct.
17 - Livermore
18 - Antioch Pump P.
19 - Tracy P. P.
20 - Tracy Carbona
21 - Stockton WSO
22 - Stockton F.S.
23 - Lodi
24 - Camp Pardee
25 - Electra P.H.
26 - Tiger Creek P.H.
27 - Calaveras Big Trees
28 - Salt Springs P.H.
29 - Twin Lakes
30 - Woodfords
31 - Sonora R.S.
32 - Dudleys
33 - Cherry Valley Dam
34 - Hetch Hetchy
35 - Yosemite Park H.Q.
36 - Bridgeport
37 - Bodie
38 - Mono Lake
39 - Lee Vining
40 - Modesto
41 - Denair 3 NNE
42 - Turlock
43 - San Jose
44 - San Gregorio 2 SE
45 - Los Gatos
46 - Ben Lomond 4
47 - Santa Cruz
48 - Watsonville Waterworks
49 - Gilroy
50 - Mount Hamilton
51 - Newman
52 - San Luis Dam
53 - Los Banos Det. Res.
54 - Los Banos
55 - Merced Arpt.
56 - Le Grand
57 - Cathay Bull Run R.
58 - S. Entrance Yosemite
59 - White Mountain 2
60 - Deep Springs College
61 - Bishop Arpt.
62 - Huntington Lake
63 - North Fork R.S.
64 - Auberry 1 NW
65 - Friant Gov. Camp
66 - Madera
67 - Fresno Arpt
68 - Hollister
69 - Salinas 2 E
70 - Salinas Arpt.
71 - Monterey
72 - Carmel Valley
73 - Pinnacles N.M.
74 - Five Points 5 SSW
75 - Orange Cove
76 - Grant Grove
77 - Balch P.H.
78 - Lemon Cove
79 - Three Rivers Ham.
80 - Ash Mountain
81 - Giant Forest
82 - Lodgepole
83 - Independence
84 - Death Valley

184 Sites

"Regular" WRCC web pages:

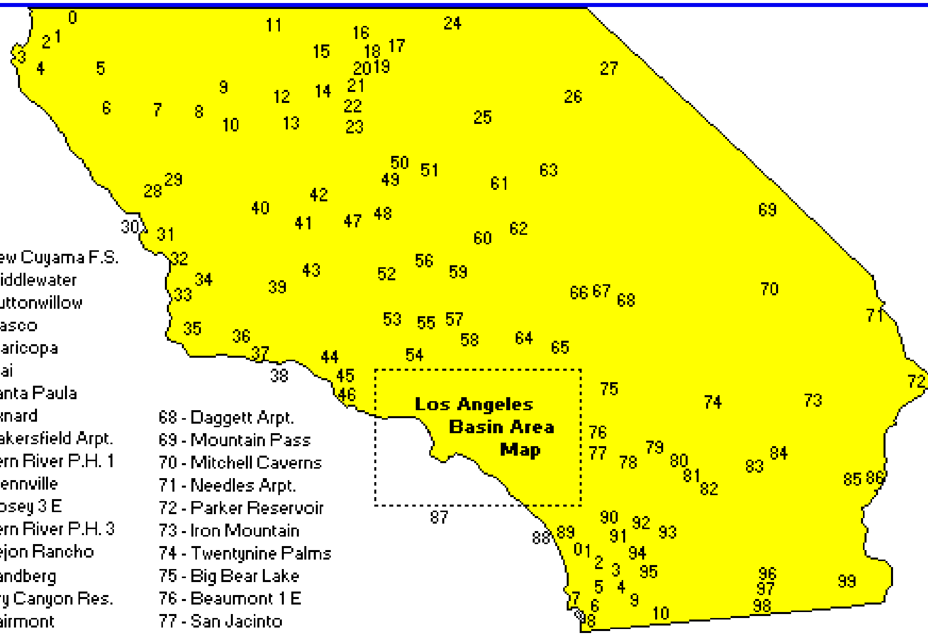
Sites included if > 5 yrs, Temp and Precip, a few are precip-only.

Southern California Climate Summaries

Back to: **Western U.S. map** **Home Page**

Alphabetical Station List

- Alpine
- Ash Mountain
- Avalon Pleasure Pier
- Bakersfield WSO
- Barstow
- Barstow Fire Station
- Beaumont 1 E
- Big Bear Lake
- Blythe
- Blythe CCA Airport
- Borrego Desert Park
- Brawley 2 SW
- Buttonwillow
- Cachuma Lake
- Campo
- Cantil
- Carmel Valley
- Chula Vista
- Coalinga
- Corcoran Irrig. Dist.
- Cuyamaca
- Daggett
- Death Valley
- Dry Canyon Reservoir
- Eagle Mountain
- El Cajon
- El Capitan Dam
- El Centro 2 SSW
- El Mirage Field
- Escondido
- Escondido 2
- Fairmont
- Five Points 5 SSW



0 - Hollister
1 - Salinas 2 E
2 - Salinas Arpt
3 - Monterey
4 - Carmel Valley
5 - Pinnacles N.M.
6 - King City
7 - Priest Valley
8 - Coalinga
9 - Five Points 5 SSW
10 - Kettleman Stn
11 - Fresno Arpt
12 - Hanford 1 S
13 - Corcoran Irrig.
14 - Visalia
15 - Orange Cove
16 - Grant Grove
17 - Lodgepole
18 - Giant Forest
19 - Ash Mountain
20 - Three Rivers Ham.
21 - Lemon Cove
22 - Lindsay
23 - Porterville
24 - Independence
25 - Haiwee
26 - Wildrose R.S.
27 - Death Valley
28 - Paso Robles
29 - Paso Robles Arpt.
30 - Morro Bay F. D.
31 - San Luis Obispo P.
32 - Pismo Beach
33 - Santa Maria Arpt.
34 - Twitchell Dam
35 - Lompoc
36 - Cachuma Lake
37 - Santa Barbara Arpt
38 - Santa Barbara
39 - New Cuyama F.S.
40 - Middlewater
41 - Buttonwillow
42 - Wasco
43 - Maricopa
44 - Ojai
45 - Santa Paula
46 - Oxnard
47 - Bakersfield Arpt.
48 - Kern River P.H. 1
49 - Glennville
50 - Posey 3 E
51 - Kern River P.H. 3
52 - Tejon Rancho
53 - Sandberg
54 - Dry Canyon Res.
55 - Fairmont
56 - Tehachapi
57 - Lancaster FSS
58 - Palmdale
59 - Mojave
60 - Cantil
61 - Inyokern
62 - Randsburg
63 - Trona
64 - El Mirage Field
65 - Victorville
66 - Barstow
67 - Barstow Fire Stn.
68 - Daggett Arpt.
69 - Mountain Pass
70 - Mitchell Caverns
71 - Needles Arpt.
72 - Parker Reservoir
73 - Iron Mountain
74 - Twentynine Palms
75 - Big Bear Lake
76 - Beaumont 1 E
77 - San Jacinto
78 - Idyllwild Fire Dept.
79 - Palm Springs
80 - Indio Fire Station
81 - Thermal Arpt.
82 - Mecca 2 SE
83 - Hayfield Reservoir
84 - Eagle Mountain
85 - Blythe Aprt.
86 - Blythe
87 - Avalon Pleasure Pier
88 - Oceanside Marina
89 - Vista 1 NE
90 - Palomar Mountain Ob.
91 - Henshaw Dam
92 - Warner Springs
93 - Borrego Desert Park
94 - Julian Wynola
95 - Cuyamaca
96 - Brawley 2 SW
97 - Imperial
98 - El Centro 2 SSW
99 - Gold Rock Ranch
0 - Escondido
1 - Escondido 2
2 - San Pasqual Animal Park
3 - Ramona Fire Dept.
4 - El Capitan Dam
5 - El Cajon
6 - La Mesa
7 - San Diego Arpt.
8 - Chula Vista
9 - Alpine
10 - Campo

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Western Regional Climate Center, wrcc@dri.edu

110 sites

San Francisco Bay Area, California Climate Summaries

Western U.S. map | Home Page

Back to:

Alphabetical Station List

- Berkeley
- Half Moon Bay
- Kentfield
- Livermore
- Los Gatos
- Martinez Water Plant
- Mount Diablo Junction
- Newark
- Oakland Museum
- Oakland WSO Airport
- Palo Alto
- Petaluma F.S.
- Port Chicago Naval Dep.
- Redwood City
- Richmond
- Saint Marys College
- San Francisco WSO Airport
- San Francisco Mission Dolores
- San Francisco Richmond
- San Gregorio 2 SE
- San Jose
- San Mateo
- San Rafael Civic Center
- Santa Clara University
- Upper San Leandro Fltr
- Woodside Fire Station 1

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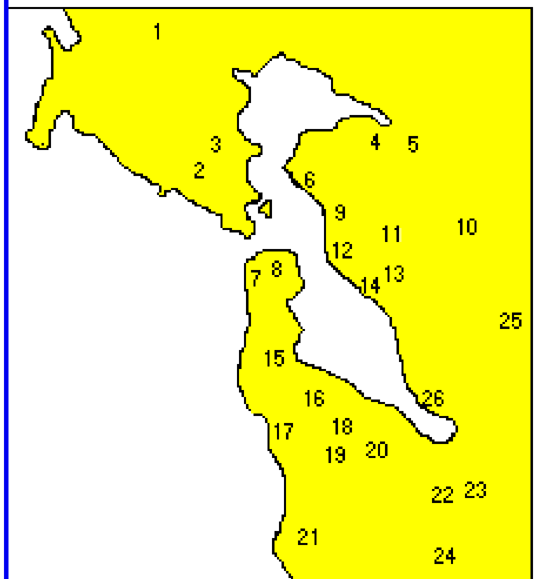
1 - Petaluma Fire Station
2 - Kentfield



3 - San Rafael Civic Center
4 - Martinez Water Plant
5 - Port Chicago Naval Depot
6 - Richmond
7 - San Francisco Richmond
8 - San Francisco Mission Dolores
9 - Berkeley
10 - Mount Diablo Junction
11 - Saint Marys College
12 - Oakland Museum
13 - Upper San Leandro Fltr
14 - Oakland WSO AP
15 - San Francisco WSO AP
16 - San Mateo
17 - Half Moon Bay
18 - Redwood City
19 - Woodside Fire Stn 1
20 - Palo Alto
21 - San Gregorio 2 SE
22 - Santa Clara University
23 - San Jose
24 - Los Gatos
25 - Livermore
26 - Newark

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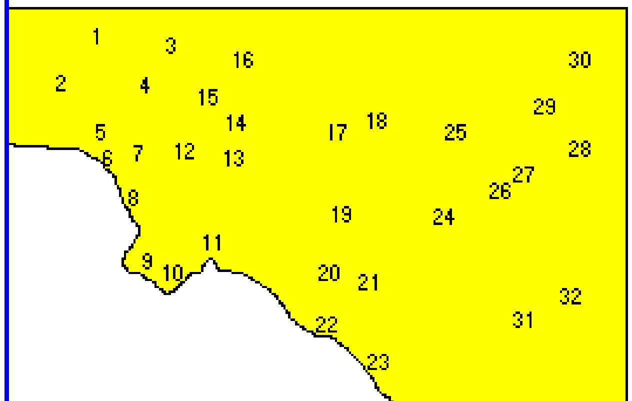
26 sites

Los Angeles Basin Area, California Climate Summaries

- Burbank Valley Pump Plant
- Canoga Park Pierce College
- Claremont Pomona College
- Corona
- Culver City
- Elsinore
- Fontana Kaiser
- Laguna Beach
- Lake Arrowhead
- Long Beach
- Los Angeles Airport
- Los Angeles Civic Center
- Montebello
- Mount Wilson
- Newport Beach Harbor
- Pasadena
- Pomona Cal Poly
- Redlands
- Riverside Citrus Exp. Farm
- Riverside Fire Station 3
- San Bernardino
- San Fernando
- San Gabriel Fire Dept.
- San Pedro
- Santa Ana Fire Station
- Santa Monica Pier
- Sun City
- Torrance
- Tujunga
- Tustin Irvine Ranch
- U. C. L. A.
- Yorba Linda

1 - San Fernando
2 - Canoga Park Pierce College
3 - Tujunga
4 - Burbank Valley Pump Plant
5 - U.C.L.A.
6 - Santa Monica Pier
7 - Culver City
8 - Los Angeles WSO Airport
9 - Torrance
10 - San Pedro
11 - Long Beach WSCMO
12 - Los Angeles Civic Center
13 - Montebello
14 - San Gabriel Fire Dept.
15 - Pasadena
16 - Mt. Wilson No. 2
17 - Pomona Cal Poly
18 - Claremont Pomona College
19 - Yorba Linda
20 - Santa Ana Fire Stn
21 - Tustin Irvine Ranch
22 - Newport Beach Harbor
23 - Laguna Beach
24 - Corona
25 - Fontana Kaiser
26 - Riverside Citrus Exp Stn
27 - Riverside Fire Stn 3
28 - Redlands
29 - San Bernadino
30 - Lake Arrowhead
31 - Elsinore
32 - Sun City



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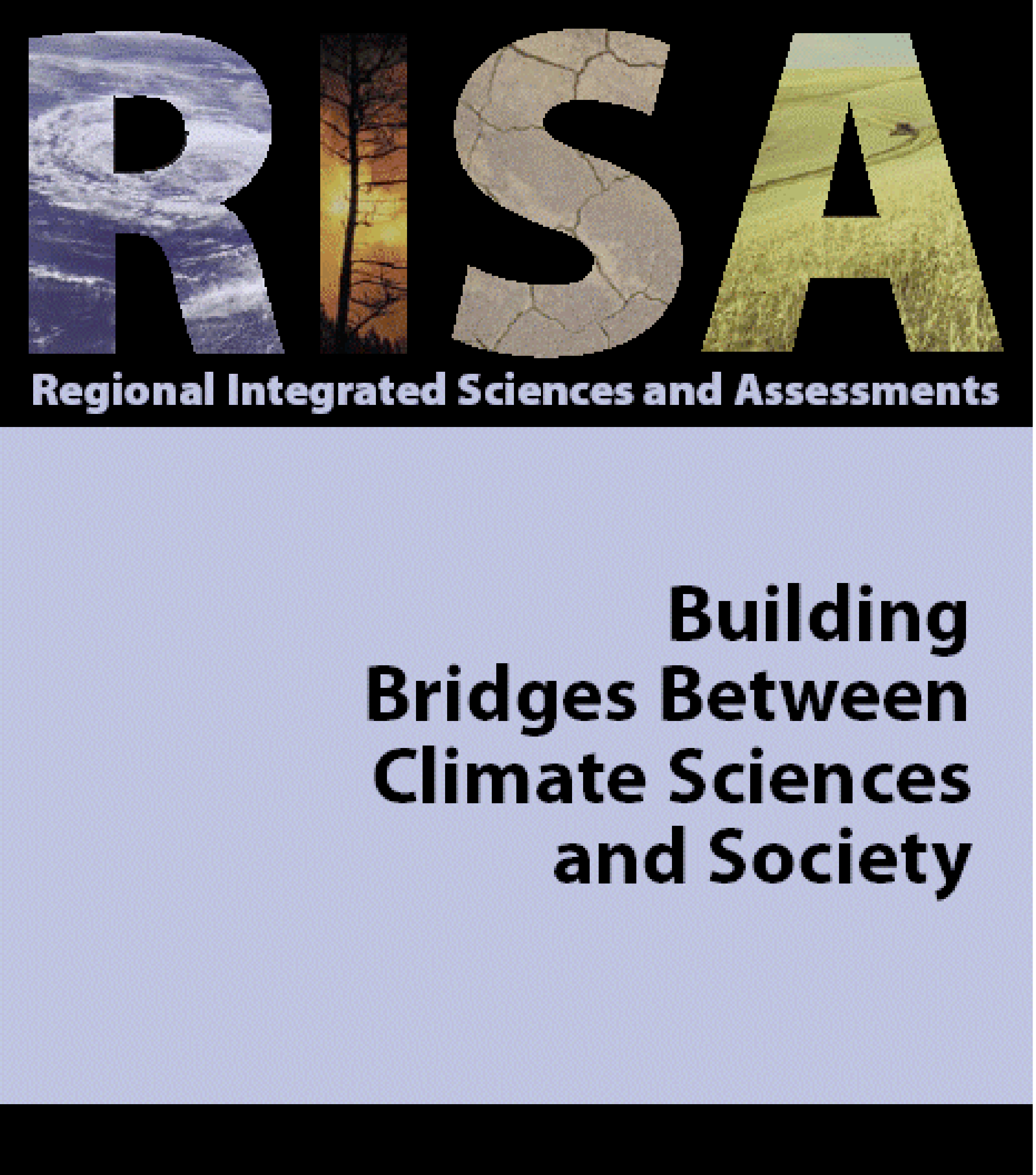
32 sites



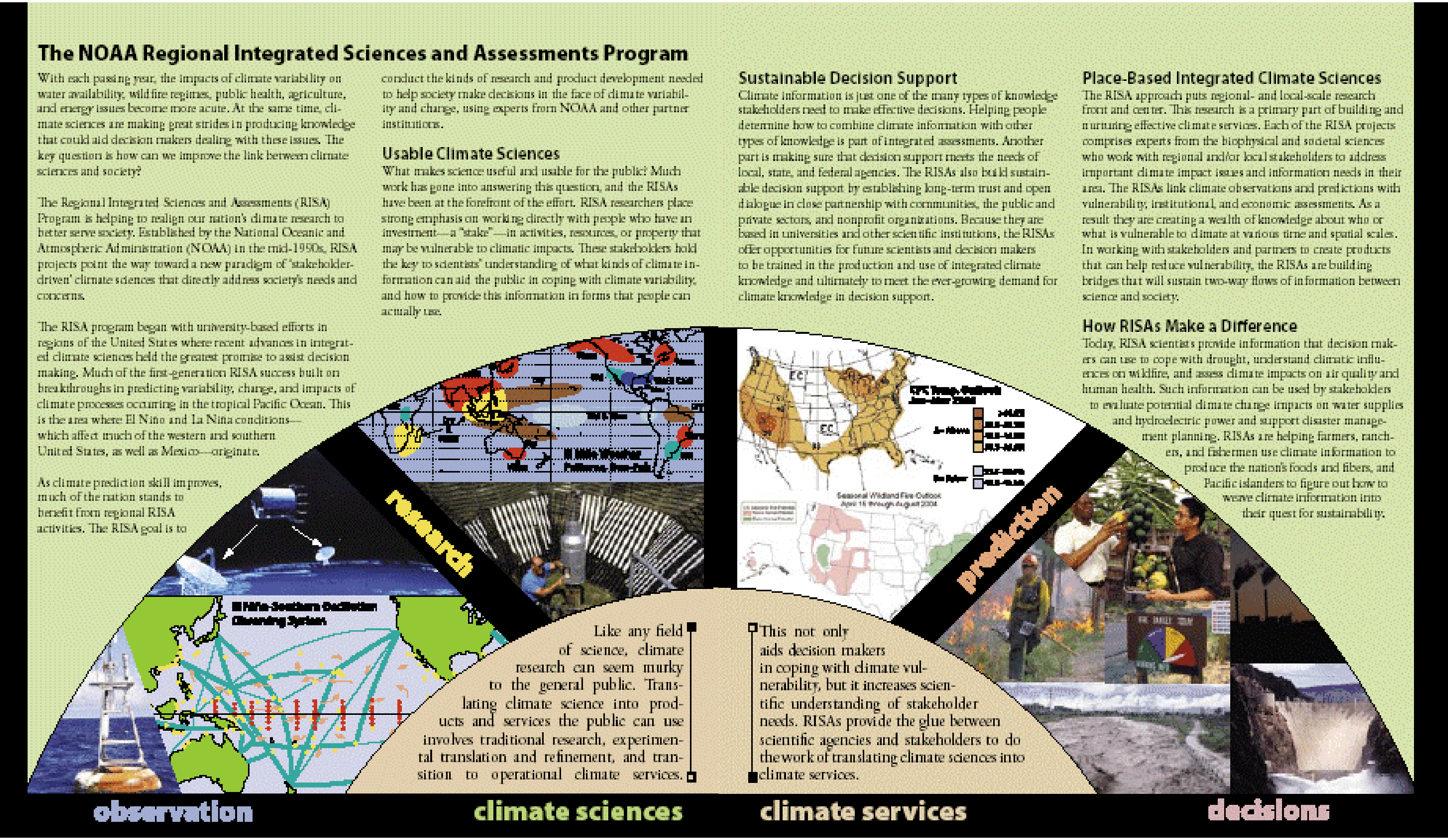
A NOAA activity within the Office of Global Programs

Now concluding its tenth year.

Program has made numerous inroads into climate issues of wide concern.

Physical and social sciences interacting.

Climate Services: A "decision-centric" activity.*



The NOAA Regional Integrated Sciences and Assessments Program

With each passing year, the impacts of climate variability on water availability, wildfire regimes, public health, agriculture, and energy issues become more acute. At the same time, climate sciences are making great strides in producing knowledge that could aid decision makers dealing with these issues. The key question is how can we improve the link between climate sciences and society?

The Regional Integrated Sciences and Assessments (RISA) Program is helping to realign our nation's climate research to better serve society. Established by the National Oceanic and Atmospheric Administration (NOAA) in the mid-1990s, RISA projects point the way toward a new paradigm of 'stakeholder-driven' climate sciences that directly address society's needs and concerns.

The RISA program began with university-based efforts in regions of the United States where recent advances in integrated climate sciences held the greatest promise to assist decision making. Much of the first-generation RISA success built on breakthroughs in predicting variability, change, and impacts of climate processes occurring in the tropical Pacific Ocean. This is the area where El Niño and La Niña conditions—which affect much of the western and southern United States, as well as Mexico—originate.

As climate prediction skill improves, much of the nation stands to benefit from regional RISA activities. The RISA goal is to conduct the kinds of research and product development needed to help society make decisions in the face of climate variability and change, using experts from NOAA and other partner institutions.

Usable Climate Sciences

What makes science useful and usable for the public? Much work has gone into answering this question, and the RISAs have been at the forefront of the effort. RISA researchers place strong emphasis on working directly with people who have an investment—a "stake"—in activities, resources, or property that may be vulnerable to climatic impacts. These stakeholders hold the key to scientists' understanding of what kinds of climate information can aid the public in coping with climate variability, and how to provide this information in forms that people can actually use.

Sustainable Decision Support

Climate information is just one of the many types of knowledge stakeholders need to make effective decisions. Helping people determine how to combine climate information with other types of knowledge is part of integrated assessments. Another part is making sure that decision support meets the needs of local, state, and federal agencies. The RISAs also build sustainable decision support by establishing long-term trust and open dialogue in close partnership with communities, the public and private sectors, and nonprofit organizations. Because they are based in universities and other scientific institutions, the RISAs offer opportunities for future scientists and decision makers to be trained in the production and use of integrated climate knowledge and ultimately to meet the ever-growing demand for climate knowledge in decision support.

Place-Based Integrated Climate Sciences

The RISA approach puts regional- and local-scale research front and center. This research is a primary part of building and nurturing effective climate services. Each of the RISA projects comprises experts from the biophysical and societal sciences who work with regional and/or local stakeholders to address important climate impact issues and information needs in their area. The RISAs link climate observations and predictions with vulnerability, institutional, and economic assessments. As a result they are creating a wealth of knowledge about who or what is vulnerable to climate at various time and spatial scales. In working with stakeholders and partners to create products that can help reduce vulnerability, the RISAs are building bridges that will sustain two-way flows of information between science and society.

How RISAs Make a Difference

Today, RISA scientists provide information that decision makers can use to cope with drought, understand climatic influences on wildfire, and assess climate impacts on air quality and human health. Such information can be used by stakeholders to evaluate potential climate change impacts on water supplies and hydroelectric power and support disaster management planning. RISAs are helping farmers, ranchers, and fishermen use climate information to produce the nation's foods and fibers, and Pacific islanders to figure out how to weave climate information into their quest for sustainability.

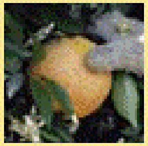
Like any field of science, climate research can seem murky to the general public. Translating climate science into products and services the public can use involves traditional research, experimental translation and refinement, and transition to operational climate services.

This not only aids decision makers in coping with climate vulnerability, but it increases scientific understanding of stakeholder needs. RISAs provide the glue between scientific agencies and stakeholders to do the work of translating climate sciences into climate services.

* NRC, 2001: A Climate Services Vision: First Steps Toward the Future

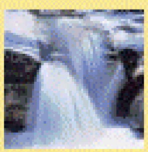
RISA Payoffs

The knowledge RISA scientists and their stakeholder partners produce is opening doors to thinking more broadly about the ways climate, environment, and society work together to create the many dimensions of risk.



Agriculture: Annual U.S. gross farm income exceeds $245 billion, according to USDA statistics. Farmers have always kept track of the weather in managing their crops and animals. Now, through the kinds of climate information RISAs provide, they can plan seasons or longer in advance to increase their profitability and decrease their risk exposure.

Wildland Fire: Wildfires are expensive and can be deadly. In 2003 alone, wildfires burned about 4 million acres, destroyed more than 5,000 structures, took the lives of 30 firefighters, and required more than $1 billion to extinguish the blazes. The National Interagency Fire Center's Predictive Services Unit, in collaboration with RISAs, now issues fire-climate forecasts for planning in advance of fire seasons across the country. The forecasts allow decision makers to estimate resource needs, identify opportunities to reduce serious fuel overloads, and develop public information campaigns to reduce fire risk.

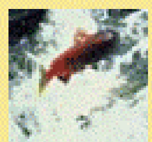


Water: Life cannot thrive without adequate water. In California alone, by 2020, economic losses linked to water scarcity are projected to average $1.6 billion per year. Assuring water to meet the vast array of demands requires the best science available. RISAs have been at the forefront in providing climate and hydrological information stretching from thousands of years in the past to a hundred or more years into the future. For example, RISA scientists studying snow hydrology in the West are developing cutting-edge hydrological models to aid water resource managers in planning.

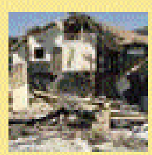
Public Health: Medical and air quality experts increasingly look to climate information to protect people from threats to air and water quality, as well as from diseases carried by mosquitoes, rodents, and other carriers influenced by climate conditions. RISAs are working to provide the decision-support tools needed to include climate, ecology, and health interactions in public health planning.

Drought: Between 1983 and 2003, drought losses amounted to nearly $160 billion, leading all other weather/climate disaster costs. In 2000 alone, drought and associated fire weather accounted for $6.3 billion in property and crop damage losses. Managing drought risk means having a good plan in place before drought makes itself known, and being able to implement the plan quickly when drought impacts occur. The RISA projects provide the scientific knowledge needed to anticipate, track, assess, and respond to drought threats at regional and local levels.

Energy Demand: Trends in climate and non-transportation energy demand go hand in hand. The federal government's 2001 National Energy Policy Report estimates that total U.S. energy consumption will rise by about 32 percent between now and 2020. A large portion of this energy will be used for heating and cooling—demands that are heavily influenced by climate. The energy industry increasingly relies on the kinds of climate information RISAs provide to anticipate and meet these energy demands.



Fisheries: Climate has a strong impact on fisheries off the coasts of the United States. For example, Pacific salmon catches are affected by El Niño and La Niña, and by the Pacific Decadal Oscillation. RISA stands at the forefront of interdisciplinary climate research that benefits fishery operations and salmon recovery efforts.



Extreme Events: NOAA estimates that between 1983 and 2003, hurricanes, storm events, and floods in the United States generated total losses ranging from $49.2 to $92.1 billion. Climate models suggest that over the next hundred years, the intensity and occurrence of extreme events are likely to grow. Anticipated impacts such as sea level rise, snowpack reduction, increase in heat waves and air pollution, and changes in water resource availability pose serious challenges to the nation. The RISAs endeavor to foster understanding about past, present, and potential future climate and build the capacity to evaluate and use a wide range of climate information. These efforts help the public prepare for today's challenges and for future climatic conditions.

Biggest Lesson:

Cannot fully understand how climate information is used, without understanding the decision environment.

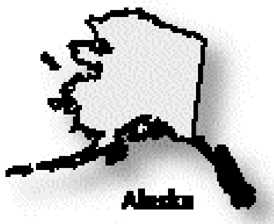
Requires:

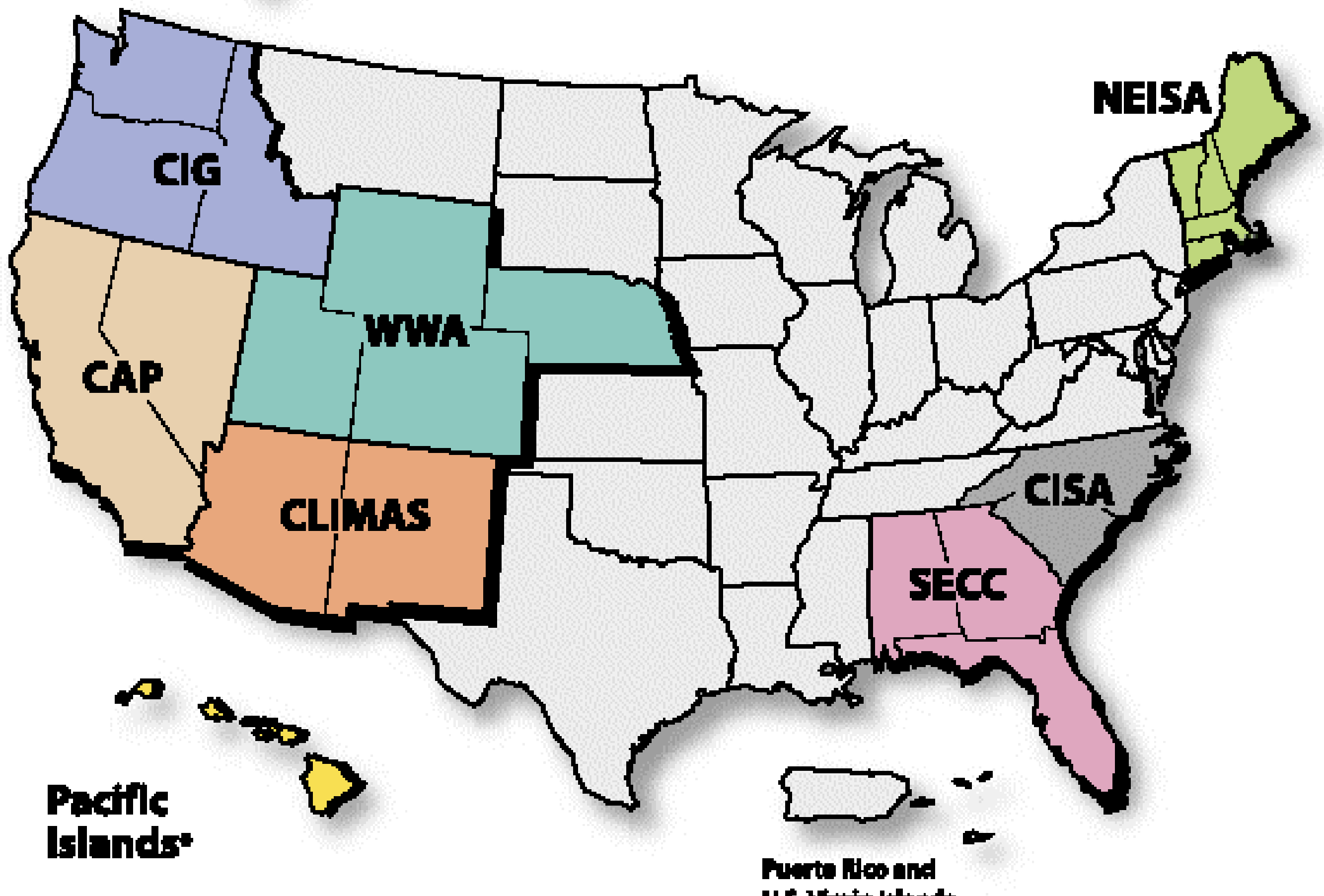
Sustained interaction with stakeholders to develop trust.

THE RISA NETWORK

The map below shows eight regions where currently funded RISA programs operate. While each RISA targets a specific U.S. region, the work of each program extends past these boundaries—creating research and products that are useful for stakeholders across the country and beyond.

NOAA is also sponsoring workshops in regions across the United States that currently have no formal link with existing RISA programs. Workshops have already been held in the southern Great Plains and Alaska. The workshops serve to educate the RISA program management about opportunities and needs for climate-relevant integrated research and the available regional research capacity in the area. In addition, the meetings are designed to educate regional research and decision-making communities about the RISA program's goals, research philosophy, and methodologies.





California Applications Program (CAP) &
The California Climate Change Center (CCCC)

meteora.ucsd.edu/cap

Climate information for California decision makers

Funded by the NOAA Office of Global Programs and
California Energy Commission

CAP is a NOAA/OGP Regional Integrated Sciences and Assessments (RISA) member

Our partner site: California Climate Data Archive

2003 Annual Report
References
Conferences
Requests for Proposals
Contacts

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15 April 2005 *RISA Speaker's Series presents:* Dan Cayan and Tony Westerling of the California Applications Program (CAP), Scripps Institution of Oceanography: California's vulnerability to climate variability and change and CAP's efforts to assist decisionmakers on water resources, wildfire and human health issues
(see Conferences for more details).

Success Stories

The California Applications Program (CAP) and the California Climate Change Center (CCCC) aim to develop and provide better climate information and forecasts for decision makers in California and the surrounding region. By working directly with users, CAP and CCCC are working to evaluate climate information needs and utility from the user perspective.

Objectives

- Evaluate weather and climate forecasts for California
- Improve local models and forecasts of water resources and fire risks
- Tailor and disseminate forecasts to local users

Approach

- Downscale climate forecasts and simulations from global to regional to local scales
- Provide a variety of forecasts in real time
- Determine forecast reliability using historical hindcasts
- Work directly with users to develop useful forecast applications

Lessons Learned

- Interest level of public and private sectors varies; Climatologists must be ready to strike when iron is hot
- Simple, clear illustrations are needed
- Relationships with end-users need to be cultivated
- Communication enhances credibility
- More focus is needed on non-winter seasons and broader regions
- Collaborations with large institutional programs are key
- Climate data needs to be updated and maintained

Special CAP/CCCC Topics

Illilouette Adventure

Brian Huggett attempted to reach Illilouette Creek weekend of 19/20 March 2005

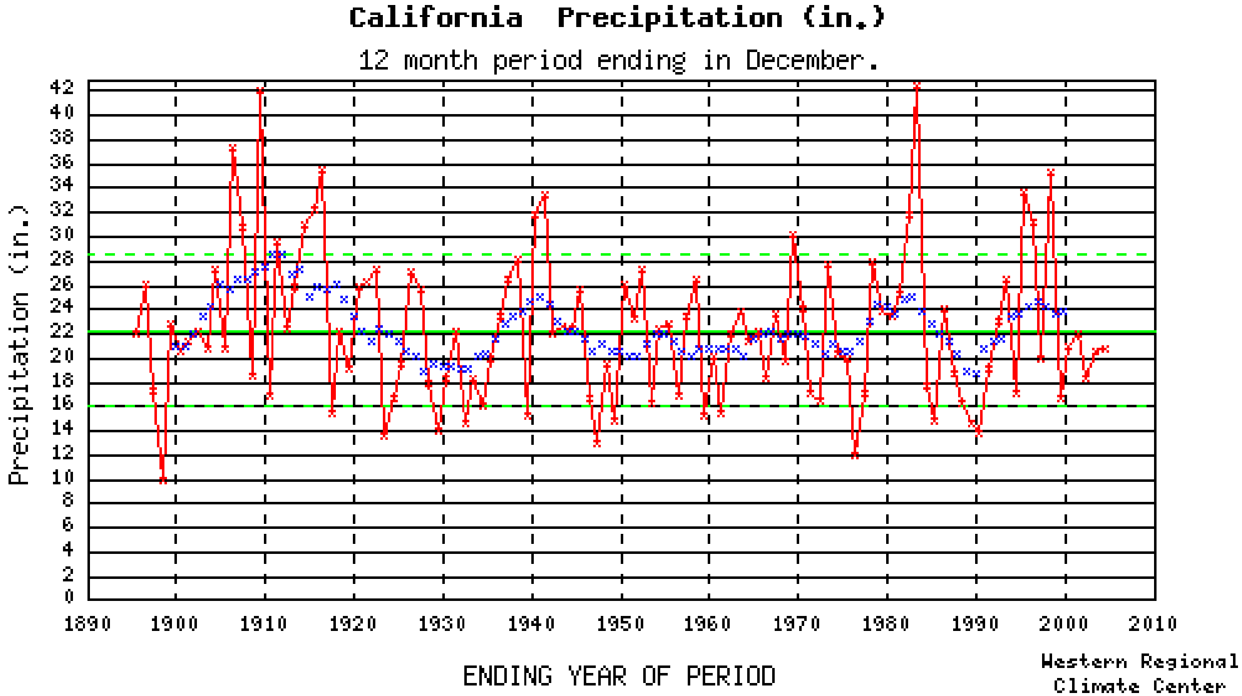
Winter image of the California region

CAP/CCCC Research

- **From climate-change spaghetti to climate-change distributions for 21st Century California**
- *Updated daily*
  Medium-range Hetch Hetchy precipitation and Tuolumne Meadows temperature forecast
- **The CALFED Bay-Delta Program: Climate Science issues and needs of the CALFED Bay-Delta Program**
- **Climate Variability and CALFED -- CAP/CCCC Contributions to the 2003 CALFED Science Conference**
- **El Niño and California 2002-2003**
- **Potential Impacts of Global Warming on California's Hydrology**
- **Changes in Spring in the Western United States: Updated for 1999-2001**
- **Climate and Human Health**
- **Streamflow and Precipitation Forecasts for the Merced, Carson and Kings Rivers**

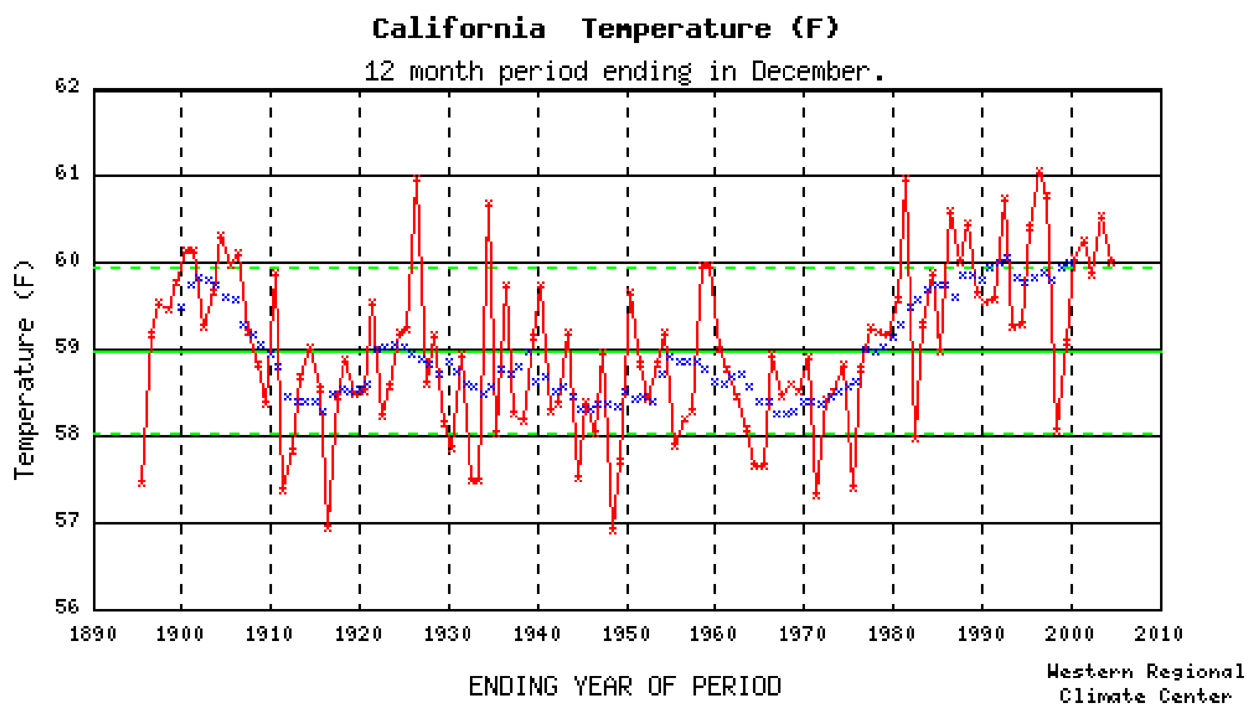
California Statewide Precipitation

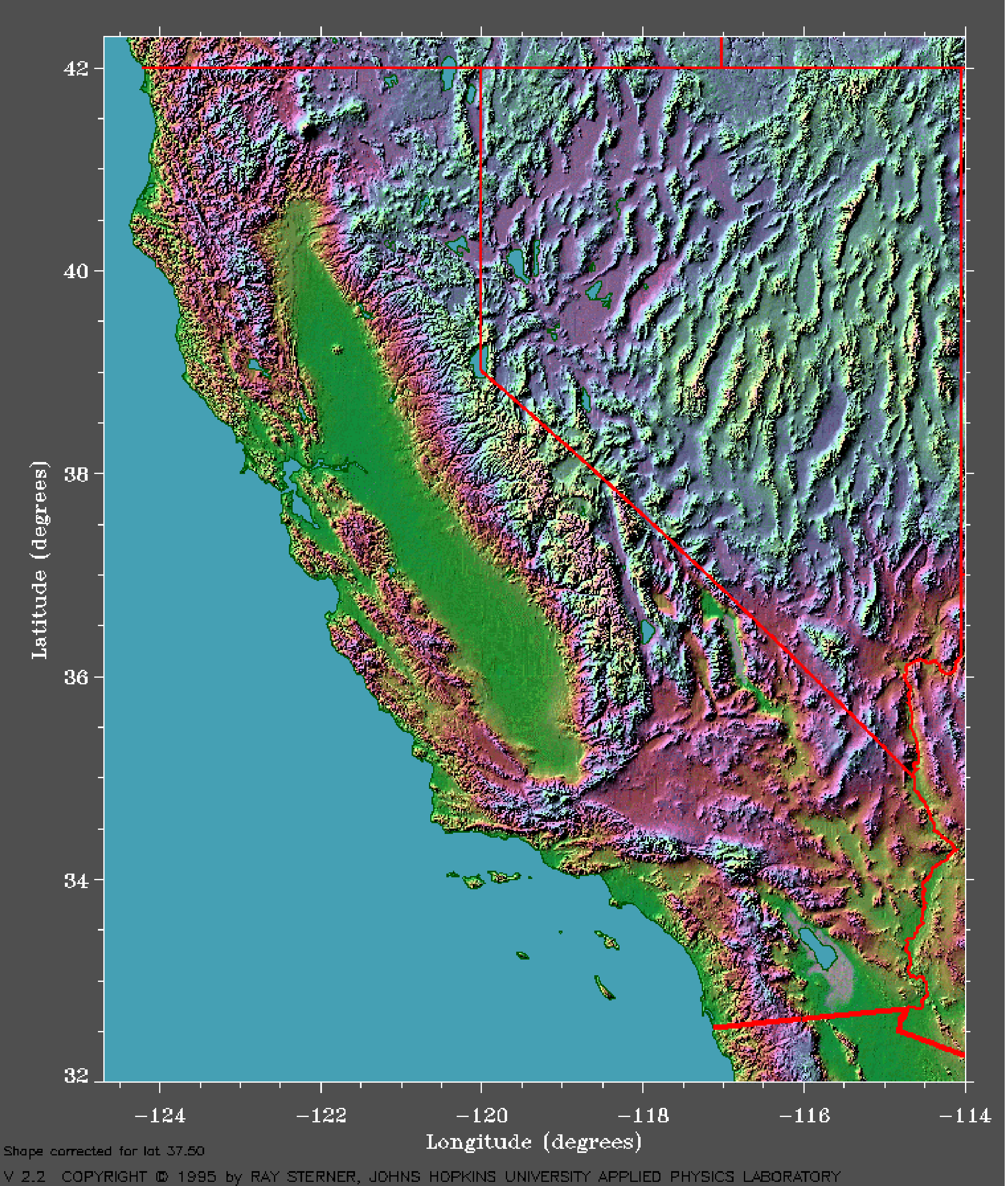
1895-2004



California Statewide Temperature

1895-2004

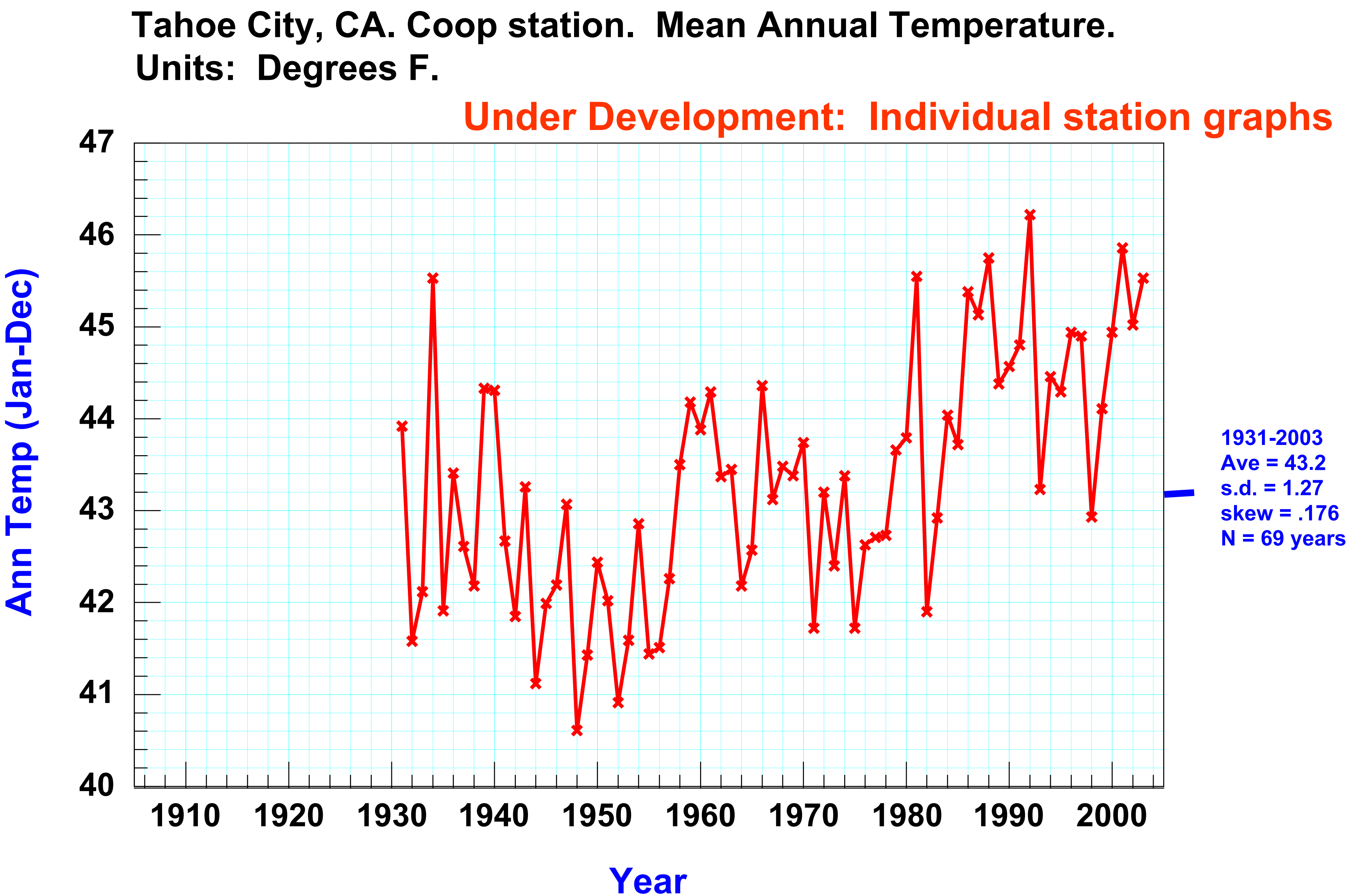




Does this:

Capture this ?

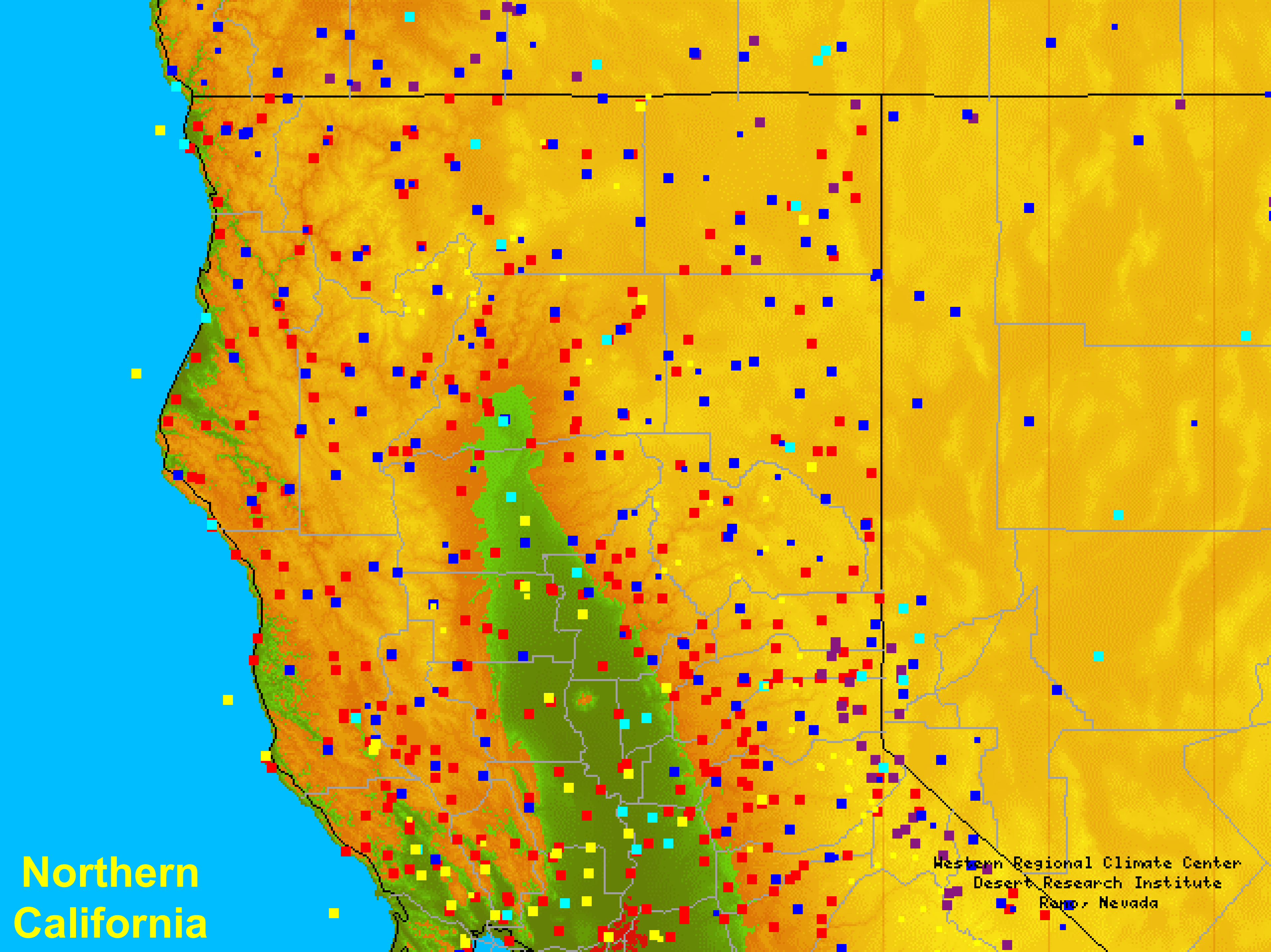
More details, please !

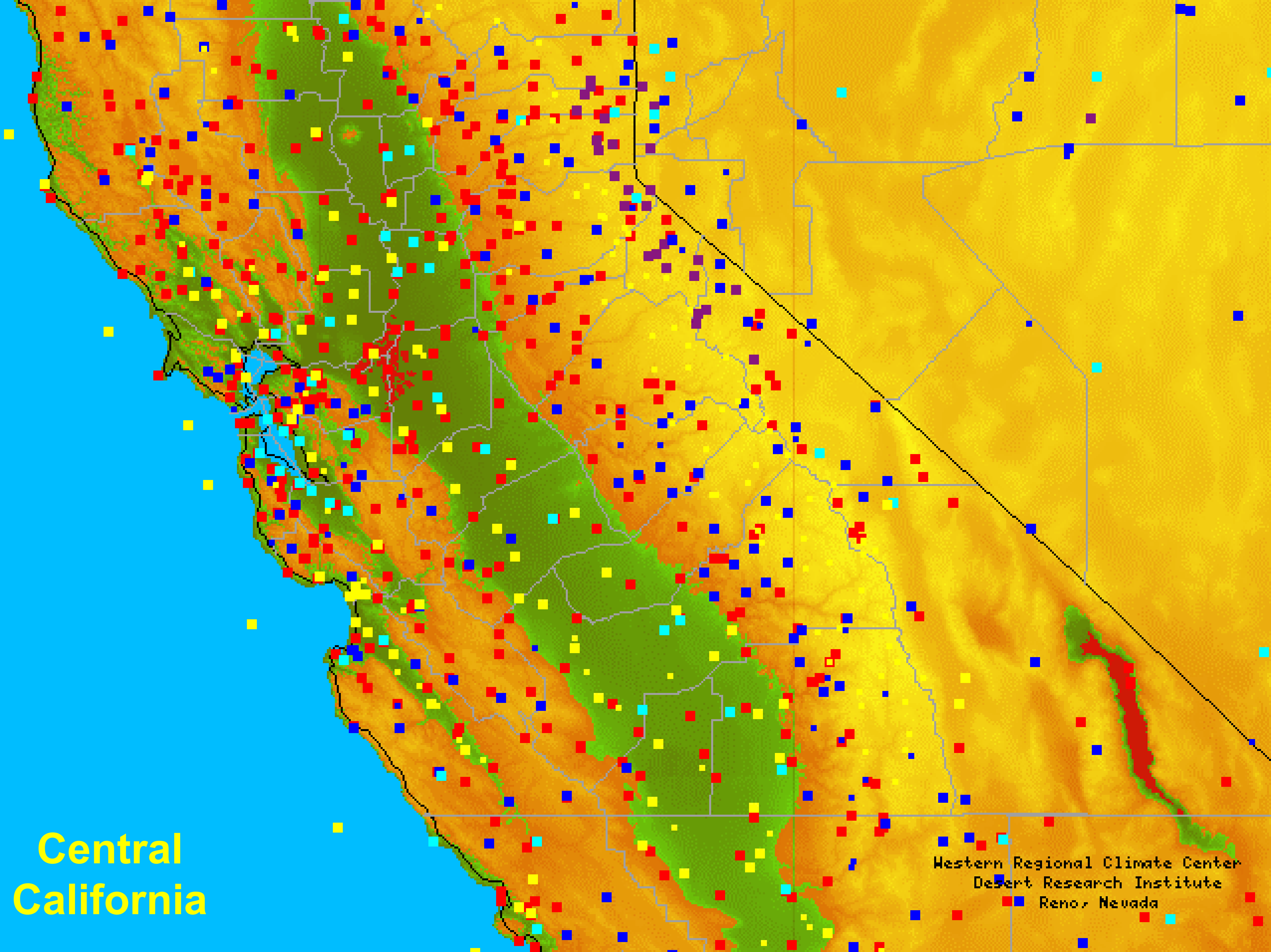

Tahoe City, CA. Coop station. Mean Annual Temperature.
Units: Degrees F.
Under Development: Individual station graphs
Ann Temp (Jan-Dec)
Year
47
46
45
44
43
42
41
40
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
1931-2003
Ave = 43.2
s.d. = 1.27
skew = .176
N = 69 years

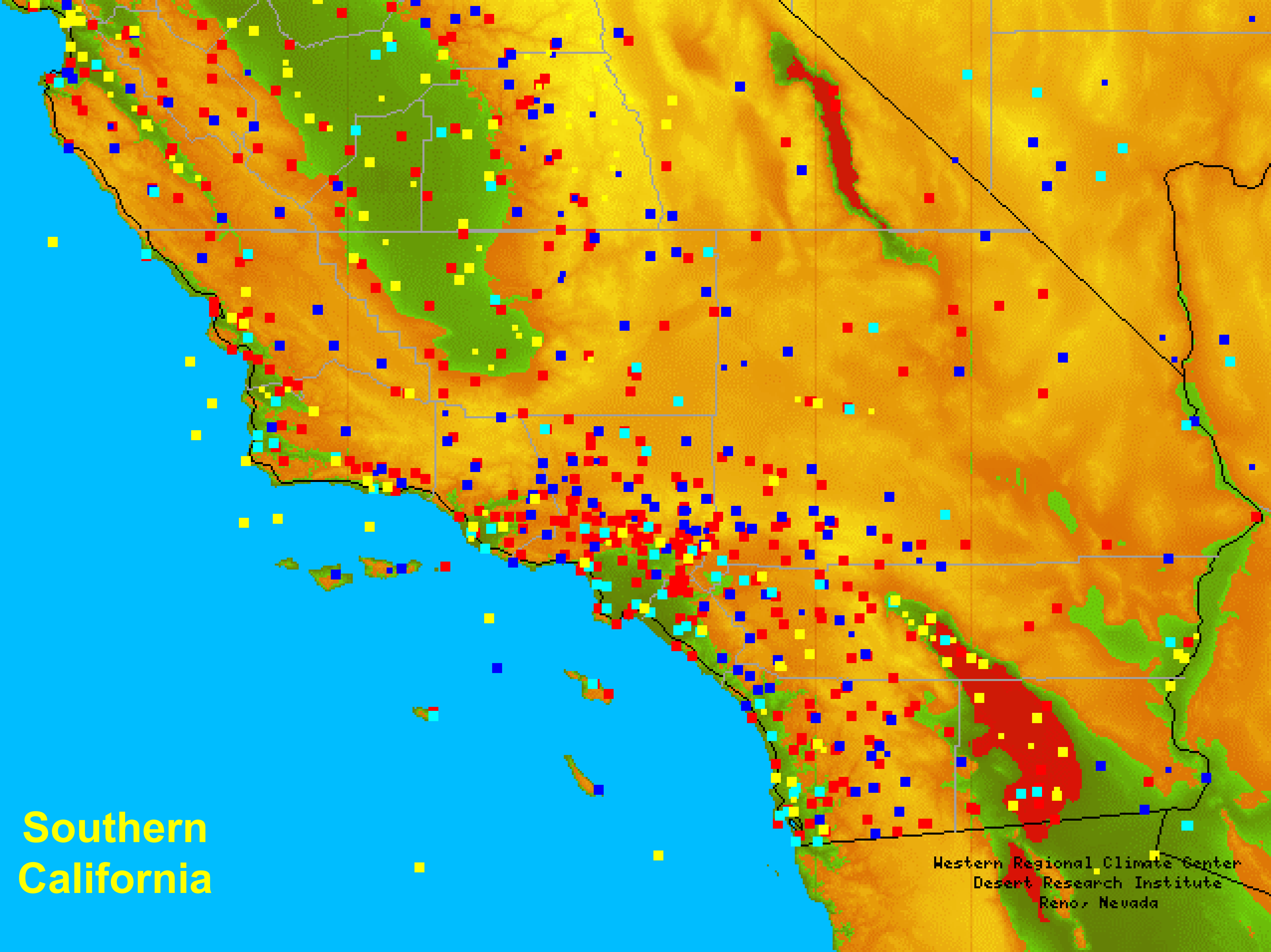
Data Sets

- NOAA
  - Cooperative
  - Surface Airways (NWS, FAA, ASOS, AWOS)
  - Upper Air
  - Coastal and buoys
- USDA Snotel
- Interagency RAWS
- Climate Reference Network
- Cal Dept Water Resources / Snow Survey & Precip
- Cal CIMIS (Cal Irrigation Management & Info System)
- Cal Air Resources Board and Air Quality Mgmt Districts
- Specialized mesonets and California projects
- Research data sets
- *National Cooperative Mesonet – ISOS: Int Sfc Obs Sys
  or NERON: National Env Real-time Obs Network
- Derived, gridded, analyzed data under consideration

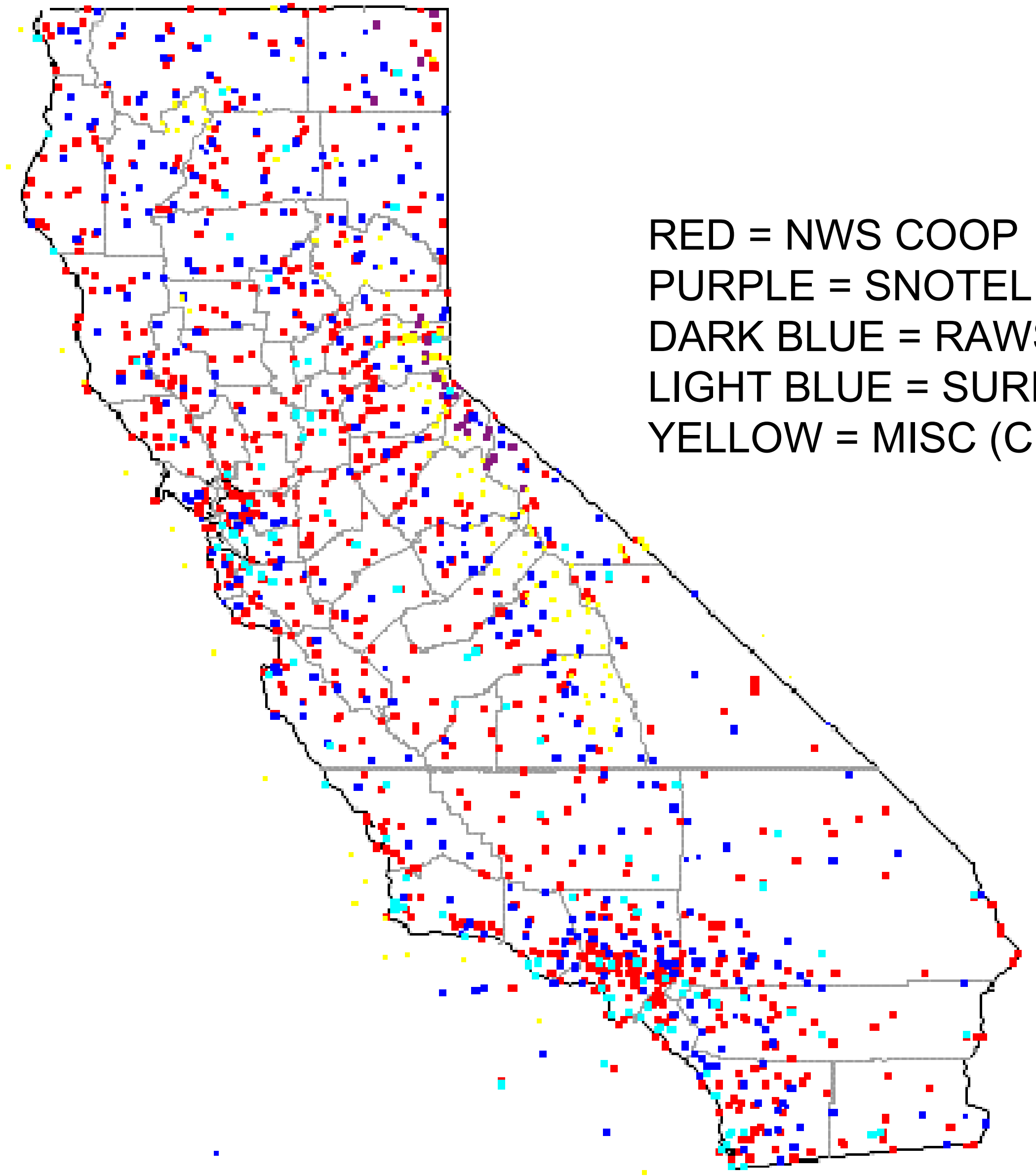
California climate – index time series


Northern California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada


Central
California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada

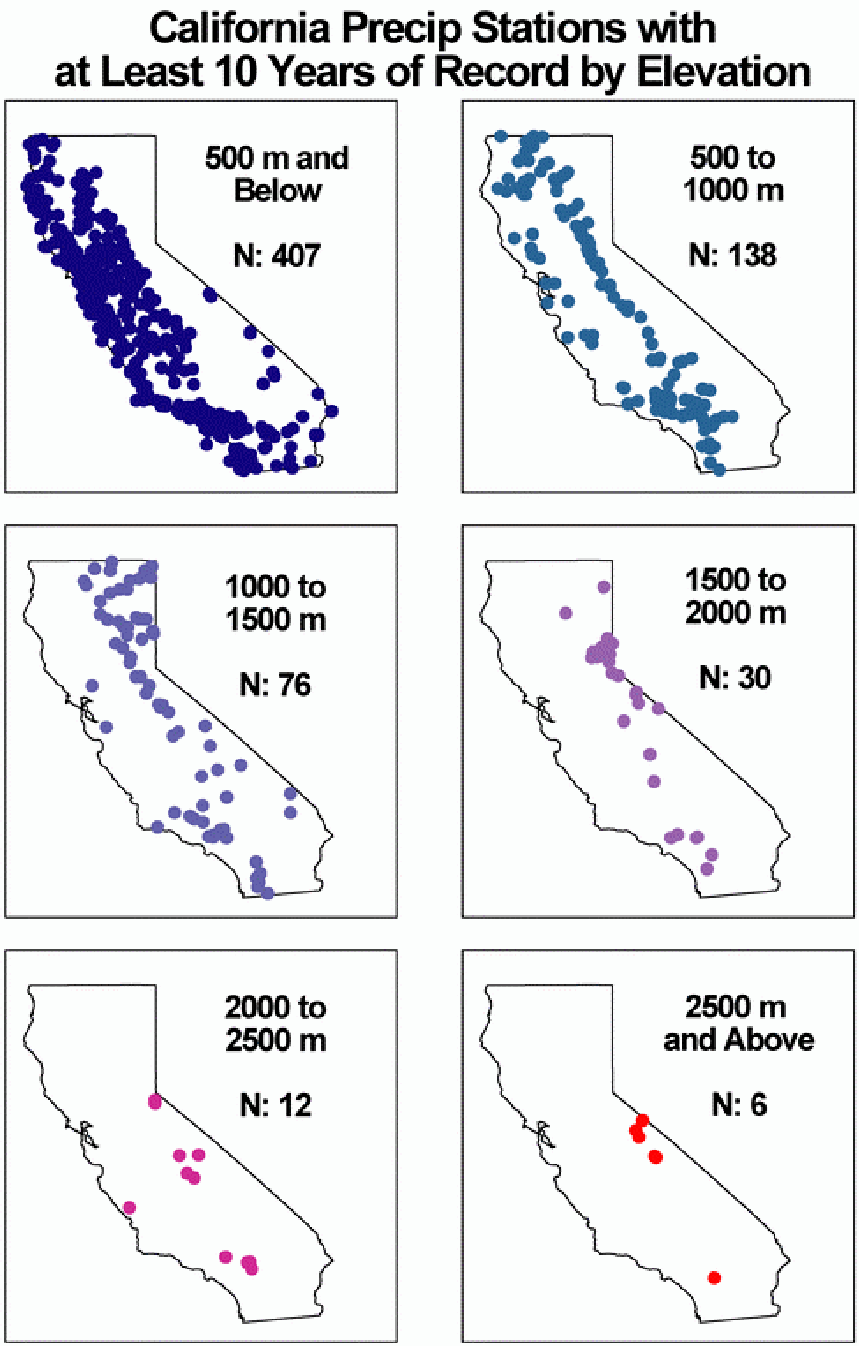

Southern
California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada

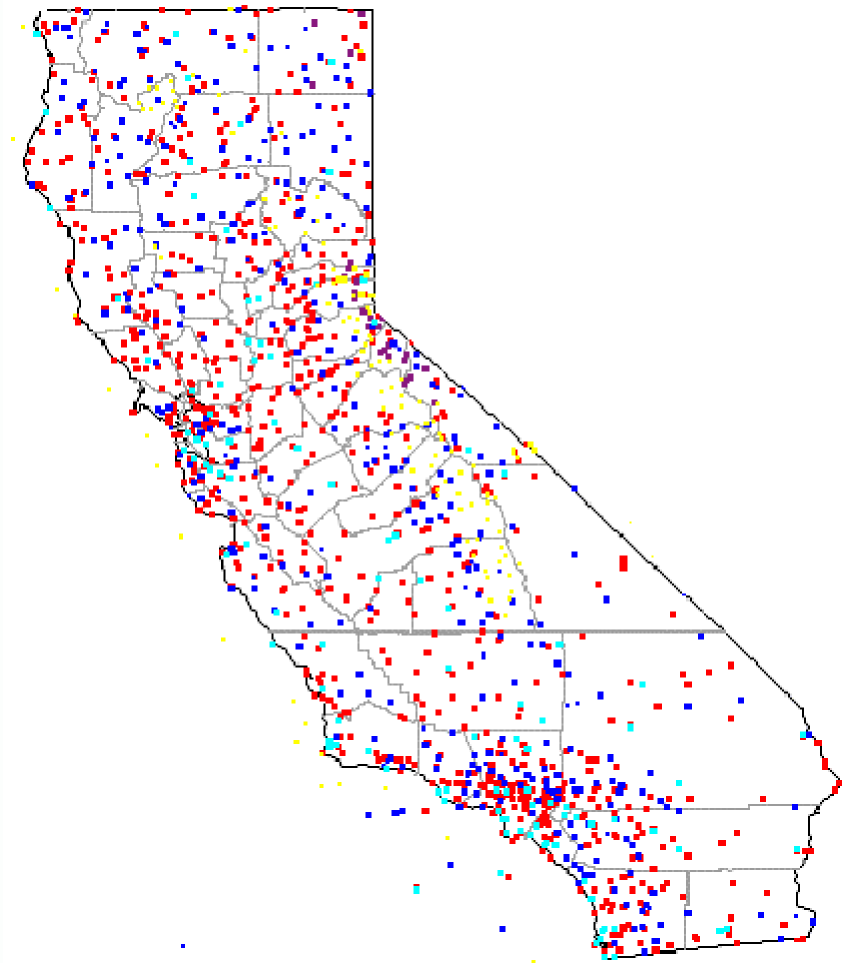
Current Stations



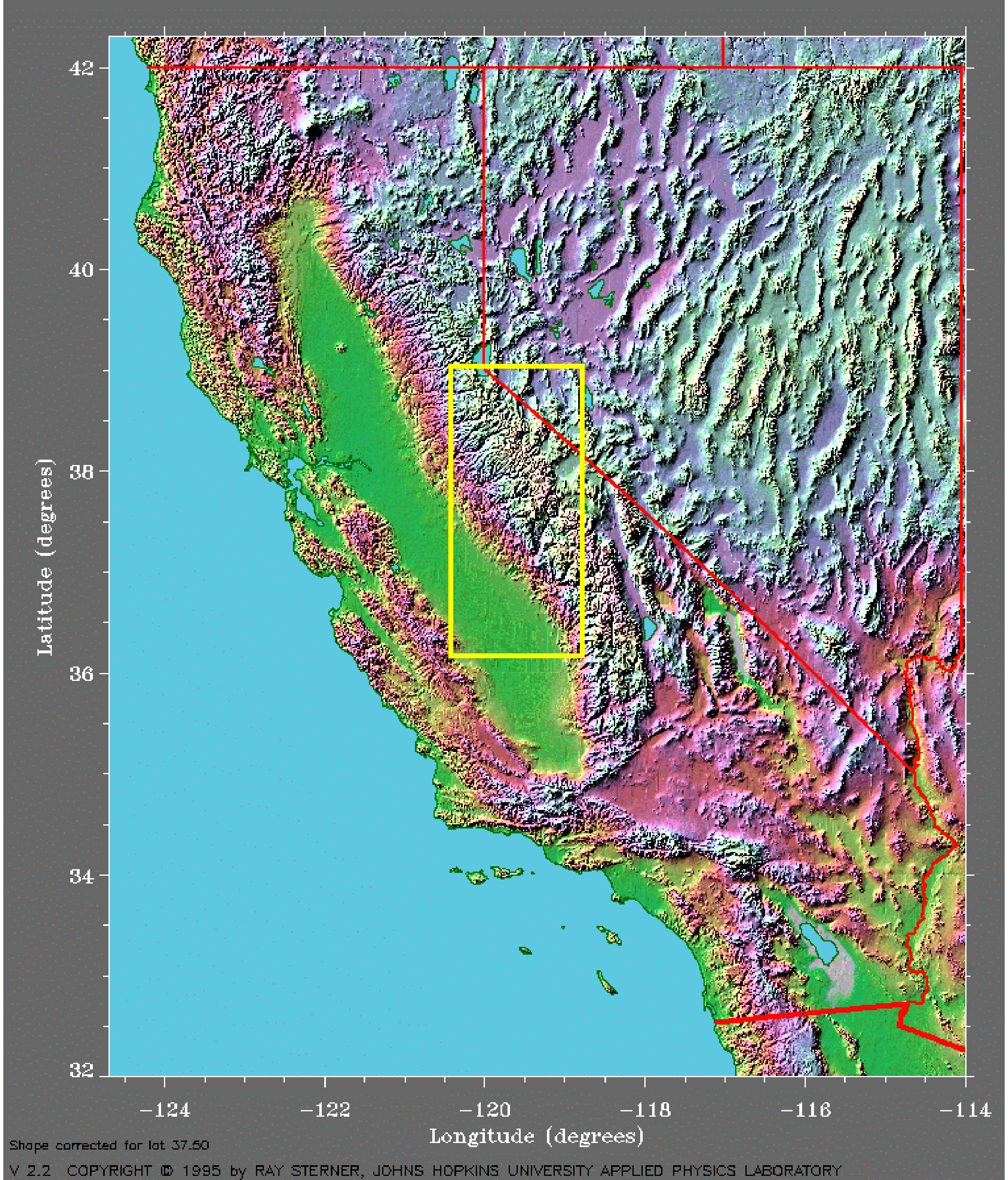
RED = NWS COOP
PURPLE = SNOTEL
DARK BLUE = RAWS
LIGHT BLUE = SURFACE AIRWAYS
YELLOW = MISC (CURRENTLY CIMIS, CDEC, BUOYS)

A Need for High Elevation Sites





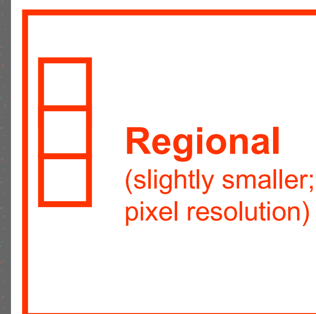
Left figure: Dan Cayan, Scripps Climate Research Division, California Applications Program



Grids.

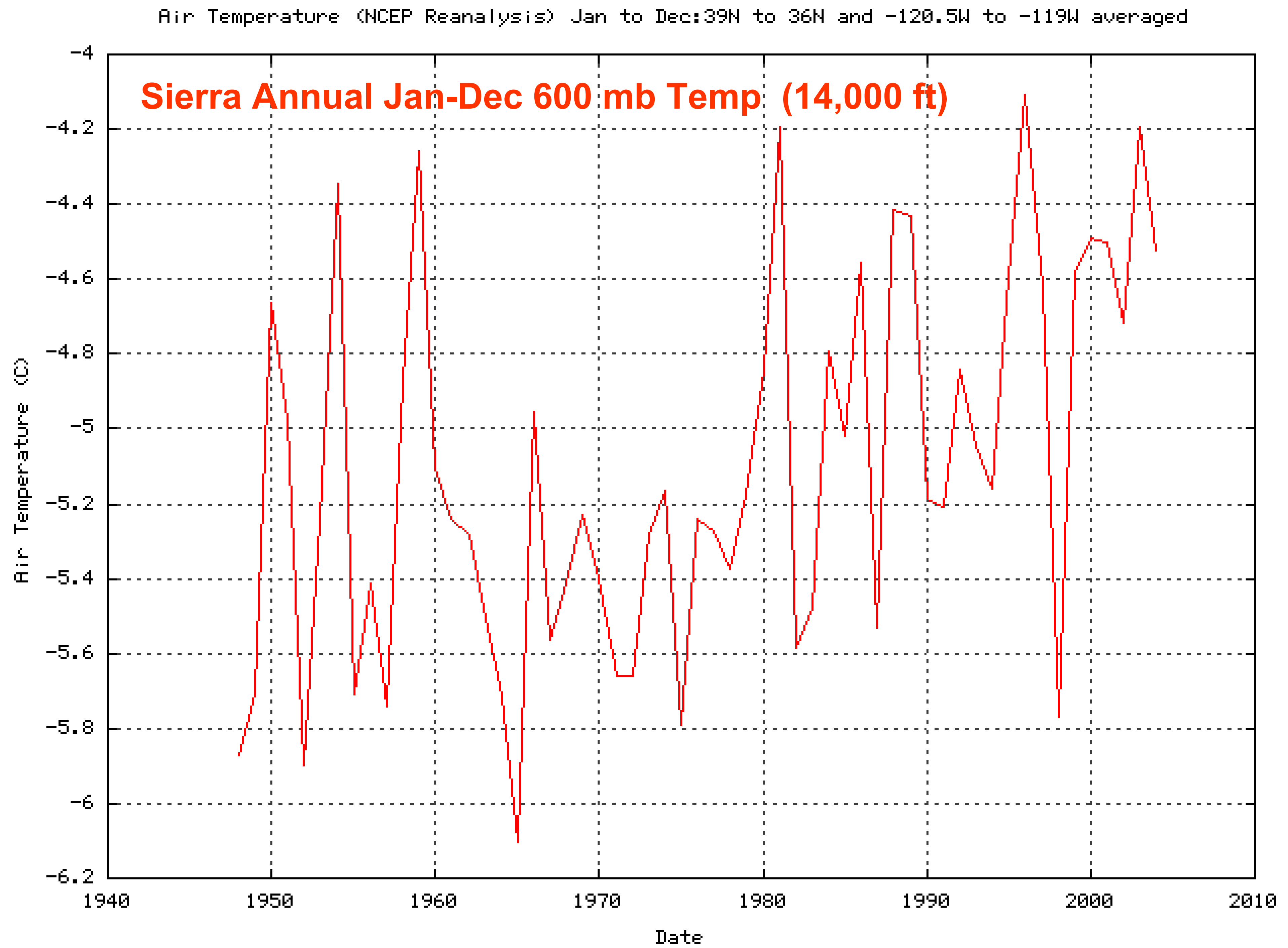
Reanalysis Resolution:

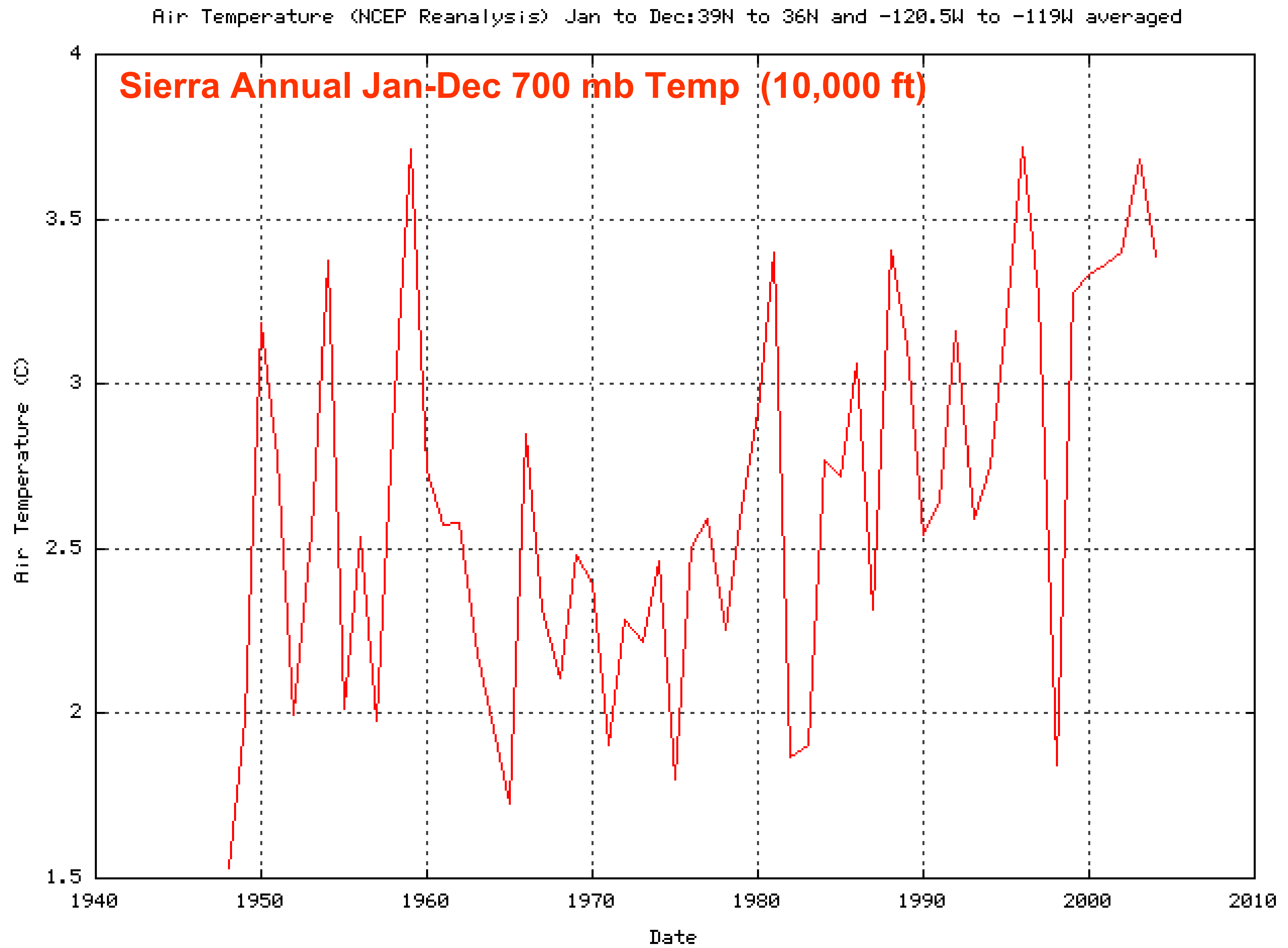
Global

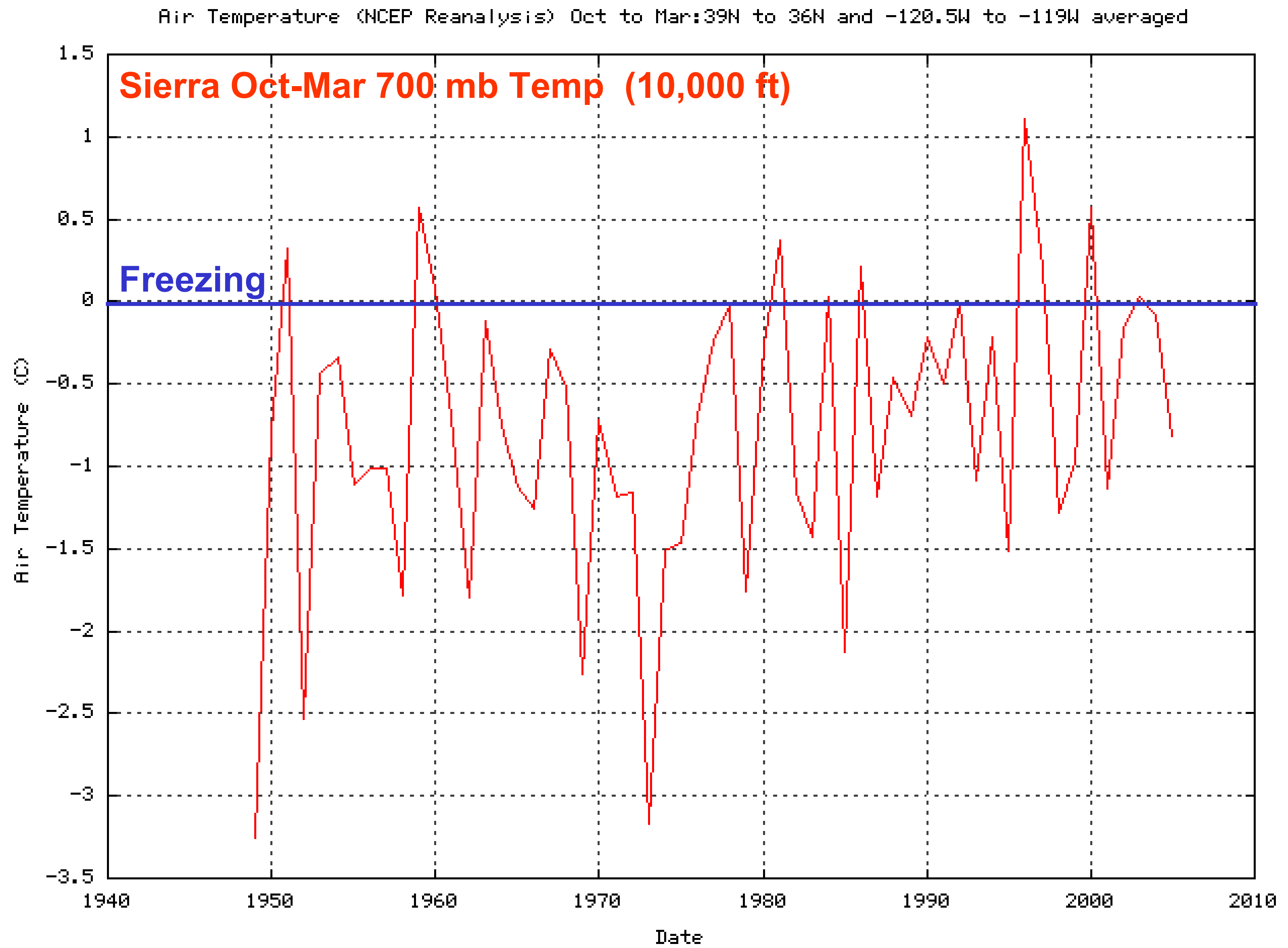


Desired Resolution

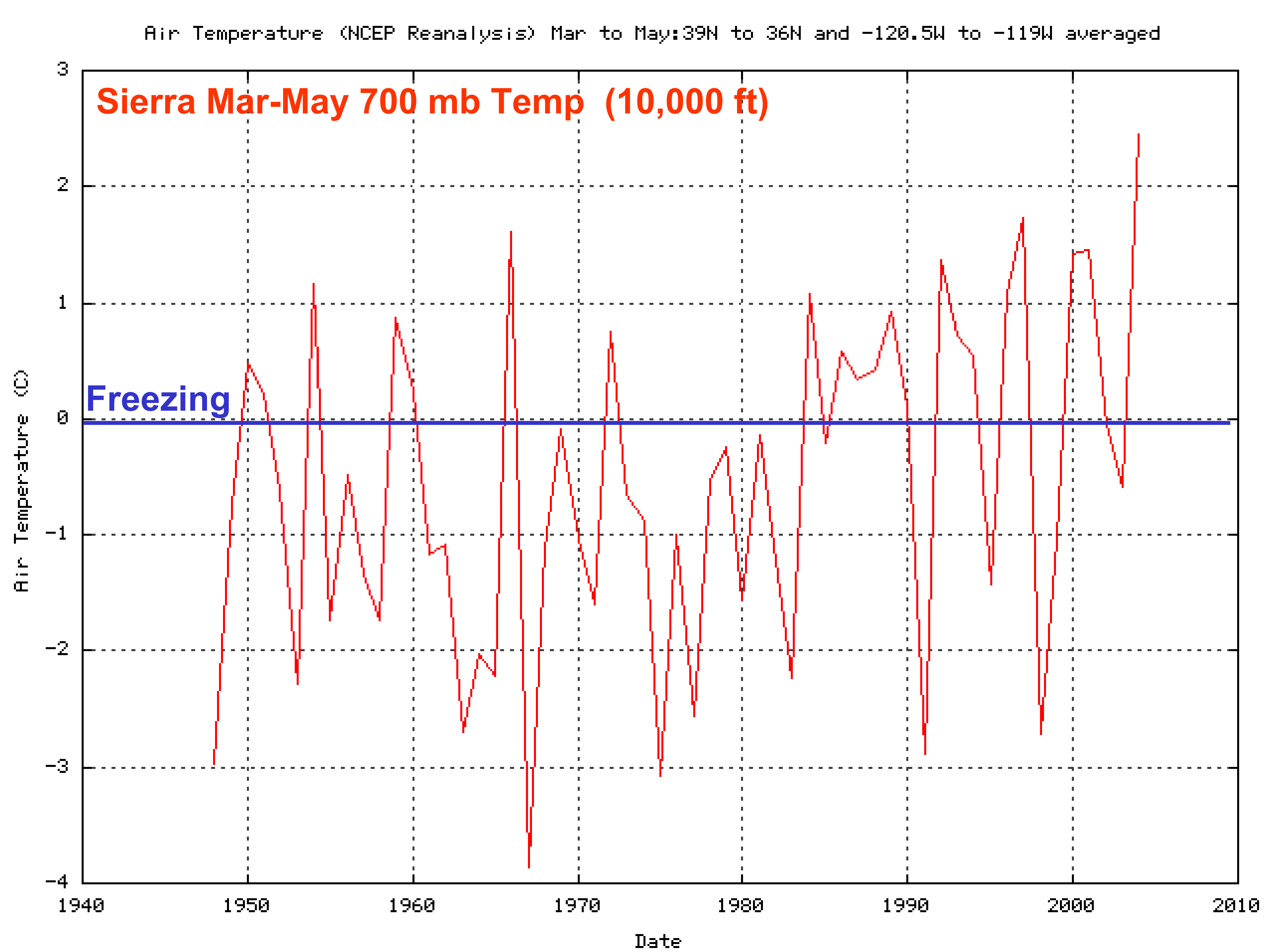
About 1 km

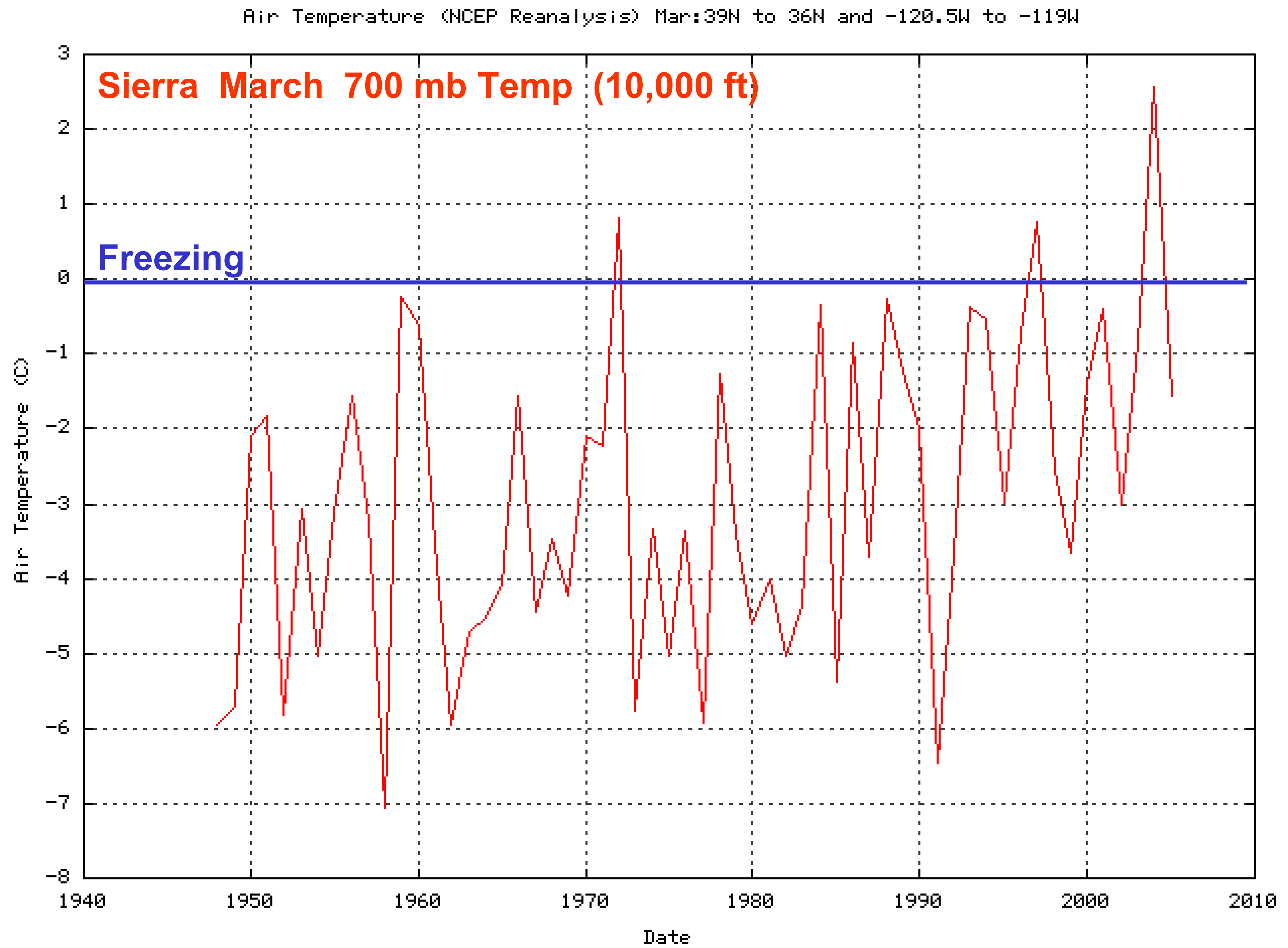

Air Temperature (NCEP Reanalysis) Jan to Dec:39N to 36N and -120.5W to -119W averaged
Sierra Annual Jan-Dec 600 mb Temp (14,000 ft)
-4
-4.2
-4.4
-4.6
-4.8
-5
-5.2
-5.4
-5.6
-5.8
-6
-6.2
Air Temperature (C)
1940
1950
1960
1970
1980
1990
2000
2010
Date


Air Temperature (NCEP Reanalysis) Jan to Dec:39N to 36N and -120.5W to -119W averaged
Sierra Annual Jan-Dec 700 mb Temp (10,000 ft)
Air Temperature (C)
4
3.5
3
2.5
2
1.5
1940
1950
1960
1970
1980
1990
2000
2010
Date



Air Temperature (NCEP Reanalysis) Oct to Mar:39N to 36N and -120.5W to -119W averaged
Sierra Oct-Mar 700 mb Temp (10,000 ft)
Freezing
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Air Temperature (C)
1940
1950
1960
1970
1980
1990
2000
2010
Date


Air Temperature (NCEP Reanalysis) Mar to May:39N to 36N and -120.5W to -119W averaged
Sierra Mar-May 700 mb Temp (10,000 ft)
Freezing
Air Temperature (C)
3
2
1
0
-1
-2
-3
-4
1940
1950
1960
1970
1980
1990
2000
2010
Date



Air Temperature (NCEP Reanalysis) Mar:39N to 36N and -120.5W to -119W
Sierra March 700 mb Temp (10,000 ft)
Freezing
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
Air Temperature (C)
1940
1950
1960
1970
1980
1990
2000
2010
Date


2003 March 10

White Mountain Summit.

Highest active live transmission station in North America.

14246 ft. / 4342 m.

Summer 2003


White Mtn Summit
Wind braces July 2004

White Mtn Summit
Solar Sensor July 2004

White Mtn Summit
Reconfigured July 2004

White Mountain
Summit

East Mast

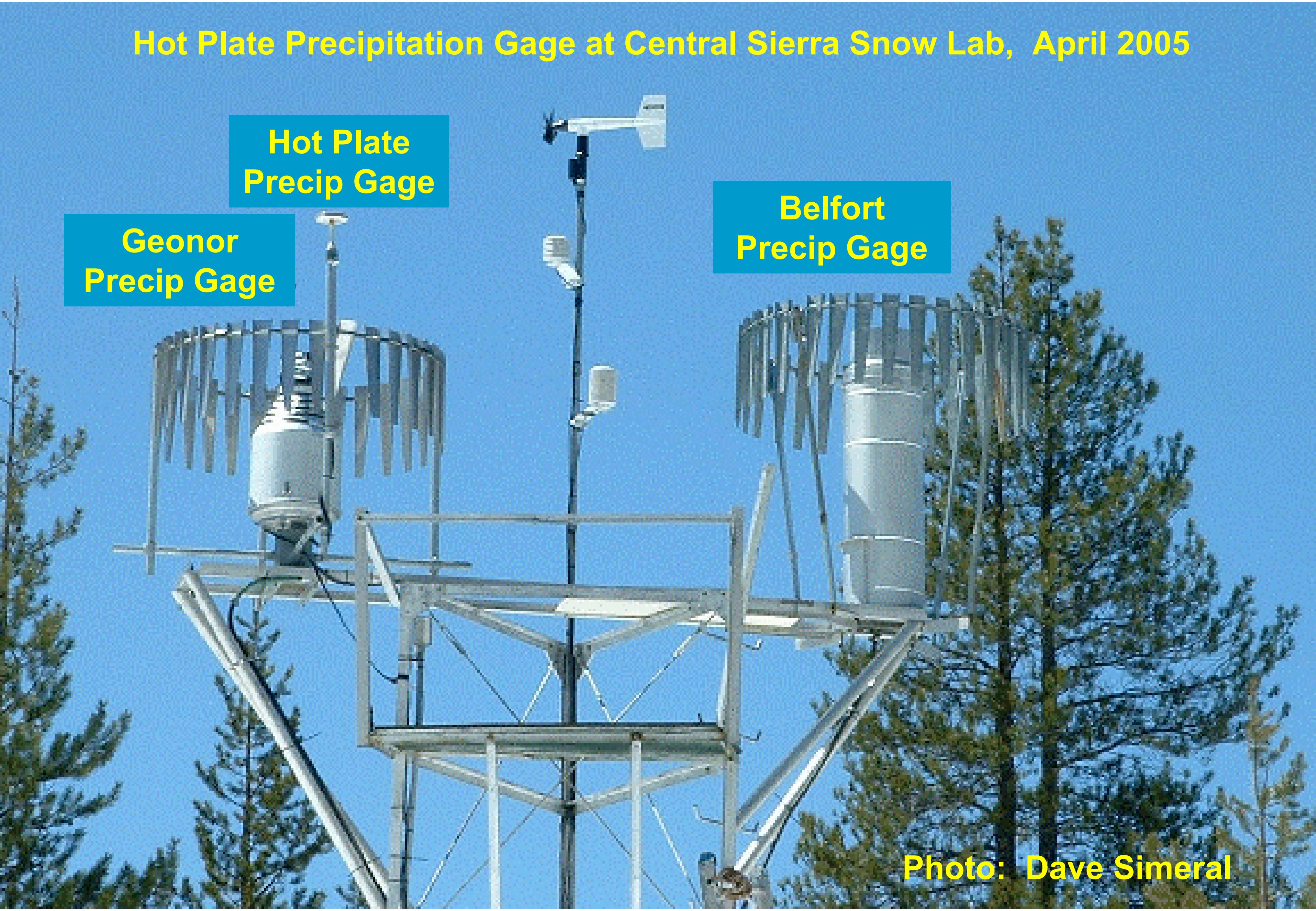
Light Riming

December 8, 2004

Photo Courtesy
John Smiley, WMRS

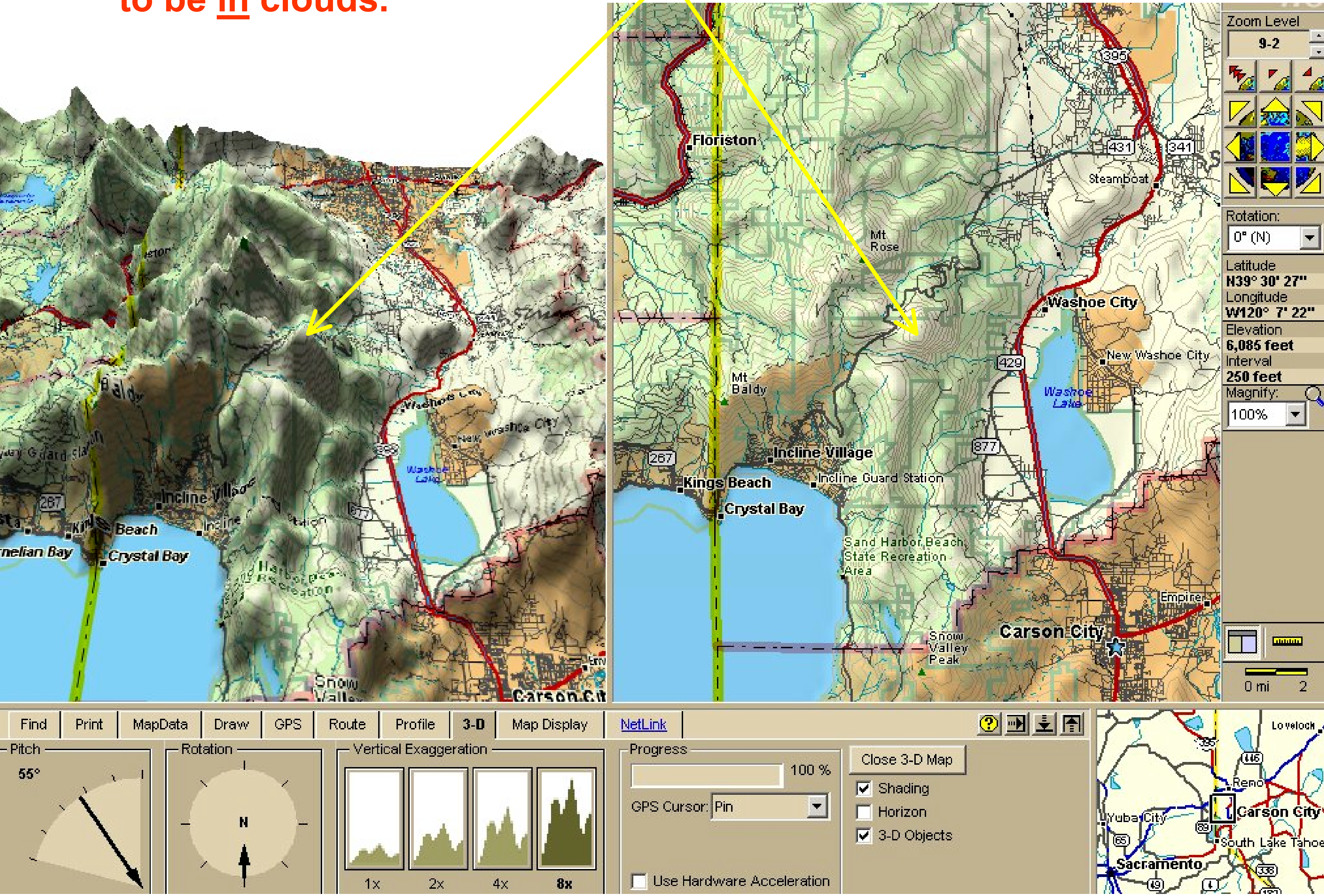
South **Central Sierra Snow Lab** East

Photo: Dave Simeral


Hot Plate Precipitation Gage at Central Sierra Snow Lab, April 2005
Hot Plate Precip Gage
Geonor Precip Gage
Belfort Precip Gage
Photo: Dave Simeral

Chemists, for example, like to be <u>in</u> clouds.

Slide Mountain, Lake Tahoe Basin, 9650 ft.




Slide Mountain
Toward SSW
Photo: Dave Simeral

Slide Mountain Toward NW

Photo: Dave Simeral

Needs AC Power!
Our current mission

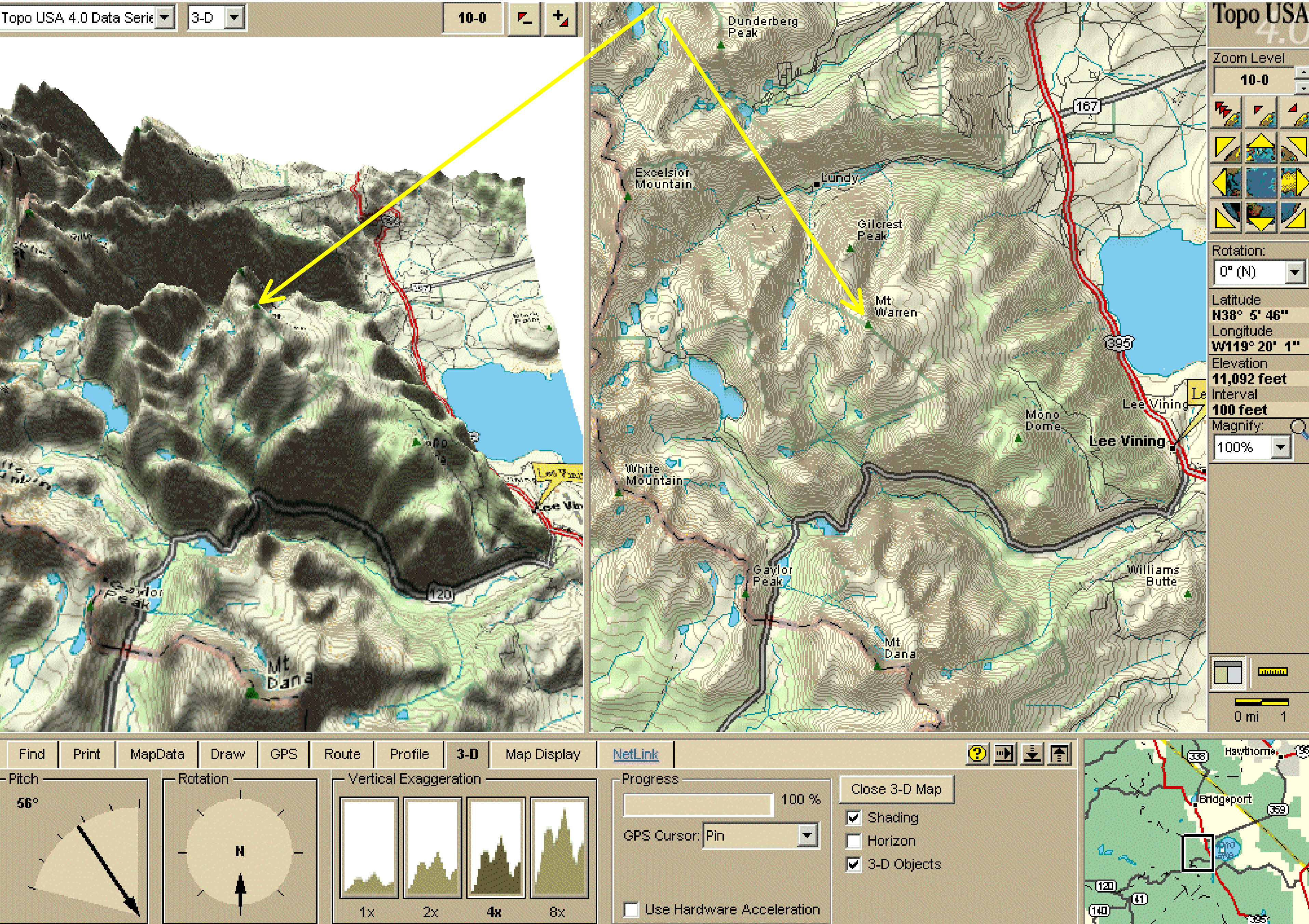
<u>operations</u>? or <u>testing</u> ?

Ice
+
Wind
+
Imbalance
+
Shaking
+
Clouds
+
Battery Discharge
+
Many Hours
=
"Interesting Data"

Ward Peak. Lake Tahoe Basin. 8600 feet.

Photo: Arlen Huggins

Mt Warren



Topo USA 4.0 Data Serie
3-D
10-0
Dunderberg Peak
Excelsior Mountain
Lundy
Gilcrest Peak
Mt Warren
Mono Dome
Lee Vining
White Mountain
Gaylor Peak
Williams Butte
Mt Dana
167
395
120
Topo USA 4.0
Zoom Level
Rotation:
0° (N)
Latitude
N38° 5' 46"
Longitude
W119° 20' 1"
Elevation
11,092 feet
Interval
100 feet
Magnify:
100%
0 mi
1
Find
Print
MapData
Draw
GPS
Route
Profile
3-D
Map Display
NetLink
Pitch
56°
Rotation
N
Vertical Exaggeration
1x
2x
4x
8x
Progress
100 %
GPS Cursor:
Pin
Use Hardware Acceleration
Close 3-D Map
Shading
Horizon
3-D Objects
Hawthorne
Bridgeport

Mt Warren (12327 ft) Toward South. July 2000.

View looking south up Deer Cr (NB: beautiful Pleistocene Rock Glacial cyn), a tributary of Lundy Cyn (note also limber pines at left foreslope (one of our sites). 7/00

Photo: Connie Millar


Photo: Dave Simeral

Temporal Variability of

Orographic Effect on Precipitation

Sacramento (10')

Versus

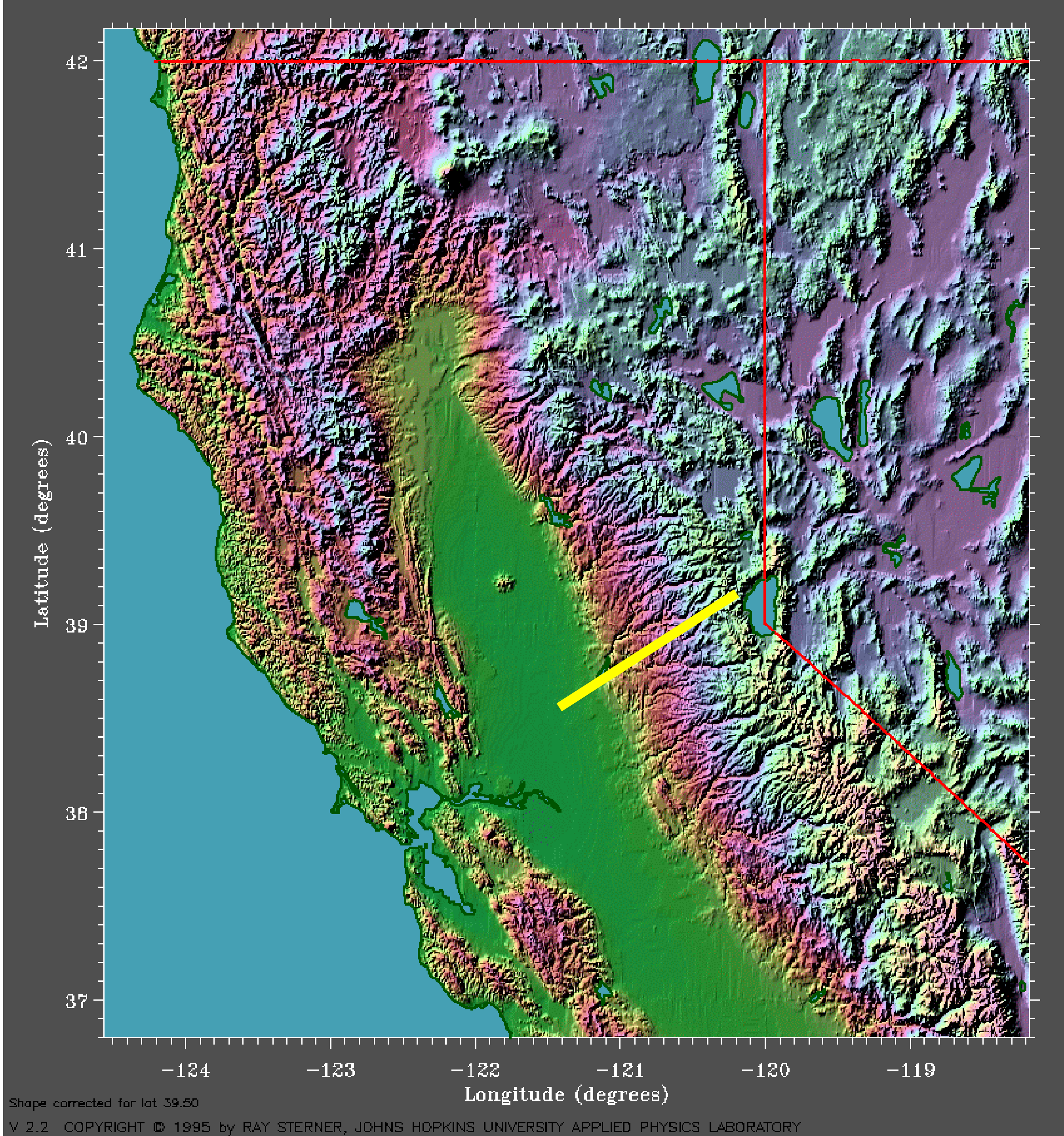
Tahoe City (6230')

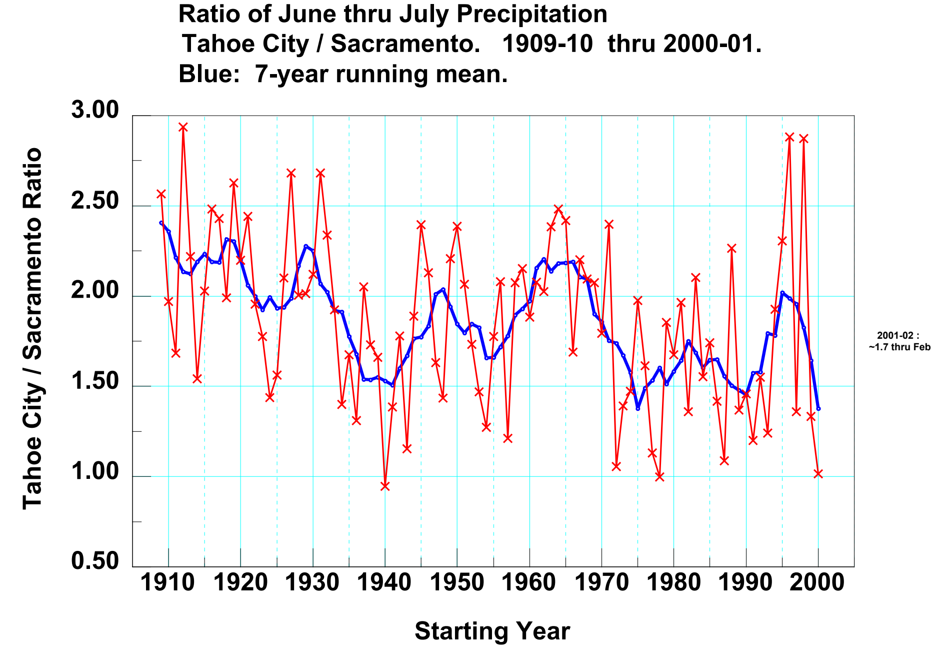
July thru June

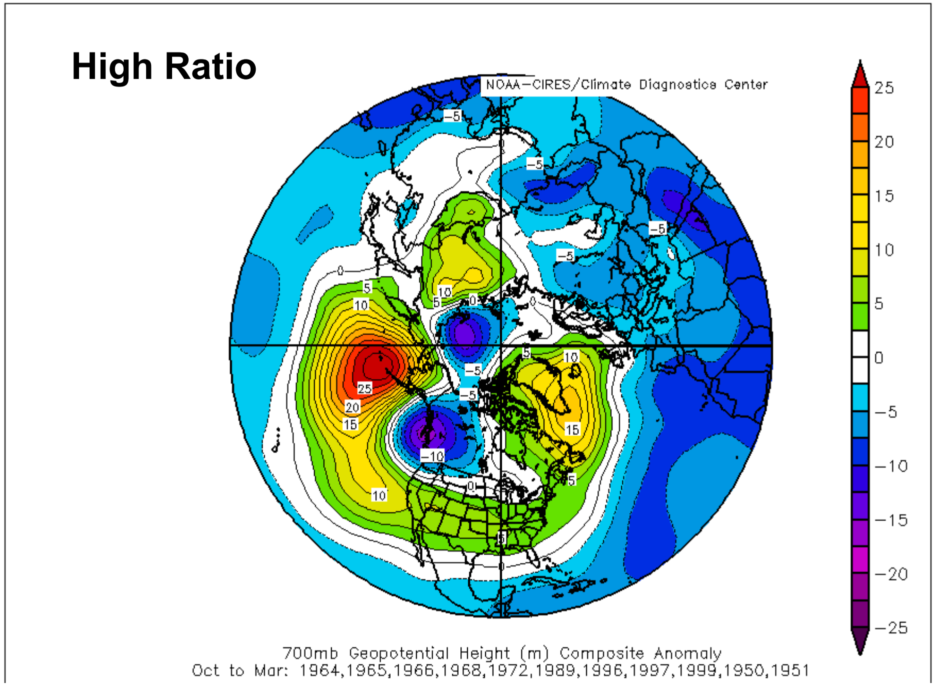
Oct-March Percent of Annual:

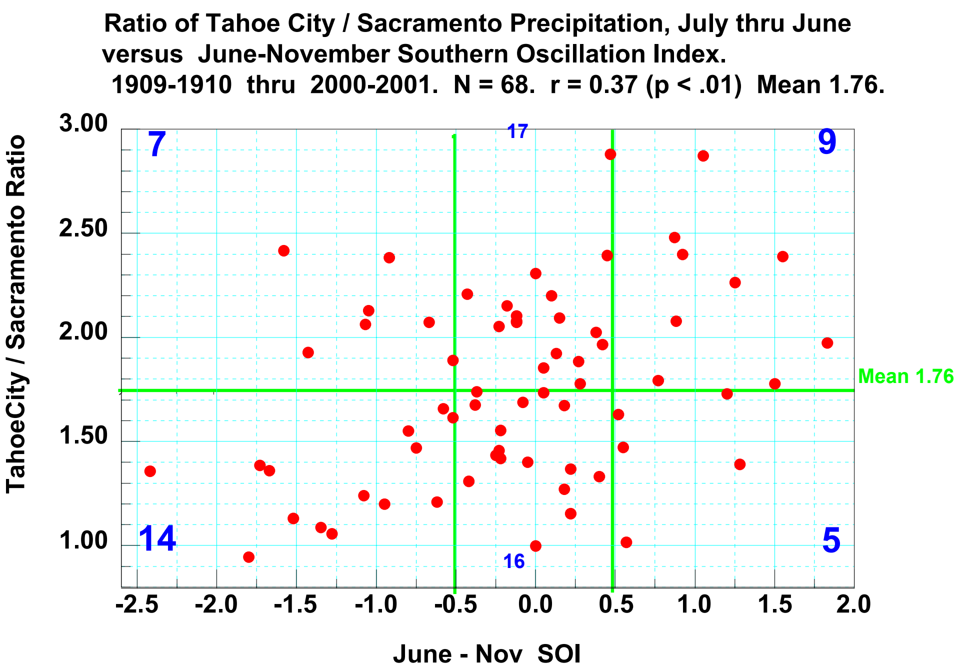
83% at Tahoe

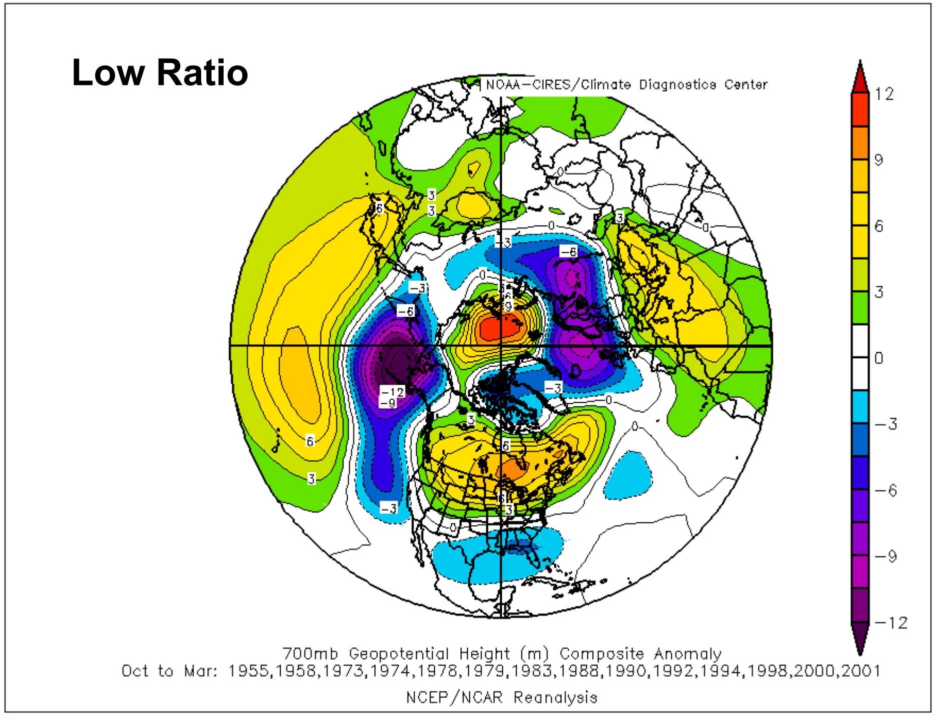
88% at Sacramento



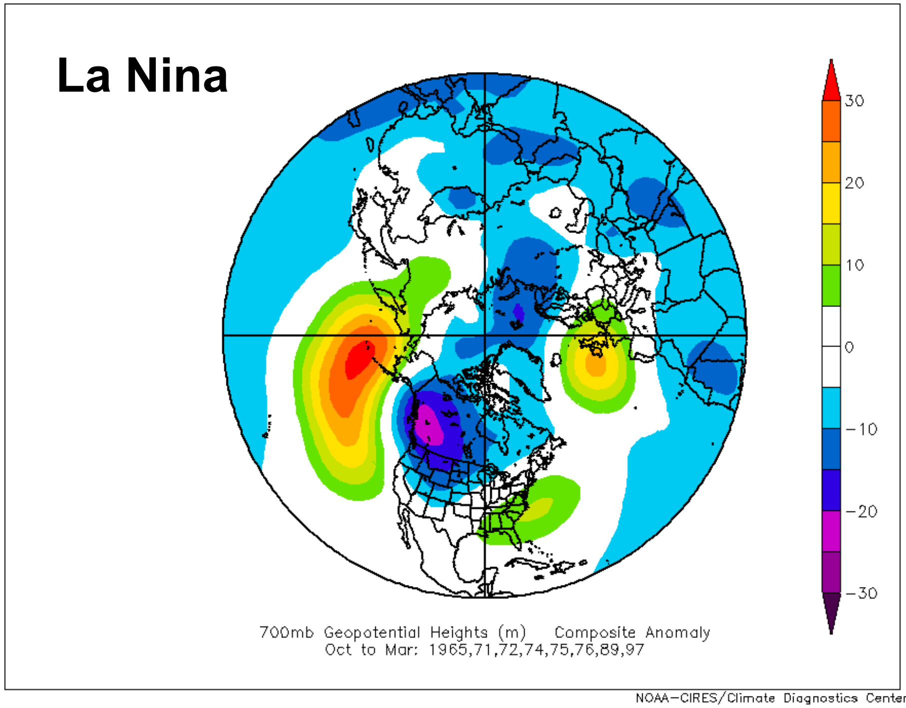


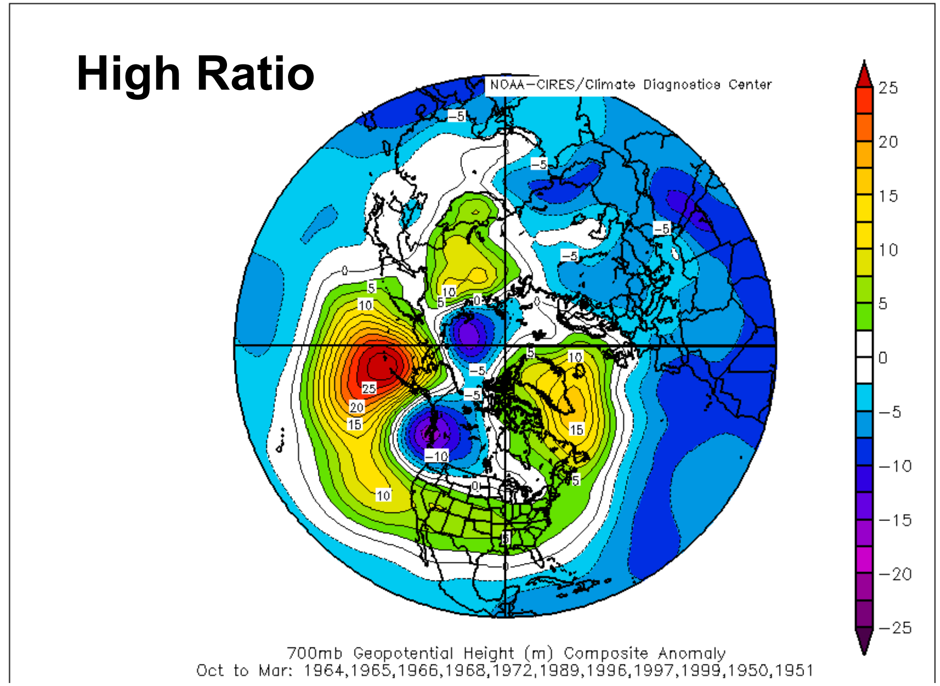


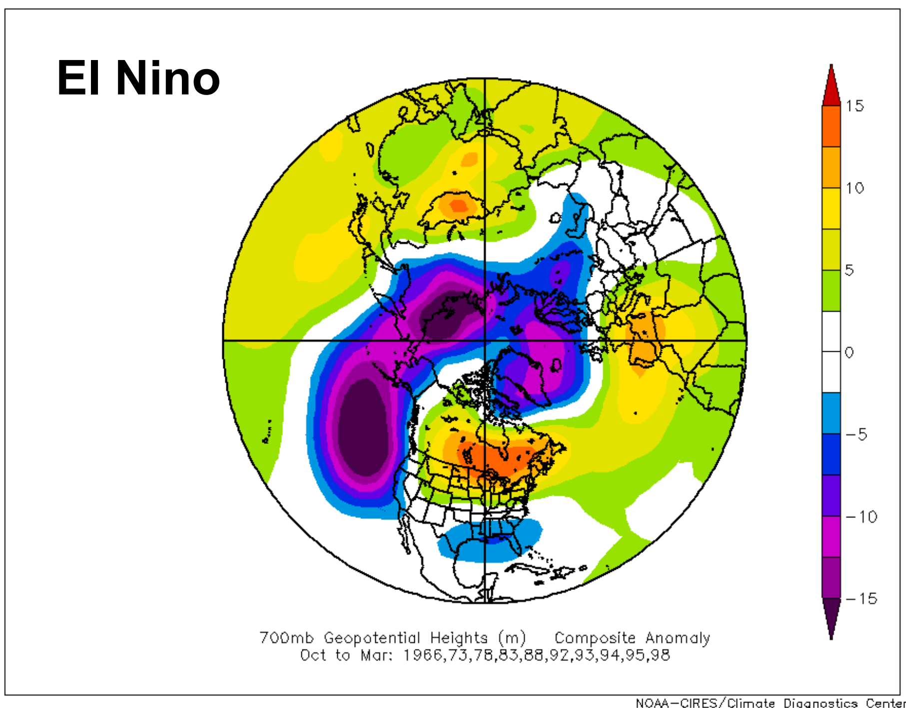


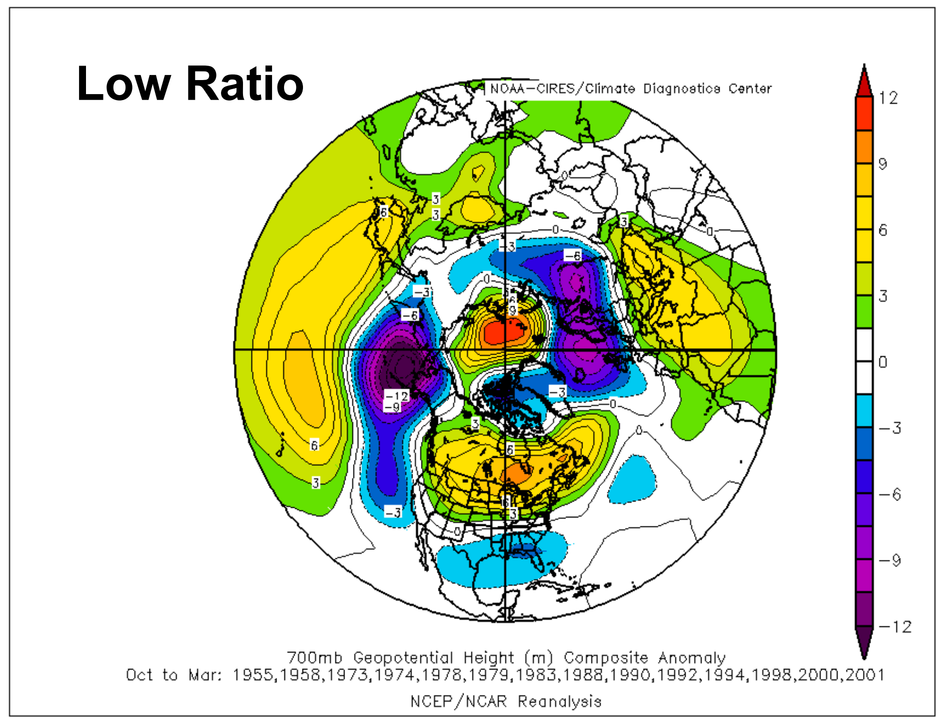


Kelly. Redmond, Western Regional Climate Center.


La Nina
30
20
10
0
-10
-20
-30
700mb Geopotential Heights (m) Composite Anomaly
Oct to Mar: 1965,71,72,74,75,76,89,97
NOAA-CIRES/Climate Diagnostics Center


High Ratio
NOAA-CIRES/Climate Diagnostics Center
25
20
15
10
5
0
-5
-10
-15
-20
-25
700mb Geopotential Height (m) Composite Anomaly
Oct to Mar: 1964,1965,1966,1968,1972,1989,1996,1997,1999,1950,1951


El Nino
15
10
5
0
-5
-10
-15
700mb Geopotential Heights (m) Composite Anomaly
Oct to Mar: 1966,73,78,83,88,92,93,94,95,98
NOAA-CIRES/Climate Diagnostics Center


Low Ratio
NOAA-CIRES/Climate Diagnostics Center
12
9
6
3
0
-3
-6
-9
-12
700mb Geopotential Height (m) Composite Anomaly
Oct to Mar: 1955,1958,1973,1974,1978,1979,1983,1988,1990,1992,1994,1998,2000,2001
NCEP/NCAR Reanalysis

Conclusion:

Even this extremely simple analysis indicates:

Orographic effects vary significantly from winter to winter.

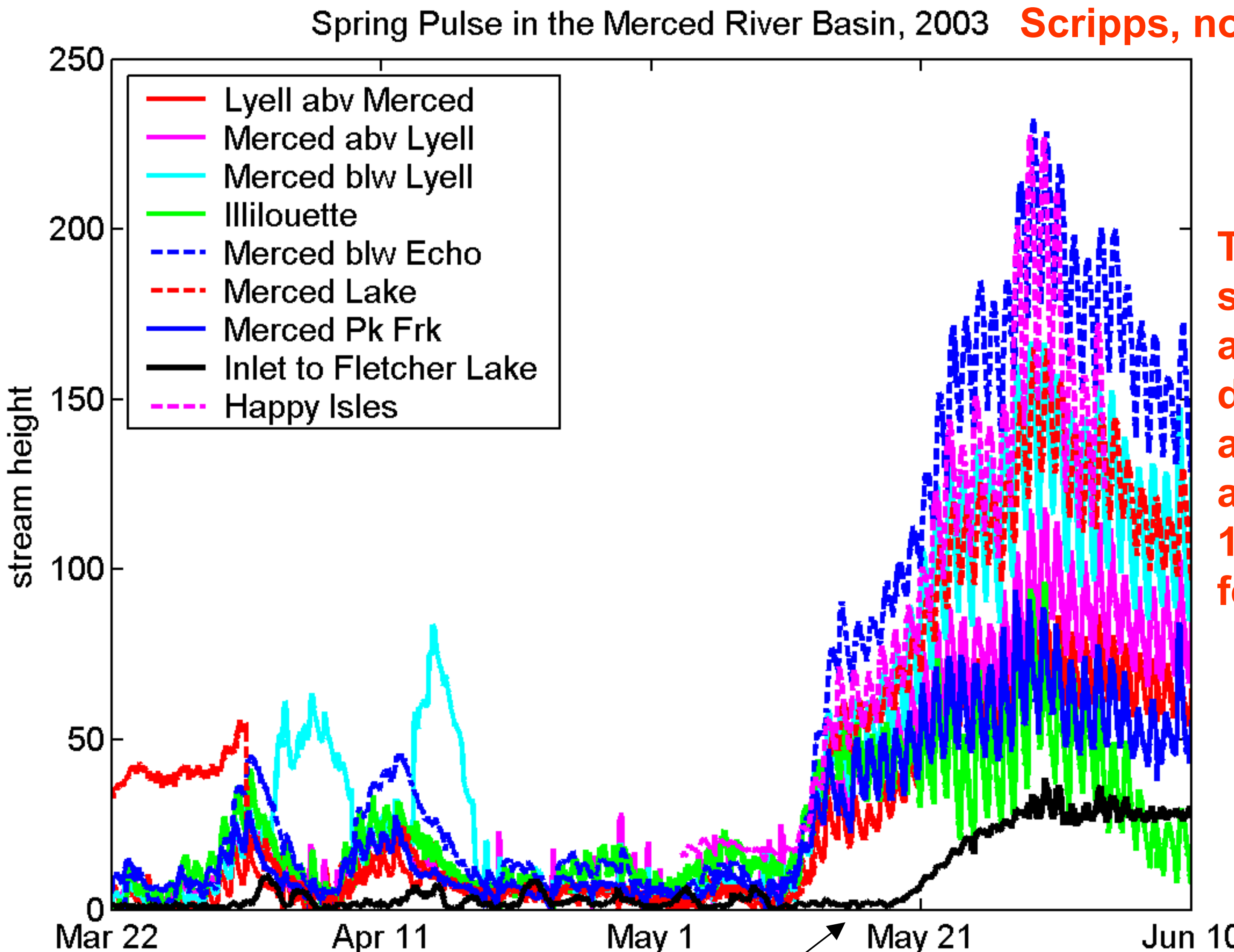
Variability exists at both interannual and multi-decade scales.

In the Central Sierra, a clear relation to the Southern Oscillation Index.

In the Central Sierra, we have found no relation whatever with precipitation itself, just with enhancement percentages.

In the Central Sierra, major floods are not associated with El Nino, but seem to occur preferentially in La Nina winters.

Jessica Lundquist, Scripps, now at CDC



Things seem to act differently above about 10,000 feet.

Near Vogelsang, only gage above 10,000 ft

MTNCLIM 2005

Consortium for Integrated Climate Research in Western Mountains

Anticipating Challenges to Western Mountain Ecosystems and Resources

www.fs.fed.us/psw/mtnclim

www.fs.fed.us/psw/mtnclim

Mountain Climate Network - MONET

SYMPOSIUM SPONSORS

National Oceanic and Atmospheric Administration, Office of Global Programs, Climate Diagnostics Center and Paleoclimatology Branch

USDA Forest Service
PSW Research Station
Sierra Nevada Research Center

USDA Forest Service
PNW Research Station
Fire and Environmental Research Applications

Montana State University, The Big Sky Institute for Science & Natural History

U.S. Geological Survey, Geological, Biological and Water Resources Divisions

Desert Research Institute, Western Regional Climate Center

University of California, White Mountain Research Station

University of California, Scripps Institution of Oceanography

University of Arizona, Laboratory of Tree-Ring Research

Mountain Research Initiative, Berne, Switzerland

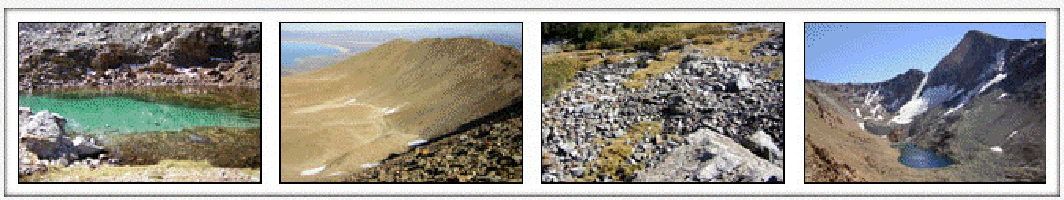
California Bay-Delta Authority

MARCH 1-4, 2005 AT CHICO HOT SPRINGS, PRAY, MONTANA

MTNCLIM is a new biennial research conference, sponsored by the Consortium for Integrated Climate Research on Western Mountains (CIRMOUNT), dedicated to mountain climate sciences and effects of climate variability on ecosystems, natural resources, and conservation in western North American mountains. The first conference, MTNCLIM 2005, featured invited and contributed talks, poster sessions, and action-oriented working-group sessions. A post-conference workshop, "Climate 101" addressed implications of climate variability and change to natural resource managers. MTNCLIM 2005 was held March 1-4, 2005, at Chico Hot Springs Historic Resort, in Pray, Montana, near Yellowstone National Park and a one-hour drive from Gallatin Airport in Bozeman, MT.

MTNCLIM 2005 Participation

Open to all scientists, students, managers, policy makers and other professionals interested in mountain climate sciences, their effects on ecosystems and interactions with resource management, conservation, policy, and society.



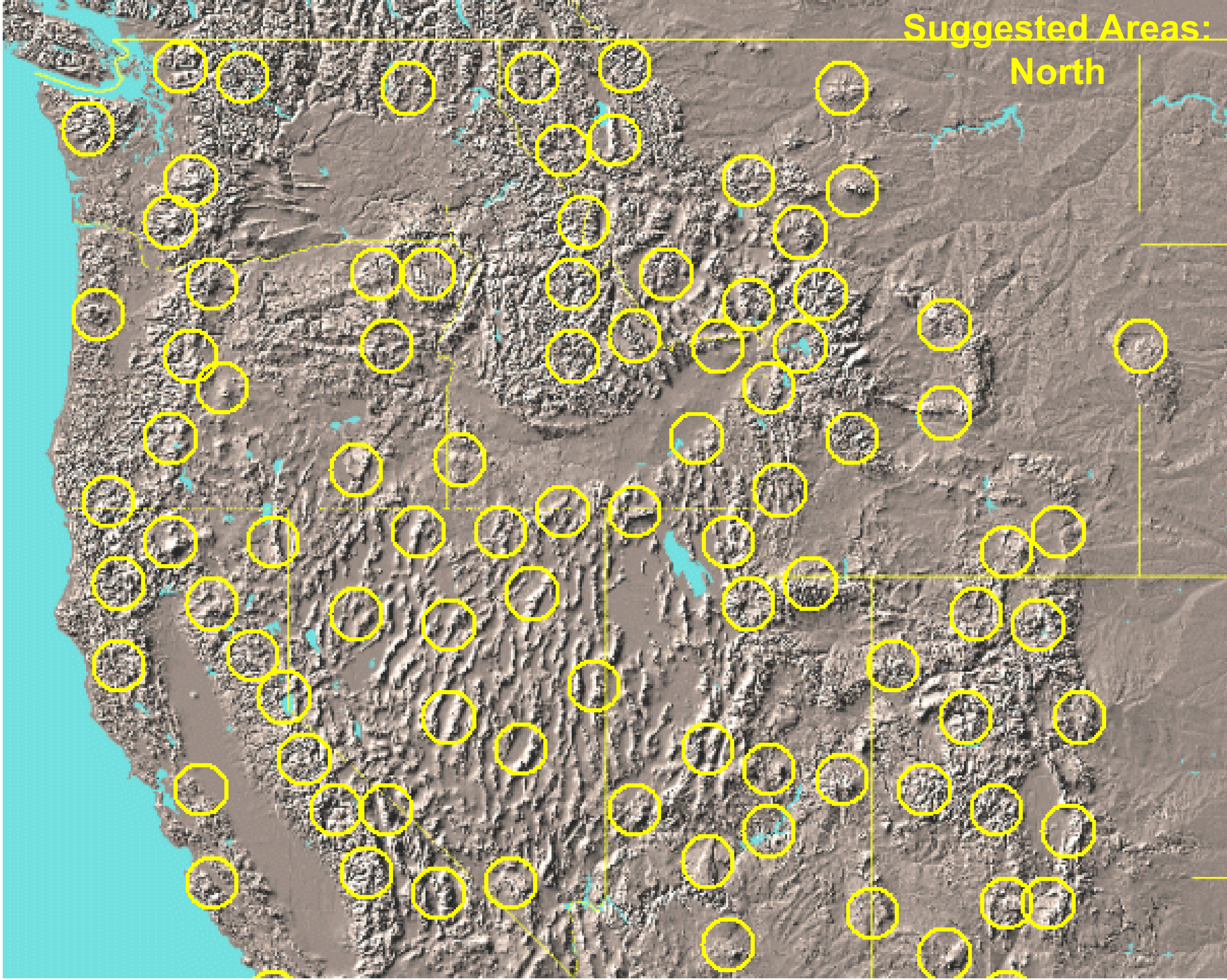
MTNCLIM Goals

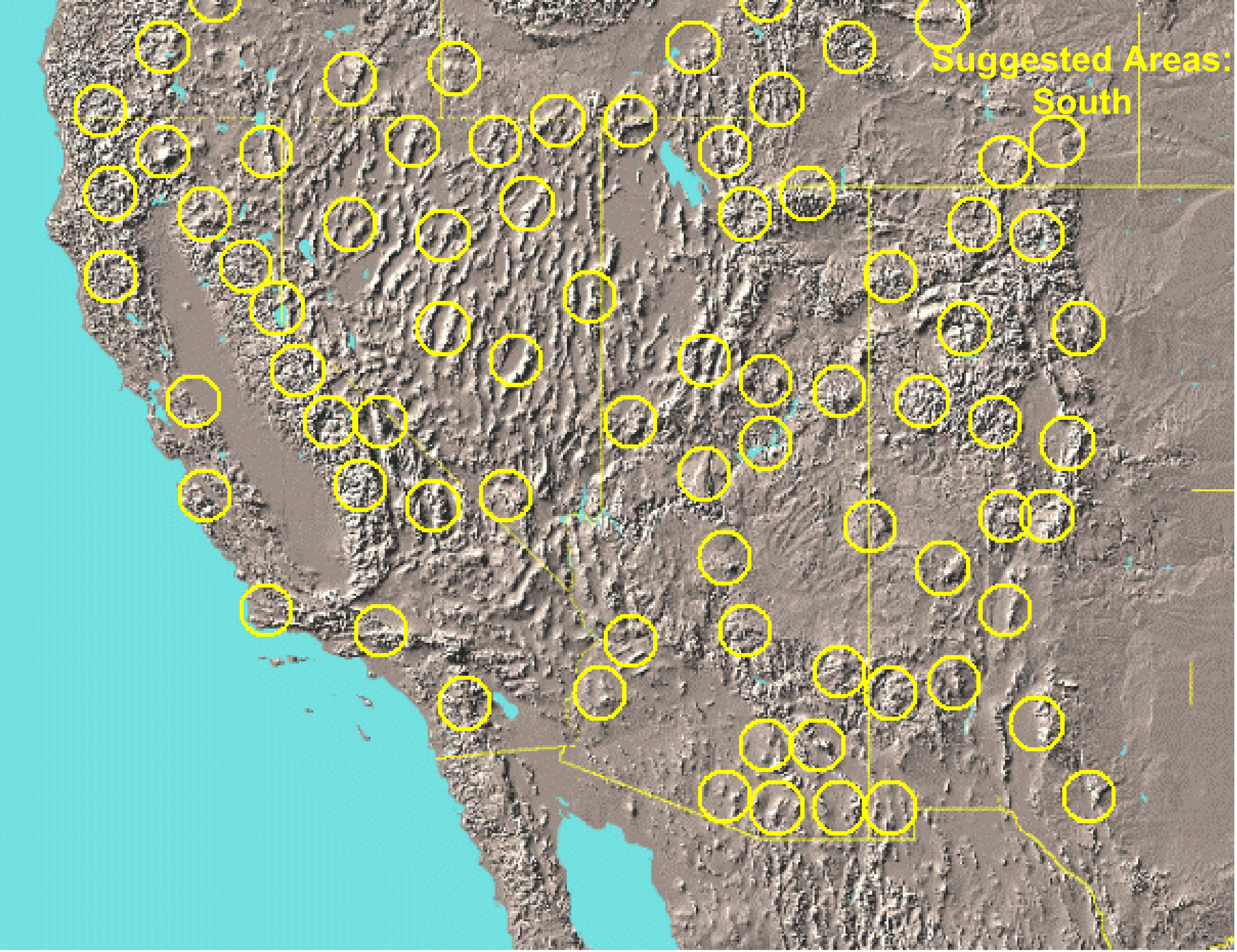
MTNCLIM aims to advance the sciences related to climate and its interaction with physical, ecological, and social systems of western North American mountains. Within this arena, MTNCLIM goals are to:

- Provide a biennial forum for presenting and encouraging current, interdisciplinary research through invited and contributed oral and poster sessions
- Promote active integration of science into resource-management application through focused sessions, panels, and ongoing problem-oriented working groups
- Advance other goals of CIRMOUNT through ad hoc committees, networking opportunities, co-hosting meetings, and targeted fund-raising efforts

Sponsors

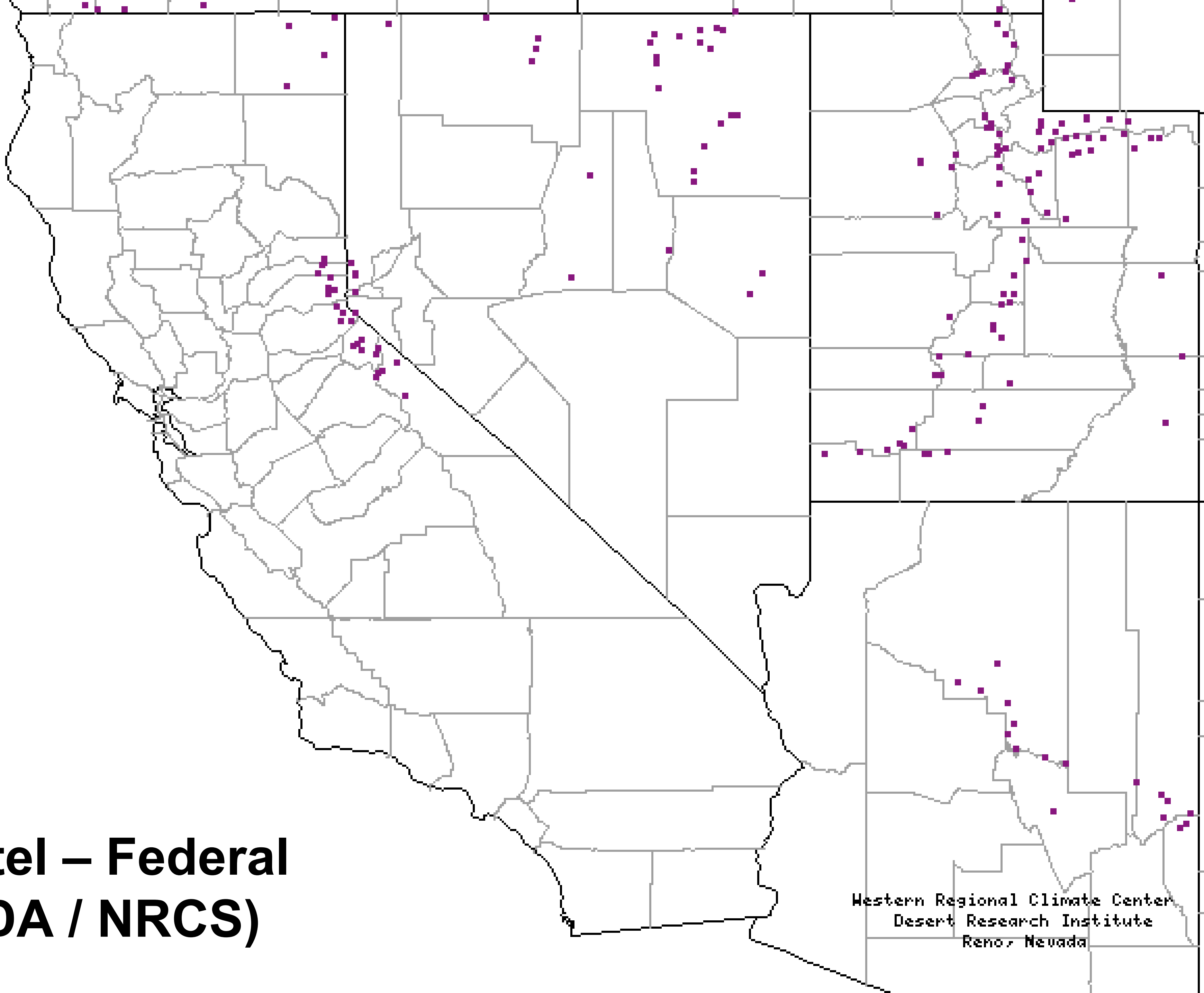
MTNCLIM 2005 is sponsored by CIRMOUNT, with funding and support from the following agencies and institutions:


Suggested Areas:
North


Suggested Areas:
South

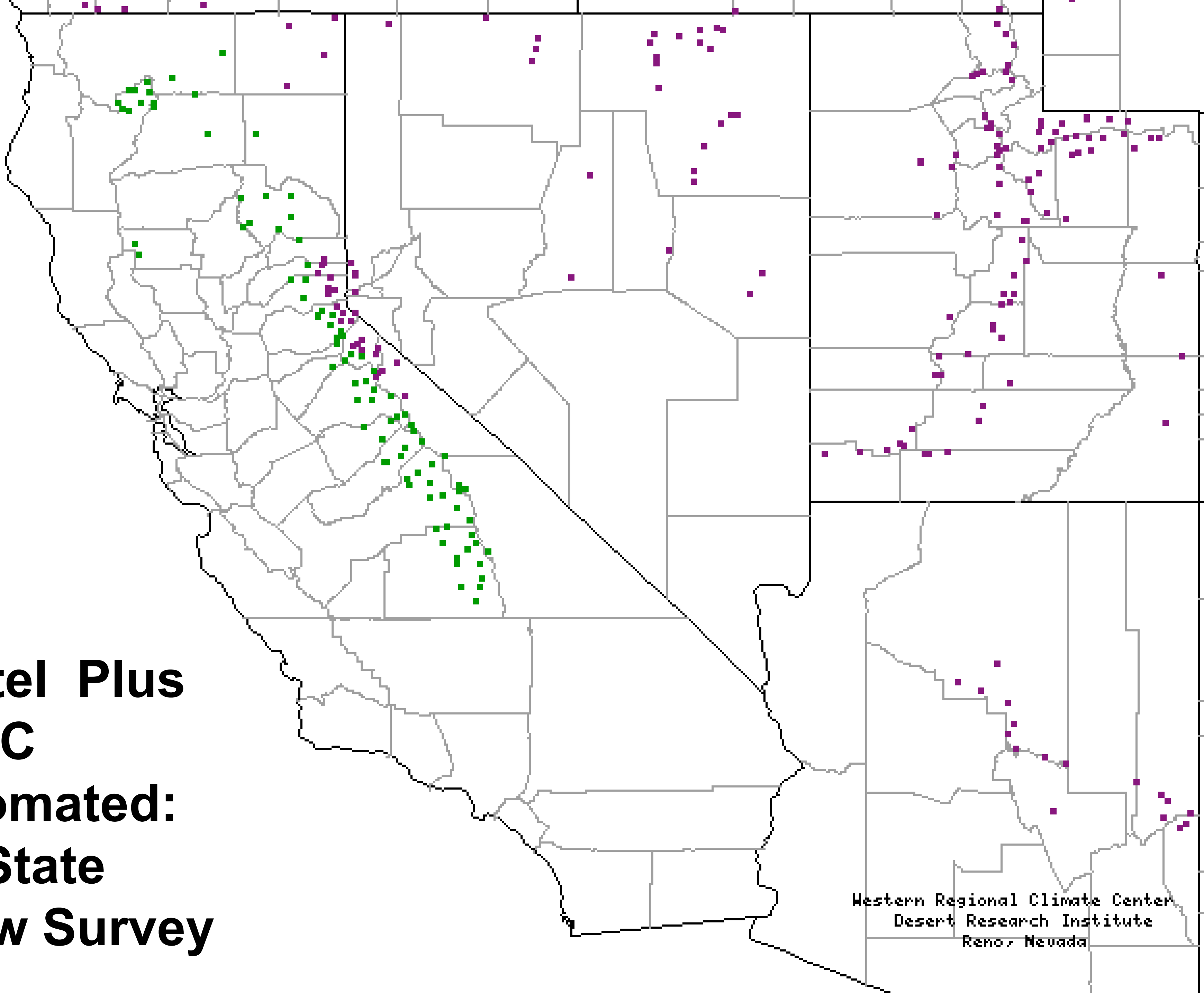
A strategy to attain this goal involves these elements:

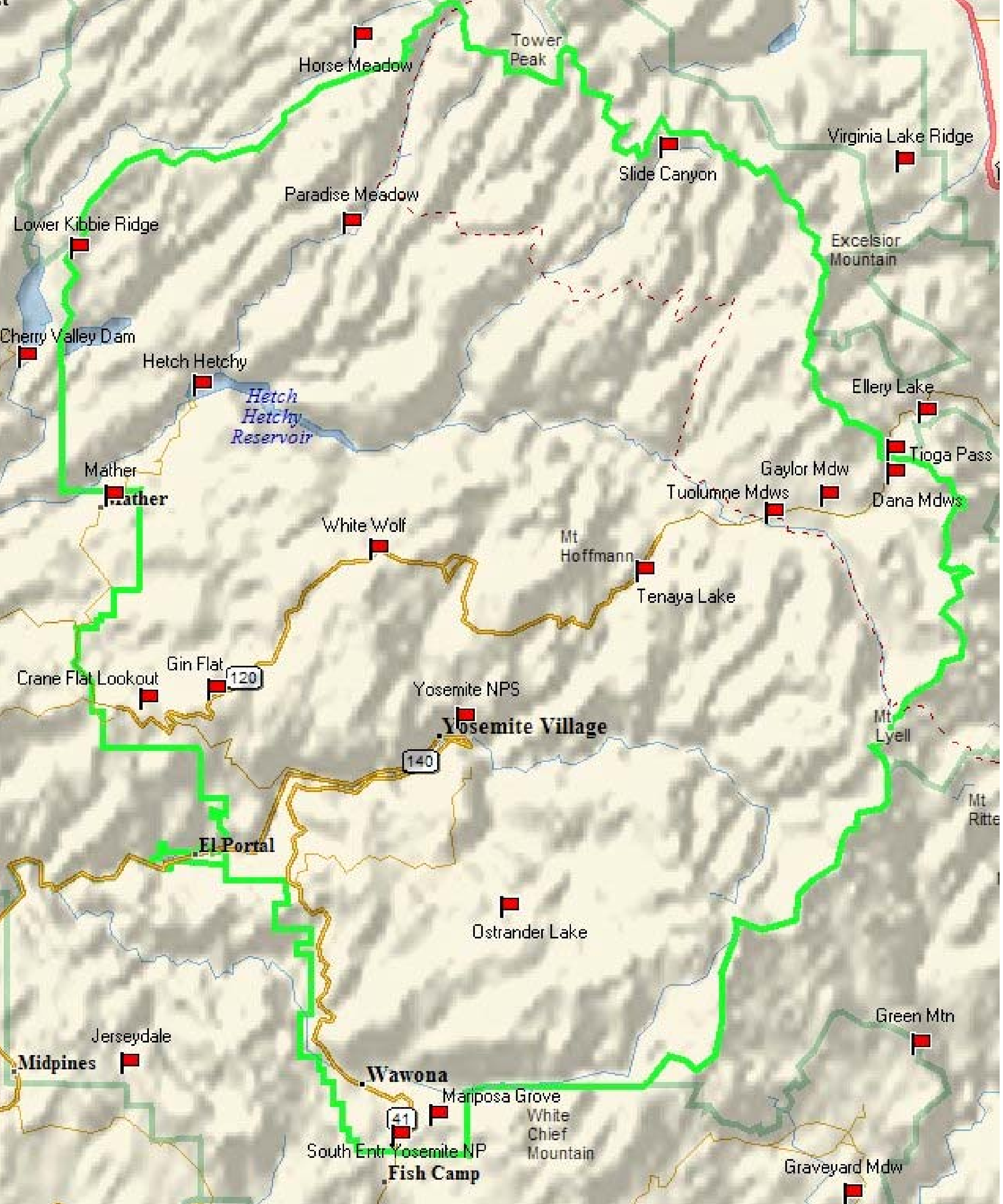
- **All major mountain ranges should be sampled.**
- **Along-axis and cross-axis sampling for major mountain chains.**
- **Approximately 5-10 sites per state (1 per 28000 - 56000 km^2)**
- **Highest sites as high as possible within each state, but at both high relative and absolute elevations.**
- **Free air exposures at higher sites.**
- **Utilize existing measurements and networks, and extend existing records, when possible.**
- **AC power to prevent ice/rime when practical.**
- **Temperature, relative humidity, wind speed and direction, solar radiation as main elements, others as feasible.**
- **Hourly readings, and real-time communication whenever possible**
- **Absence of local artificial influences, site stable for next 5-10 decades.**
- **Current and historical measurements accessible via World Wide Web when possible.**
- **Hydro measurements (precipitation, snow water content, and depth) not practical at highest points, so have lower sites in more protected settings to permit these.**
- **Maintain stable site characteristics (e.g., vegetation height) needed for measurement homogeneity.**
- **High quality, rugged, durable instrumentation with proven track records greatly desirable.**
- **Site documentation history available and accessible.**



Snotel – Federal (USDA / NRCS)

Snotel Plus CDEC Automated: CA State Snow Survey





Yosemite

Weather and Climate Stations

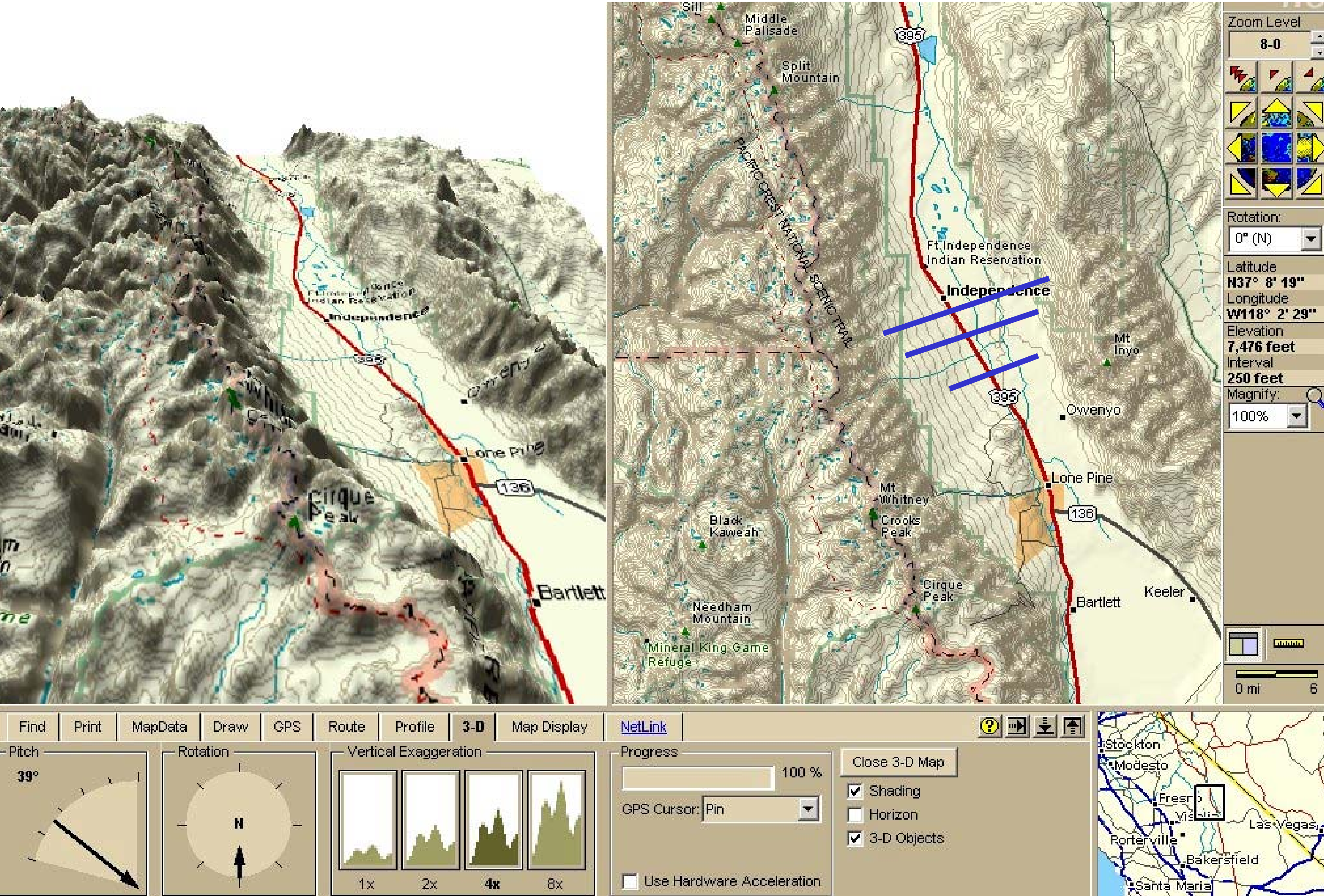
www.yosemite.dri.edu

TREX – Terrain Induced Rotors Experiment

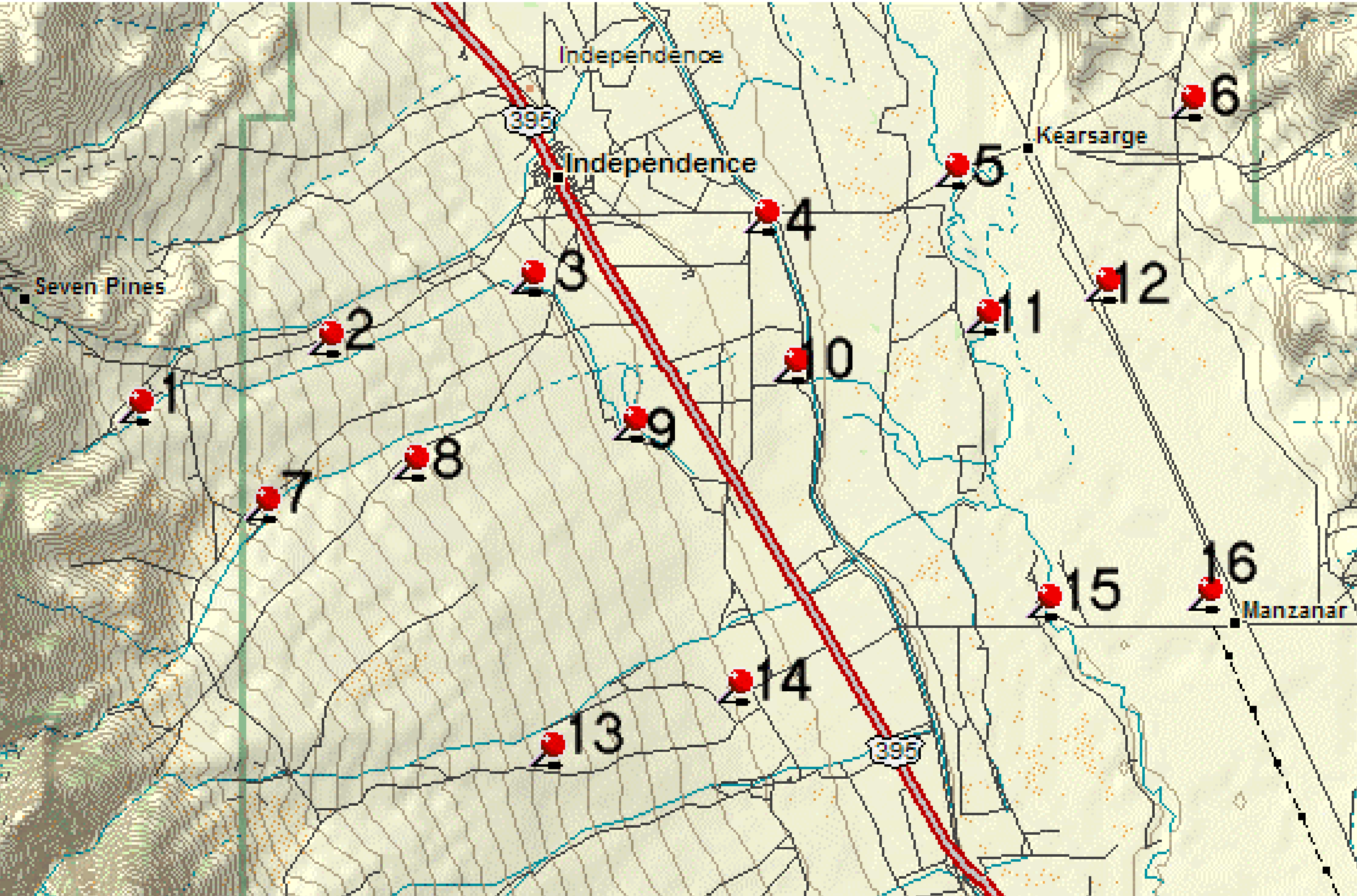
Independence CA Owens Valley

www.wrcc.dri.edu/trex

6 mi
10 km

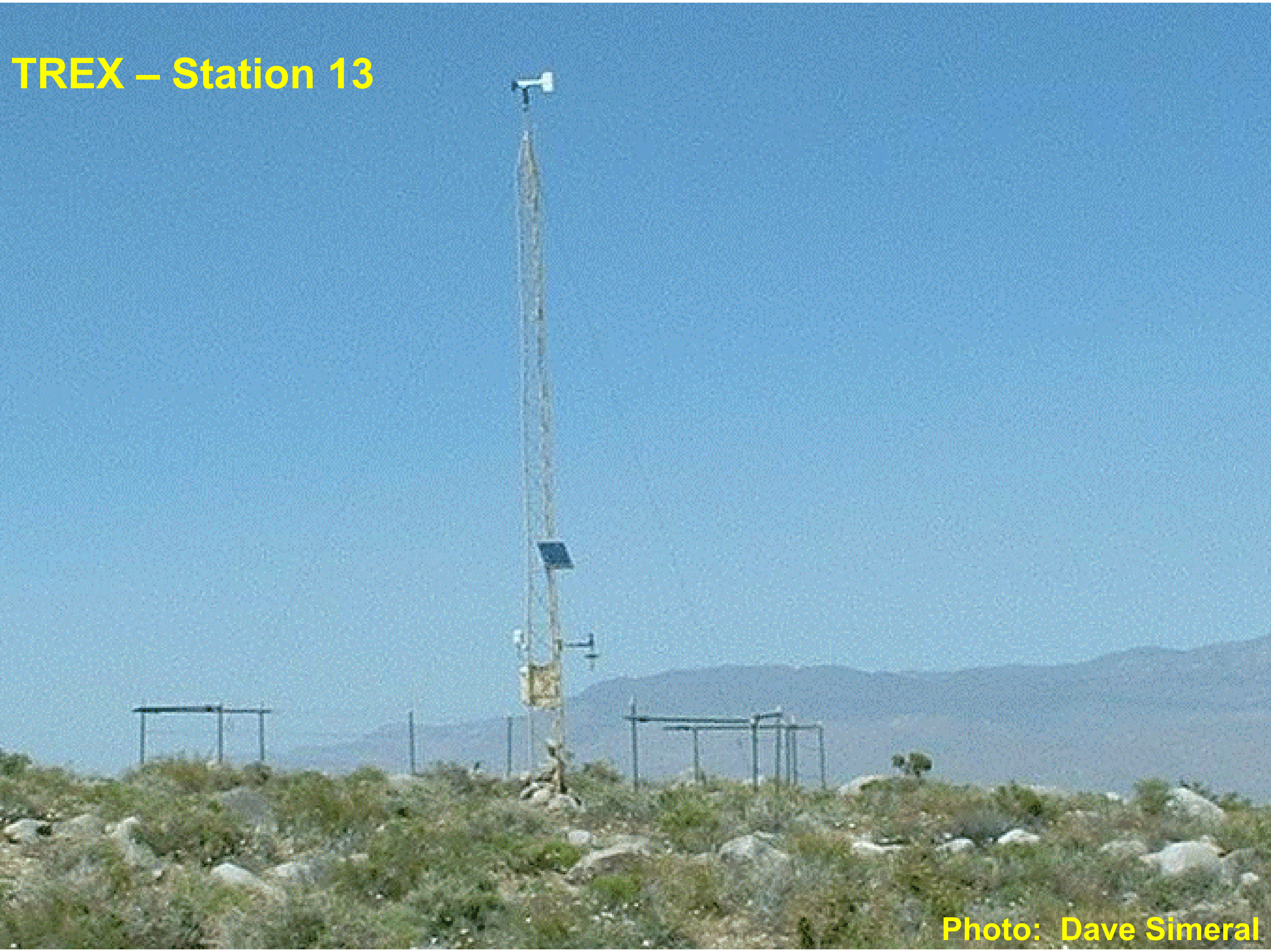


TREX – Terrain Induced Rotors Experiment
Independence CA Owens Valley

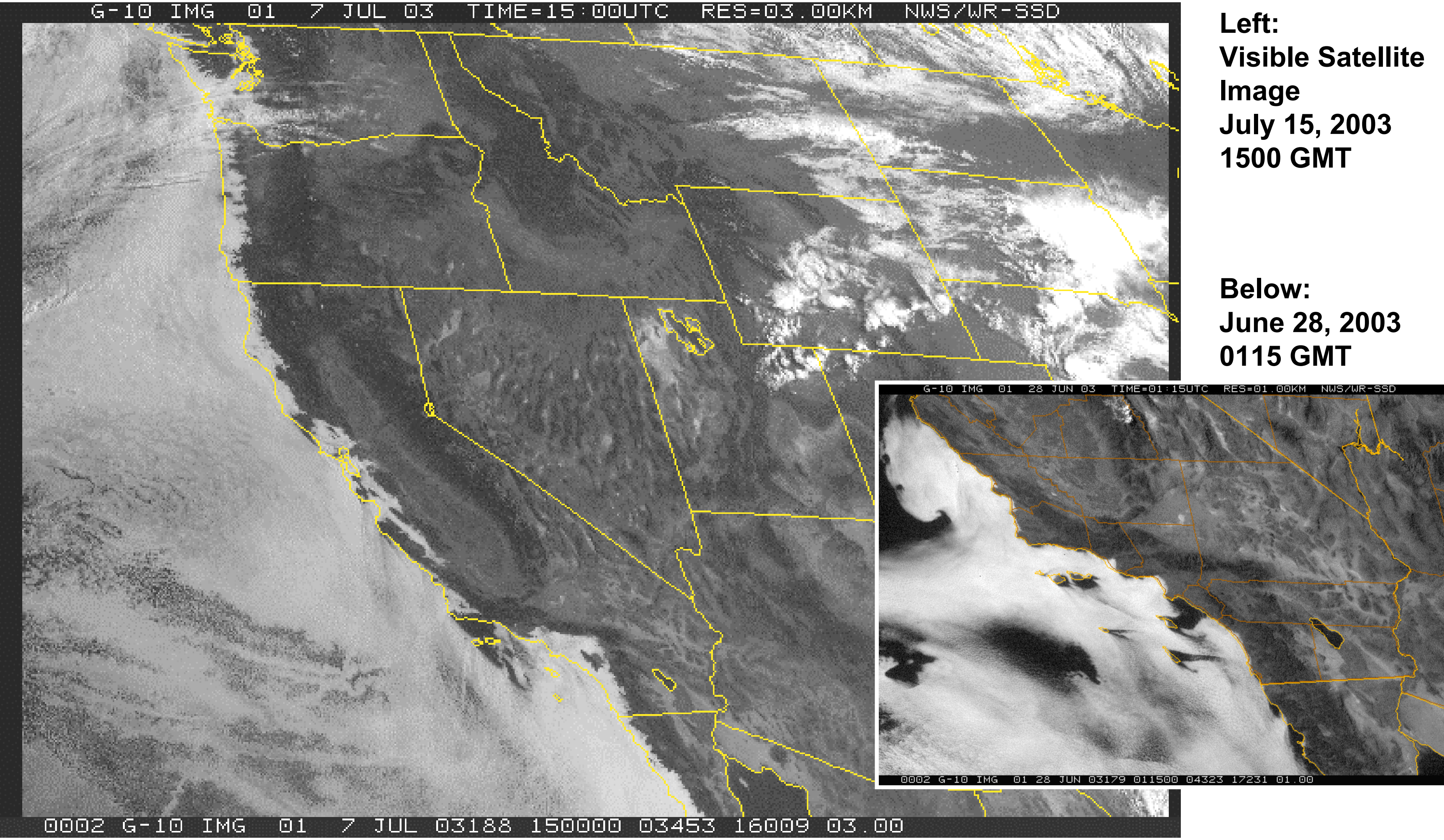


TREX – Station 14

Photo: Dave Simeral


TREX – Station 13
Photo: Dave Simeral

What's so special about the coast?



Left:
Visible Satellite Image
July 15, 2003
1500 GMT

Below:
June 28, 2003
0115 GMT

Why special ?

The coast marks a sharp transition in climate, esp in summer.

Very large numbers of people crowd the shoreline.

Slight movement of sea breeze can have major energy effects.

Climatic variations of some elements (temperature, wind) are poorly correlated with variations just a short distance inland, on several time scales, hours to months.

Important biological species (e.g. anadromous fish), and ecological systems, utilize both marine and terrestrial waters.

Ocean-land, and local-regional-global scale interactions; variable vertical and horizontal structure in the water.

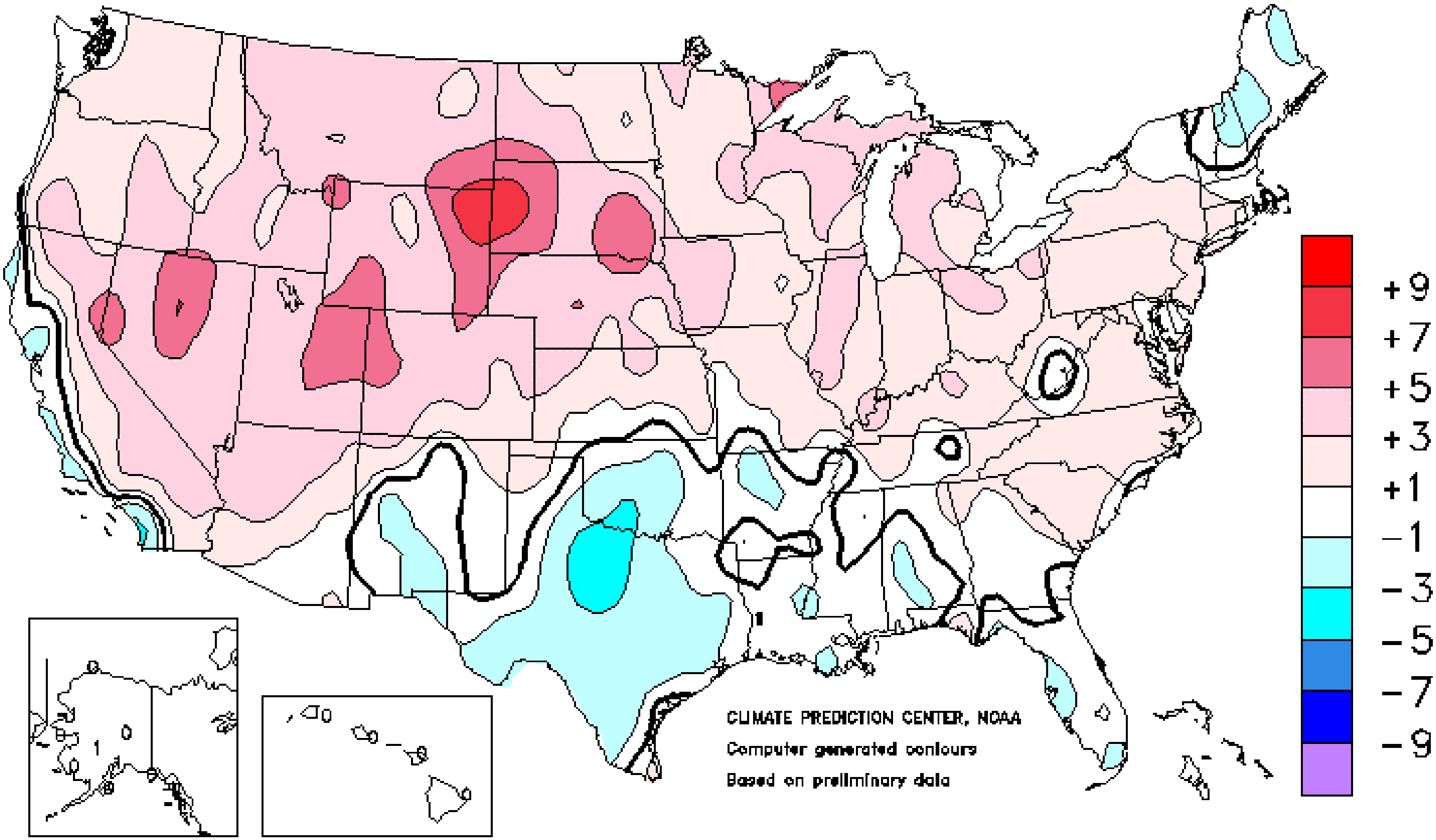
Sky conditions: social, economic, psychological effects ("June Gloom").

Sharp gradients in both horizontal and vertical dimensions.

"America's Oceans in Crisis" - Pew Ocean Commission, 2003

Departure of Average Temperature from Normal (°F)

July 2002



Channel Island National Park Stations

RAWS/NDBC Buoy/Manual Ranger Stations

Recent web page changes:

- Composite Daily Summaries added. (Link found below the map.)

Click on site of interest for more information.
Data is subject to review and verification.

Composite Daily Summaries

Historical Climate Data

Anacapa Island
Santa Barbara Island
Santa Cruz Island
San Miguel Island
Santa Rosa Island

Cooperating Agencies:

Desert Research Institute

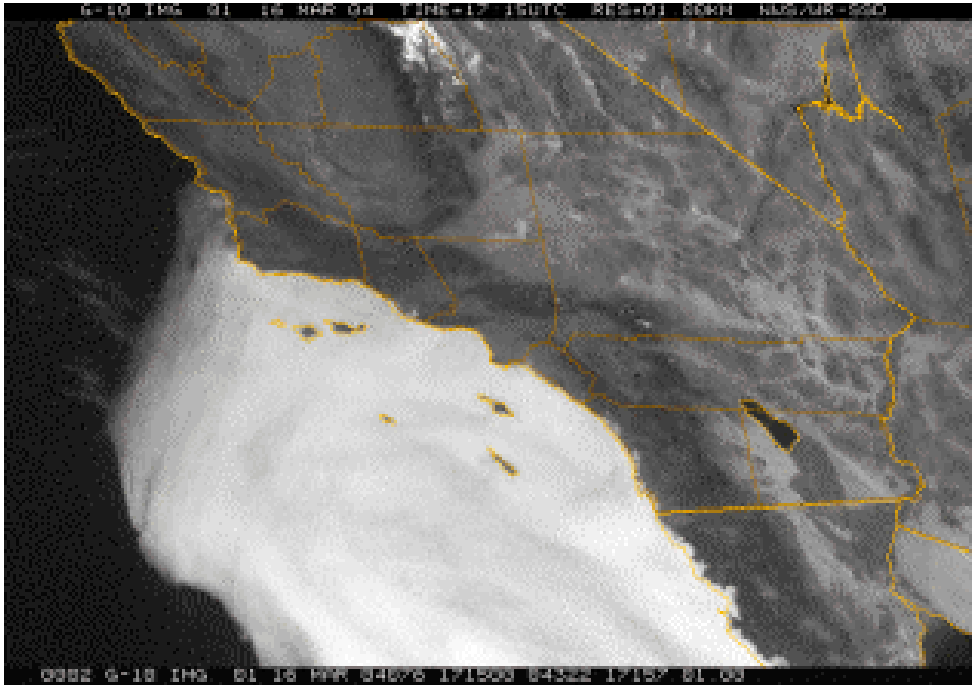
National Interagency Fire Center

Western Regional Climate Center

National Park Service

National Data Buoy Center

Channel Islands National Park: Design Considerations for Weather and Climate Monitoring



Draft final can be found at

ftp.wrcc.dri.edu/nps/chis

Kelly Redmond
Greg McCurdy

Report WRCC 05-02
March 2005

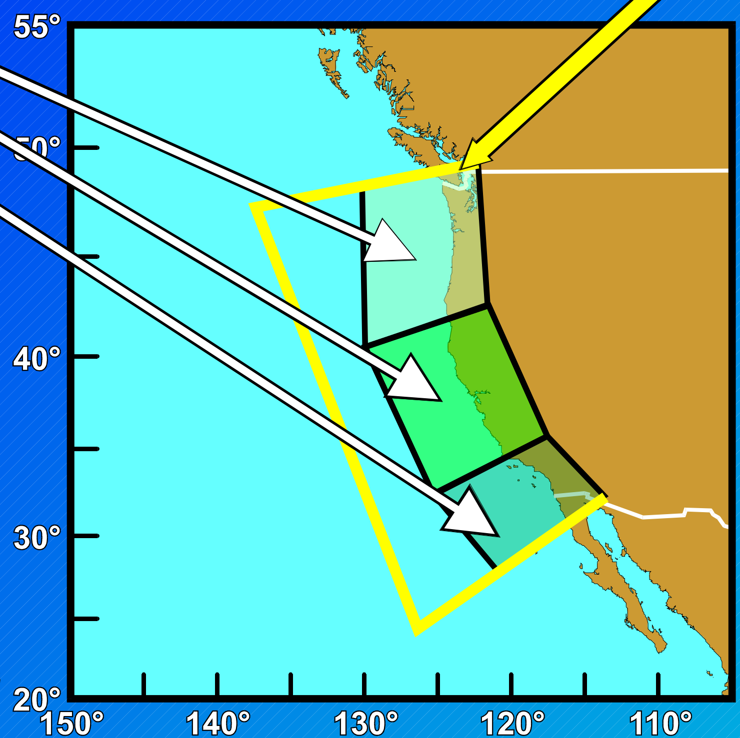
Western Regional Climate Center
Desert Research Institute
2215 Raggio Parkway
Reno Nevada 89512-1095

Coastal - Integrated Ocean Observing System (IOOS) in the California Current System of the US

Regional Coastal Ocean Observing System

NaNOOS
CenCOOS
SCCOOS

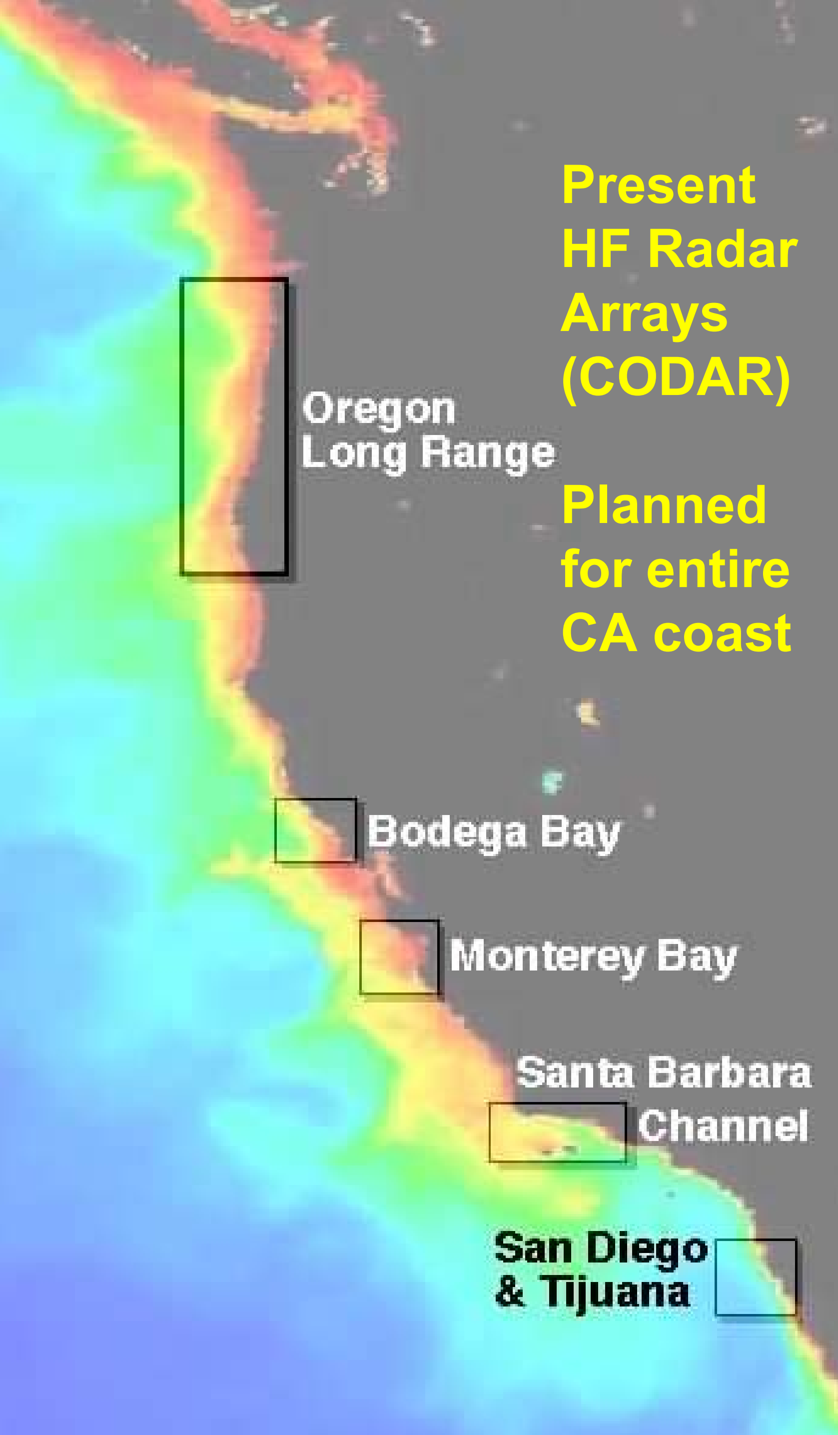
- Enhance National backbone
- Increased time-space resolution
- Terrestrial-influence
- R & D projects
- Coastal radar network
- Involves private sector
- Serves local user needs



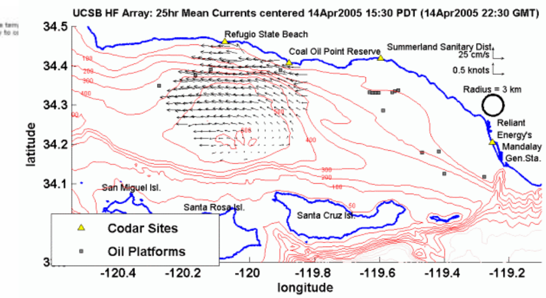
National Backbone PaCOOS Contributions

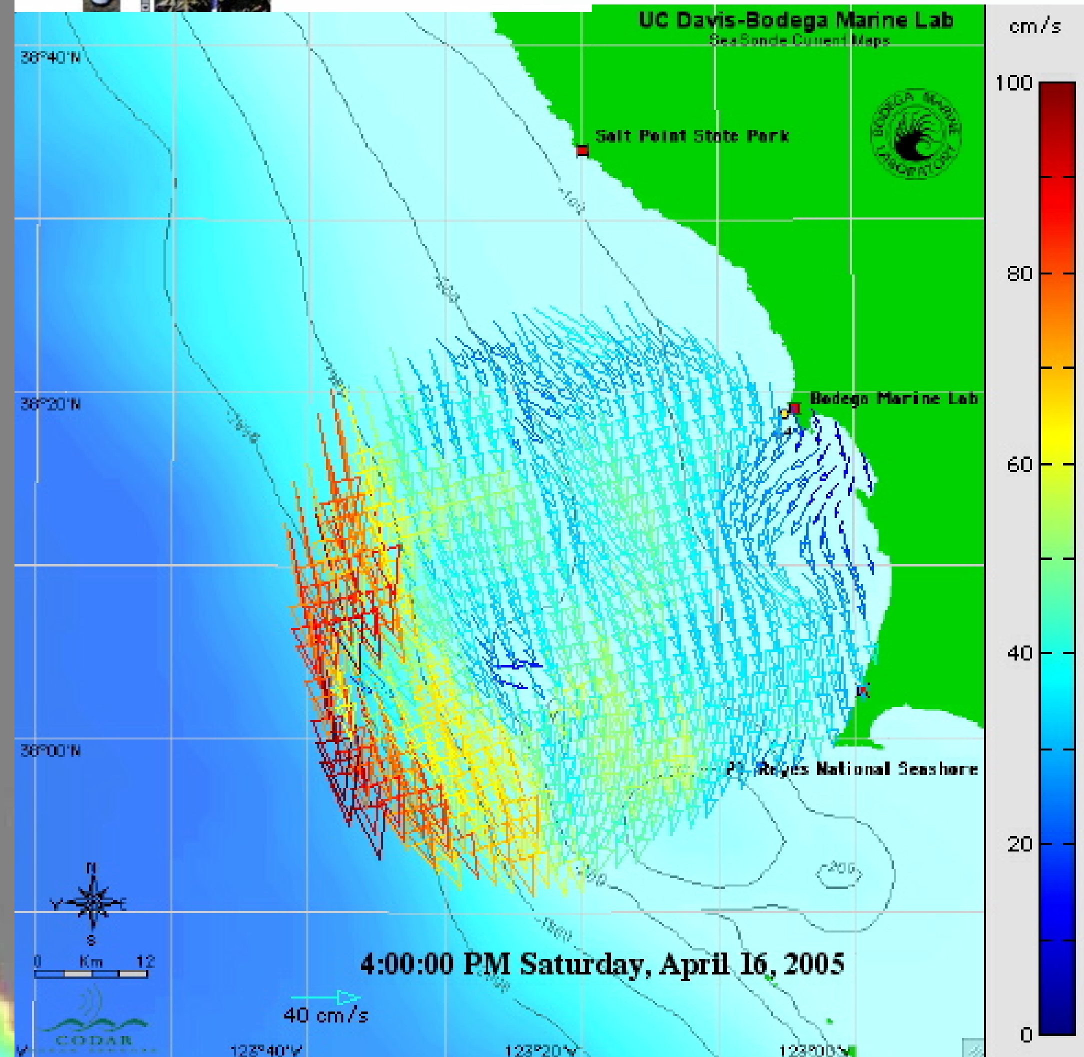
- US EEZ Coast-wide:
  - Ecosystem observations
  - Species inventories
  - Process variables
  - Catch & bycatch
- Maintain Sentinel Species Lines of observation
- Serves ecosystem-based resource management
- Provides offshore boundary conditions for regional systems

Source: www.pacoos.org/Pages/readings.htm


Present
HF Radar
Arrays
(CODAR)
Planned
for entire
CA coast
Oregon
Long Range
Bodega Bay
Monterey Bay
Santa Barbara
Channel
San Diego
& Tijuana


BOON
BODEGA OCEAN OBSERVING NODE


UCSB HF Array: 25hr Mean Currents centered 14Apr2005 15:30 PDT (14Apr2005 22:30 GMT)
Refugio State Beach
Coal Oil Point Reserve
Summerland Sanitary Dist.
25 cm/s
0.5 knots
Radius = 3 km
Reliant Energy's Mandalay Gen.Sta.
San Miguel Isl.
Santa Rosa Isl.
Santa Cruz Isl.
Codar Sites
Oil Platforms
latitude
longitude


UC Davis-Bodega Marine Lab
SeaSonde Current Maps
Salt Point State Park
Bodega Marine Lab
Pt. Reyes National Seashore
38°40'N
38°20'N
38°00'N
123°40'W
123°20'W
123°00'W
4:00:00 PM Saturday, April 16, 2005
40 cm/s
cm/s
100
80
60
40
20
0
Km
CODAR

California Coastal Climate Data Archive

Joint effort with Scripps

NOAA Cooperative Sites

NOAA / FAA / Surface Airways

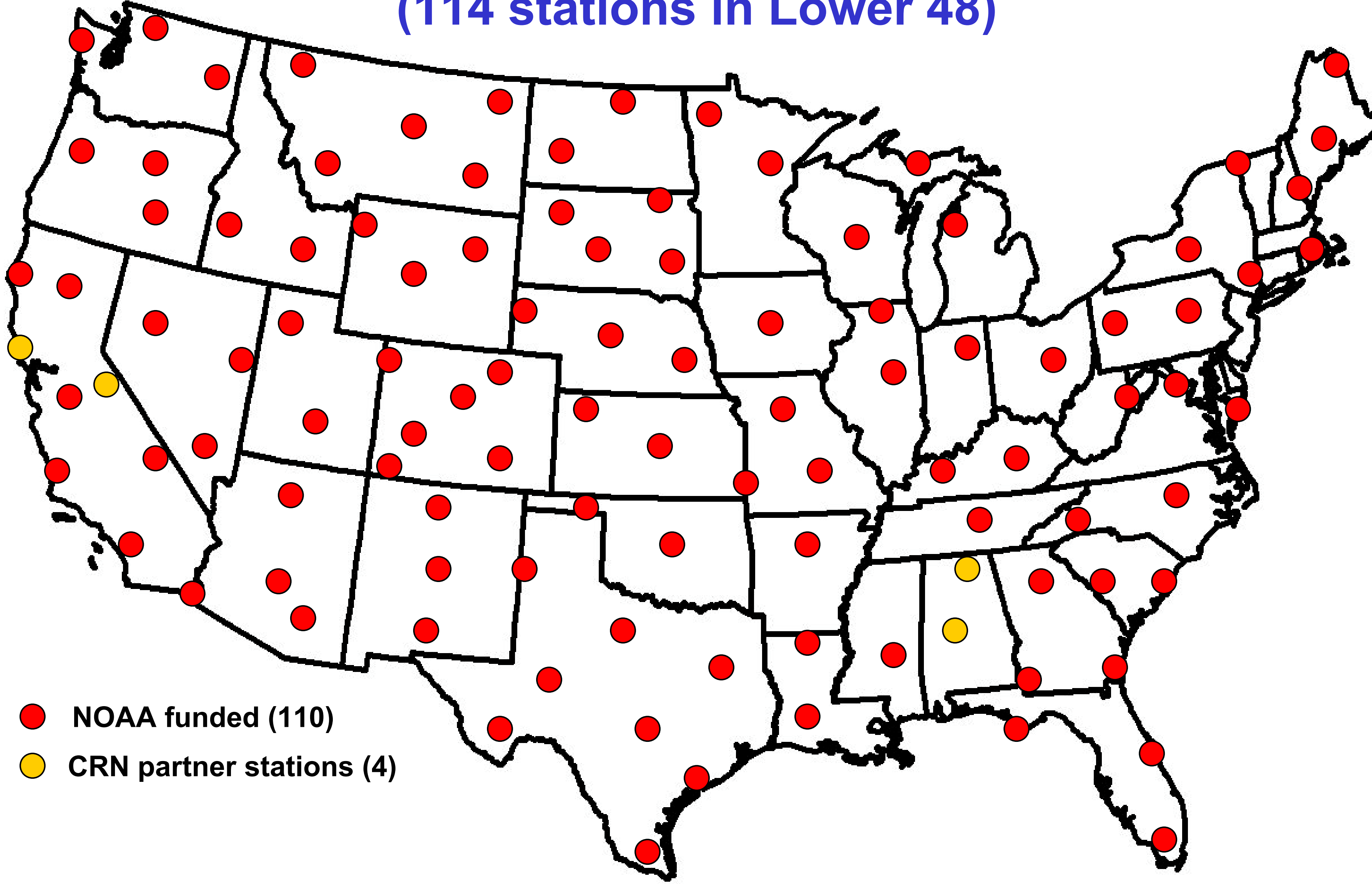
NOAA Data Buoys

NOAA CMAN – Coastal Marine Automated Network

Air quality, lighthouses, piers, local

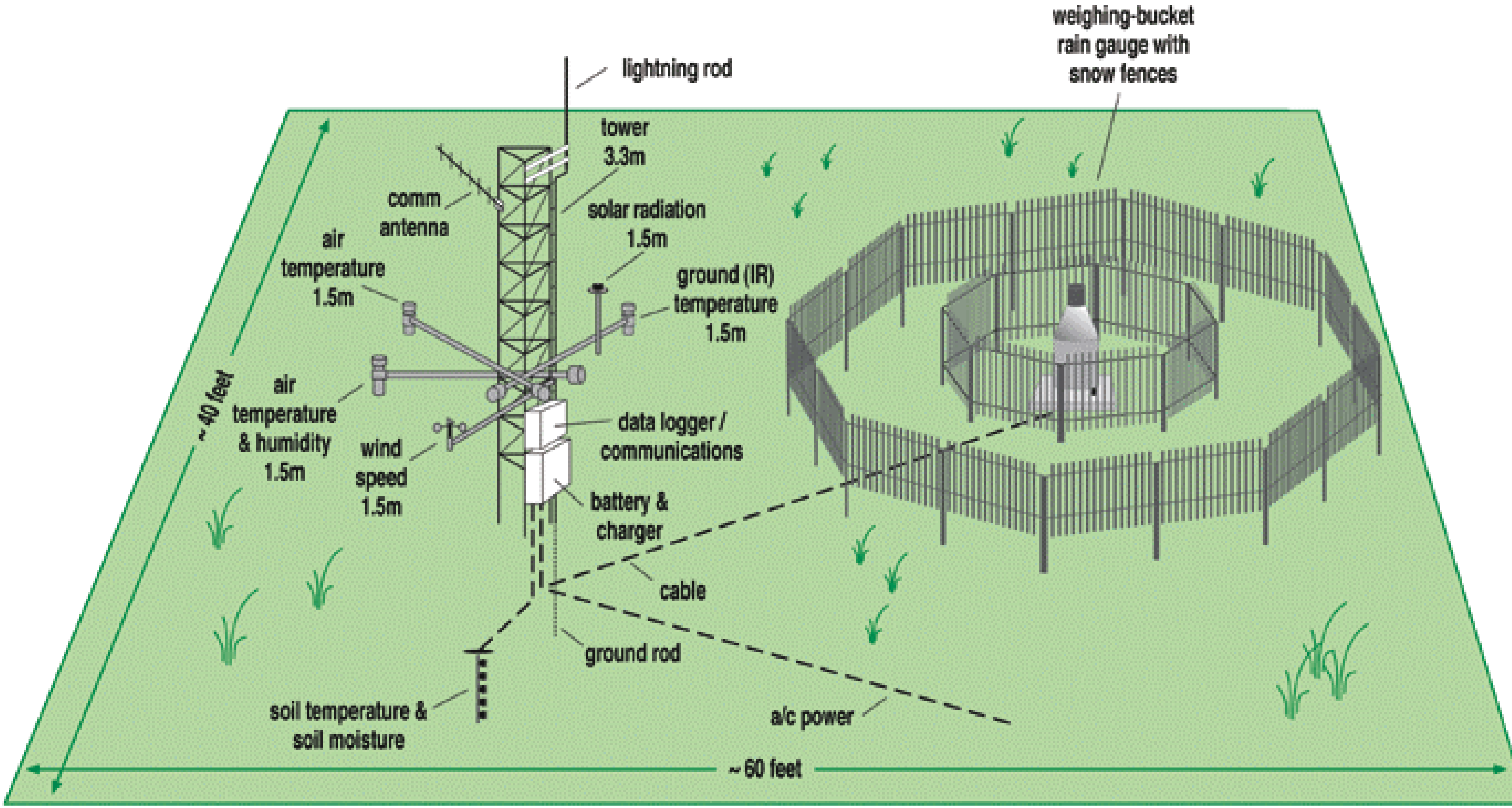
Research data sets as available, profilers, etc

US Climate Reference Network Planned Configuration
(114 stations in Lower 48)



Final Configuration, USCRN in CONUS, Jan 05.ppt (mrh)

Proposed Typical CRN Station Configuration



Death Valley, Stovepipe Wells CRN

CA Merced 23 WSW, Kesterson Reservoir, (U.S. Bureau of Reclamation)

37.2 N 120.9 W 64’

March 25, 2004

ECCM Strategy as of April 2005

Special California CRN stations appear to be too expensive for ECCM

One or two transects from the near shore ocean to far western Great Basin.

Augment selected Sierra mountaintops.

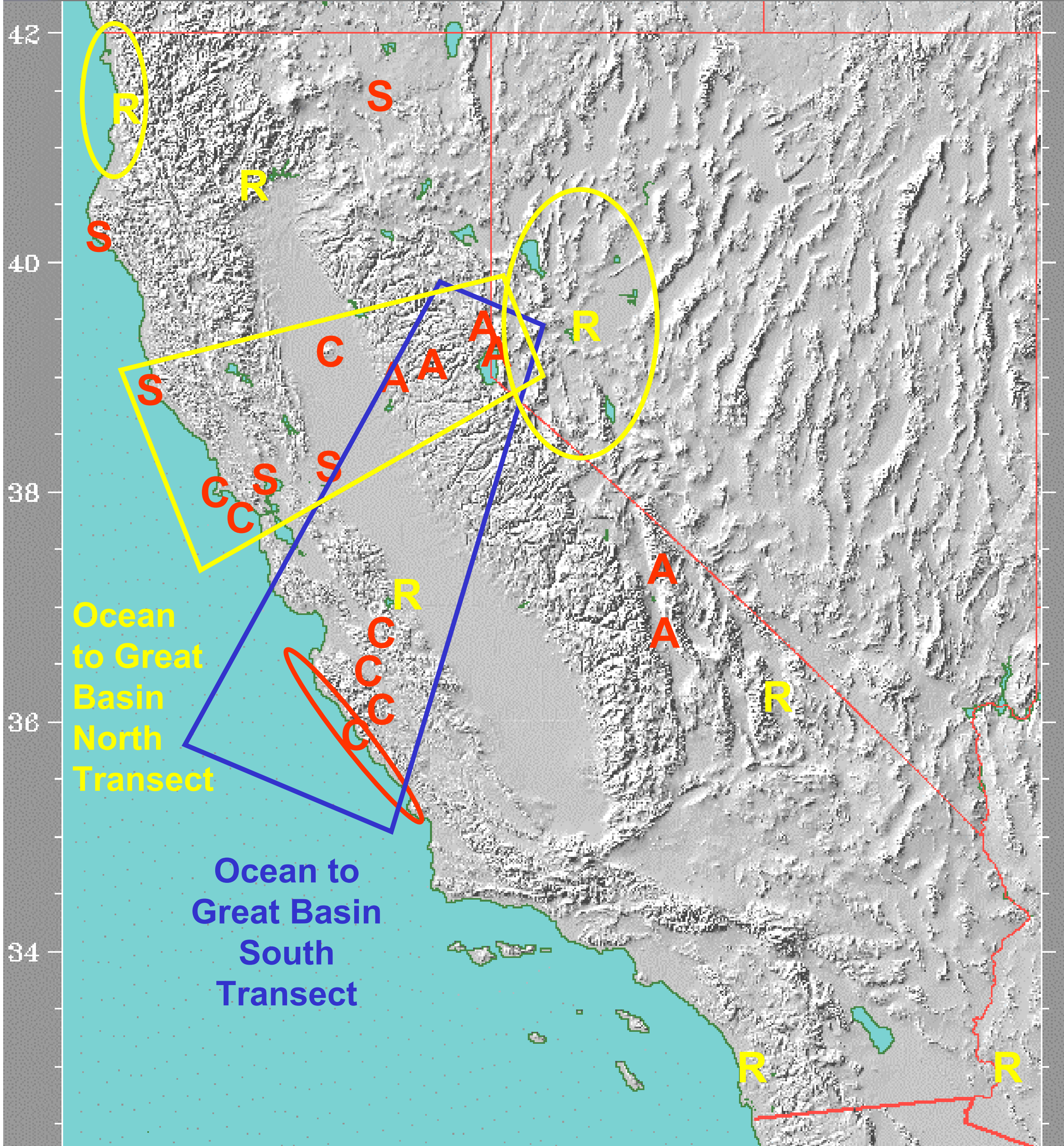
Leverage other current and planned projects.

R – Existing or "expected" national CRN

C – Potential New California Climate Monitoring Site

A – Potential Augmentation Site

S – Additional sites of opportunity



CEC / PIER Enhanced California Climate Monitoring Project - 1

10-15 Full or augmented stations possible.

Transects / clusters across strong climatic gradients: coast and mountains.

Transects across relatively unobserved areas.

Transects across relatively simple topography & geometry when feasible.

A few long term sites in San Francisco Bay area away from artificial influences
(but can leverage with area groups, NPS, etc)

Coastal points and headlands (coordinated with Coastal Ocean Obs System).

Long term site stability and acceptable exposure is a priority.

Willing site hosts for power, communications, to anticipate maintenance.

Mountaintop sites (White Mtns (3), Mt Warren, Slide Mt, Mt Hoffman, Mammoth?)

Platforms for added instruments (aerosols, solar radiation, etc)

CEC / PIER Enhanced California Climate Monitoring Project - 2

Coordinate with CEC Sierra obs, NOAA Hydromet Test Bed, CODAR/OOS,
  other coastal, CRN, NPS I&M, NOAA-NWS, air quality networks,
  NOAA Climate Test Bed, others)

Identify areas to deploy equipment if future resources materialize
  Southeastern deserts, northeast plateau, Sierra north-to-south, Klamath River
  interior coastal

Facilitate an east-side strong-gradient cluster (Sierra – Owens – White/Inyo).

Blue Oak (Quercus douglasii) woodlands are found in the foothills surrounding the Great Central Valley of California. These woodlands still contain literally thousands of hectares of ancient blue oak in the 200-to 500-year age class. This massive blue oak is located in Pacheco Pass State Park.

Ancient trees in the Central Valley.

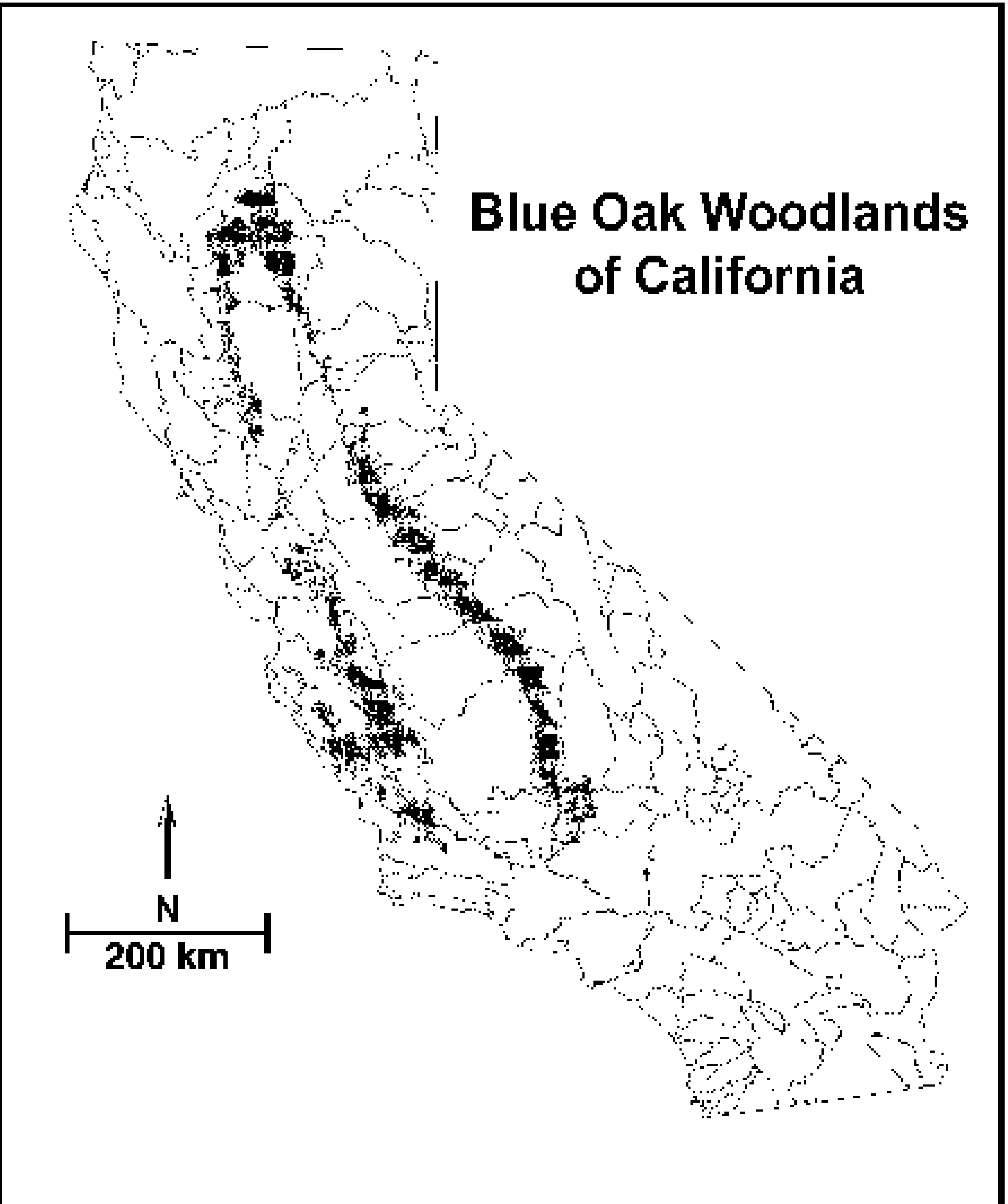
Highly correlated with precipitation.

Blue Oak

Lifetime: 200-500 years

Valley Oak

Courtesy Dave Stahle, University of Arkansas Tree Ring Laboratory

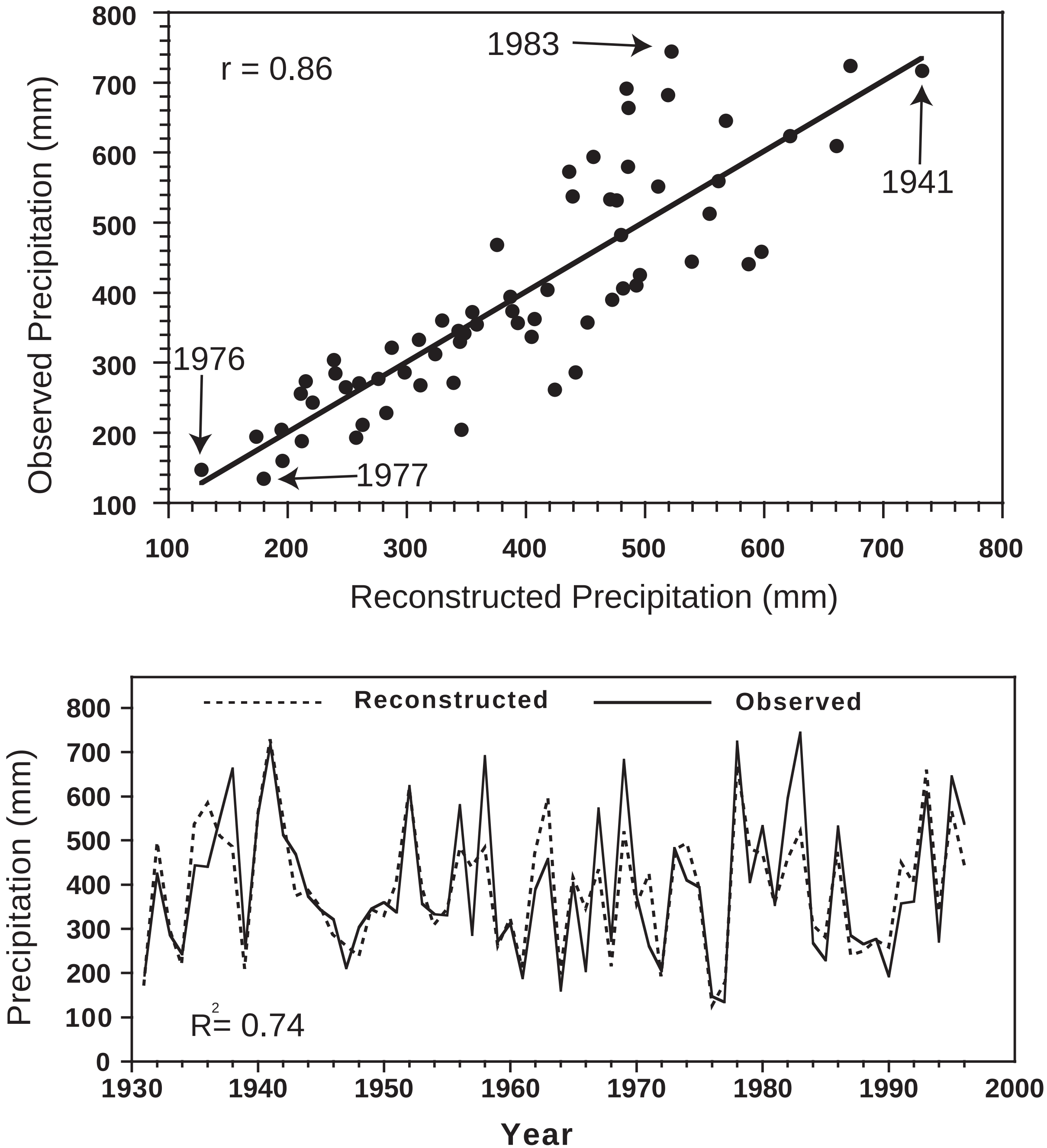


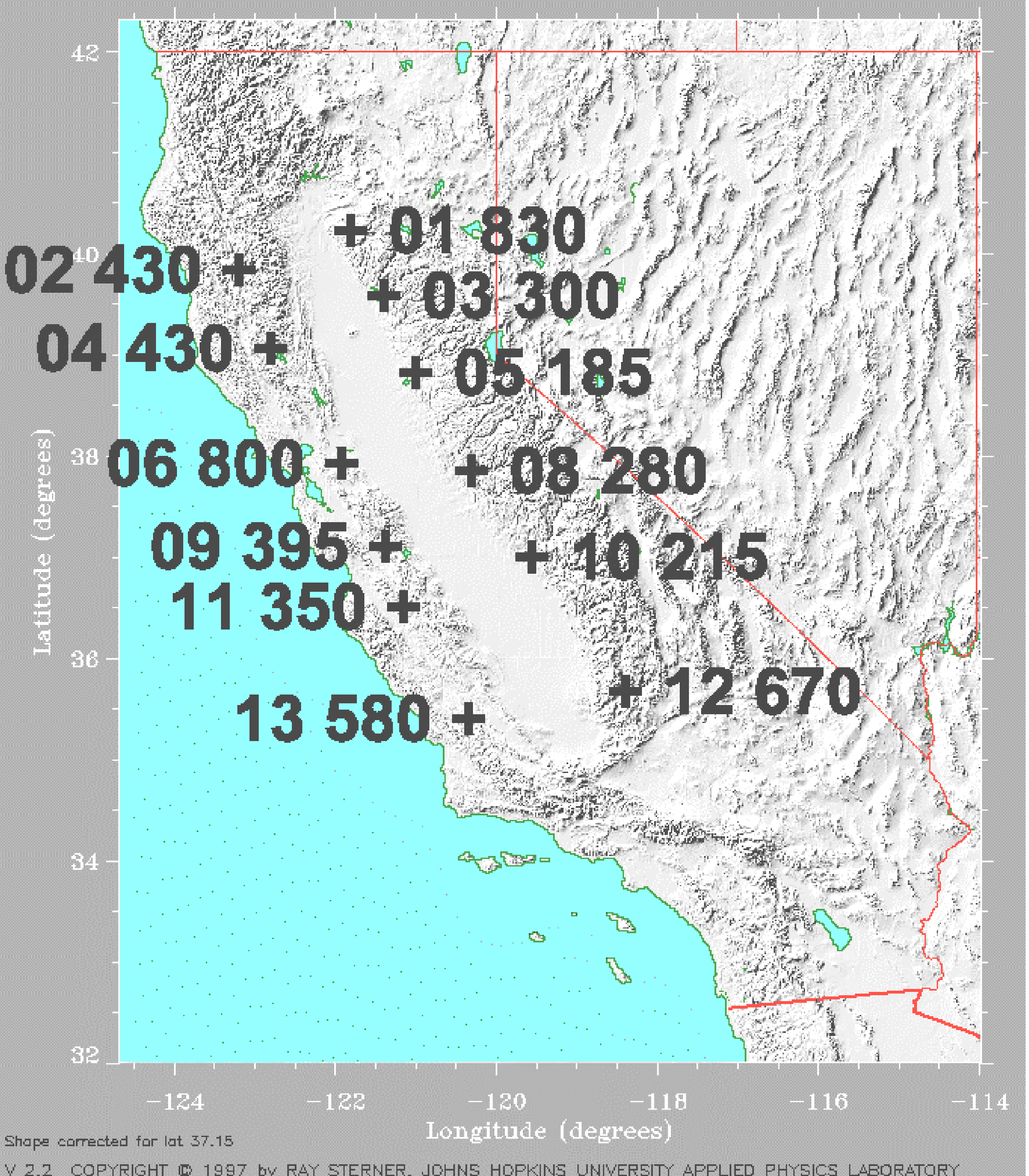
Blue oak grow at approximately 100-1200 meters elevation.

1-3 million hectares, roughly 10-50 trees per hectare.

Total approximately 40 million trees.

Observed vs Tree-Ring Reconstructed
Central California Precipitation 1931-1996





Blue Oak Chronologies.

\+ site location

XX YYY:

XX site number

YYY elevation (meters)

Cored in late 1990s by Dave Stahle.

Stahle, D.W., M.D. Therrell, M.K. Cleaveland, D.R. Cayan, and M.D. Dettinger, 2001. Ancient blue oaks reveal human impact on San Francisco Bay salinity. EOS, 82(12), 141-145.

Four runs:

Run A: Basic set.

All 12 sites. 1711-1992

Run B: Longer set.

Stations 1,2,3,4,6,8,9,11,12,13 1670-1992

Run C: Longer set, more recent.

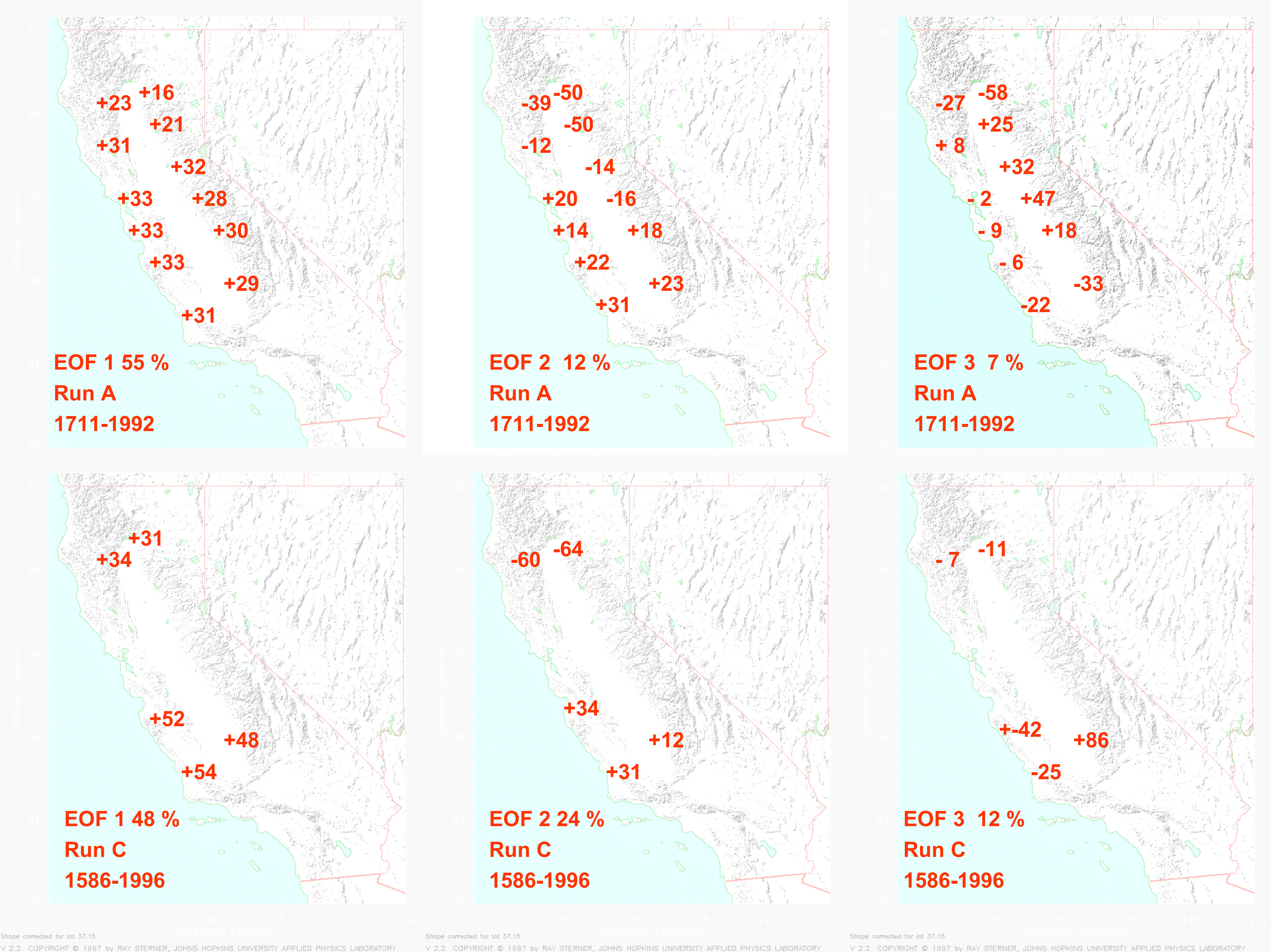
Stations 1,2,11,12,13 1586-1996.

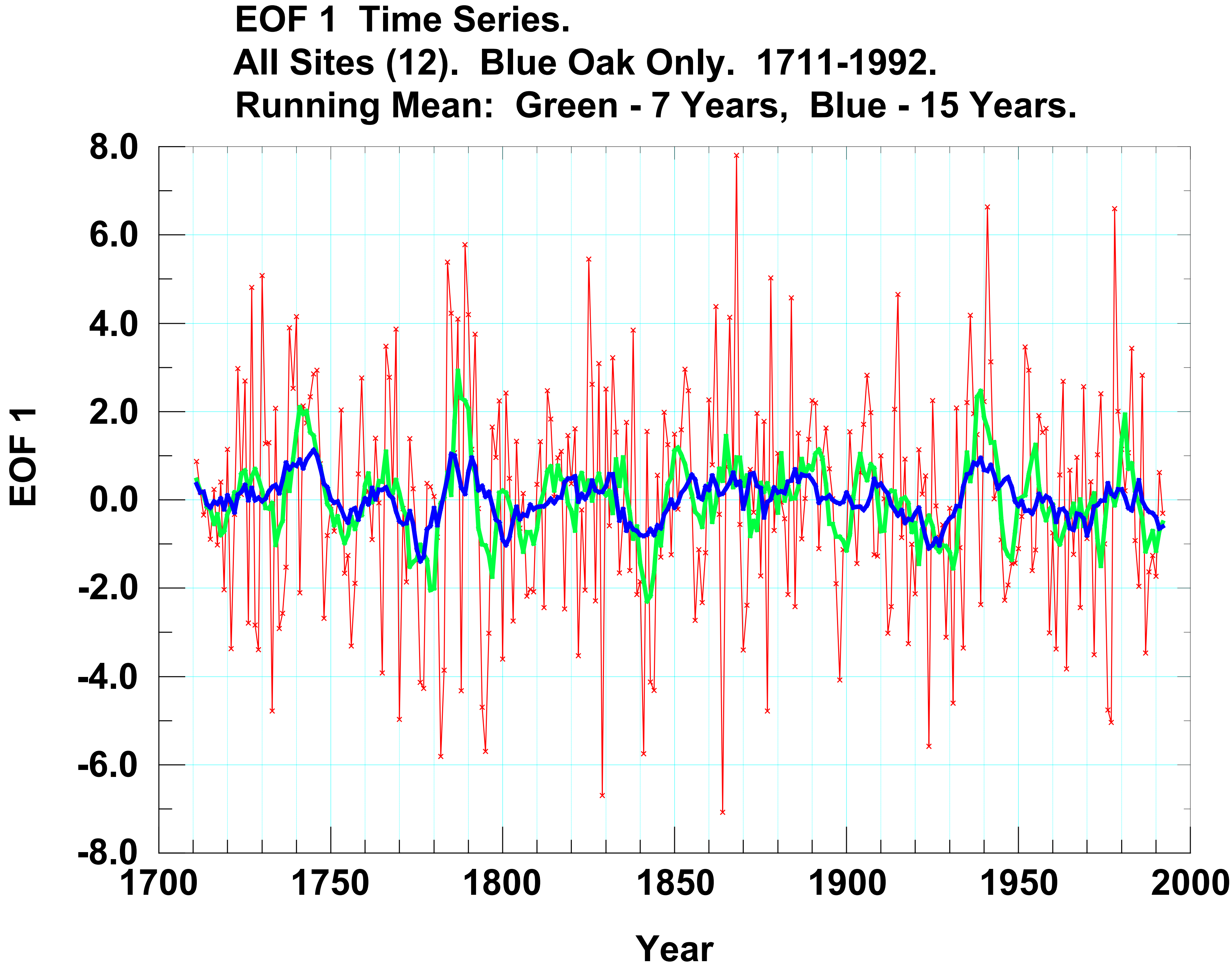
Run D. Central Central Valley, I-80 corridor only.

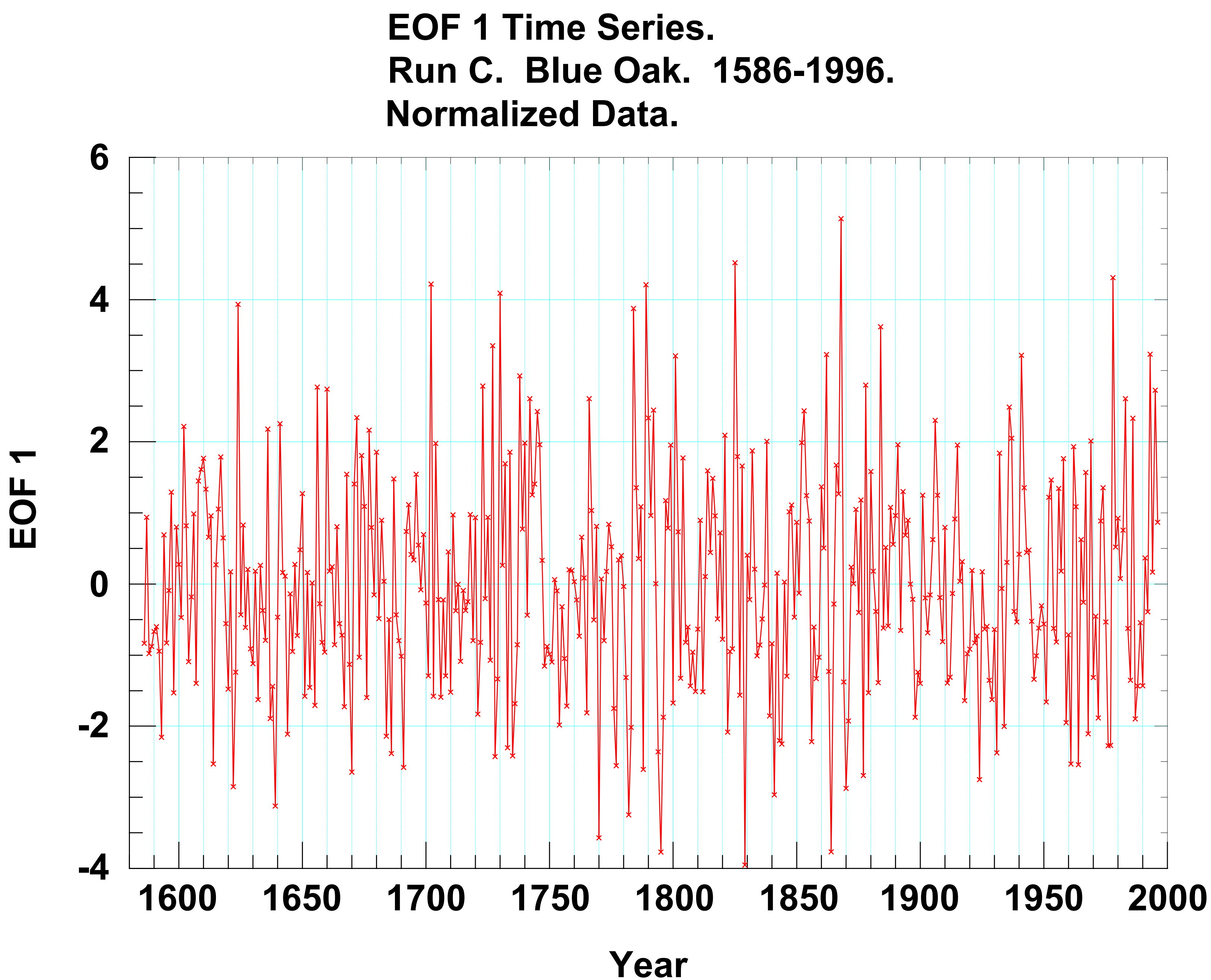
Stations 3,4,5,6 1647-1996

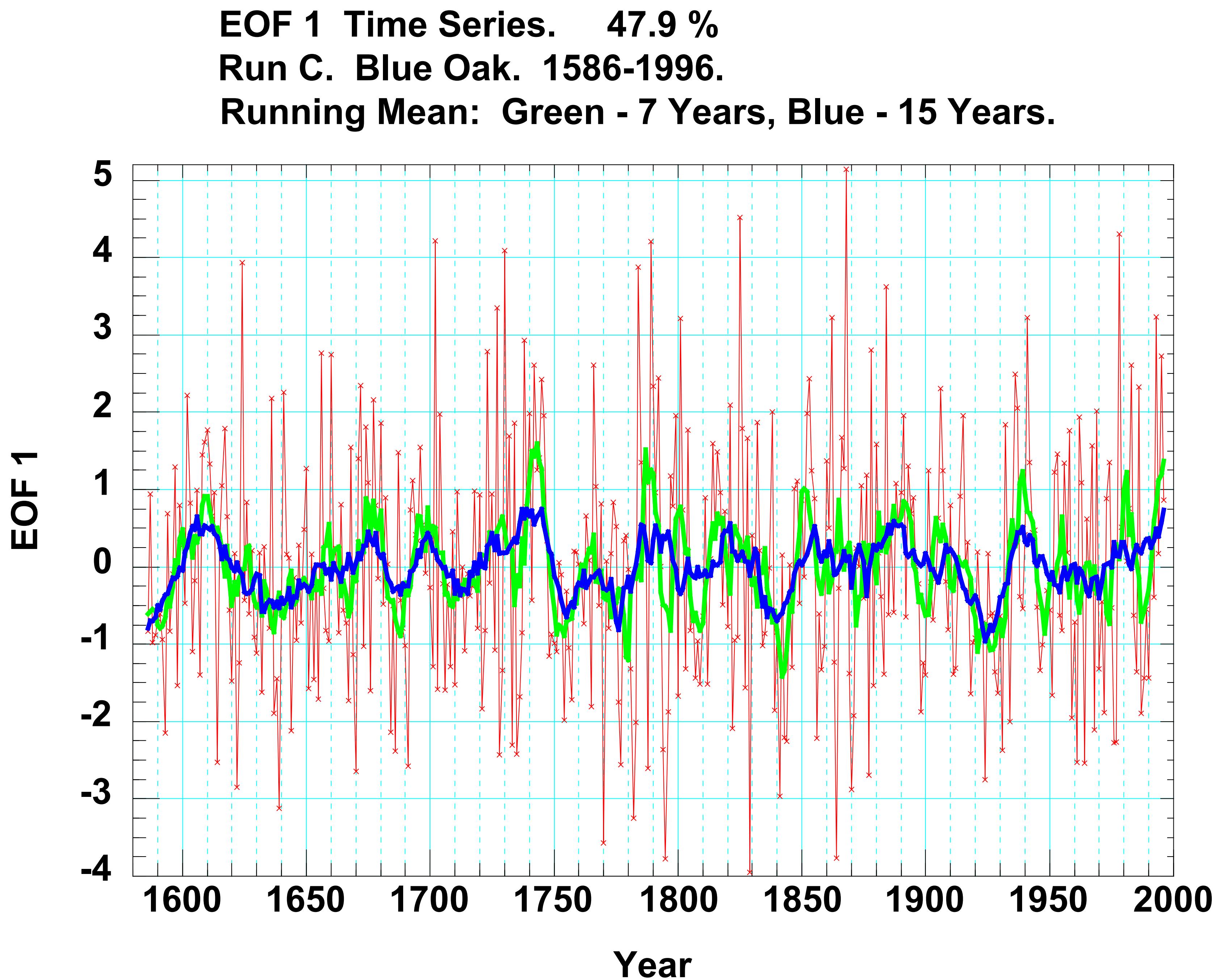
Report:

Redmond, K.T., D.W. Stahle, M.K. Therrell, D.R. Cayan, and M.D. Dettinger, 2002.
400 years of California Central Valley Precipitation Reconstructed from Blue Oaks.
Preprint, 13th AMS Symposium on Global Change and Climate Variations, Orlando FL, 13–17 January 2002, pp. 20-23.

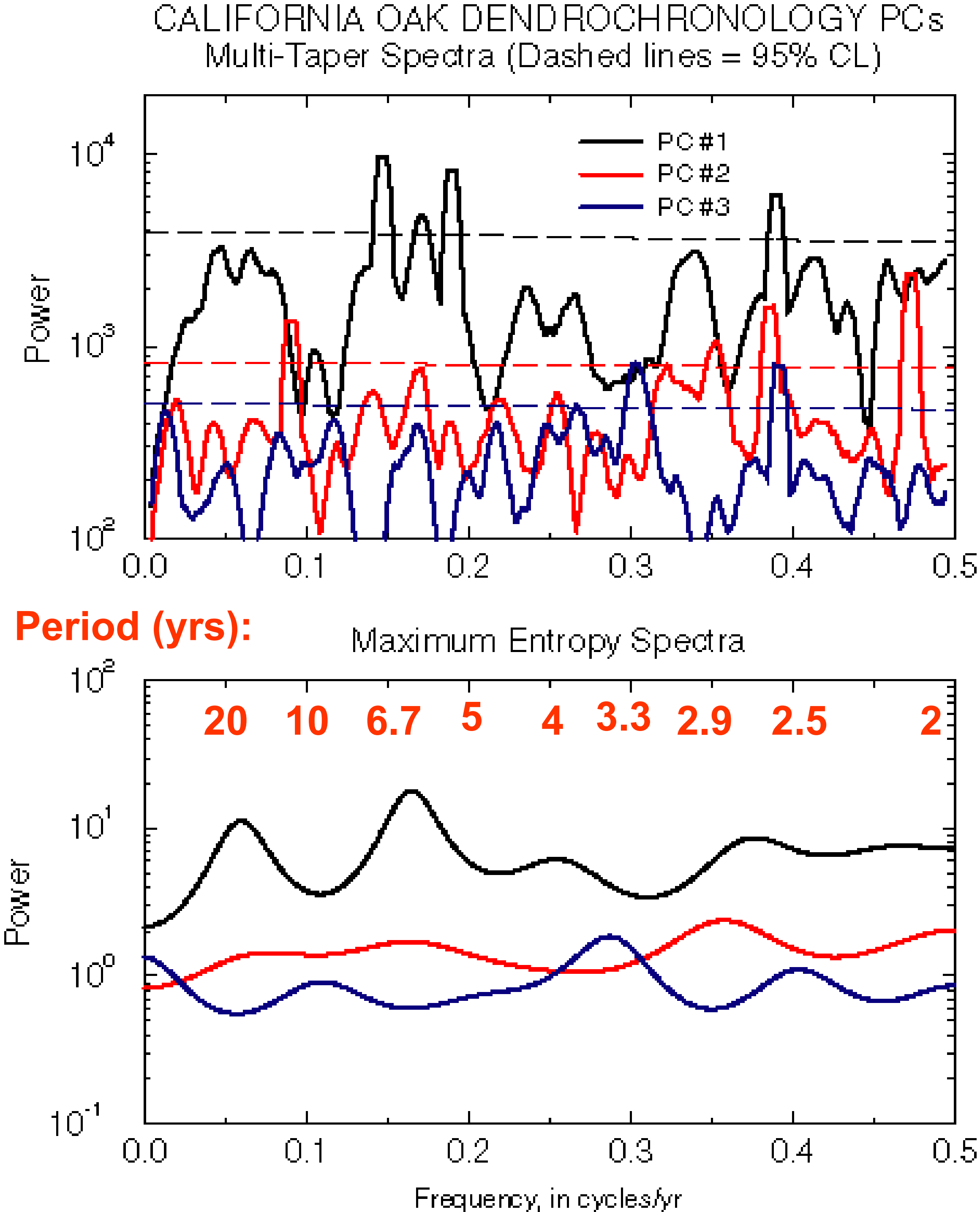

+23
+16
+21
+31
+32
+33
+28
+33
+30
+33
+29
+31
EOF 1 55 %
Run A
1711-1992
-39
-50
-50
-12
-14
+20
-16
+14
+18
+22
+23
+31
EOF 2 12 %
Run A
1711-1992
-27
-58
+25
+ 8
+32
- 2
+47
- 9
+18
- 6
-33
-22
EOF 3 7 %
Run A
1711-1992
+31
+34
+52
+48
+54
EOF 1 48 %
Run C
1586-1996
-60
-64
+34
+12
+31
EOF 2 24 %
Run C
1586-1996
- 7
-11
+-42
+86
-25
EOF 3 12 %
Run C
1586-1996
V 2.2 COPYRIGHT © 1997 by RAY STERNER, JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY


EOF 1 Time Series.
All Sites (12). Blue Oak Only. 1711-1992.
Running Mean: Green - 7 Years, Blue - 15 Years.
EOF 1
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
-8.0
1700
1750
1800
1850
1900
1950
2000
Year


EOF 1 Time Series.
Run C. Blue Oak. 1586-1996.
Normalized Data.
6
4
2
0
-2
-4
EOF 1
1600
1650
1700
1750
1800
1850
1900
1950
2000
Year



EOF 1 Time Series. 47.9 %
Run C. Blue Oak. 1586-1996.
Running Mean: Green - 7 Years, Blue - 15 Years.
EOF 1
5
4
3
2
1
0
-1
-2
-3
-4
1600
1650
1700
1750
1800
1850
1900
1950
2000
Year



Run A.
1711-1992.
282 years.

Top:
Multi-taper spectra.

EOF #1, #2, #3

Bottom:
Maximum entropy Spectra.

EOF #1, #2, #3

Run C similar.

Blue Oak Preliminary Conclusions:

The "overall-wet/dry" and "north-south" patterns emerge fairly clearly.
The "east-west" cross-valley differences are more ambiguous.

Appears to replicate 20th Century overall precipitation fairly well.

Regime-like behavior is present, but few sharp breaks such as 1976-77 shift.

Spectra show both ENSO scale (2-4 years, in EOF #2) and longer scale (6-8 years, and approx 15 years, in EOF #1). True PDO behavior would be at 30-50 years for full cycles. No clear evidence of PDO-type behavior in Central Valley.

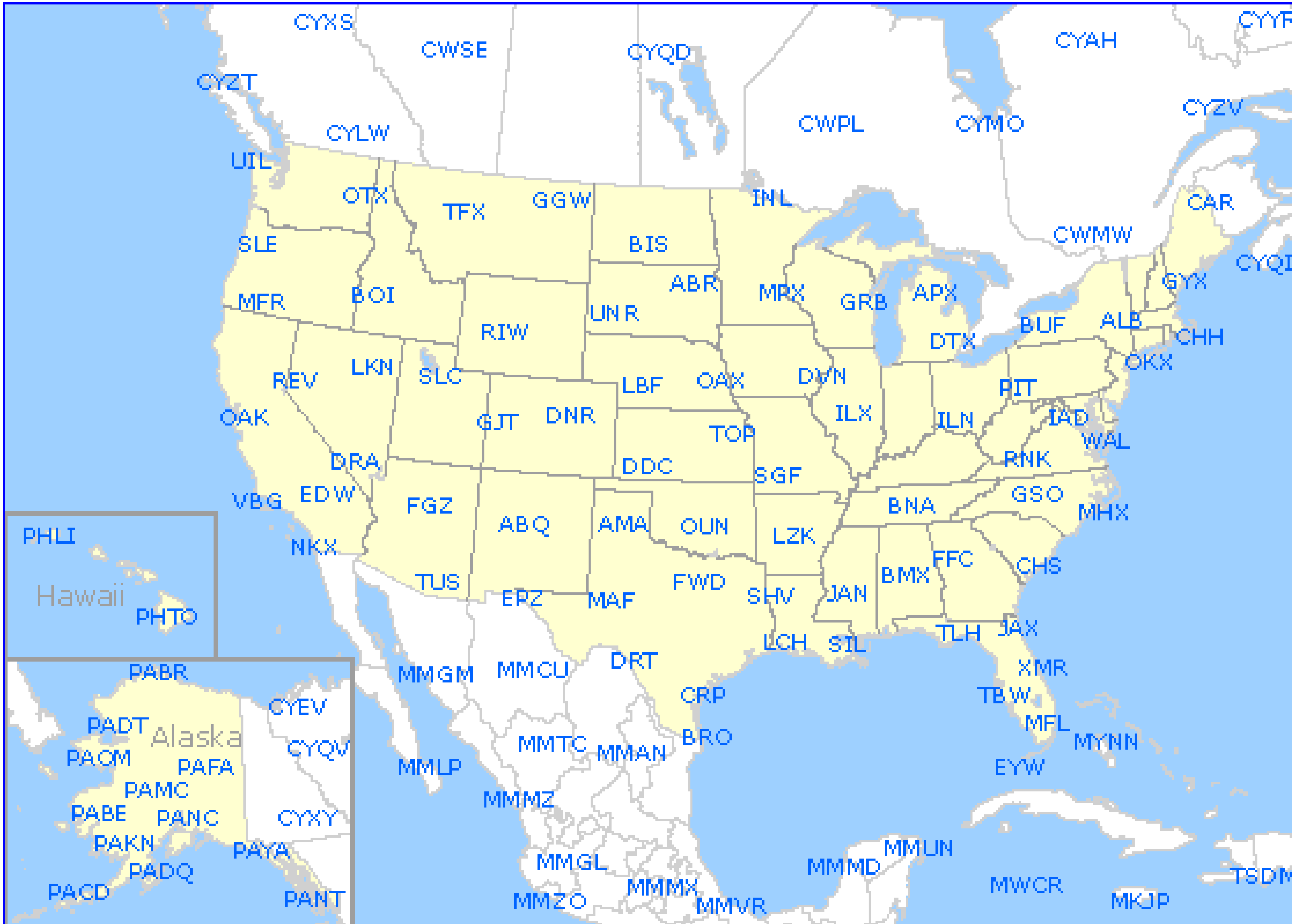
Numerous 6-8 year short-term regimes visible in the time series, like the recent drought and recent wet spells.

Current CALFED Blue Oak Project:

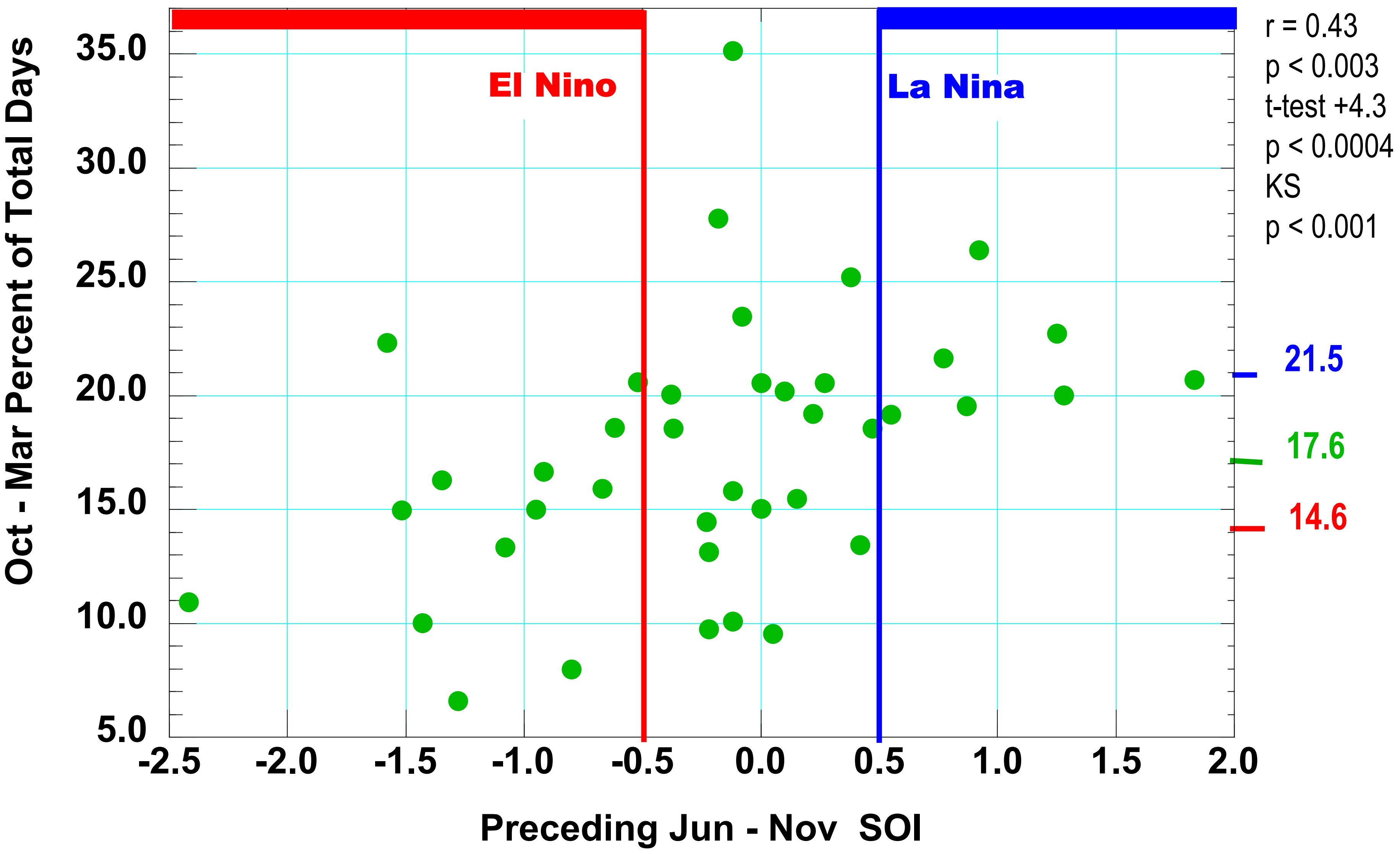
Dave Stahle, Dave Meko, Dan Cayan, Mike Dettinger, Kelly Redmond

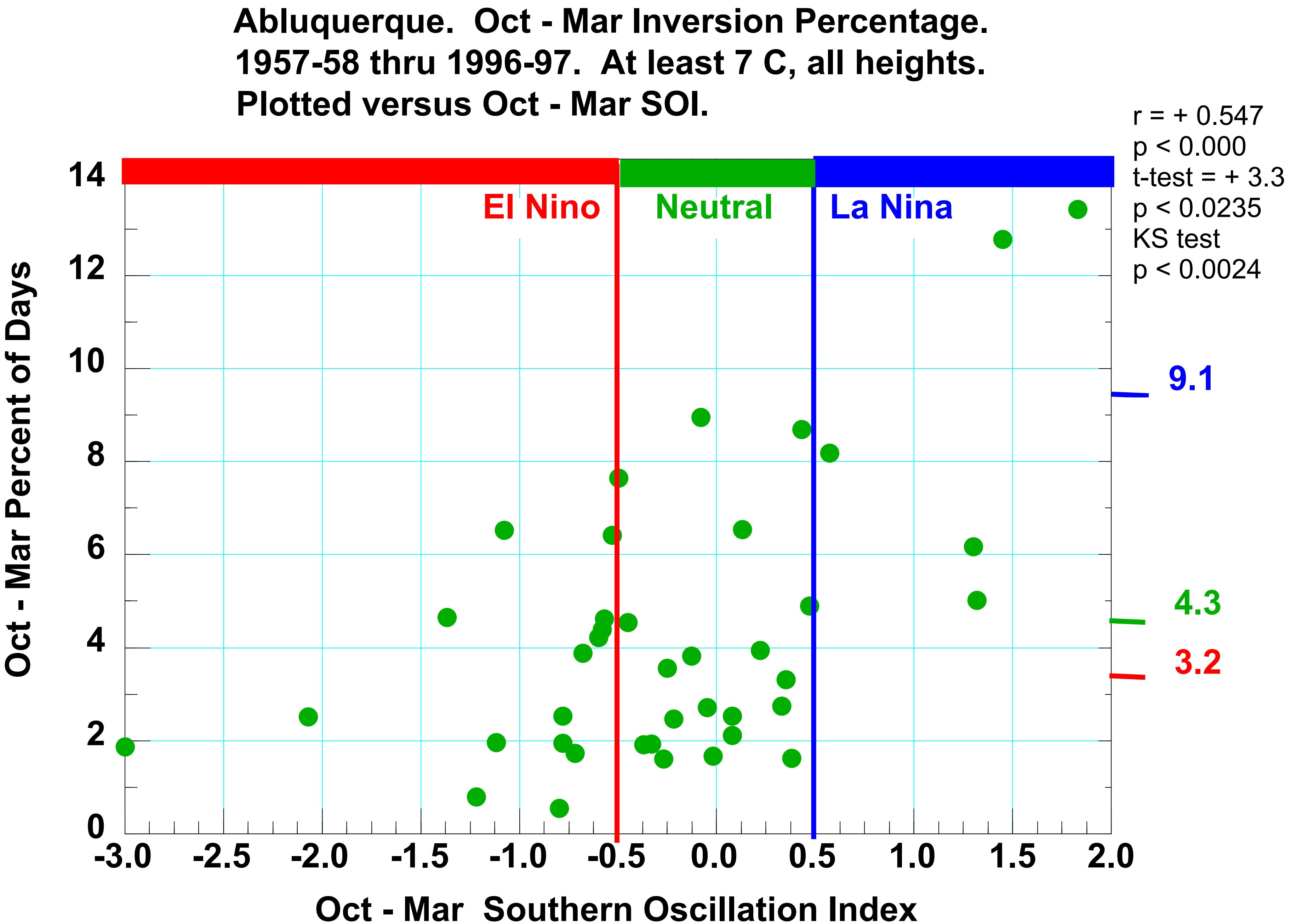
Dave Stahle and crew are now coring an additional 2000 trees, for more spatial detail, and to see if vertical (orographic) effects can be seen. Analysis phase awaits these chronologies. Preparing better climate data sets.

UCAR Upper Air Plots. Station Map. Source: www.rap.ucar.edu/weather/upper/

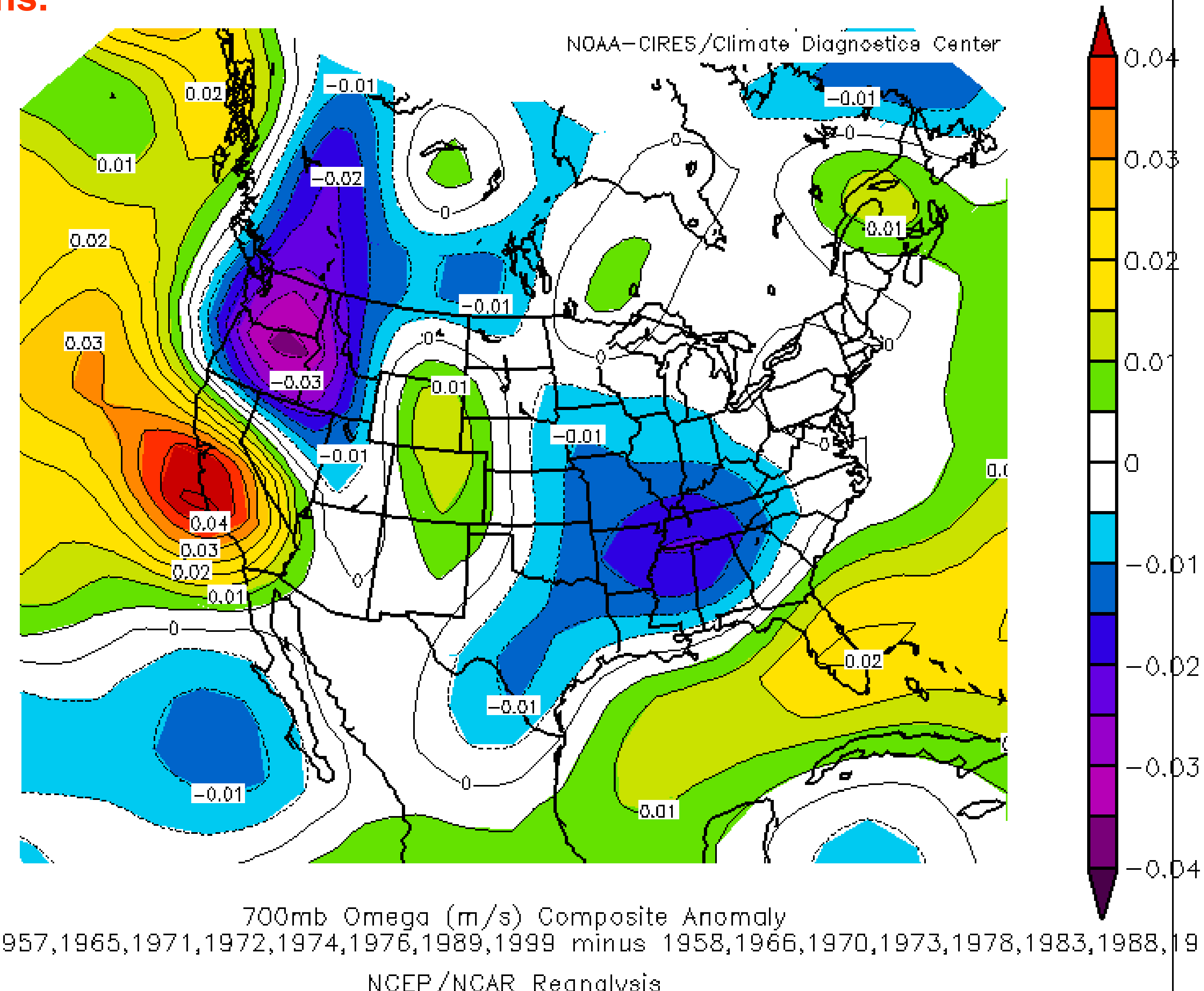


San Diego. Oct-Mar inversion percentage.
1957-58 thru 1996-97. At least 7 C, all heights.
Plotted versus prior Jun-Nov SOI.




Abluquerque. Oct - Mar Inversion Percentage.
1957-58 thru 1996-97. At least 7 C, all heights.
Plotted versus Oct - Mar SOI.
r = + 0.547
p < 0.000
t-test = + 3.3
p < 0.0235
KS test
p < 0.0024
El Nino
Neutral
La Nina
9.1
4.3
3.2
Oct - Mar Percent of Days
Oct - Mar Southern Oscillation Index
0
2
4
6
8
10
12
14
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Vertical motion, 700 mb. 10 La Nina minus 10 El Nino. Red = more sinking. Winter months.



Conclusions thus far:

Quite clear that some meteorological factors relevant to air quality are tied to very large scale climate patterns, extending across the Pacific and elsewhere.

To the extent that these patterns are related to El Nino or La Nina, they possess a modest degree of predictability.

It seems likely that other aspects of ventilation and stagnancy are related to large scale patterns of atmospheric and oceanic climate in the Pacific and elsewhere in the Northern Hemisphere.

Today's visit

Traditionally not a lot of interaction between climate services and the air quality community. Air quality meteorological data sets are relatively unknown and unused by this community.

One goal is to learn whether air quality meteorological data and metadata are sufficiently accessible, have sufficient documentation of past practices and sites, and whether suitable for studies of climate and climate variability.

What is the nature of air quality ties to large scale climate patterns?

What is the geographic distribution, spatial density, degree of artificial exposure, length of record, etc of air quality meteorological data?

Can stations in air quality meteorological networks and other networks be used better to meet multiple or mutually supportive objectives?

What products are presently generated (real-time or afterward) by air quality meteorological stations?

What are the major unmet gaps in air quality meteorological data, and could some of these be met by coordinating with other networks? Mountains? Coasts?

If AQ met data are useful, is it worth folding them into a "one stop shopping" retrieval environment? What are the fundamental mechanics of this?

Provide update on California climate activities at WRCC and elsewhere?

Identify areas of mutual interest, possible collaboration or interaction.

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www.wrcc.dri.edu

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CalFed Bay Delta Program
National Science Foundation
U.S. Geological Survey
Bureau of Land Management
National Park Service
Desert Research Institute

People: Greg McCurdy Laura Edwards Dave Simeral