




JOINT INSTITUTE FOR MARINE OBSERVATIONS  
NA17RJ1231

ANNUAL REPORT DATA INDEX CARD

Reporting Period: July 1, 2009 – June 30, 2010

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Before beginning, read all instructions on the last page of this document.

## 1. PROJECT DETAILS

Project Title: California Nevada Applications Program

Principal Investigator(s): Daniel R. Cayan

Affiliation(s): Scripps Institution of Oceanography


 Keywords: regional climate applications

 Task/Theme: Human Dimensions, RISA Program


 NOAA Strategic Goal(s):

**Goal 2:** Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond;


**Goal 3:** Serve Society's Needs for Weather and Water Information;

 NOAA Line Office / Program Officer: Caitlin Simpson, Adam Parris, OGP/RISA

## 2. RESEARCH OBJECTIVES AND SPECIFIC PLANS TO ACHIEVE THEM: (One to Two Short Paragraphs)

 The California Nevada Applications Program (CNAP) aims to develop and provide better climate information and forecasts for decision makers in California and the surrounding region. Applications addressed include problems involving water resources, wildfire, and human health. Time scales of interest range from seasonal to secular changes associated with natural and anthropogenic influences. By working directly with users and practitioners, CNAP is working to evaluate climate information needs and utility from the user perspective.

## 3. RESEARCH ACCOMPLISHMENTS (500 Words): (please *refrain from in-text citation or including references* in the report body)

 Ms. Theresa Carpenter, a graduate student at Scripps Institution of Oceanography, working with K. Georgakakos at Hydrologic Research Center (HRC), is developing flash flood hazard assessment maps for Southern California to assist emergency management and flood control agencies in the region to more effectively mitigate life loss from flash floods.

Randy Hanson and colleagues at USGS worked with CNAP and SIO to implement long-term climate change scenarios to the California Central Valley. The research is a continuation of research and testing of the statistical skill of weather forecasts from GCMs linked to existing regional hydrologic models (RHMs) that simulate the use and movement of water on the landscape as well as surface-water and ground-water flow.

Mike Dettinger, working with Phil Mote, Climate Decision Support Consortium (CDSC) at Oregon State University, are undertaking a new regional version of massive climate modeling; this effort is being leveraged by funding from the California Energy Commission. This effort is a regional counterpart of climateprediction.net to provide a broad set of simulations from which to estimate probabilistic projections.

Tim Brown continued the California and Nevada Smoke and Air Committee (CANSAC) partnership, a consortium of federal, state, county and local wildland fire and air quality agencies formed to address short-term prediction issues of fire weather, fire danger, fire behavior, smoke dispersion/transport and air quality as related to wildland fire, prescribed fire and fire use. Brown also performed a climate analysis of the major fire event during June 2008 in northern California.

Tony Westerling and graduate student Alisa Keyser continued work to examine the impact of management effects on vegetation and fire regimes and how these intersect with fire regime responses to warming and earlier springs to influence observed changes in large fire occurrence in the western US. Westerling continued our work testing models using extreme value distributions for estimating expected burned area in large wildfires, nonlinear multinomial logistic regressions for estimating expected large fire occurrence, and skew-normal distributions for forecasting the distributions of summer temperatures at seasonal lead times.

Alexander Gershunov linked with public health professionals, which resulted in NIH ARRA funding of a project in collaboration with Dr. Helene Margolis (Cal Dept of Public Health and UC Davis School of Medicine) to investigate the effects of heat wave activity on mortality and morbidity and a view towards how socio-economic and other demographic factors modulate the space-time relationships between heat waves and health impacts.

Dan Cayan, Mary Tyree, Mike Dettinger with colleague Kim Cahill, Stanford University worked to develop an empirical understanding of how climate has historically affected the timing of development (phenology) and composition of wine grapes in the Napa Valley, which is a key growing and viticulture region for premium wine production.

The CNAP Team along with partners from Universities, NOAA, and Reclamation has been working to evaluate how and why climate projections of Colorado River flow reductions from climate warming have varied so much.

#### 4. HIGHLIGHTS (Bulleled Accomplishments):



- Dettinger has continued as climate-change advisor to CALFED Program, on Climate Technical Advisory Group to DWR, on CALWATER planning, and Statewide Watershed Science Panel.
- Brown and colleagues continued working with Nevada and California fire weather meteorologists in utilizing monthly and seasonal climate forecasts and information in operations (in particular monthly and seasonal fire outlooks). Two National Seasonal Fire Assessment Workshops were held in 2009 – the first in Shepherdstown, WV in January and the second in Boulder, CO in April.
- Westerling conducted fire modeling, analysis and interpretation with applications to climate change impact assessment and fire climatology, in the form of white papers published by the California Energy Commission (Westerling et al 2009; Bryant and Westerling 2009).
- Cayan served as co-Chair of the California Climate Change Scenarios Steering Team and was contributing (lead author) on the Scenarios and Sea Level Projections elements of the 2008 Assessment. Tyree was key in processing and archiving GCM, downscaled regional, hydrological and sea level simulation data for this project and distributing and interpreting it for the various Assessment study teams, which numbered more than 30.
- Gershunov, Cayan and Sam Iacobellis have continued and finalized a comprehensive regional study of heat waves in California and Nevada that examined their synoptic causes and climatic trends. This work culminated in 2009 and resulted in an article published in the December 2009 issue of the Journal of Climate (Gershunov, Cayan and Iacobellis 2009)
- Under the aegis of the USGS Multi-Hazards Initiative, Dettinger and Redmond are contributing to a large-scale exercise initiated in California to test the state's emergency operations response to a prolonged weather-climate event.

#### 5. COLLABORATION: (Research linkages and leveraging of NOAA funded research and spin-off to other agencies: Interagency, Partnerships, and Collaborators)



##### **Interagency (Any Federal Agency or Office akin to NOAA. e.g., OGP, ONR, NASA, JPL, DOE, etc.):**

CNAP scientists are working with scientists and staff from the U.S. Geological Survey, USDA Forest Service, National Park Service, Bureau of Reclamation, Pacific Northwest National Laboratory, and the Department of Energy.

##### **Partnerships (Other Academic and Research Institutions, as well as state, local, foreign, and private sector agencies):**

CNAP has active partnerships with the California Energy Commission (through the California Climate Change Center), UC Davis (Mosquito-Human Health Program), Yosemite National Park, Stanford University, California Department of Water Resources, California Department of Public Health, California Air Resources Board, California Department of Boating and Waterways, University of Washington, University of Barcelona, and CICESE.

##### **Collaborators (Individual collaborators, include their affiliation):**

William Reisen (UC Davis), Jane Burns (UCSD Medical School), Kim Cahill (Stanford University), Tereza Cavazos (CICESE), Guido Franco (California Energy Commission), Frank Gehrke (California Department of Water Resources), Krista Geibert (US Forest Service), Helene Margolis (California Department of Public Health), Joe Meyer, Jim Roche, and Jan vanWagtendonk (Yosemite National Park), David Peterson (US Geological Survey), Xavier Rodo (University of Barcelona), Haiganoush Preisler (USDA Forest Service)

**6. COMMUNICATIONS, NETWORKING & OUTREACH** (provide as much information on outreach as possible, along with any available photographs)

Activity	Objective	Partners
<b>Communications</b> Communication with different NOAA Offices	To improve cross-communication on western climate issues and in general on climate, climate observations, and tools for visualization of climate	NOAA, NCDC
Participation in California Enhanced Flood Response and Emergency Preparedness	To improve emergency response to climatic events in California	CA Dept of Water Resources
Participation in "ArkStorm" program	To test and improve California's emergency response to prolonged weather-climate event.	USGS
Participation in Western Water Assessment Workshop	To improve access to climate data and visualization tools to better understand climate	NOAA, USDA Forest Service
<b>Networking</b> Collaboration with California State Climate Office	Develop better access to within-state sources of climate information	WRCC, State of California
Developed cross-RISA activity involving climate change and management of the Colorado River	To improve access to climate monitoring information relating to natural resource management	NOAA, Bureau of Reclamation, and several universities
<b>Academic Development</b>		
<b>K-12 Outreach</b>		
<b>Fellowship Programs/Internships</b>		

**7. CONFERENCES, SEMINARS, SYMPOSIUMS, PRESENTATIONS, WORKSHOPS**

Conference Name	Dates/Location	Representatives
Community Environmental Monitoring Workshop	July 29, 2009 / Ely, NV	Kelly Redmond
Participation in ongoing Work Group on Climate Change for Central Valley Flood Protection Plan, MWH	August 26, 2009 / Sacramento, CA	Kelly Redmond
6 <sup>th</sup> Annual California Climate Change Symposium	September 8-10, 2009 / Sacramento, CA	Kelly Redmond
Water and Energy Conservation Workshop, US Department of Commerce International Trade Administration, International Center for Water Technology, Services for Agribusiness	September 15, 2009 / Fresno, CA	Kelly Redmond
Water and Energy Conservation Workshop, US Department of Commerce International Trade Administration, Imperial Valley Economic Development Corporation, Services for Agribusiness	September 17, 2009 / El Centro, CA	Kelly Redmond
DRI Foundation	October 16, 2009 / Reno, NV	Kelly Redmond

National Park Service, Lake Mead National Recreation Area	October 22, 2009 / Boulder City, NV	Kelly Redmond
AWRA Annual Water Resources Conference	November 9-12, 2009 / Seattle, WA	Julie Vano, Tapash Das, Dennis Lettenmaier
National Weather Service Forecast Office for San Francisco meeting of WERA-102, Western Extension Research Activity-102, Climate Data and Analyses for Applications in Agriculture and Natural Resources, at National Weather Service	November 18-19, 2009 / Monterey, CA	Kelly Redmond
American Geophysical Union 2009 Fall Meeting	December, 2009 / San Francisco, CA	T. Das, D. W. Pierce, D. R. Cayan, M. Dettinger, S. F. Jacobellis
90th Annual Meeting, Weather, Climate, and Society: New Demands on Science and Services	17--21 January 2010 / Atlanta, GA	Robert S. Webb, OAR, Boulder, CO; and B. H. Udall, M. Hoerling, J. Overpeck, H. C. Hartman, D. P. Lettenmaier, J. Vano, D. R. Cayan, T. Das, L. D. Brekke, and K. Werner
NASA 'Climate-in-a-Box' Workshop	March, 2010 / Goddard Spaceflight Center, Washington, DC	R.T. Hanson, Flint, A.L., Flint, L.E., Wolfgang Schmid, Dettinger, M.D., Faunt, C.C., Cayan, D.R., and Cecil, D

**8. NOAA EMPLOYMENT** (if JIMO supported students/staff gained NOAA employment within this reporting period, provide the information below)

Name	Degree	Date of Employment	Employing NOAA Lab / Division

**9. HONORS AND AWARDS** (Include all honors and awards presented to JIMO personnel during the current reporting period)

Award	Recipient	Year

**10. PUBLICATIONS** (Separate publications by category with full citation. Indicate in a short parenthetical whether Joint Institute (JI) or NOAA (NOAA) Lead Author. Also, indicate peer-reviewed publications in **bold**. Include presentations with no publication outcome in Sec. 7 under Conferences, etc.).

*Journal Articles:*

Abatzoglou, J.T, K.T. Redmond, and L.M. Edwards, 2009. Classification of regional climate variability in the state of California. *J. Appl. Meteor. Climatol.*, 48(8), 1527-1541, DOI: 10.1175/2009JAMC2062.1.

Brekke, L.D., Maurer, E.P., Anderson, J., Dettinger, M.D., Townsley, E.S., Harrison, A., and Pruitt, T., 2009, Assessing reservoir operations risk under climate change: *Water Resources Research*, W04411, doi:10.1029/2008WR006941, 16 p.

Das, T., H. Hidalgo, D. Cayan, M. Dettinger, D. Pierce, C. Bonfils, T.P. Barnett, G. Bala and A. Mirin, 2009: Structure and origins of trends in hydrological measures over the western United States. *Journal of Hydrometeorology*, 10, 871-892. doi:10.1175/2009JHM1095.1.

Favre, A. and A. Gershunov, 2009: North Pacific cyclonic and anticyclonic transients in a global warming context: possible consequences for Western North American daily precipitation and temperature extremes. *Climate Dynamics*, 32, 969-987.

- Gershunov, A., D. Cayan and S. Iacobellis, 2009: The great 2006 heat wave over California and Nevada: Signal of an increasing trend. *Journal of Climate*, 22, 6181–6203.
- Graham, N.E., and K.P. Georgakakos, 2010: Towards Understanding the Value of Climate Information for Multi-Objective Reservoir Management Under Present and Future Climate and Demand Scenarios. *Journal of Applied Meteorology and Climatology*, 49, 557-573.
- Hidalgo H.G., T. Das, M.D. Dettinger, D.R. Cayan, D.W. Pierce, T.P. Barnett, G. Bala, A. Mirin, A.W. Wood, C. Bonfils, B.D. Santer, and T. Nozawa, 2009: Detection and Attribution of Stream flow Timing Changes to Climate Change in the Western United States. *Journal of Climate*, 22, DOI: 10.1175/2009JCLI2470.1, 3838-3855.
- Kozubowski, T.J., A.K. Panorska, F. Qeadan and A. Gershunov, and D. Rominger, 2009: Testing exponentiality versus Pareto distribution via likelihood ratio. *Communications in Statistics: Simulation and Computation*, 38, 118-139.
- Littell, J.S., D. McKenzie, D.L. Peterson, A. L. Westerling, 2009: "Climate and wildfire area burned in Western U.S. ecoprovinces, 1916-2003," *Ecological Applications*, 19, 1003-1021.
- Maurer, E.P., Hidalgo, H., Das, T., Dettinger, M., and Cayan, D., 2010: "The utility of daily large-scale climate data in the assessment of climate change impacts on daily streamflow in California." *Hydrology and Earth System Sciences*, 14, 1125-1138.
- Spracklen, D. V., L. J. Mickley, J. A. Logan, R. C. Hudman, R. Yevich, M. D. Flannigan, A. L. Westerling 2009: "Impacts of climate change from 2000 to 2050 on wildfire activity and carbonaceous aerosol concentrations in the western United States," *Journal of Geophysical Research*, 114, D20301. doi:10.1029/2008JD010966.
- Westerling, A.L., H.G. Hidalgo, D.R. Cayan, T.W. Swetnam: "Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity" republished with commentary in *Science Magazine's State of the Planet 2008-2009*. Island Press. Donald Kennedy, Ed. ISBN 1-59726-405-9. Pub. Date: 12/18/2008.
- White, M.A., de Beurs, K., Didan, K., Inouye, D., Richardson, A., Jensen, O., O'Keefe, J., Zhang, G., Nemani, R., van Leeuwen, W., Brown, J., de Wit, A., Schaepman, M., Lin, X., Dettinger, M., Baily, A., Kimball, J., Schwartz, M., Baldocchi, D., Lee, J., and Lauenroth, W., 2009, Intercomparison, interpretation and assessment of spring phenology in North America estimated from remote sensing for 1982 to 2006: *Global Change Biology*, 25 p., doi:10.1111/j.1365-2486.2009.01910.x.

**Books/Articles-in-Books:**

- Lundquist, J.D., Dettinger, M., Stewart, I., and Cayan, D., 2009, Variability and trends in spring runoff in the western United States, in Wagner, F. (ed.), *Climate warming in western North America/Evidence and environmental effects*: University of Utah Press, 63-76.
- Westerling, A. L., 2009: "Wildfires," Chapter 8 in *Climate Change Science and Policy*, Schneider, Mastrandrea, Rosencranz, Kuntz-Duriseti, Eds., Island Press.

**Reports:**

- Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham and R. Flick, 2009: *Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment*. California Climate Change Center, publication #CEC-500-2009-014-F, 64 pages, August 2009.
- Dettinger, M.D., Hidalgo, H., Das, T., Cayan, D., and Knowles, N., 2009, *Projections of potential flood regime changes in California*: California Energy Commission Report CEC- 500-2009-050-D, 68 p.
- Iacobellis, S. F., J. R. Norris, M. Kanamitsu, M. Tyree, and D. C. Cayan, 2009: *Climate variability and California low-level temperature inversions*. California Climate Change Center, publication #CEC-500-2009-020-F, 48 p.

**Conference Proceedings/Workshops:**

***Ph.D. Dissertations:***

Mansbach, David K: 2010. Synoptic and local influences on boundary layer processes, with an application to California wind power. University of California, San Diego, 199 p.

***Submitted and In Press:***

Ben Ari, T., A. Gershunov, T. Rouyer, B. Cazelles, K.L. Gage, N.Ch. Stenseth, 2009: Interannual variability of human plague occurrence in the western United States explained by tropical and North Pacific Ocean climate variability. *American Journal of Tropical Medicine & Hygiene*, *in review*.

Bryant, B. P. and A. L. Westerling: "Potential Effects of Climate Change on Residential Wildfire Risk in California" Public Interest Energy Research, California Energy Commission. , Sacramento, CA. *in review*.

Das, T., Dettinger, M., Cayan, D., and Hidalgo, H., *in review*, Potential increase in floods in California's Sierra Nevada under future climate projections: *Climatic Change*, 33 p.

Dettinger, M.D., *in review*, Climate change, atmospheric rivers and floods in California—A multimodel analysis of storm frequency and magnitude changes: *Journal of American Water Resources Association*, 14 p.

Dettinger, M.D., Ralph, F.M., Hughes, M., Das, T., Neiman, P., Cox, D., Estes, G., Reynolds, D., Hartman, R., Cayan, D., and Jones, L., *in review*, Requirements and designs for a winter storm scenario for emergency preparedness and planning exercises in California: *Weather, Climate and Society*, 52 p.

Earman, S., and Dettinger, M.D., *in review*, Potential impacts of climate change on groundwater resources—A global review: *Hydrology and Earth System Sciences*, 20 p.

Goddard, L., Aithcellouche, Y., Baethgen, W., Dettinger, M., Graham, R., Hayman, P., Kadi, M., Martinez, R., Meinke, H., *in press*, Providing seasonal-to-interannual climate information for risk management and decision making: *Procedia, Earth and Planetary Sciences*, 32 p.

Major, D.C., Omojola, A., Dettinger, M., Hanson, R., and Sanchez-Rodriguez, R., *in review*, Water and Wastewater Challenges: First Urban Climate Change Research Network (UCCRN) Assessment Report on Climate Change in Cities (ARC3), Cambridge University Press, 45 p.

Preisler, H. K., A.L. Westerling, K. Gebert, T. Holmes, F. Munoz, S. Shrestha: "Spatially Explicit Forecasts of Large Wildland Fire Probability and Suppression Costs for California", *International Journal of Wildland Fire*, *in review*.

Ralph, M., Sukovich, E., Reynolds, D., Dettinger, M., Weagle, S., Clark, W., and Neiman, P.J., *in press*, Assessment of extreme quantitative precipitation forecasts and development of regional extreme event thresholds using data from HMT-2006 and COOP observers: *Journal of Hydrometeorology*, 31 p.

Westerling, Bryant, Preisler, Holmes, Hidalgo, Das, and Shrestha: Climate Change and Growth Scenarios for California Wildfire. *Climatic Change*, *in review*.

Westerling, A. L., B. P. Bryant, H. K. Preisler, H. G. Hidalgo, T. Das: "Climate Change, Growth and California Wildfire" Public Interest Energy Research, California Energy Commission. , Sacramento, CA. *in review*.

Westerling, A. L., T. Barnett, A. Gershunov, A. Hamlet, D. Lettenmaier, N. Lu, E. Rosenberg, A. Steinemann: "Climate Forecasts for Improving Management of Energy and Hydropower Resources in the Western U.S." Public Interest Energy Research, California Energy Commission. , Sacramento, CA. *in review*.

**11. FIGURES/PHOTOS/ILLUSTRATIONS** Please provide up to two (2) figures/photos/etc. related to your report, along with **FIGURE CAPTIONS**. Include caption text below, but attach image files as **separate attachments** along with this Word Doc when submitting the report electronically. Be sure to **assign the file name** or indicate relationship below, so caption can be correctly associated with figure.



**Figure 1:** (Describe Image or Give File Name): CNAP2010\_Fig1.pdf

FIGURE 1 CAPTION: Summary map of some extreme weather conditions resulting from the ARkStorm scenario.

**Figure 2:** (Describe Image or Give File Name): CNAP2010\_Fig2.pdf

FIGURE 2 CAPTION: Graphs showing the historical (1962-2003) and projected (2000-2009) water use for agriculture for the Central Valley (modified from Faunt et al. 2009).

# Annual Report Index Card Instructions

## REPORT GUIDELINES

- Completing the **Annual Report Data Index Card** fulfills the PI's portion of the JIMO Annual Report, as required by JIMO's Cooperative Agreement with NOAA. Additional reporting or funding requirements will depend on your individual project and Program Officer. For an updated look at these requirements, please see pg. 32, section "K. Performance Reports" of the Interim Handbook for NOAA CIs (12/05), which can be found at: <http://www.nrc.noaa.gov/ci/docs/fedreg/ci-handbook120505.pdf>
- Please follow the content and format requirements outlined below. **All items in Sections 1-11 should be addressed in your report.** Add more rows to the tables in the form if more space is needed for the information provided.
- Please include up to two (2) photographs/illustrations or graphs clear enough for reproduction (high resolution) provided separately as an attachment (preferred) in .jpg, .ps, .pdf or like format along with your report. Be sure to also include figure caption(s) in Section 11. See the [online reference for Sec. 11](#) for additional information on the requested image quality.
- If your JIMO project(s) involve subawards/subcontracts or is a multi-project program, you are responsible for collecting this information from your collaborators and incorporating it within this single report for the main project.
- The completed JIMO annual report, which includes *all project reports and a comprehensive programmatic overview and accomplishments*, will be submitted electronically to NOAA through Grants Online and a professionally printed and bound hard copy sent to NOAA Cooperative Institutes Program Office.

## CONTENT REQUIREMENTS

### 1. Project Details

Please include **ALL** of the following information:

- Project Title
  - Principal Investigator(s)
  - Affiliation(s) (e.g., SIO, UCSB, MBARI, NOAA, etc.)
  - Keywords
  - Project Task & Theme
  - NOAA Strategic Goals Associated with Project
  - Program Officer and Funding NOAA Line Office (e.g., Howard Diamond, CPO)
2. **Research Objectives and Specific Plans to Achieve Them** (Please note any significant changes in objectives, methodology or rationale from previous reports)
  3. **Research Accomplishments** (500 words)
  4. **Highlights** (brief bulleted format of "Research Accomplishment")
  5. **Collaboration** (Interagency, Partnerships & misc. Collaborators)
  6. **Communications, Networking and Outreach**
  7. **Conferences, Seminars, Symposiums, Presentations, Workshops**
  8. **NOAA Employment**
  9. **Honors/Awards**
  10. **Publications** (List only **new**—not previously submitted—publications for the reporting period and separated by category. Separate publications by category with full citation. Indicate in a short parenthetical whether Joint Institute (JI) or NOAA (NOAA) Lead Author. Also, indicate peer-reviewed publications in **bold**. Include presentations with no publication outcome in Sec. 7 under Conferences, etc.). [See examples in the online reference for Sec. 10](#)
  11. **Figure/Photo/Illustration Captions** (Attach up to 2 figures, including accompanying captions in Sec. 11)

Please send completed report index card electronically as an attachment (with figures attached separately) to Garrett Eaton at: [geaton@ucsd.edu](mailto:geaton@ucsd.edu) by **August 2, 2010**

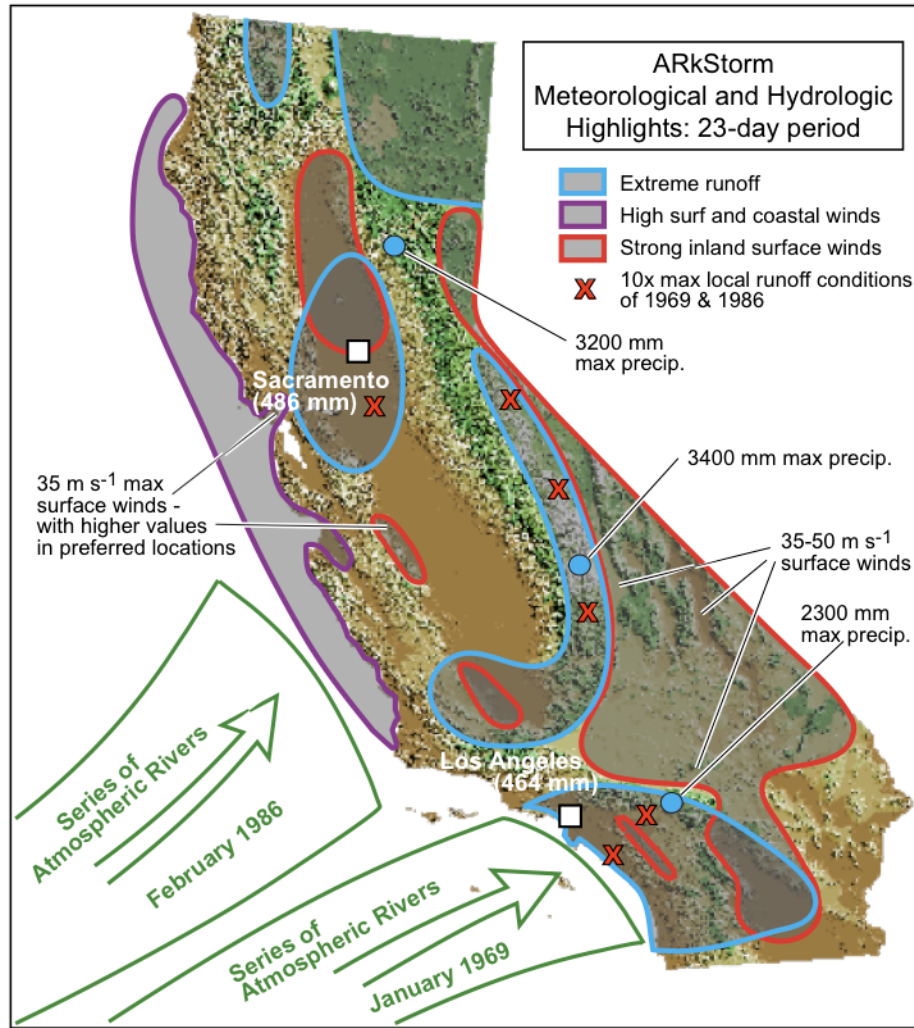


Figure 1. Summary map of some extreme weather conditions resulting from the ARkStorm scenario.

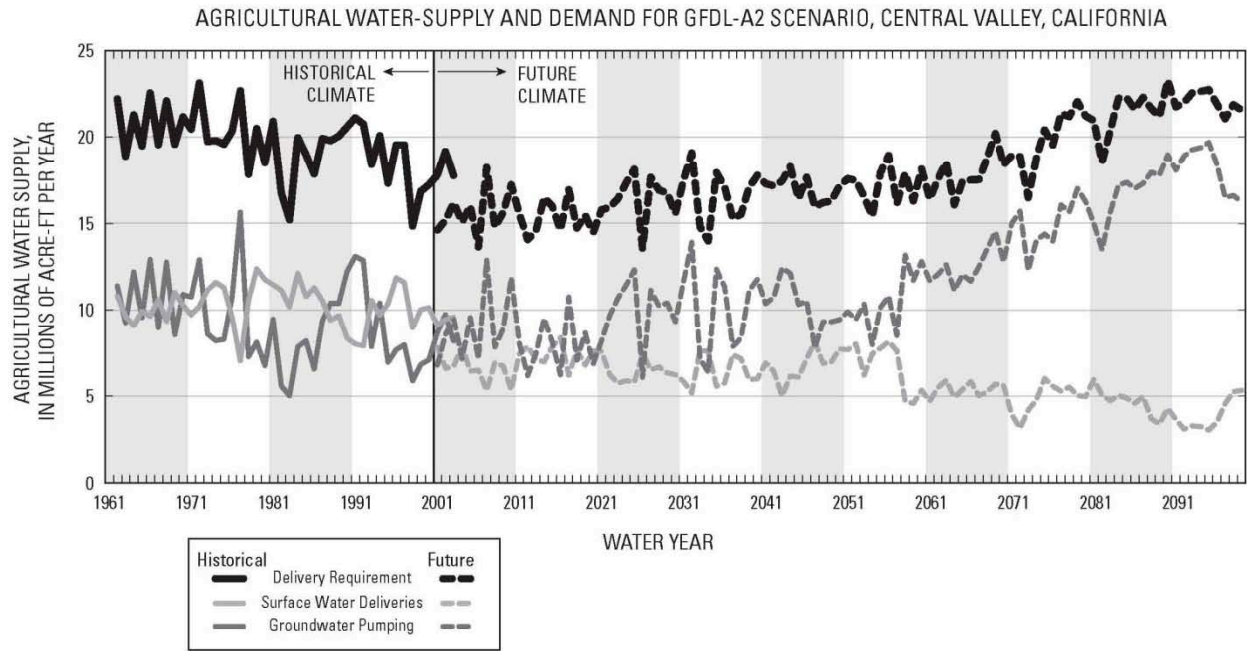


Figure 2. Graphs showing the historical (1962-2003) and projected (2000-2009) water use for agriculture for the Central Valley (modified from Faunt et al. 2009).