



California Department of Water Resources

Climate Science Support

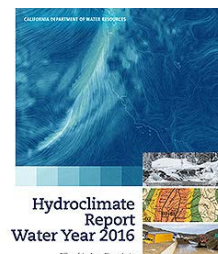
January 2018

For over 30 years, the California Department of Water Resources (DWR) has studied a changing climate and considered its potential impacts to water management. To keep DWR current with state-of-the-art climate science, and thereby provide the water management community with the best data and information available, DWR continues to conduct collaborative and extensive engagement with the academic and scientific communities. Here are 27 examples.

HYDROLOGIC IMPACTS

Hydroclimate Reports

Annual Hydroclimate Reports provide a compilation of indicators and graphical visualization of data trends for hydrology and climate in California. Each water year is set in historical context within the observed record. Select hydrologic variables are also included in the State's *Indicators of Climate Change in California* report which is being updated for release in 2018: <https://oehha.ca.gov/climate-change>.



California Climate Science and Data for Water Resources Management

Released in 2015, [*Science and Data*](#) summarizes the latest observations, projections, implications and strategies regarding a changing climate and the water-energy nexus, and provides science and data critical for climate change adaptation and mitigation for water management in California.

Sierra Snowpack

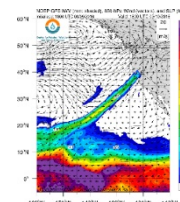
The mountain snowpack furnishes about 30 percent of California's water supply. A decreasing percentage of runoff during the April-July (A-J) snowmelt season was first noticed in the late 1980s by DWR. In 2012 and 2017, DWR assessed snowpack trends as part of the Western Snow Conference and found a decreasing trend in the volume of A-J runoff in both the northern and southern Sierra.

Rain/Snow Trends

A change in the ratio of rain to the total precipitation (or rain/snow ratio) in the winter and spring can have significant impacts on the ability to balance the multiple water management objectives of reservoir operations. Data being analyzed annually by DWR shows a greater percentage of precipitation falling as rain in California than in earlier decades. In combination with reduced snowpack, water managers can no longer rely on historical precipitation and streamflow amounts or timing.

Atmospheric Rivers

DWR supports Scripps Institution of Oceanography's (SIO) Center for Western Weather & Water Extremes for its development of decision support services for forecasting and planning in water management, and study of the impact of climate change on atmospheric rivers, flooding, precipitation and runoff.



Western Region Climate Center Data

DWR supports the California Climate Data Archive at the Western Region Climate Center's (WRCC) and the California Climate Tracker, to improve web based data services for California climate information. WRCC serves as a focal point for coordinated applied climate activities in the West.

State Climatologist Office

Hosted at DWR, the State Climatologist Office (SCO) is a cooperative program with the National Center for Environmental Information at the National Oceanic and Atmospheric Administration (NOAA), providing state-level climate data services. The California SCO works with federal, State, and local agencies along with the research community on climate and climate data issues and services.

Sea Level Rise Guidance for California

With the State Coastal Conservancy, DWR initiated the State's [Interim Sea Level Rise Guidance](#), and remains engaged with the update of this guidance through the Ocean Protection Council and the Coastal and Ocean Subgroup of the Governor's Climate Action Team.

National Research Council Study

[Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future](#), was released in 2012 by the National Research Council. DWR served as project manager on behalf of several federal and state agency partners for this detailed analysis of sea level rise projections along the Pacific Coast of the Continental US, which was the basis of the first update to the State's sea level rise guidance.

Coastal "Quick Guide"

DWR partnered with NOAA, the California Ocean Science Trust, and SIO to provide alternate approaches to local coastal floodplain management in California. Three documents released in 2016 equip local communities with tools and information to adapt to coastal flood hazards caused by climate change: [The Quick Guide Coastal Appendix; Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps: Technical Methods Manual](#); and [Addressing Sea Level Rise and Floodplain Management in California](#).

PLANNING FOR THE FUTURE

Climate Change Technical Advisory Group

As part of DWR's Climate Action Plan, a Climate Change Technical Advisory Group (CCTAG) of research experts and practitioners was empaneled in 2007-9 and again in 2012-15. The most significant contribution from CCTAG's report, "*Perspectives and Guidance for Climate Change Analysis*" was the selection of the most appropriate global climate model scenarios for California. This approach to planning for climate change is being utilized by the California Energy Commission in the State's Fourth Assessment, and for the climate change requirements under the Sustainable Groundwater Management Act and Proposition 1, the Water Storage Investment Program (WSIP). Website: <http://www.water.ca.gov/climatechange/cctag.cfm>



California Climate Change Assessments

DWR has actively contributed to California Climate Change Assessments since mandated by Executive Order S-03-05 in 2005. For the First (2006) and Second (2009), DWR contributed technical reports on cutting edge research and practical methods for using climate change information in water resources planning and management. For the Third (2012), DWR served on the steering committee. For the Fourth (to be released in 2018), DWR reviewed research proposals, is managing 16 research projects funded by CNRA, is contributing five original research papers, serves on the Planning and Management team, and is providing peer review and technical editing support.

Website: http://climatechange.ca.gov/climate_action_team/reports/climate_assessments.html

Incorporating Climate Change in Water Storage Investment Decision Making

WSIP allocates \$2.7 billion to fund public benefits associated with water storage projects. DWR built on the work of the CCTAG to refine climate projection datasets for grant applicants to calculate the public benefits of their proposed projects under projected future conditions and conduct extreme climate conditions uncertainty analyses.

Decision Scaling Analysis for the State Water Project (SWP)

To assess the impacts of climate change on the SWP, DWR is employing a decision-scaling approach that integrates vulnerability-based analysis with traditional risk-based assessment methods. In partnership with the University of Massachusetts, vulnerability for a wide range of potential conditions and the probability of specific outcomes are determined, allowing planners to quantify risks and costs of various adaptation strategies.



Extreme Event Modeling with UC Davis

The UC Davis Hydrologic Research Laboratory partners with the SCO to support better forecasting and response strategies by reconstructing historical extreme precipitation events to determine how they interact with West slope Sierra watersheds. A pilot study for the Feather/Yuba/American Rivers was conducted from 2013-2015; a follow-on study for the Upper Sacramento to the Kings Rivers is in progress.

Western States Water Council

[Proceedings of the Western Governors' Association/Western States Water Council/California Department of Water Resources Climate Change Research Needs Workshop](#) (2007) summarizes multi-state, water management-related climate information and policy needs, including interagency cooperation.

Paleohydrology Studies

Paleohydrology (or tree-ring) analysis allows assessment of hydrologic variability over centuries to millennia, gives historical context for assessing recent droughts, and can be used in climate change research. DWR partners with the University of Arizona to develop long-term streamflow or precipitation reconstructions for California's major watersheds.



California Landscape Conservation Cooperative (LCC)

This science-management partnership informs and promotes integrated science, natural resource management, and conservation to address the impacts of climate change and other stressors within and across ecosystems. DWR has been active by participating on the LCC's Steering Committee, Science-Management Team, Communications Team, and Tribal Team.

Safeguarding California

DWR leads the Water Sector of the Safeguarding California Plan: 2017 Update, California's Climate Adaptation Strategy. This plan outlines the specific vulnerabilities associated with ongoing and inevitable climate impacts, the current actions that State government is undertaking to reduce those vulnerabilities, and next steps to continue progress in adapting to threats from climate change.

Water and Energy

Reducing energy demand and GHG emissions from the water sector is a statewide priority. DWR has developed estimates for embedded energy and GHG emissions in SWP water supplies, and methodologies for calculating the embedded energy in other water supplies, to be included in Urban Water Management Plans. This information supports investments in water use efficiency and conservation. [Connecting the Dots between Water, Energy, Food, and Ecosystems Issues for Integrated Water Management in a Changing Climate](#), released in 2017, explores how water, energy, food, and climate change are interconnected with ecosystems, identifies information gaps and related challenges and opportunities for ecosystem services in multiple sectors.



OUTREACH AND EDUCATION

ProjectWET

Recognizing the importance of educating children about climate change and the associated impacts to water resources, DWR has partnered with the Water Education Foundation's Water Education for Teachers Project (ProjectWET) Program to deliver climate change training classes for K-12th grade teachers. It is anticipated that up to 9,000 students across various regions of California will use ProjectWET.



Community Collaborative Rain, Hail and Snow Network (CoCoRaHS)

This non-profit, community-based network of volunteers takes daily, local measurements of rain, hail and snow. DWR supports and promotes CoCoRaHS through regional coordination, data management, and volunteer recruitment.

DWR Climate Literacy

This training class teaches DWR staff about climate change issues that relate to water management in California. Approximately 350 DWR staff have completed the training, learning about the latest science, projections of hydrologic change, greenhouse gas emissions, State policies, DWR's Climate Action Plan, carbon mitigation, and climate change adaptation strategies for the water sector.

Science On a Sphere

Science On a Sphere (SOS) is a six-foot video display globe showing spherical projections of hurricanes, tsunamis, climate change, atmospheric rivers, oceans, and visualizations of the Moon, Sun, and planets. Upwards of a million visitors experienced SOS at the California State Fair in 2007, where DWR and the Sacramento National Weather Service Office had it showcased.



Tribal Ecological Knowledge and Engagement

DWR engages with native tribes to help determine how climate change may impact tribal communities, to discover how traditional ecological knowledge is utilized, and to identify data gaps and opportunities for technical assistance which DWR could provide. *Climate Conversations* - videos of Tribes' perspectives on climate change - will be released at the Tribal Water Summit in 2018.

Public Website and Climate News Digest

DWR works to educate staff and the public about the basics of climate science so they can be informed and motivated to take action. Climate Change 101: <http://www.water.ca.gov/climatechange/cc101.cfm>. Monthly recap of relevant climate change articles: <http://www.water.ca.gov/climatechange/news.cfm>.

SCIENCE SERVICE AWARDS

The purpose of DWR's Science Service Awards is to recognize ongoing assistance provided by scientists who have been working closely with DWR on climate research activities. For a list of recipients and their research areas, please go to: <http://www.water.ca.gov/climatechange/awards.cfm>.

More on PARTNERSHIPS between the DWR Climate Change Program and the scientific community can be found here: <http://www.water.ca.gov/climatechange/partnership.cfm>