



Responding to Drought in 2014

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State Response Actions

- May 2013 Executive Order on water transfers
- Dec 2013 formation of Drought Task Force
- Jan 2014 Governor's emergency proclamation
- March 2014 drought relief legislation
- April 2014 Executive Order redoubling drought efforts





State Water Project Operations

- Challenging operations in 2014; likely 3-4th driest year in Sac & SJ basins, no operational precedent in recent years
- Upcoming briefing June 4th on ops challenges of 2014 drought



Drought Emergency Proclamation

- 1.State agencies, led by the Department of Water Resources, will execute a statewide water conservation campaign to make all Californians aware of the drought and encourage personal actions to reduce water usage. This campaign will be built on the existing Save Our Water campaign (www.saveourh20.org) and will coordinate with local water agencies. This campaign will call on Californians to reduce their water usage by 20 percent.
- 2.Local urban water suppliers and municipalities are called upon to implement their local water shortage contingency plans immediately in order to avoid or forestall outright restrictions that could become necessary later in the drought season. Local water agencies should also update their legally required urban and agricultural water management plans, which help plan for extended drought conditions. The Department of Water Resources will make the status of these updates publicly available.
- 3.State agencies, led by the Department of General Services, will immediately implement water use reduction plans for all state facilities. These plans will include immediate water conservation actions, and a moratorium will be placed on new, non-essential landscaping projects at state facilities and on state highways and roads.
- 4.The Department of Water Resources and the State Water Resources Control Board (Water Board) will expedite the processing of water transfers, as called for in Executive Order B-21-13. Voluntary water transfers from one water right holder to another enables water to flow where it is needed most.
- 5.The Water Board will immediately consider petitions requesting consolidation of the places of use of the State Water Project and Federal Central Valley Project, which would streamline water transfers and exchanges between water users within the areas of these two major water projects.
- 6.The Department of Water Resources and the Water Board will accelerate funding for water supply enhancement projects that can break ground this year and will explore if any existing unspent funds can be repurposed to enable near-term water conservation projects.
- 7.The Water Board will put water right holders throughout the state on notice that they may be directed to cease or reduce water diversions based on water shortages.
- 8.The Water Board will consider modifying requirements for reservoir releases or diversion limitations, where existing requirements were established to implement a water quality control plan. These changes would enable water to be conserved upstream later in the year to protect cold water pools for salmon and steelhead, maintain water supply, and improve water quality.
- 9.The Department of Water Resources and the Water Board will take actions necessary to make water immediately available, and, for purposes of carrying out directives 5 and 8, Water Code section 13247 and Division 13 (commencing with section 21000) of the Public Resources Code and regulations adopted pursuant to that Division are suspended on the basis that strict compliance with them will prevent, hinder, or delay the mitigation of the effects of the emergency. Department of Water Resources and the Water Board shall maintain on their websites a list of the activities or approvals for which these provisions are suspended.

Drought Emergency Proclamation

- 10. The state's Drinking Water Program will work with local agencies to identify communities that may run out of drinking water, and will provide technical and financial assistance to help these communities address drinking water shortages. It will also identify emergency interconnections that exist among the state's public water systems that can help these threatened communities.
- 11. The Department of Water Resources will evaluate changing groundwater levels, land subsidence, and **agricultural land fallowing** as the drought persists and will provide a public update by April 30 that identifies groundwater basins with water shortages and details gaps in groundwater monitoring.
- 12. The Department of Water Resources will work with counties to help ensure that well drillers submit required groundwater well logs for newly constructed and deepened wells in a timely manner and the Office of Emergency Services will work with local authorities to enable early notice of areas experiencing problems with residential groundwater sources.
- 13. The California Department of Food and Agriculture will launch a one-stop website (www.cdfa.ca.gov/drought) that provides timely updates on the drought and connects farmers to state and federal programs that they can access during the drought.
- 14. The Department of Fish and Wildlife will evaluate and manage the changing impacts of drought on threatened and endangered species and species of special concern, and develop contingency plans for state Wildlife Areas and Ecological Reserves to manage reduced water resources in the public interest.
- 15. The Department of Fish and Wildlife will work with the Fish and Game Commission, using the best available science, to determine whether restricting fishing in certain areas will become necessary and prudent as drought conditions persist.
- 16. The Department of Water Resources will take necessary actions to protect water quality and water supply in the Delta, including installation of temporary barriers or temporary water supply connections as needed, and will coordinate with the Department of Fish and Wildlife to minimize impacts to affected aquatic species.
- 17. The Department of Water Resources will refine its seasonal climate forecasting and drought prediction by advancing new methodologies piloted in 2013.**
- 18. The California Department of Forestry and Fire Protection will hire additional seasonal firefighters to suppress wildfires and take other needed actions to protect public safety during this time of elevated fire risk.
- 19. The state's Drought Task Force will immediately develop a plan that can be executed as needed to provide emergency food supplies, financial assistance, and unemployment services in communities that suffer high levels of unemployment from the drought.
- 20. The Drought Task Force will monitor drought impacts on a daily basis and will advise me of subsequent actions that should be taken if drought conditions worsen.

March Emergency Drought Relief Funding Highlights

\$549 million from the accelerated expenditure of voter-approved bonds, Proposition 84 and Proposition 1E, in the form of infrastructure grants for local and regional projects that are already planned or partially completed to increase local reliability, including recapturing of storm water, expanding the use and distribution of recycled water, enhancing the management and recharging of groundwater storage and strengthening water conservation.

\$30 million from the Greenhouse Gas Reduction Fund to the Department of Water Resources (DWR) for direct expenditures and grants to state and local agencies to improve water use efficiency, save energy and reduce greenhouse gas emissions from state and local water transportation and management systems.

\$14 million for groundwater management across the state, including assistance to disadvantaged communities with groundwater contamination exacerbated by the drought.

\$10 million from the Greenhouse Gas Emissions Fund for the California Department of Food and Agriculture to invest in irrigation and water pumping systems that reduce water use, energy use and greenhouse gas emissions.

\$15 million from the General Fund for Emergency Drinking Water Fund to address emergency water shortages due to drought.

\$13 million from the General Fund to augment the California Conservation Corps and local community conservation corps to expand water use efficiency and conservation activities and to reduce fuel loads to prevent catastrophic fires.

\$25.3 million from the General Fund for food assistance, which will be structured to maximize the potential federal drought assistance that can be provided to provide food assistance to those impacted by the drought.

\$21 million from the General Fund and federal funds for housing related assistance for individuals impacted by the drought.

April 2014 Executive Order

- 1. The orders and provisions contained in Proclamation No. 1-17-2014, dated January 17, 2014, remain in full force and effect except as modified herein.
- 2. The Department of Water Resources and the State Water Resources Control Board (Water Board) will immediately and expeditiously process requests to move water to areas of need, including requests involving voluntary water transfers, forbearance agreements, water exchanges, or other means. If necessary, the Department will request that the Water Board consider changes to water right permits to enable such voluntary movements of water.
- 3. Recognizing the tremendous importance of conserving water during this drought, all California residents should refrain from wasting water:
 - a. Avoid using water to clean sidewalks, driveways, parking lots and other hardscapes.
 - b. Turn off fountains and other decorative water features unless recycled or grey water is available.
 - c. Limit vehicle washing at home by patronizing local carwashes that use recycled water.
 - d. Limit outdoor watering of lawns and landscaping to no more than two times a week.
- Recreational facilities, such as city parks and golf courses, and large institutional complexes, such as schools, business parks and campuses, should immediately implement water reduction plans to reduce the use of potable water for outdoor irrigation.
- Commercial establishments such as hotel and restaurants should take steps to reduce water usage and increase public awareness of the drought through measures such as offering drinking water only upon request and providing customers with options to avoid daily washing of towels or sheets.
- Professional sports facilities, such as basketball arenas, football, soccer, and baseball stadiums, and hockey rinks should reduce water usage and increase public awareness of the drought by reducing the use of potable water for outdoor irrigation and encouraging conservation by spectators.
- The Water Board shall direct urban water suppliers that are not already implementing drought response plans to limit outdoor irrigation and other wasteful water practices such as those identified in this Executive Order. The Water Board will request by June 15 an update from urban water agencies on their actions to reduce water usage and the effectiveness of these efforts. The Water Board is directed to adopt emergency regulations as it deems necessary, pursuant to Water Code section 1058.5, to implement this directive. Californians can learn more about conserving water from the Save Our Water campaign (SaveOurH2O.org).
- 4. Homeowners Associations (commonly known as HOAs) have reportedly fined or threatened to fine homeowners who comply with water conservation measures adopted by a public agency or private water company. To prevent this practice, pursuant to Government Code section 8567, I order that any provision of the governing document, architectural or landscaping guidelines, or policies of a common interest development will be void and unenforceable to the extent it has the effect of prohibiting compliance with the water-saving measures contained in this directive, or any conservation measure adopted by a public agency or private water company, any provision of Division 4, Part 5 (commencing with section 4000) of the Civil Code notwithstanding.
- 5. All state agencies that distribute funding for projects that impact water resources, including groundwater resources, will require recipients of future financial assistance to have appropriate conservation and efficiency programs in place.
- 6. The Department of Fish and Wildlife will immediately implement monitoring of winter-run Chinook salmon in the Sacramento River and its tributaries, as well as several runs of salmon and species of smelt in the Delta as described in the April 8, 2014 Drought Operations Plan.
- 7. The Department of Fish and Wildlife will implement projects that respond to drought conditions through habitat restoration and through water infrastructure projects on property owned or managed by the Department of Fish and Wildlife or the Department of Water Resources for the benefit of fish and wildlife impacted by the drought.
- 8. The Department of Fish and Wildlife will work with other state and federal agencies and with landowners in priority watersheds to protect threatened and endangered species and species of special concern and maximize the beneficial uses of scarce water supplies, including employment of voluntary agreements to secure instream flows, relocation of members of those species, or through other measures..

April 2014 Executive Order

- 9. The Department of Water Resources will expedite the consideration and, where appropriate, the implementation, of pump-back delivery of water through the State Water Project on behalf of water districts.
- 10. The Water Board will adopt statewide general waste discharge requirements to facilitate the use of treated wastewater that meets standards set by the Department of Public Health, in order to reduce demand on potable water supplies.
- 11. The Department of Water Resources will conduct intensive outreach and provide technical assistance to local agencies in order to increase groundwater monitoring in areas where the drought has significant impacts, and develop updated contour maps where new data becomes available in order to more accurately capture changing groundwater levels. The Department will provide a public update by November 30 that identifies groundwater basins with water shortages, details remaining gaps in groundwater monitoring, and updates its monitoring of land subsidence and agricultural land fallowing.
- 12. The California Department of Public Health, the Office of Emergency Services, and the Office of Planning and Research will assist local agencies that the Department of Public Health has identified as vulnerable to acute drinking water shortages in implementing solutions to those water shortages.
- 13. The Department of Water Resources and the Water Board, in coordination with other state agencies, will provide appropriate assistance to public agencies or private water companies in establishing temporary water supply connections to mitigate effects of the drought.
- 14. For the protection of health, safety, and the environment, CAL FIRE, the Office of Emergency Services, the Department of Water Resources, and the Department of Public Health, where appropriate, may enter into contracts and arrangements for the procurement of materials, goods, and services necessary to quickly mitigate the effects of the drought.
- 15. Pursuant to the drought legislation I signed into law on March 1, 2014, by July 1, 2014, the California Department of Food and Agriculture, in consultation with the Department of Water Resources and Water Board, will establish and implement a program to provide financial incentives to agricultural operations to invest in water irrigation treatment and distribution systems that reduce water and energy use, augment supply, and increase water and energy efficiency in agricultural applications.
- 16. To assist landowners meet their responsibilities for removing dead, dying and diseased trees and to help landowners clear other trees and plants close to structures that increase fire danger, certain noticing requirements are suspended for these activities. Specifically, the requirement that any person who conducts timber operations pursuant to the exemptions in Title 14, California Code of Regulations sections 1038 (b) and (c) submit notices to CAL FIRE under the provisions of Title 14, California Code of Regulations, section 1038.2 is hereby suspended. Timber operations pursuant to sections 1038(b) and (c) may immediately commence operations upon submission of the required notice to CAL FIRE and without a copy of the Director's notice of acceptance at the operating site. All other provisions of these regulations will remain in effect.
- 17. The Water Board will adopt and implement emergency regulations pursuant to Water Code section 1058.5, as it deems necessary to prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water, to promote water recycling or water conservation, and to require curtailment of diversions when water is not available under the diverter's priority of right.
- 18. In order to ensure that equipment and services necessary for drought response can be procured quickly, the provisions of the Government Code and the Public Contract Code applicable to state contracts, including, but not limited to, advertising and competitive bidding requirements, are hereby suspended for directives 7 and 14. Approval by the Department of Finance is required prior to the execution of any contract entered into pursuant to these directives.
- 19. For several actions called for in this proclamation, environmental review required by the California Environmental Quality Act is suspended to allow these actions to take place as quickly as possible. Specifically, for actions taken by state agencies pursuant to directives 2, 3, 6—10, 13, 15, and 17, for all actions taken pursuant to directive 12 when the Office of Planning and Research concurs that local action is required, and for all necessary permits needed to implement these respective actions, Division 13 (commencing with section 21000) of the Public Resources Code and regulations adopted pursuant to that Division are hereby suspended. The entities implementing these directives will maintain on their websites a list of the activities or approvals for which these provisions are suspended. This suspension and that provided in paragraph 9 of the January 17, 2014 Proclamation will expire on December 31, 2014, except that actions started prior to that date shall not be subject to Division 13 for the time required to complete them.
- 20. For several actions called for in this proclamation, certain regulatory requirements of the Water Code are suspended to allow these actions to take place as quickly as possible. Specifically, for actions taken pursuant to directive 2, section 13247 of the Water Code is suspended. The 30-day comment period provided in section 1726(f) of the Water Code is also suspended for actions taken pursuant to directive 2, but the Water Board will provide for a 15-day comment period. For actions taken by state agencies pursuant to directives 6 and 7, Chapter 3 of Part 3 (commencing with section 85225) of the Water Code is suspended. The entities implementing these directives will maintain on their websites a list of the activities or approvals for which these provisions are suspended.

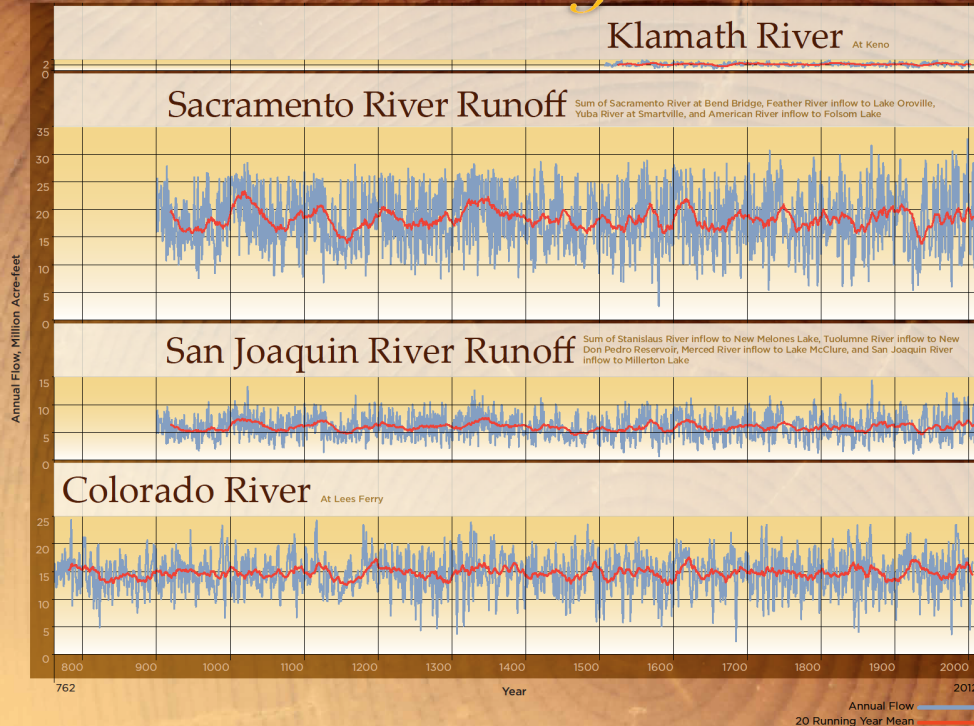
More Details

- Coordinating operations of SWP and CVP to meet the severe hydrologic conditions
 - Delta export levels
 - ESA BiOps, Water Quality Control Plan
 - Carry-over storage for 2015
- Evaluation of emergency temporary Delta barriers
- DWR-ACWA Save Our Water program
- Facilitating water transfers
- Tracking groundwater levels & land subsidence
- Administering local assistance funding

How Can NOAA/NIDIS Help?

- CDWR request to NOAA for sub-seasonal to seasonal forecasting assistance
 - Improving statistical models for California (DWR's 7th annual winter outlook workshop, Nov 2014)
 - Analog years analysis
 - Improved understanding of natural climate variability from very long-term record (new UofAZ reconstructions for DWR -- Sac, SJ, Klamath Rivers)
 - Using emerging information on predictive capacity associated with ARs (NOAA/DWR \$25M observing system for extreme precip)

Reconstructed Streamflows & Drought Periods



USING TREE-RINGS TO RECONSTRUCT STREAMFLOW

A tree-ring reconstruction is a set of tree-ring width data that have been calibrated with an instrumental or gaged record of a hydrologic or climatic variable such as annual streamflow or precipitation. The reconstruction, based on a statistical model that describes the relationship between tree growth and the gage record, extends that record back hundreds of years into the past.

Tree growth in dry climates is limited by water availability. Trees that provide the best information about hydroclimatic variability are those particularly sensitive to variations in moisture. These include species such as blue oak, ponderosa pine, Douglas fir, and western juniper, usually growing at lower elevations in sparse stands on dry and rocky sites where soil moisture storage is minimal.

Tree-ring reconstructions of hydroclimatic variables are developed from tree-ring chronologies. A tree-ring chronology is a time-series of annual values derived from the ring width measurements of 10 or more trees of the same species at a single site. To create a tree-ring chronology, cores from the sampled trees at each site are cross-dated (i.e., patterns of narrow and wide rings are matched from tree to tree) to account for missing or false rings, so that every annual ring is absolutely dated to the correct year. Then all rings are measured to the nearest thousandth of a millimeter using a computer-assisted measuring device. After growth-related trends unrelated to climate are statistically removed, the ring width values from all sampled trees for each year are averaged to create a time series of annual ring width indices. The complete series of ring width indices from a site is called a tree-ring chronology.

Once a gaged record of interest is selected for reconstruction, a set of tree-ring chronologies from the region near the gage is calibrated with the gage record to form a reconstruction model. A statistical technique called multiple linear regression is commonly used. The reconstruction is evaluated by comparing the observed gage values with the reconstructed values by assessing the amount of variance in the gage record that is explained by the reconstruction.

DROUGHTS PRIOR TO THE HISTORICAL RECORD

The period of reliably measured streamflows for rivers throughout the West seldom reaches beyond 100 years, which represents only a fraction of climatologically modern time. As these streamflow reconstructions show, there have been droughts prior to the historical period that were more severe - particularly in duration - than those in the measured record. The reconstructed record captures a broader range of hydrologic variability than does the historical record, making reconstructions useful for drought preparedness planning. Of particular interest from a scientific perspective is the Medieval Climate Anomaly, a time during which sustained severe drought gripped much of the western United States, as exemplified illustrated in the Sacramento, San Joaquin, and Colorado River reconstructions.



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Data source: Work performed by the University of Arizona under contract to the California Department of Water Resources. COWR Agreements 4600003862 (David Meko, 2006) and 4600008850 (David Meko, Connie Woodhouse, Ramon Touchan, 2014)

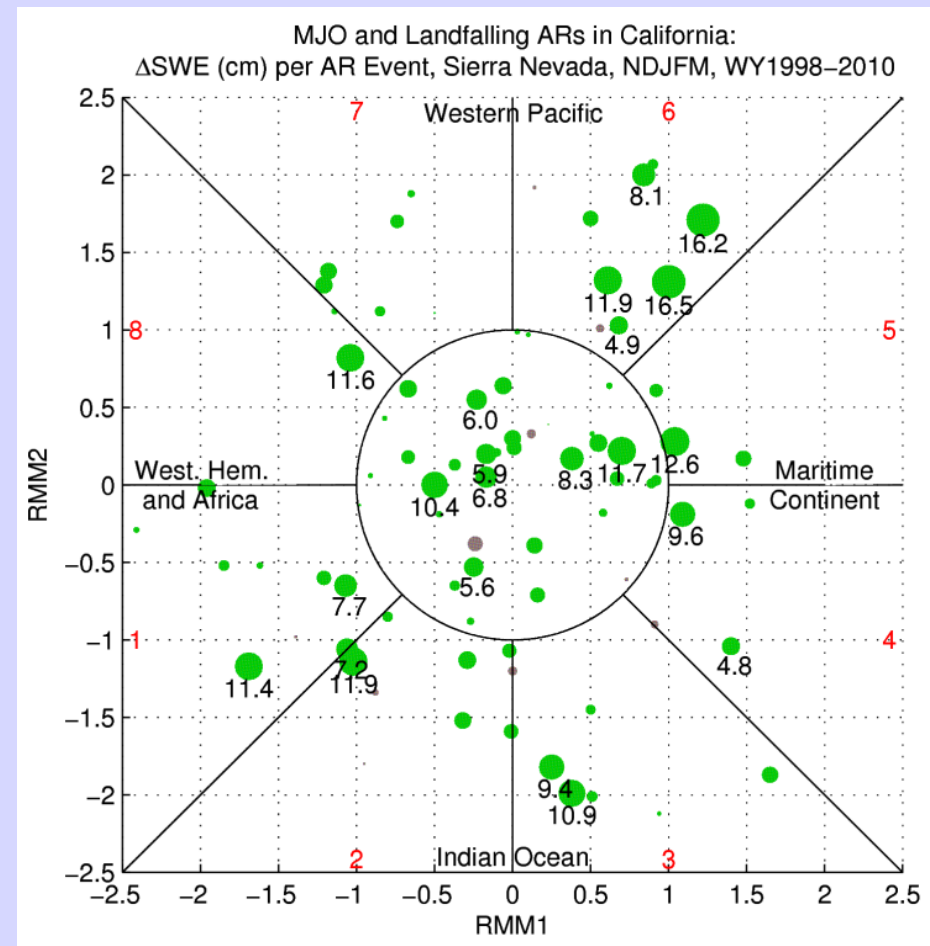
DWR Workshop on “Nameless Oscillation” May 27-28 at Scripps



Does the MJO Influence Atmospheric Rivers Timing or Frequency?

AR events during WY 1998-2010 are plotted in relation to the phase and amplitude of the MJO. The amplitude of the AR is shown in terms of ΔSWE as size of green circles. AR dots/events inside the unit circle occur during weak/no MJO. AR dots/events outside unit circle occur during strong MJO events in the given phase of the MJO life-cycle.

More high-impact ARs are observed during **MJO phase 6 – convection in the W. Pacific Ocean**, including the top two events during WY1998-2010



Guan, B., D. E. Waliser, N. Molotch, E. Fetzer, P. Neiman, 2012: Does the Madden-Julian Oscillation Influence Wintertime Atmospheric Rivers and Snowpack in the Sierra Nevada?, Mon. Wea. Rev., 140, 325–342,

