

THE Model Citizen

JANUARY 2023

HIGHLIGHTS FROM THE MODELING SUPPORT OFFICE

Modeling Support Office

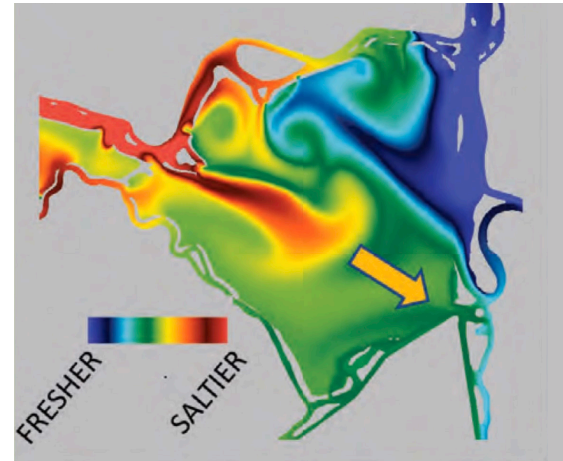
WHO WE ARE

The Modeling Support Office (MSO) provides integral support to State Water Project (SWP) planning and operations through the implementation and development of state-of-the-art modeling and analysis tools for water and environmental management.

MSO members are specialized, technically strong, problem solvers that work together in teams and collaborate with multiple water and environmental agencies at the federal, state and local levels. Teams work on projects to safely supply affordable high-quality water for the benefit of Californians and the environment.

MSO models are mathematical representations of parts of California's water resources such as water project operations, Delta flows and water quality, and integrated surface and groundwater. MSO models are informed by the best available science.

MSO modeling analyses replicate historical conditions, represent proposed physical or operational changes, and reflect climate change impacts such as early snowmelt, wildfires in upper watersheds, sea level rise and salinity intrusion in the Delta. MSO's models generate high fidelity simulations that inform robust technical analyses and decision making.



SCHISM illustration of tidal pumping near Frank's Tract in the Delta

MSO VISION

The Modeling Support Office supports State Water Project planning and operations by developing and applying world-class simulation models and analytical tools that use the best science to generate accurate, transparent, and accessible results.

WHAT'S INSIDE

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MSO BY THE NUMBERS

45 highly skilled modelers from around the world (4 continents, a dozen countries)

10+ models & tools developed & maintained

200,000 core-hours computation time used in Nov 2022

SWP DELIVERY CAPABILITY REPORT

FUN FACTS

1. Updated every 2 years
2. Estimates current and future SWP delivery capability
3. Used by Public Water Agencies for future planning
4. Informs estimates of DWR's future power supply needs

What We Do

STATE WATER PROJECT PLANNING & MANAGEMENT

Modeling analyses include:

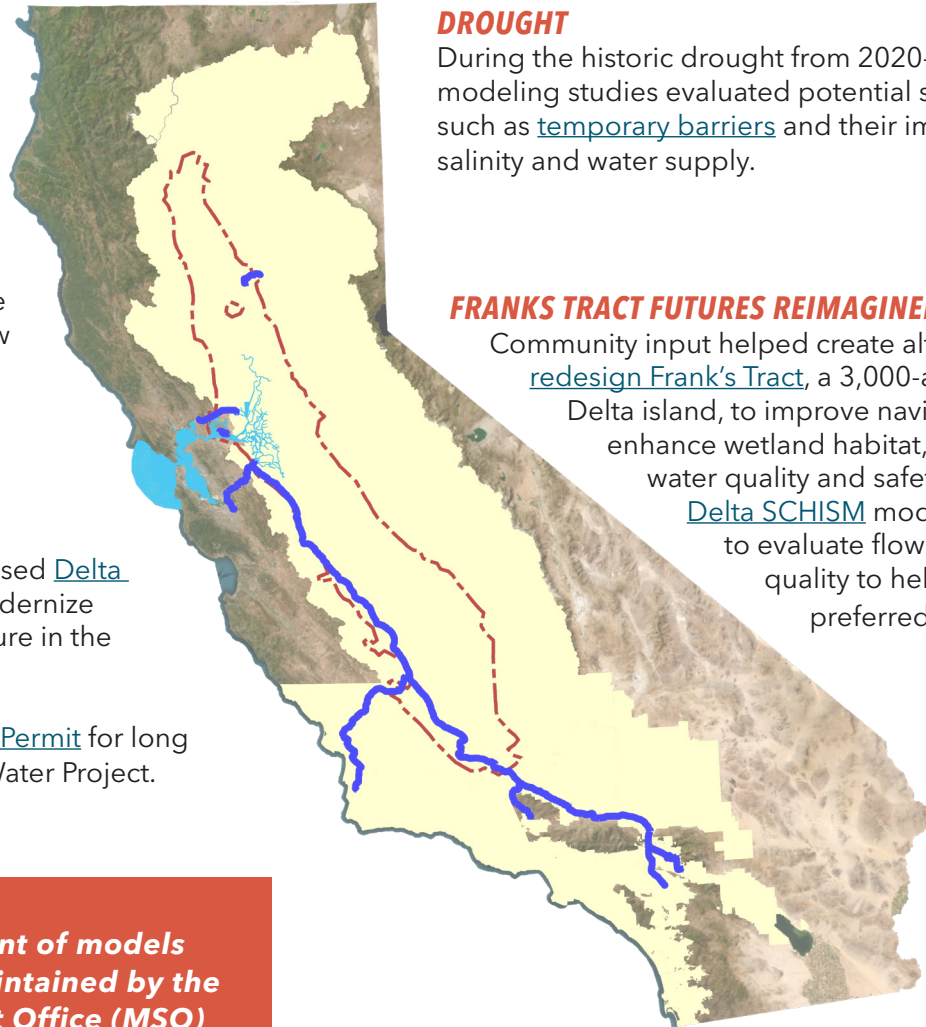
- 1) [Voluntary Agreement](#) negotiations between water agencies to enhance Delta conditions using flow augmentation, modified storage releases, and non-flow actions such as floodplain inundation,
- 2) [Environmental impact assessments](#) for the proposed [Delta Conveyance Project](#) to modernize water transport infrastructure in the Delta,
- 3) and the [Incidental Take Permit](#) for long term operations of State Water Project.

DROUGHT

During the historic drought from 2020-2022, modeling studies evaluated potential solutions such as [temporary barriers](#) and their impact on salinity and water supply.

FRANKS TRACT FUTURES REIMAGINED

Community input helped create alternatives to [redesign Frank's Tract](#), a 3,000-acre flooded Delta island, to improve navigation, enhance wetland habitat, and improve water quality and safety. The [Bay-Delta SCHISM](#) model was used to evaluate flow and water quality to help identify a preferred concept.



Geographic extent of models developed and maintained by the Modeling Support Office (MSO)

MSO models represent water project operations and deliveries (yellow), integrated surface and groundwater for the Central Valley (red dotted outline), and flows and water quality in the San Francisco Bay Delta (light blue). The State Water Project is shown in dark blue for reference.

Map scale: 1 inch - 79 miles

GROUNDWATER AND SURFACE WATER MODELING

The [Integrated Water Flow Model \(IWFM\)](#) and [IWFM Demand Calculator \(IDC\)](#) developed by MSO are used in planning projects such as the [Delta Conveyance Project](#), [Merced River Flood-Managed Aquifer Recharge](#), and studies of [water transfers](#). Several [Groundwater Sustainability](#) Agencies apply IWFM to develop their Groundwater Sustainability Plans. Several irrigation districts use IDC to develop their [Agricultural Water Management Plans](#). MSO maintains the application of IWFM to the Central Valley ([C2VSimCG](#)).

Improvements We Have Made

TO MODELS AND TOOLS



WATER PROJECT OPERATIONS

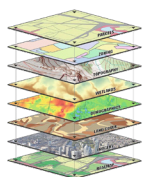
The Modeling Support Office (MSO) develops, enhances, and applies the CalSim suite of models ([CalSim II](#), [CalSim 3](#) and [CalLite](#)) to simulate the State Water Project (SWP) and Central Valley Project (CVP) operations. These models are the best available models for planning studies over a range of hydrologic conditions and project operations. The recently released CalSim 3 incorporates many improvements, such as a finer spatial resolution, improved groundwater representation, better demand estimation, upstream watershed representation, extended simulation period, and thorough model documentation. CalSim models have been successfully used for projects such as Coordinated Operation Agreement (2018), Long-Term Operation, Incidental Take Permit, and Delta Conveyance Project.



DELTA

MSO conducts extensive modeling to assess water quality and water conveyance issues in one of California's most ecologically important estuaries and a hub of California's water supply—the Sacramento-San Joaquin Delta.

To accomplish this, one of the mathematical models that MSO applies to simulate hydrodynamics, water quality, and particle tracking is the [Delta Simulation Model II \(DSM2\)](#). Recently, DSM2 has been extended to include a [Delta Mercury Model \(DSM2-Hg\)](#), a mechanistic mercury and suspended sediment model, in support of the Delta Mercury Control Program's phased adaptive management approach.



GEOGRAPHIC INFORMATION SYSTEMS

MSO works with data-driven models that rely heavily on geospatial datasets. ArcGIS software analysis is used for in-depth data research, collaboration, online communication, cloud database systems, and provides a platform for web-based geospatial map sharing.



INTEGRATED GROUND/SURFACE WATER

The [Integrated Water Flow Model \(IWFM\)](#) has been updated to enable linkages with the [Water Resources Integrated Modeling System \(WRIMS\)](#). The IWFM-WRIMS linkage allows simulated reservoir operations from [CalSim 3](#) to be used for integrated groundwater and surface water modeling applications. Additionally, MSO has improved IWFM through helping neighboring Groundwater Sustainability Agencies (GSAs) link their IWFM models to better quantify exchange boundary flows.



RESEARCH & COLLABORATION

Much of MSO's work involves continual research and development in collaboration with academic institutions, federal partners, and consultants.

In one example, the Bureau of Reclamation and UC Davis partnered with DWR to implement a new, open-source Mixed-Integer Linear Programming (MILP) solver, which is now included in the latest version of [WRIMS](#). With UC Davis, MSO continues to conduct [machine learning research](#), which aims to emulate process-based Delta salinity models to facilitate rapid decision support and scenario screening.



HYDROLOGY

MSO continuously develops/improves CalSim 3 hydrologic inputs, including the development of rim watershed rainfall-runoff models, extending historical hydrology, and synthesizing future climate change scenarios.

Shout Outs



AWARDS

During the pandemic, MSO volunteers provided essential support services. Notably, **Michael Mehrdadi** received an award for his 16 months of service as a contact tracer, case investigator, and aid to county health. **Ines Ferreira** and **Chris Quan** served as case investigators for six months.



Newly retired **Parviz Nader-Tehrani** received the **Career Achievement Award** from the California Water and Environmental Modeling Forum. This award honors Parviz's significant contributions in computer modeling of Sacramento-San Joaquin Delta flows and water quality.



Nazrul Islam received the **2022 Jonathon Burdette Brown Education Award** from the Sacramento Section of the American Society of Civil Engineers for outstanding contributions to students and engineering education.



PUBLICATIONS

The MSO regularly releases publications such as journal articles and biennial and annual reports. The highlighted publications from 2022 are shown below. For additional publications, please visit water.ca.gov/Library/Modeling-and-Analysis.

SWP Delivery Capability Report

Delta Modeling Annual Progress Report

Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh

Novel Salinity Modeling Using Deep Learning for the Sacramento-San Joaquin Delta of California

Feature Paper: Deep Learning

Assessing Changes in 21st Century Mean and Extreme Climate of the Sacramento-San Joaquin Delta in California

Feature Paper: Machine Learning

Editor's Choice: Delta Climate Change

The biennial **SWP Delivery Capability Report** (DCR) and **Annual Delta Modeling Progress Report** are regular publications from MSO. The SWP DCR provides estimations of SWP delivery reliability to the 29 water contractors. The Annual Progress Report documents progress in the development and enhancement of the Delta Modeling Section's computer models.

Three publications from MSO staff earned prestigious, highly selective "Feature Paper" (2) and "Editor's Choice Article" (1) designations from the peer-reviewed journals *Water* and *Climate*. These honors reflect papers that include the most advanced research and have significant potential for high impact in the field.

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