

THE Model Citizen

OCTOBER 2024

HIGHLIGHTS FROM THE MODELING SUPPORT OFFICE

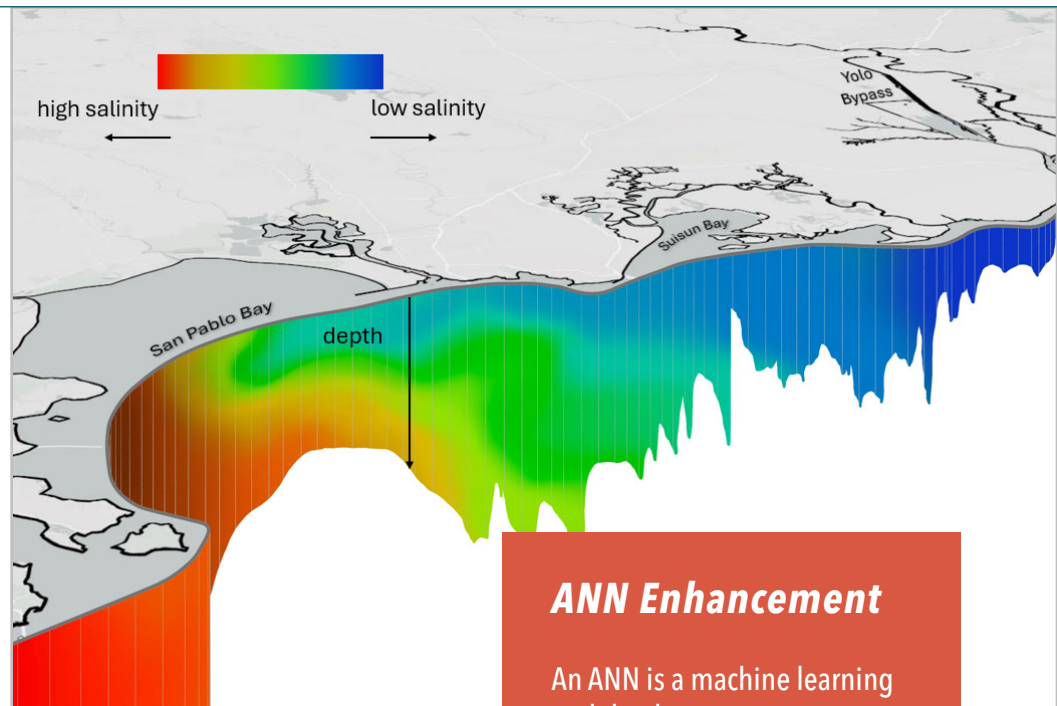
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The Delta Salinity Project (DSP)

One of the current efforts by the Modeling Support Office (MSO) is to enhance the performance of [CalSim 3](#), an operations planning model of the State Water Project (SWP) and Central Valley Project (CVP). In partnership with the Delta Stewardship Council and Research Management Associates, MSO is undertaking the complex task of training Artificial Neural Networks (ANNs) to estimate the salinity predictions of our 3-D numerical model of the Bay-Delta, enabling more accurate large-scale operational planning in an unpredictable future.

Global climate change has led to projections of sea level rise and large-scale island restoration scenarios that, when combined with atmospheric dynamics, could significantly impact the Delta's salinity response to flow operations. To plan effectively, it's vital to understand how these scenarios might affect SWP and CVP operations. CalSim 3, a water resources planning model, evaluates these operations but doesn't directly calculate Delta salinity. Instead, it relies on an ANN to estimate salinity at

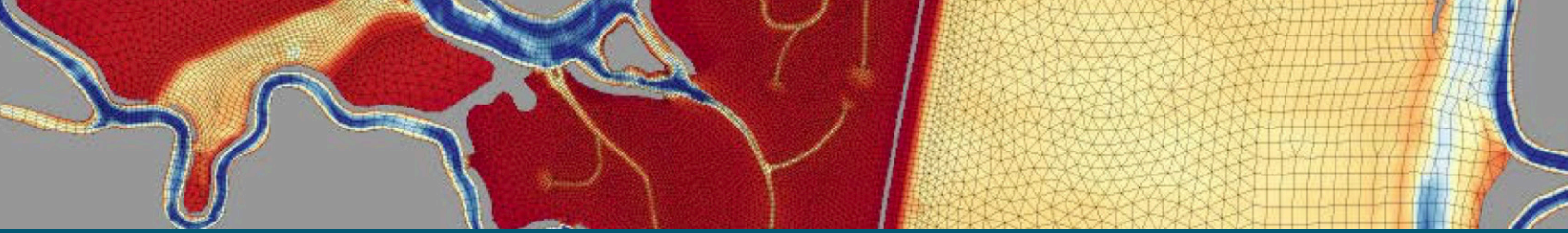


specific locations related to water quality standards.

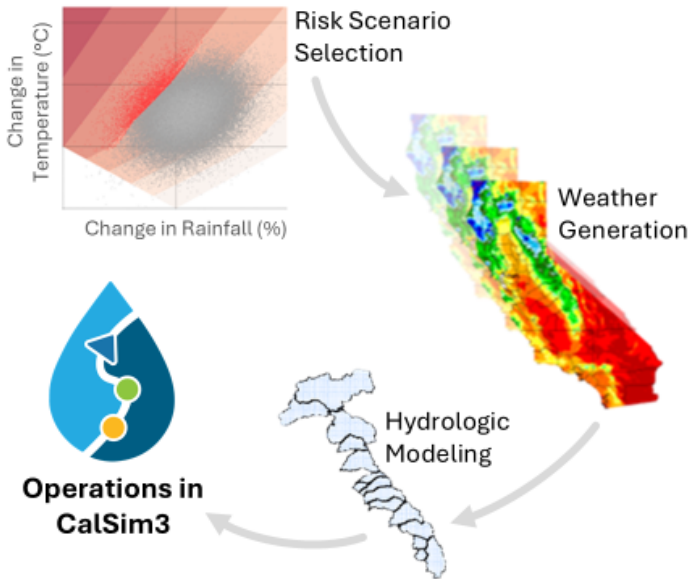
The DSP explores training CalSim 3's ANN with [Bay-Delta SCHISM](#) (Semi-implicit Cross-scale Hydroscience Integrated System Model), rather than the current 1-D model ([DSM2](#)) being used for training. Enhancing CalSim's ANN technology ultimately facilitates sustainable operations and management of California's water system while adapting to climate change impacts.

ANN Enhancement

An ANN is a machine learning tool that learns patterns from data by using many interconnected units. For instance, it can be trained to distinguish between a dog and a cat by analyzing pictures. In our case, the ANN takes in the same inputs a hydrodynamic model would use—such as river inflows, exports, diversions, and tidal behavior—and learns to predict salinity levels at specific locations. It does this by replicating how the hydrodynamic model simulates salinity based on these inputs.



It's in the Name: Modeling *Support* Office —

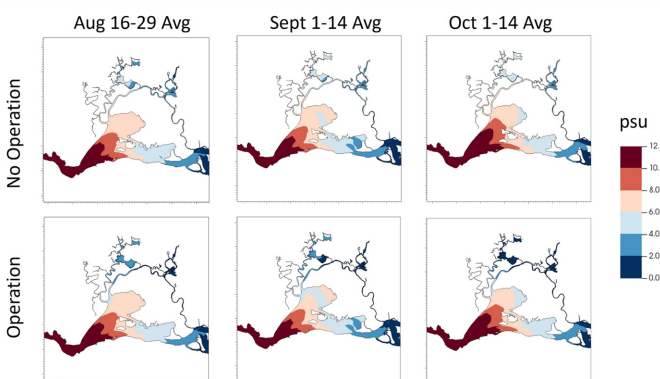


CLIMATE CHANGE

The California Department of Water Resources (DWR) has undertaken an extensive effort to develop risk-informed future climate scenarios for the SWP [Delivery Capability Report](#) (DCR), a biennial report issued by the SWP. The Modeling Support Office (MSO) is supporting this effort by providing extensive technical assistance to develop a range of hydrologic conditions based on multiple risk informed climate change scenarios. MSO also integrated these hydrologic conditions in CalSim 3 to analyze how climate change, regulatory, and operational considerations affect SWP delivery capability, and to explore various uncertainties in terms of risk to SWP performance.

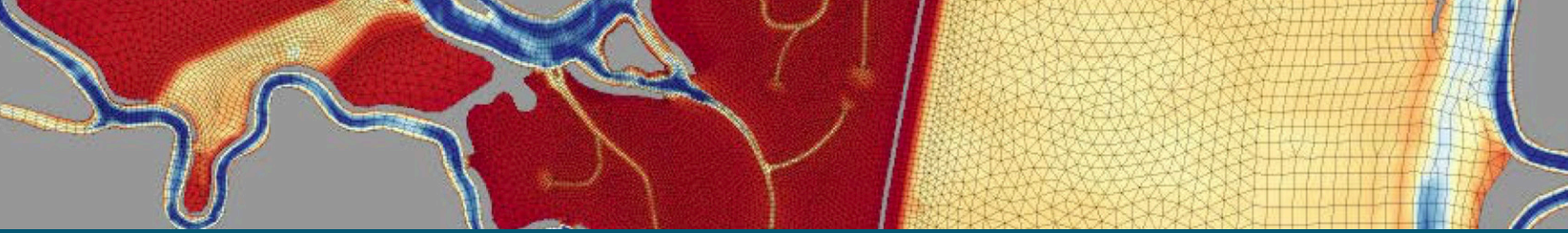
OPERATIONS & MAINTENANCE

MSO has long provided analysis for DWR's Operations & Maintenance (O&M) team and is currently supporting O&M's Long Term Operations (LTO) project. For this effort, MSO provides modeling support in the form of designing and interpreting the results of over 100 different CalSim 3 scenarios. These scenarios aid the decision-making and negotiation efforts for the LTO project.



DEPT FISH & WILDLIFE

MSO conducts 3-D hydrodynamics modeling using the Semi-Implicit Cross-scale Hydroscience Integrated System Model (SCHISM) to investigate the Suisun Marsh Salinity Control Gate (SMSCG) and flow augmentation post operation. The SCHISM model results are used to produce a habitat metric of low salinity zone over the summer-fall season. These results are presented to Fish & Wildlife in an annual report for years when salinity control gate operations occur.



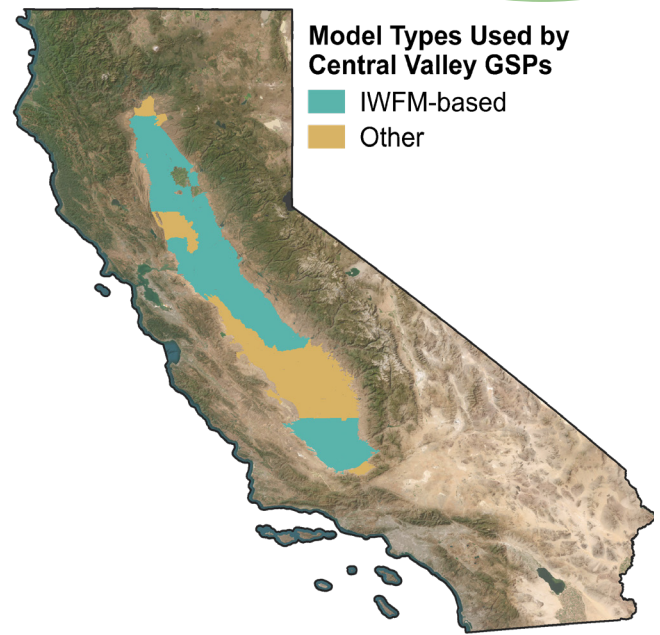
DELTA STEWARDSHIP COUNCIL

MSO supported a Delta Stewardship Council (DSC) project which evaluated modifications to CalSim machine learning tools that are used to better predict operational responses to sea level rise and large-scale habitat restoration. This project led to the Salinity Management Workshop held March 26th & 27th, 2024. The workshop was a part of a series put on by the DSC to present ideas, discuss available tools and strategies, and identify knowledge gaps in adaptive management.



CALIFORNIA WATER & ENVIRONMENTAL MODELING FORUM

In 2024, California Water & Environmental Modeling Forum (CWEMF) is marking three decades of promoting advancement in water resources modeling & management. The MSO stands as one of the major organizations participating in CWEMF, having previously been convener, vice convener, and chairs for numerous sub-committees. MSO has contributed significantly to CWEMF, conducting modeling workshops, and facilitating peer reviews for various water resource models including CalSim 3 and MODFLOW. Moreover, MSO's support extends beyond workshops to include annual meeting logistics: ensuring smooth operations and fruitful discussions. Through collaborative efforts between DWR and other participating organizations, CWEMF has become a cornerstone of progress in water resource management.



SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Of the 36 groundwater subbasins within the Central Valley, 25 of them use [Integrated Water Flow Model](#) (IWFM)-based models to develop their Groundwater Sustainability Plans (GSPs), including C2VSimFG and SVSim which are both developed and maintained by DWR's Sustainable Groundwater Management Office (SGMO). IWFM is a groundwater modeling engine developed by MSO staff. MSO staff provide technical assistance to the Groundwater Sustainability Agencies directly, as well as to SGMO.



Shout Outs

RETIREMENTS

Congratulations to recently retired senior engineers from the Central Valley Section, Hongbing Yin and Sanjaya Seneviratne.



Hongbing has led the Hydrology Development group since 2005. He and his group ensured successful CalSim 3 model formulation, development, public release, and its hydrology extension from 2015 to 2021. He and his group have also made significant contributions to recent Central Valley climate change studies.



Sanjaya led the CalSim Development unit since 2004. He and his group made significant contributions to CalSim processes. His team developed and improved the way Delta standards are represented in the model using machine learning. His team also collaborated with UC Davis to develop an open-source solver for WRIMS2 and CalSim 3.

ACKNOWLEDGEMENTS



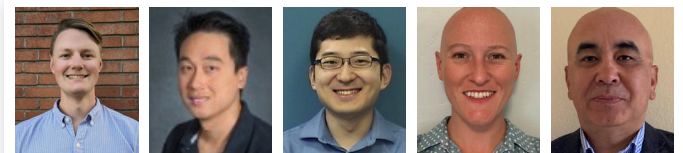
GRA Invited Speaker - Emin Can Dogrul was the invited speaker at the February 2023 meeting of the Southern California Branch of the Groundwater Resources Association (GRA).



Climate Change and Water Resources Expert - Minxue (Kevin) He, a regular contributor to academic journals, was also a proposal reviewer for California's Fifth Climate Change Assessment. Kevin is also an editorial board member and editor

for journals on artificial intelligence, hydrodynamics, and hydrological modeling.

New Professional Engineers - Zachary Roy, Yiwei Cheng, Han Sang (Hans) Kim, Lily Tomkovic, and Shalamu Abudu are the new licensed California Professional Civil Engineers in MSO.



Award - DWR was a co-recipient with United States Geological Survey (USGS) of the 2024 Outstanding Environmental Project Award by the Friends of the San Francisco Estuary. The

project title is "Effects of Emergency Drought Barrier on Water Quality and Water Age in Franks Tract."

PUBLICATIONS

MSO regularly releases publications such as journal articles and biennial and annual reports. The biennial **SWP Delivery Capability Report (DCR)** and Annual Delta Modeling Progress Report are two of the MSO's regular publications. For additional publications and journal articles, please visit: water.ca.gov/Library/Modeling-and-Analysis.

Contact: For additional information please email MSO_newsletter@water.ca.gov

