California Water and Environmental Modeling Forum

2021 ANNUAL MEETING ONLINE TECHNICAL SESSIONS

October 4-5, 2021

Summary of Sessions

Sessions 1 & 2: October 4, 2021 8:30 a.m. – 12:15 p.m.

8:30 – 8:35	Welcome and Introduction (Kadir)
8:35 – 8:40	Zoom Format Overview (Jankowski)
8:40 – 10:15	Session 1: Drought Planning and Response (Escriva-Bou)
10:15 – 10:30	Break
10:30 – 12:15	Session 2: Risk-Based Climate Vulnerability Assessments in Water Resource Projects (Schwarz)

Join Zoom Meeting
https://us06web.zoom.us/j/88435005492?pwd=dFBoUDdwd0dmZXc5azhmRnhpOFVRUT09
Meeting ID: 884 3500 5492
Passcode: 720349
Phone: (253) 215-8782

Session 3: October 4, 2021 1:00 p.m. – 2:45 p.m.

1:00 – 2:45	Session 3: Water Supply Reliability (Lund)

Join Zoom Meeting
https://us06web.zoom.us/j/86940197183?pwd=eWw3R2dxMzI6NzRjdjUyRlRDQm9BQT09
Meeting ID: 869 4019 7183
Passcode: 728685
Phone: (253) 215-8782

Sessions 4 & 5: October 5, 2021 8:30 a.m. – 12:15 p.m.

8:30 – 8:35	Welcome and Introduction (Kadir)
8:35 – 8:40	Zoom Format Overview (Anderson)
8:40 – 10:15	Session 4: Grab Bag (Johns)
10:15 – 10:30	Break
10:30 – 12:15	Session 5: Delta Simulation Model Updates & Development (He)

Join Zoom Meeting
https://us06web.zoom.us/j/86061671218?pwd=MVNJZFBoZTdPbHBtcld6SHZOa1dIUT09
Meeting ID: 860 6167 1218
Passcode: 006624
Phone: (253) 215-8782

Summary of Sessions (cont'd)

Session 6: October 5, 2021 1:00 p.m. – 2:45 p.m.

1:00 – 2:45 Session 6: Pop-Up Talks (Tanaka)

Join Zoom Meeting
https://us06web.zoom.us/j/89761565547?pwd=N2pIT01xbWNobDZPWjVURmVsaG5sZz09
Meeting ID: 897 6156 5547
Passcode: 813085
Phone: (253) 215-8782

October 4, 2021

Session 1. Drought Planning and Response

Moderator: Alvar Escriva-Bou (PPIC)

Panelists:

Jeanine Jones (DWR Interstate Resources Manager)
Fethi Benjemaa (DWR Urban & Agricultural Water Use Efficiency Grant Program)
Michael Anderson (DWR State Climatologist)
Rich Juricich (Colorado River Board of California)
Dianne Riddle (SWRCB Bay-Delta Section)

Droughts are a prominent feature of California water resources planning and management. The effects of climate change make it clear that planning for, and responding to, this periodic climatic extreme will continue to be essential. Modeling tools supported by robust data and information will continue to play critical roles in this process. Join this expert panel, where representatives of different state agencies will discuss the challenges posed by our current drought, especially as it relates to the state of management tools, models, and planning strategies.

Session 2. Risk-Based Climate Vulnerability Assessments in Water Resource Projects

Moderator: Andrew Schwarz (DWR)

Panelists:

Mohammad Rayej (DWR)
Cory Copeland (Delta Stewardship Council)
Patrick Ray (University of Cincinnati)
Romain Maendly (DWR)
Karandev Singh (DWR)

The frameworks for making water resource investment decisions in the face of growing climate and regulatory uncertainty is undergoing a rapid evolution. Decision makers face shrinking budgets and growing stressors. Decision Scaling is specifically designed to support decision making under climatic uncertainty (as well as other dimensions of uncertainty). The process is designed to make the best and most efficient use of uncertain but potentially useful climate change projections to inform and support decision making. Join this expert panel as they discuss the emerging field of Decision Scaling and its application in California on water supply and flood management projects as well as a discussion of how decision scaling is being used throughout the world.

Session 3. Water Supply Reliability

Moderator: Jay Lund (U.C. Davis)

Panelists:

- ***Erik Reyes (DWR)***
- ***Lee Bergfeld (MBK Engineers)***
- ***Matthew Holland (SWRCB)***
- ***Sujoy Roy (Tetra Tech, Inc.)***

This session will present issues and implications from a public review draft publication recently released by the Delta Independent Science Board, titled *Review of Water Supply Reliability Estimation Related to the Sacramento-San Joaquin Delta*. The discussion will bring to life the paper's recommendations to incorporate broader "public health, economic, ecological, and social objectives, rather than technical reliability objectives alone," among others.

October 5, 2021

Session 4. Grab Bag

Moderator: Norman Johns (DWR)

1. Integrating Monitoring and Optimization Modeling to Inform Flow Decisions for Juvenile Chinook Salmon in the South Delta
   Presenter: Patti Wohner (Oregon State University)

2. Modeling South Delta Ion Constituents using Machine Learning
   Presenter: Peyman Hosseinzadeh-Namadi (DWR)

3. Highlights of CalSim 3.0 Model – Public Release Version of 2021
   Presenter: Hongbing Yin (DWR)

4. Adapting Planning Modeling Perspectives to CalSim3
   Presenter: Nancy Parker (U.S. Bureau of Reclamation)

Session 5. Delta Simulation Model 2 (DSM2) Updates & Development

Moderator: Kevin He (DWR)

1. Inferring Unknown Salinity Sources for a Natural Delta System using a Data Assimilation Approach
   Presenter: Zhenlin Zhang (DWR)

2. DSM2 v8.2 Georeferenced Grid Maps
   Presenter: Bradley Tom (DWR)

3. Machine Learning Models for Prediction of Suspended Sediment Concentration
   Presenter: HanSang Kim (DWR)

4. DSM2 Water Temperature Modeling Input Extension (1922-2015)
   Presenter: Yu Zhou (DWR)

Session 6. Pop-Up Talks

Moderator: Stacy Tanaka (Watercourse Engineering)

Five-minute overviews summarizing modeling work using a maximum of five PowerPoint slides per speaker.

If you would like to present a brief talk, please email stacy.tanaka@watercourseinc.com with your name, affiliation, and topic.

ABSTRACTS

Session 4. Grab Bag

Moderator: Norman Johns (DWR)

1. Integrating Monitoring and Optimization Modeling to Inform Flow Decisions for Juvenile Chinook Salmon in the South Delta
   Presenter: Patti Wohner (Oregon State University)

Monitoring is usually among the first actions taken to help inform recovery planning for declining species, but these data are rarely used formally to inform conservation decision making. For example, Central Valley Chinook salmon were once abundant, but anthropogenic activities have led to widespread habitat degradation resulting in significant population declines. Juvenile Chinook salmon survival through the southern Sacramento-San Joaquin River Delta in particular, is one of the main limiting factors for juveniles outmigrating from the San Joaquin River and tributaries. However, survival and routing monitoring data have not been formally used to inform water management. Here, we illustrate how estimates derived from monitoring data can be used to inform water management and as a basis for adaptively managing flows. Specifically, we conducted a meta-analysis of juvenile Chinook salmon survival and routing estimates through the south Delta. We then used the resulting parameter estimates to develop a routing and survival simulation model to estimate optimal flows for the San Joaquin River during juvenile outmigration from February–May. We found that large flow pulses at predictable times during the spring are projected to be optimal for increasing juvenile Chinook salmon survival to the Bay and that optimal scenarios differed with water year type. Sensitivity analysis revealed temperature and juvenile salmon outmigration timing are driving optimal pulse distribution.

2. Modeling South Delta Ion Constituents using Machine Learning
   Presenter: Peyman Hosseinzadeh-Namadi (DWR)

Water quality directly affects human health and contributes to defining the suitable area for fish habitat and ecosystem health. Water quality varies from place to place, depending on the conditions of water sources and sinks. Ion constituents are typically treated as water quality indicators and can be measured by laboratory methods. Specific Conductance (SC) is an important water quality variable that can be measured by sensors. In South Delta, previous regression-based models were developed to use SC (as the predictor) to estimate 12 other ion constituents (as the predictand) based on grab sample data collected from 2018-2019 at seven key locations in South Delta. Four Machine Learning (ML) methods were implemented in this study to improve the accuracy of previous prediction models, including Generalized Additive Model (GAM), Regression Trees (TR), Random Forest (RF), Artificial Neural networks (ANNs). Random Forest could predict the level of 12 ion constituents in the South Delta with excellent accuracy.

3. Highlights of CalSim 3.0 Model – Public Release Version of 2021
   Presenter: Hongbing Yin (DWR)
   Collaborators: Z. Richard Chen (DWR), Idy Mei Lui (DWR), Jianzhong (Jay) Wang (DWR), James Polsinelli (DWR), Francis Chung (DWR), Nancy Parker (USBR), Andy Draper (Stantec)

The CalSim 3.0 was released to the public on July 30, 2021. This presentation summarizes some major highlights of the CalSim 3.0 model. CalSim 3.0 is the third generation of jointly developed water resources planning model by DWR and Reclamation to simulate operations of SWP and CVP as well as much of the water resources infrastructure in the Central Valley of California and Sacramento-San Joaquin Delta region. Major highlights presented here include model spatial resolution for both water supply and water demand, automated rainfall-runoff and water demand calculation, groundwater representation, Delta hydrology integration, model validation to recent historical flows, enhanced model output presentation and evaluation, and thorough model documentation.

4. Adapting Planning Modeling Perspectives to CalSim3
   Presenter: Nancy Parker (U.S. Bureau of Reclamation)

Reclamation and DWR have long advised that results of CalSim models should be used comparatively and not deterministically – i.e. to identify potential differences in project operations between a baseline and an alternative rather than to quantify precise system conditions given a set of input assumptions. Nevertheless, it is increasingly common for stakeholders and seasoned agency modelers alike to process and interpret model results predictively, and not without reason. As the increments of CVP and SWP operational flexibility have increasingly narrowed under evolving regulatory criteria, it is ever more important to capture both baseline and potential alternative conditions as accurately as possible to better characterize operational differences and project benefits.

Operational logic in Calsim2 has improved markedly in the past decade, tightening allocation profiles, representing infrequent but key Delta operations, and targeting desired project benefits in carefully selected conditions. These improvements have all been carried forward to CalSim3. CalSim3's refined spatial resolution and integration with physical hydrology models further raises expectations of the model to accurately capture and predict precise system conditions. The embedded groundwater model is positioned to better characterize stream groundwater interaction as well as the implications of pumping and recharge on water table levels. The use of climate-driven hydrology models to determine applied water demand and local accretions/depletions is an improvement over previous methods. However, challenges remain in initialization, calibration, and use of other input assumptions.

Considering the needs of diverse audiences is key to appropriately disseminating CalSim results. The broader and larger volume of information produced by CalSim3 will carry new challenges in its use for planning analyses.

Session 5. Delta Simulation Model (DSM2) Updates & Development

Moderator: Kevin He (DWR)

1. Inferring Unknown Salinity Sources for a Natural Delta System using a Data Assimilation Approach
   Presenter: Zhenlin Zhang (DWR)

We have developed the capacity for DSM2-GTM (Generalized Transport Model) to be online coupled with the open-source Parallel Data Assimilation Framework (PDAF). Such development enables the model to assimilate field observations of continuous electrical conductivity (EC) for the purpose of 1) improving EC modeling, 2) inferring unknown EC sources, and 3) exposing the limitation of the observational network for future refinement. The data assimilation approach was first tested under idealized conditions with hypothetical sources and was shown to be effective in inferring the mean, trend, and cycles of the hypothetical sources. And then the approach was applied with the field observational data in the South Delta system and the assimilated time series of EC sources falls within the reasonable ranges of EC loads previously observed in the system. Applying data assimilation also greatly improved the modeled EC compared to the best current GTM run without data assimilation, where the EC sources were modeled offline by a Delta Channel Depletion model. By performing a partial model forecast, where we assume that the inflows and EC at the model boundaries are known and the only uncertainty is the EC sources, we demonstrate that the benefit of data assimilation persisted weeks to months afterwards in the forecast model. Similar approach can also be applied to infer sources and improve the modeling of flow, stage, and other water quality variables in the system.

2. DSM2 v8.2 Georeferenced Grid Maps
   Presenter: Bradley Tom (DWR)

Georeferenced grid maps in GIS and PDF formats have been created for DSM2 v8.2 using an updated methodology, which creates GIS shapefiles from files created by the DSM2 Cross-Section Development Program (CSDP). This process ensures that the shapefiles match the geometry created by the CSDP. This presentation will provide an overview of the methodology, explain the information in the grid maps, and demonstrate the usage of the grid maps.

3. Machine Learning Models for Prediction of Suspended Sediment Concentration
   Presenter: HanSang Kim (DWR)

A machine learning model employing the Long Short-Term Memory (LSTM) Networks was developed to predict suspended sediment concentration (SSC) in the Delta. It differs from process-based models (e.g., DSM2) in that it treats the unknown as a missing piece in an expected pattern, rather than solving the governing equations behind the physics. In the first phase of the study, the model was trained with historical observations of flow, stage, and SSC at selected study locations. In the second phase, results from DSM2-GTM were incorporated in the model training. Comparison between the model predictions and the observation showed that the LSTM model is comparable or superior to that of DSM2.

4. DSM2 Water Temperature Modeling Input Extension (1922-2015)
   Presenter: Yu Zhou (DWR)

DSM2-QUAL requires meteorological, water temperature, and flow boundary condition data to simulate temperature across the Delta. It was calibrated and validated during the period from 1990-2012 for water temperature modeling in the Delta in previous studies. The current study aims to extend its water temperature simulation period to water years 1922-2015 to align with the CalSim3 simulation period. For that purpose, gridded daily historical meteorological dataset are disaggregated and bias-corrected to generate meteorological data required; Artificial Neural Network models (ANNs) are developed to generate water temperature boundaries; historical and CalSim3-simulated effluent flow data are utilized as the flow boundary conditions for DSM2-QUAL during the extended simulation period. This presentation discusses the input data requirement of Delta water temperature modeling via DSM2-QUAL and the methods and datasets applied to assemble or derive these data.