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California Natural Resources Agency

DEPARTMENT OF WATER RESOURCES

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

35th Annual Progress Report to the State Water Resources Control Board in Accordance with Water Right Decisions 1484 and 1641

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Governor	Secretary for Natural Resources	Director
State of California	California Natural Resources Agency	Department of Water Resources

Foreword

This is the 35th annual progress report of the California Department of Water Resources' San Francisco Bay-Delta Evaluation Program, which is carried out by the Delta Modeling Section. This report is submitted annually by the section to the California State Water Resources Control Board pursuant to its Water Right Decision 1485, Term 9, which is still active pursuant to its Water Right Decision 1641, Term 8.

This report documents progress in the development and enhancement of the Bay-Delta Office's Delta Modeling Section's computer models and reports the latest findings of studies conducted as part of the program. This report was compiled under the direction of Tara Smith, program manager for the Bay-Delta Evaluation Program.

Online versions of previous annual progress reports are available at:

http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/annualreports.cfm.

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Table of Contents

Figures

Tables

Preface

Chapter 1 Channel Volume Correction in DSM2-Qual Version 8.1

DSM2-Qual calculates volume of a channel by starting with the initial channel volumes read from the DSM2-Hydro tidefile at the beginning of a run , and then using flows from the Hydro tidefile to calculate the volume into or out of a channel at every time step. This calculation determines the water volume left in the channels (represented by parcels). The channel volumes at other time steps are available in the Hydro tidefile but not used.

This method would be accurate if water mass balances in channels are perfect. However, when there are water mass balance errors in Hydro, the errors will accumulate in Qual. In rare situations, the errors may accumulate significantly and stop Qual from running. This chapter describes a correction procedure that has been added to Qual and tested for accuracy.

Chapter 2 Quantitative Calibration of DSM2

For the first time in its use, DSM2, the 1D hydrodynamic and water quality simulation model of the Sacramento-San Joaquin Delta, is being calibrated in a quantitative manner with mathematically-based techniques. This chapter describes the background, motivation, goals, and status of the project, as well as preliminary findings.

Chapter 3 DSM2 Version 8.1 Time Step Sensitivity Test

This chapter gives the update on DSM2 version 8.1.2 time step sensitivity test results. The sensitivity tests are important because relatively small changes in time steps should not result in large changes in water quality results. If there are large differences in results due to differences in time step size, this reflects a problem in the model's ability to converge. Time steps for Hydro (the DSM2 hydrodynamic module), the tidefile (output from Hydro), and Qual (the DSM2 water quality module) have been tested. Sensitivity tests were done to evaluate the effects of different time steps on simulated EC. These results suggest DSM2 converges well. Time steps for the version 8.1 (v8.1) calibration were chosen based on these results.

Chapter 4 DSM2-GTM

DWR's Delta Modeling Section is developing a new DSM2 transport module, the General Transport Model (GTM). The mesh for GTM is fixed (Eulerian) rather than moving with flow (Lagrangian), and this should make it easier to interact with other models, georeferenced data and visualization as well as to couple to Hydro. It is also based on a more flexible software framework that is easier to adapt to new groupings of constituents -- mercury and sediment are of particular interest. The algorithm is a second order upwind solver developed in a prior collaboration with UC Davis with low numerical diffusion and an elaborate verification framework covering tough problems.

This chapter describes some of the practical issues of embedding such a model in a looped network or in a DSM2 grid with many intermediate junctions (nodes) along a single physical channel reach. We demonstrate the effect the DSM2-Qual schema can have on numerical diffusion, and make some preliminary comparisons with DSM2-Qual on advection problems in which GTM appears to be less diffusive in more complex flow fields or on more intricate grids.

Chapter 5 Automation of Spatial Map with Temporal Data from DSM2-QUAL Output using ArcGIS

This chapter presents a new post-processing tool for DSM2-QUAL output which enables generation of ArcGIS geo-referenced contour maps and time-varying animations to visualize water quality distributions in the Sacramento-San Joaquin Delta area.

Chapter 6 Delta Modeling for Emergency Drought Barriers

This chapter is a summary of work and documentation completed by several staff members from the Department of Water Resources' Bay-Delta Office and the Division of Operations and Maintenance. It summarizes the modeling processes used to determine the potential water quality and water supply impacts of Rock Barriers in Sutter Slough, Steamboat Slough, and False River.

Chapter 7 Bay-Delta SELFE Calibration Overview

The Delta Modeling Section and Virginia Institute of Marine Sciences are completing an initial calibration of the semi-implicit Eulerian-Lagrangian finite element (SELFE) 2-D/3-D model on the Bay-Delta domain. This chapter describes the project scope and the SELFE model and also gives some preliminary results representative of the forthcoming calibration document. SELFE is open source, uses a second-generation semi-implicit algorithm and has been used in a variety of cross-scale contexts on estuary problems around the world. Results for the Bay-Delta suggest the model is able to accurately reproduce the most important transport processes in this domain. Greater emphasis will now be placed on usability and applications, although the chapter also identifies areas of uncertainty or potential improvement.