DSM2 Overview

The Delta Simulation Model II (DSM2) is a one-dimensional mathematical model for dynamic simulation of one-dimensional hydrodynamics, water quality and particle tracking in a network of riverine or estuarine channels. DSM2 can calculate stages, flows, velocities, mass transport processes for conservative and non-conservative constituents including salts, water temperature, dissolved oxygen, and trihalomethane formation potential, and transport of individual particles. DSM2 thus provides a powerful simulation package for analysis of complex hydrodynamic, water quality, and ecological conditions in riverine and estuarine systems.

DSM2 currently consists of three modules: HYDRO, QUAL, and PTM. The relationship between HYDRO, QUAL and PTM is shown in Figure 1. HYDRO simulates one-dimensional hydrodynamics including flows, velocities, depth, and water surface elevations. HYDRO provides the flow input for QUAL and PTM. QUAL simulates one-dimensional fate and transport of conservative and non-conservative water quality constituents given a flow field simulated by HYDRO. PTM simulates pseudo 3-D transport of neutrally buoyant particles based on the flow field simulated by HYDRO. PTM has multiple applications ranging from visualization of flow patterns to simulation of discrete organisms such as fish eggs and larvae. A forth module for sediment transport is currently being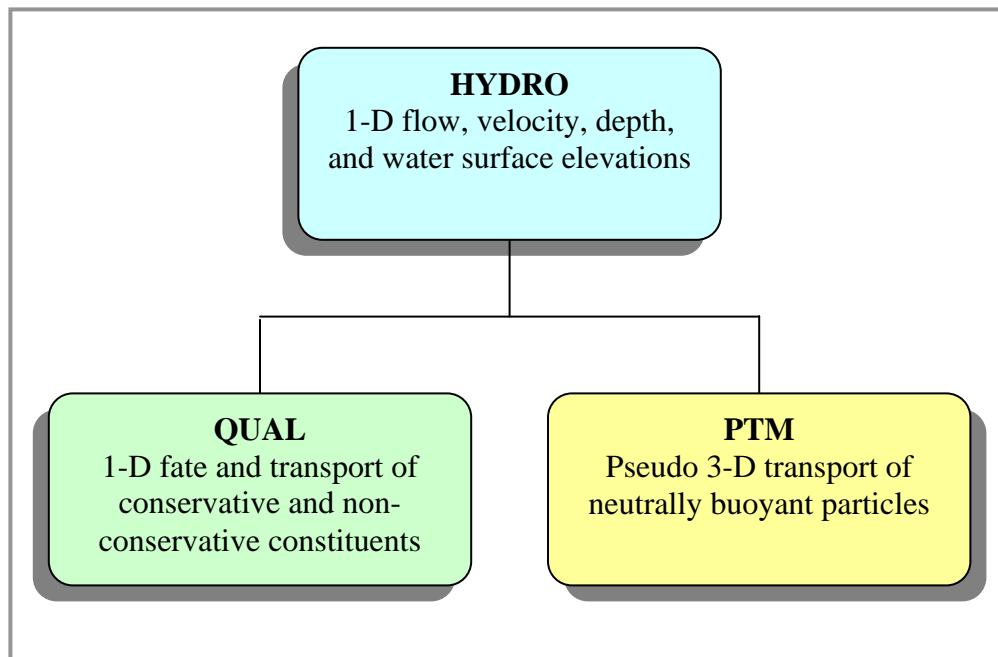 developed. Further information is available on the web at http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/dsm2/dsm2.cfm

DSM2 Modules
- **HYDRO**
- **QUAL**
- **PTM**

HYDRO
1-D flow, velocity, depth, and water surface elevations

QUAL
1-D fate and transport of conservative and non-conservative constituents

PTM
Pseudo 3-D transport of neutrally buoyant particles

Figure 1: Schematic of DSM2 Modules

DSM2 Study Types

DSM2 is usually used for three kinds of Delta simulations: historic conditions, forecasting future conditions (real-time), and planning studies (Figure 2 and Table 1). Each type of DSM2 study is briefly described below

Historical simulations replicate past operations, hydrologic conditions, water quality and Delta configurations. These historical simulations enable calibration and validation of the model by comparison of simulation results and field data. Historical simulations also augment available field data to provide a more spatially and temporally complete representation of the hydrodynamic and water quality conditions for that time period.

Forecasting simulations, also known as real-time simulations, use recent field data and forecast data to project Delta conditions into the near future (typically one to ten weeks). Recently collected historical data provide current conditions for the Delta. Recent tidal elevations at Martinez are used with an astronomical tide forecast to project the Martinez tide into the near future. Corresponding hydrodynamic and water quality conditions in the Delta are then simulated. Forecasting simulations can assist State Water Project operations decisions.

DSM2
Study Types
• **Historical**
• **Forecasting**
• **Planning**

Recreate Historic Conditions

Forecast Future Conditions

Delta planning studies evaluate how hypothetical changes to factors such as hydrologic regimes, water quality standards, system operations, and Delta configurations may impact Delta conditions. To explore the impacts of a given scenario under various hydrologic conditions, DSM2 planning studies are typically run under a 16-year sequence of Delta inflows and exports derived from statewide water transfer and storage simulations using CalSim-II[1]. Planning simulations can use historical or astronomical tidal data which incorporate influences of the spring-neap tidal cycle or simulations can use an average repeating tide (typically the 19-year mean tide). Planning simulations typically assess impacts of proposed changes to Delta operations or configuration such as modified reservoir releases or dredging of channels. Planning study may also investigate impacts of hypothesized changes in the natural environment such as sea level rise.

Planning Studies of Hypothetical Conditions

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[1] More information on CalSim-II can be found on the web at
http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSim/index.cfm .
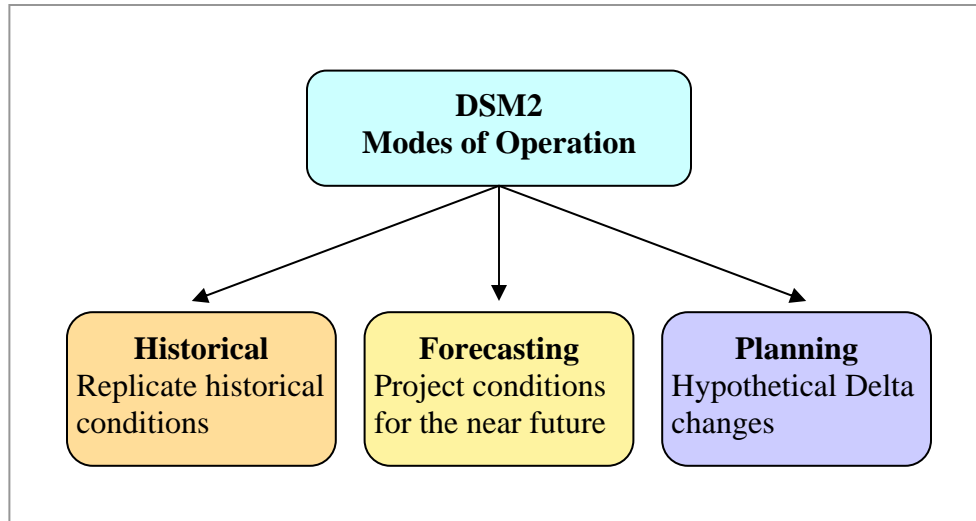
Figure 2: DSM2 Modes of Operation

Table 1: Parameter Descriptions for Three Modes of DSM2 Application

Simulation Parameter	Replicate Historic Conditions	Forecasting Future Conditions	Planning Studies for Hypothetical Conditions
Boundary Tide	Historic or astronomical tide	Historic and projected astronomical forecast tide	Historic, astronomical
Input Data	Historic inflows and exports Average Delta consumptive use	Recent and current inflows and exports Average Delta consumptive use	CalSim-II statewide operations studies provide inflows and exports Average Delta consumptive use
Simulation Period	1990-2001 are currently possible	1-10 weeks into the future	1976-1991 sequence from CalSim-II statewide operations studies