presents different forecasting challenges, but a RTDF modeling system requires coupling the individual models used to forecast water supply, demand, and quality in each of these three regions. This chapter addresses the ability of existing tools like DSM2 to forecast SWP drinking water quality (through the proof of concept) and the future development needed to meet the goals of MWQI's RTDF project.

8.2 Background of MWQI and Forecasting

The Department's Division of Environmental Service's Office of Water Quality (OWQ) is responsible for investigating and disseminating water quality data associated with the operation of the State Water Project. Created in July 2002, the OWQ includes water quality programs from the Department's former Environmental Services Office and Division of Planning and Local Assistance and shares an organizational affiliation with the Division of Operation and Maintenance's Office of Water Quality (now known as the State Water Project Water Quality Program Branch). OWQ's Municipal Water Quality Investigations (MWQI) program is directly overseen by a steering committee of the State Water Contractors who receive State Water Project water directly for municipal use (MWQI, 2004). The MWQI steering committee includes members from Urban State Water Contractors, California Urban Water Agencies, Contra Costa Water District, California Department of Health Services, State Water Resources Control Board, and U.S. Environmental Protection Agency

According to the 2002-2004 MWQI Work Plan, one of the main objectives of MWQI is "to acquire, store, assess, and transfer water quality data to the stakeholders and the public" (Breuer, 2002). With this goal in mind, a Real-Time Data and Forecasting (RTDF) steering committee was formed with representatives from the water agencies that take drinking water from the Delta, Operations and Maintenance Division (O&M), Bay-Delta Office Modeling Support Branch, and MWQI. The committee has as its primary responsibilities monitoring, forecasting, and data dissemination.

Monitoring networks provide the real-time historical data that is used as the initial conditions for any forecast. Though current O&M DSM2 forecasts are limited to simulating Delta flow, stage, and electrical conductivity (EC), a major component of the RTDF monitoring activities is to identify the monitoring needs necessary to better understand the entire SWP system. This includes extending the current monitoring network to collect data of other water quality constituents, such as total dissolved solids (TDS), bromide, and organic carbon that can be easily integrated into current water quality forecasts.

The forecasting work of the RTDF is divided into two main tasks: continuing existing forecasts and improving the current forecasting tools. At least once a week O&M forecasts the short-term EC and South Delta water levels using DSM2 (see section 8.3). The development work involved in extending these forecasts to include the entire SWP system, simulating additional water quality constituents, and addressing source water questions (via fingerprinting) is described below (sections 8.5 and 8.6).

8.3 History of Forecasting with DSM2

DSM2 has been used as a Delta hydrodynamic and water quality forecasting tool by the Department of Water Resources for several years. O&M's Operations Compliance and Studies Section has been using the existing DSM2 forecasting methodology (Mierzwa, 2001) to produce one or more forecasts of Delta conditions each week. The hydrodynamic and water quality results of these DSM2 forecasts are used by DWR operators to make adjustments to real-time State Water Project and Central Valley Project operations in order to meet Delta flow and water quality standards. An example of a DWR O&M water quality forecast is shown in Figure 8.2.

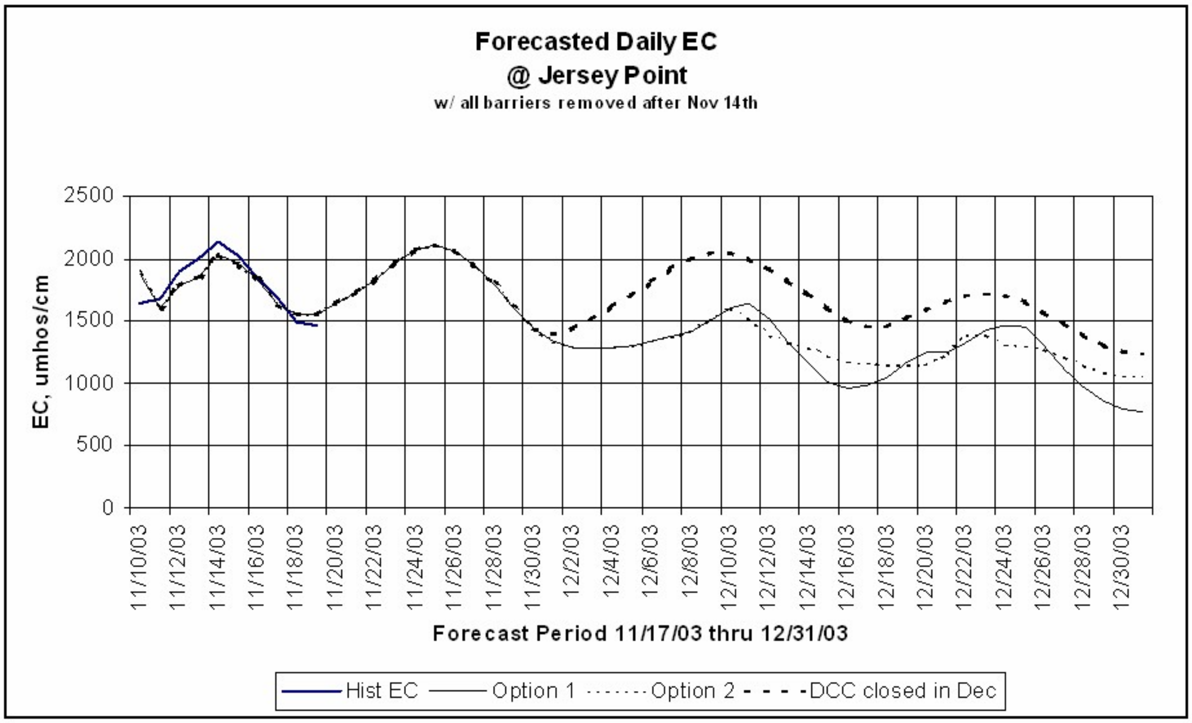

Figure 8.2: Example of Forecasted Water Quality Using DSM2.
(taken from Sun, 2004)

DWR's Bay-Delta Office Temporary Barriers and Lower San Joaquin Section uses the weekly O&M DSM2 forecasts to report both the current and anticipated South Delta water levels. An example of one of these real-time water level forecasts near the Grant Line Canal temporary barrier site is shown below in Figure 8.3. These reports are emailed to any public party with an interest in South Delta water levels and are archived at:

http://sdelta.water.ca.gov/web_pg/tempbar/weekly.html

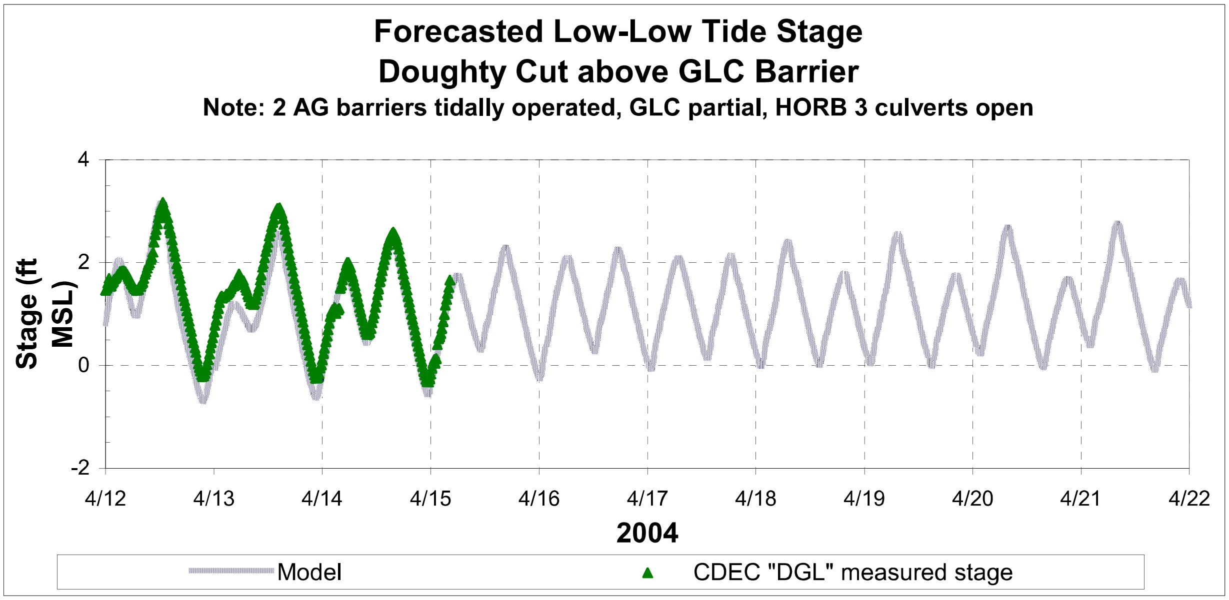

Figure 8.3: Example of Forecasted Water Levels Using DSM2.
(taken from Burns, 2004)

O&M generates these weekly forecasts by first using information on current and short-term projected water supply levels and demands to create a daily operations spreadsheet of Delta inflows and exports. The forecast flows and exports based on the spreadsheet operations along with stage estimates (Ateljevich, 2000), salinity estimates (Ateljevich, 2001), and future barrier operations are combined with hourly real-time Delta flow and operations data to produce a short-term DSM2 simulation. The length of the short-term forecast can vary depending on the purpose of the forecast. As shown in Figures 8.2 and 8.3, DSM2 was run for nearly two months in the O&M example forecast, but for only 10 days in the South Delta example forecast. The accuracy of a forecast decreases with the length of the forecast simulation. In both cases, a period of several days to several weeks in length is run before the start of the actual forecast in order to both establish initial hydrodynamic and water quality conditions prior to the actual forecast and validate model performance. This warm-up period uses real-time field data that is screened as part of a pre-processing step before beginning a model run.

At times, more than one forecast simulation is run in order to use DSM2 to help evaluate possible different Delta responses to different operation decisions. Examples of this include delaying the installation and construction of a temporary barrier by a few days, altering upstream releases and/or changing export pumping levels, or changing the operation of the Delta Cross Channel.

O&M's DSM2 Delta forecasts have shown that the DSM2 forecasting tool is effective at providing qualitative information concerning the trends in various hydrodynamic and water quality parameters. However, a more formal analysis of the ability of O&M's current DSM2-based forecasts to provide accurate quantitative results has not been conducted. It should be noted that DSM2 real-time simulations can at times fail to reproduce or predict observed data due to a combination of errors in forecast model input and DSM2 accuracy.