Annual Report

Ralph Finch, DWR

The 2010 Annual Report is currently going through DWR's approval process, and should be publically available by the end of year. The following are summaries of the two chapters included in this year's report:

Chapter 1 – Reverse Flow Study

This chapter documents the DSM2 model setup and results for studying tidally changing flows in Old and Middle Rivers (OMR) and in Victoria Canal. Flow reversal is primarily due to lower San Joaquin River flow, in-Delta diversions, and exports from the SWP and CVP. The study concentrated on when and where reverse flow conditions occur, which means the ebb tide flow in a channel is completely reversed toward the exports of SWP and CVP. Although the motivation of this study was to evaluate possible hydrologic reasons for the correlation between OMR flow and salvage at the fish-salvage facilities of SWP and CVP, this study concentrated on flow conditions only, no particle tracking or fish movement were simulated. No conclusion can be drawn about how much reverse flow affects fish entrainment/ salvage. DSM2 version 8 was used for the simulations.

Chapter 2 – DSM2 Version 8 Beta3 vs. Version 7 Testing

This chapter documents the DSM2 Version 8 vs. Version 7 testing framework setup and results. The goal for the testing was to rapidly and thoroughly test DSM2 on sample problems. Version 8 results were compared with results from Version 7. This is known as regression tests. Version 8 was validated with known results from Version 7 (not a model validation of DSM2 from scratch). The testing helped with debugging during Version 8 model development.

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California Department of Water Resources

A Tool for Conducting Long-term Delta Water Quality Forecasts using DWR Allocation Studies

Siqing Liu, DWR

This past year, DWR generated long-term forecasts of Delta water quality using DSM2 and allocation studies from the State Water Project Operations Control Office (OCO). These monthly forecasts were based on OCO studies for December 2009 through May 2010 and involved two hydrology levels (50% and 90%) and two operation scenarios (D1641 and D1641 with most restrictive OMR flows). The data received from the allocations studies include monthly Delta inflows, exports, net consumptive use, and Delta Cross Channel operation, all up to one year out from the time of the forecast. The process of generating these water quality forecasts with DSM2 has been somewhat cumbersome with user errors possible. A tool (Figure 1) was developed for streamlining the pre-processing through ten steps. Optional steps for running the simulation and post-processing results were also included. The separate steps in the tool are described below.

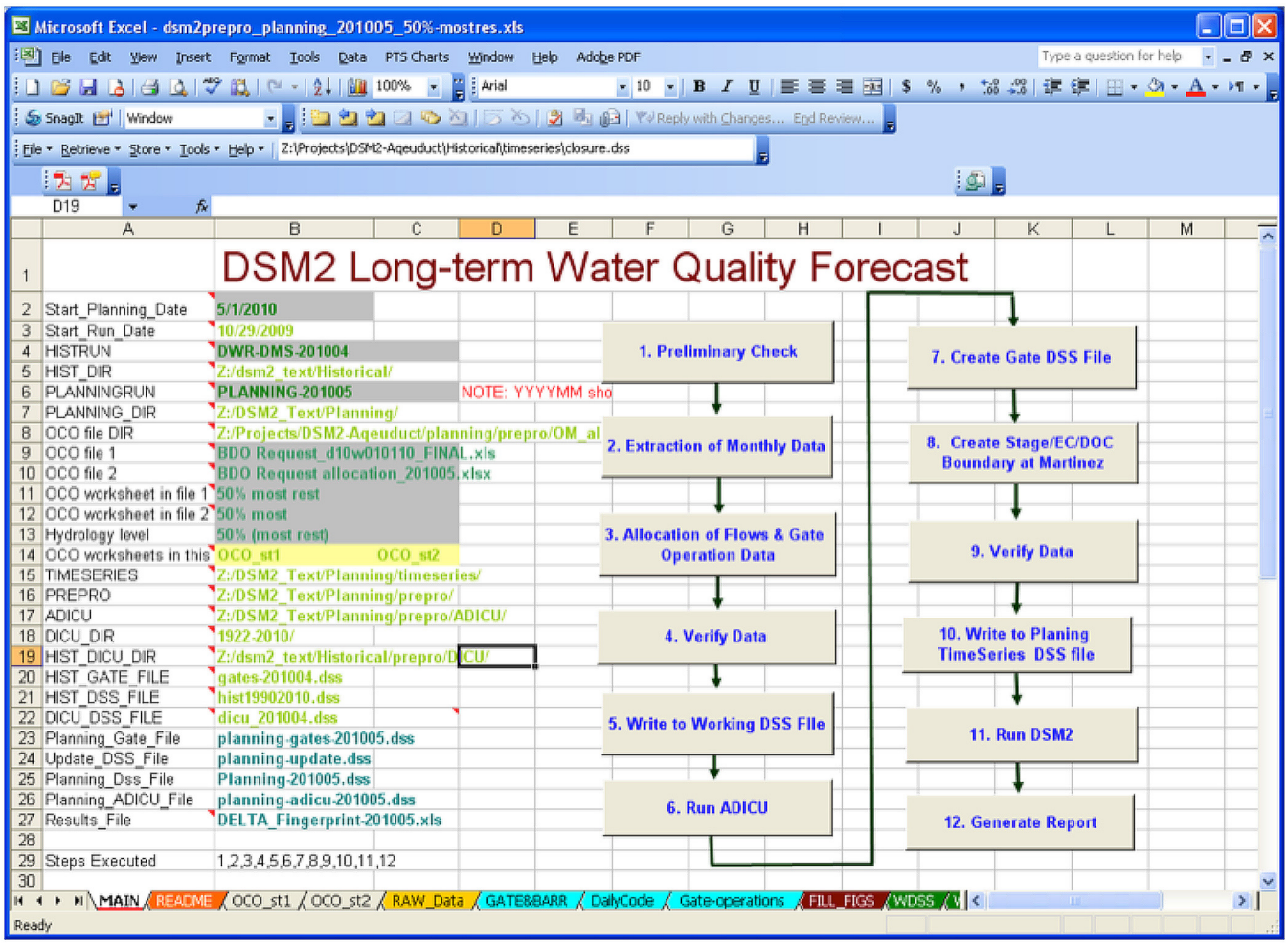


Figure 1: Interface for the tool for long-term water quality forecasts

Step 1
Checks whether all input data are complete and in the right format, all specified folders exist, and all EXCEL worksheets used by this tool exist.

Step 2
Copies needed allocation study data from a specified OCO EXCEL files to two worksheets specified by the user.

Step 3
Converts monthly data from the allocation study to a daily format for later processing.

Step 4
Graphically presents converted data to enable the user to visually verify that data have been converted correctly (Figure 2).

Step 5
Stores daily data into a dss file for further processing.

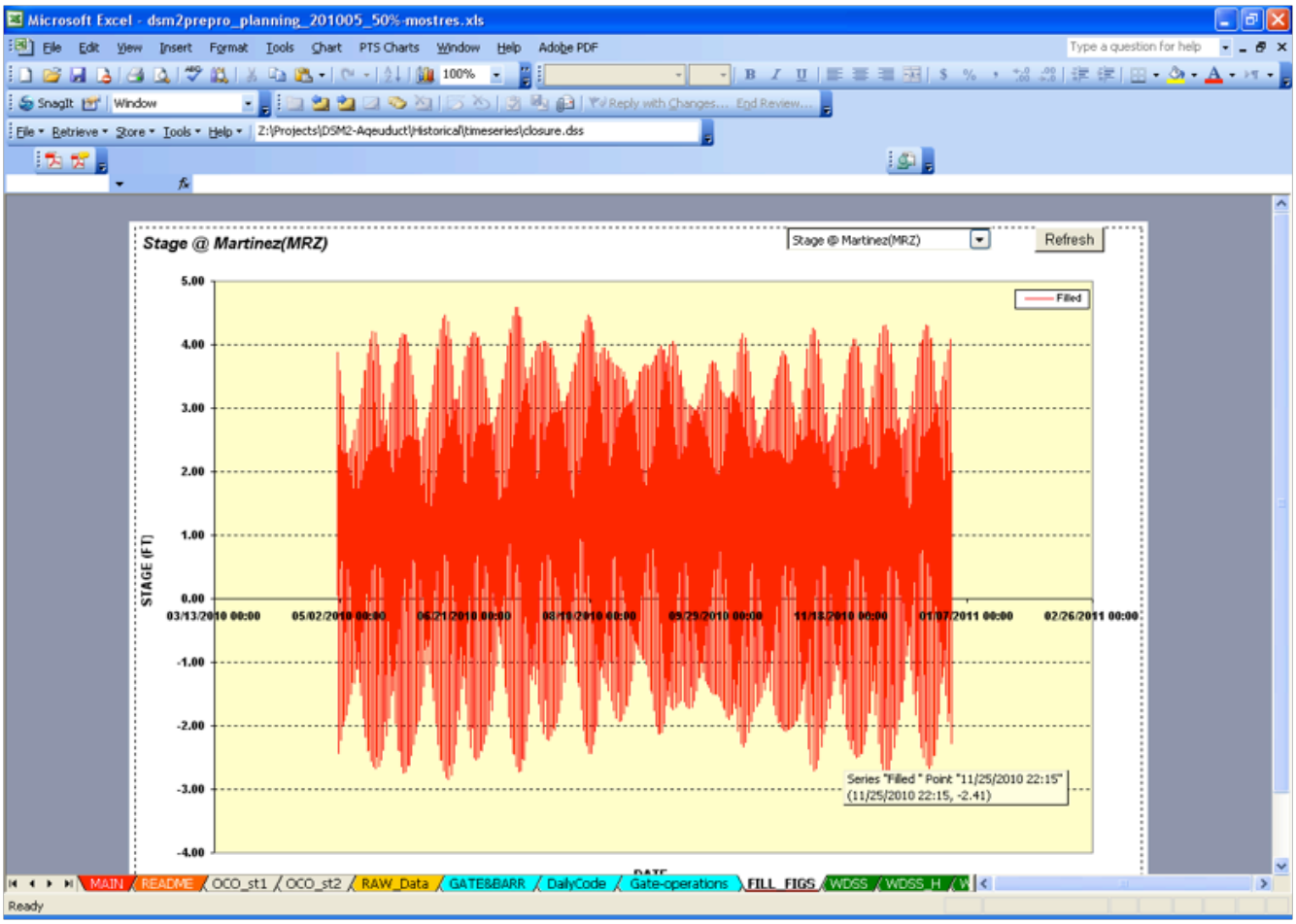


Figure 2: Dynamic graphics used for verifying time-series data

Step 6
Runs the ADICU model to create the Delta Island Consumptive Use (DICU) file

Step 7
Creates the gate file using flow data and gate information in the allocation study.

Step 8
Creates EC and stage boundary data at Martinez using an astronomical tide.

Step 9
Graphically presents Martinez stage and water quality data to allow user to verify any filled data.

Step 10
Stores all needed time-series data into the dss file used by DSM2.

Step 11
Initiates a DSM2 run. Note: it is normally better practice to run DSM2 directly from a DOS prompt.

Step 12
Retrieves data from the dss file containing simulation output and put places the data in a newly created EXCEL file.

Delta Bathymetry Visualization

Nicky Sandhu, DWR

Introduction

Bathymetry data has been collected from depth soundings since 1930s. This data has been available with CSDP (*http://modeling.water.ca.gov/delta/models/dsm2/tools/csdp/index.html*) as a large text file. This was used in CSDP for creating DSM2 cross sections of channels. CSDP could be used to visualize the depth soundings but without the context of a map. Furthermore in order to view this visualization, the user must download and install Java, CSDP and the text file.

This application attempts to make the visualization one click away. We use modern tools such as Google Maps and browsers to make this data easily accessible.

Furthermore, the CSDP raw data was processed by USGS (*http://sfbay.wr.usgs.gov/sediment/delta/index.html*) and a 10mx10m grid for depth values interpolated from the raw data was created. This work can also be visualized and compared with the depth soundings from which it was derived.

In addition, DWR has collected LIDAR data in 2007 – 2008 (*http://www.profsurv.com/magazine/article.aspx?i=70670*) for the same region and grid was derived from this data set and combined with the previous efforts to create a single grid for the bare earth topology. This can also be visualized with this effort.

Visualization Application

The visualization can simply be accessed from a browser at this link *http://dsm2bathymetry.appspot.com*. The default view is shown in Figure 1.

A user can zoom in/out and pan around the map to view finer details.

The color legend can be viewed by clicking on the Legend Tab towards the bottom right side.

The drop down box displaying “Raw Data” allows the user to select between the above mentioned data sets of raw depth soundings, interpolated depth and bare earth topology. NOAA derived navigational charts can be overlayed on the visualization by selecting the checkbox on the right hand side.

The raw data for a small region around the click point can be viewed by toggling the button “Click to show data”.

The opacity of the visualization can be changed with the slider bar.

The exact view of the map can itself be bookmarked and sent to others to view at the appropriate location and zoom level by clicking on the link “Goto Bookmark URL”.

A video highlighting the features of the application is available at *http://www.youtube.com/watch?v=DMep18zZFmU*.

Technology

The visualization was developed with Google Web Toolkit (*http://code.google.com/webtoolkit/*) and uses Java. The depth values were all converted to NGVD29 datum using NOAA tools (*http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html*) and the image tiles were generated using Java and associated

libraries. The image tiles are then overlayed over Google Maps using their map functionality. The page itself is hosted on Google's App Engine (*http://code.google.com/appengine/*) which is a cloud hosting with a small amount of free quota. This ensures that the application is available 24x7 with almost no downtime and performance on par with other Google services.

The code for the entire application is open sourced and available at *http://code.google.com/p/dsm2-grid-map/source/browse/#svn/trunk/dsm2-bathymetry-map*.

In Conclusion

- The technology involved enables instant sharing of large data sets through zero install of products other than a capable browser and a decent internet connection. This allows for easier accessibility and hopefully translates to increased use.
- The tool is also a way to quickly validate at a high level how the data looks and any discrepancies that might show up during data processing.
- It is also our intention to keep this map updated with newer more accurate bathymetry data sets as they become available.
- Further plans include being able to draw cross sections for channels and calculating mean depths and volumes of water bodies.

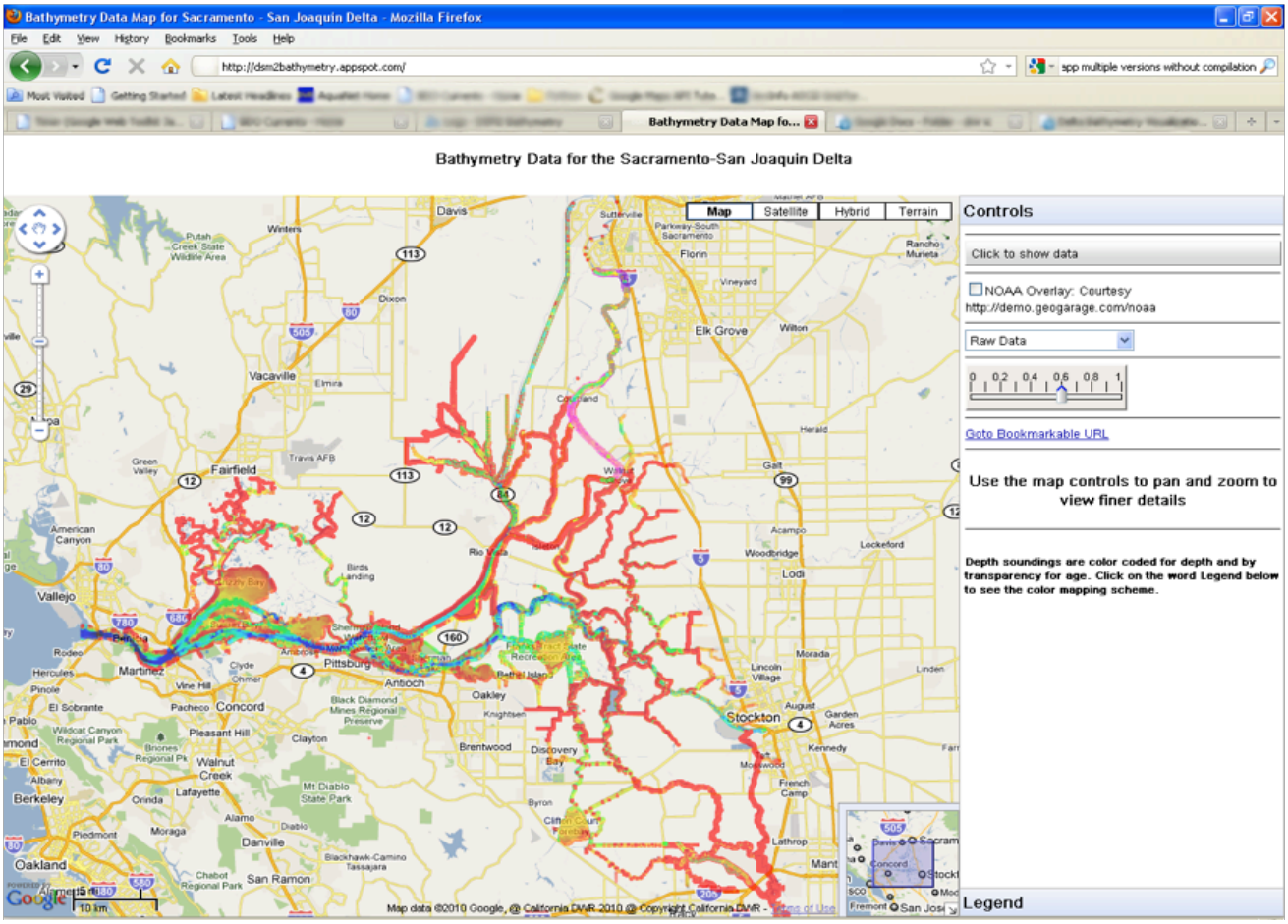


Figure 1. Bathymetry Data for the Sacramento-San Joaquin Delta

DSM2 Development and Maintenance

Eli Ateljevich, DWR

Recent DSM2 development has focused on non-conservative constituents. Modelers simulating Bay Delta Conservation Plan (BDCP) alternatives are incorporating ammonia, DO and temperature into their studies and the DSM2 development team has attempted to support this work with testing, bug fixes and enhancements.

There are several areas where we have made improvements:

1. We have corrected a solar radiation rate that was mischaracterized in the ammonia equations. The issue dates back to a typo in the original QUAL2E documentation, which was the basis for non-conservative reactions in DSM2.
2. The integration technique for source terms has been replaced by an adaptive Runge-Kutta scheme that is more robust near zero concentration. Previously, constituent concentrations could cross below zero and then react erratically. This was particularly likely to happen when the initial or boundary concentration was not carefully chosen to be physical.
3. The model was not mixing parcels adequately in dead end sloughs and other regions where the upstream side of a channel had zero flow (including the Delta Cross Channel when the gate is closed). The lack of mixing became more apparent with non-conservative constituents because parcels are left to react in isolation.

Version 8.0.6 will come out in early August, alongside a document that explains the testing of non-conservative reactions and treatment of dead-end channels. Minimum dispersive velocity, a parameter of the original BLTM model, can now be set by the user and used to force in zero-upstream-flow channels. This solution was expedient for BDCP because it allows backward compatibility for EC modeling: when the minimum dispersive velocity is set to zero, the model behavior is very similar to that of previous versions. The tradeoff is that mixing in Version 8.0.6 is still somewhat direction dependent; a direction-independent version of the QUAL mixing scheme is being tested for possible inclusion in version 8.1.

DSM2 Nutrient Module Peer Review

Paul Hutton, MWDSC

Dr. Mike Deas of Watercourse Engineering, Inc. conducted an independent peer review of the DSM2 nutrient module. This review, conducted under contract with the State and Federal Contractors Water Agency and documented in a May 2010 report, focused on a recent calibration report prepared by Dr. Marianne Guerin of Resources Management Associates, Inc. titled *Modeling the Fate and Transport of Ammonia Using DSM2-QUAL (October 2009 draft).*

Dr. Deas found that the DSM2 nutrient module can be used to inform planning activities such as the Bay Delta Conservation Planning process if employed responsibly and reasonably. Specifically, Dr. Deas states:

> *Overall, the DSM2-QUAL application is the best available tool for assessing water quality in the Delta. This is not to say that it is perfect, a point which is clearly elucidated in the draft documentation and echoed in the various reviews. For example, the model is calibrated to monthly data. While application of the tool to short time scale problems is not recommended, the model can probably be applied as [stet] scoping or planning tool to assess monthly [stet], seasonal trends, or annual trends. Because this is an initial application of a water quality model representing physical, chemical, and biological conditions, there are still elements of the model that require modification, improvement, and refinement.*

Dr. Deas recommends that the California water community embark on a long-term effort to improve water quality modeling in the Delta. He encourages the science and policy communities to "be both critical and supportive of such forward-thinking endeavors if progress is to be made in resolving complex issues such as those encountered in the Delta."

Progress in Implementing DETAW

Lan Liang, DWR

As presented previously to the DSM2 Users Group, DWR's Modeling Support Branch, under the direction of Tariq Kadir, has been advancing the implementation of a new model to estimate Delta consumptive use. This model, Delta Evapotranspiration of Applied Water (DETAW), was originally jointly developed by the University of California, Davis and DWR. DETAW calculates daily soil water balance for 15 land use categories over the period from 1921 to 2008 for each of 168 islands in the Delta. The soil water balance consists of evaportranspiration (ET) losses and water contributions from rainfall, seepage from adjacent channels, and irrigation. The calculation of ET in DETAW thus is similar to the calculation of consumptive use in the current model used with DSM2, the Delta Island Consumptive Use model (DICU).

Recoding in Python

After receiving DETAW, DWR Delta Modeling translated the program from C++ into Python script in order to increase the flexibility of making sensitivity runs, improve running time, reduce required computer space, and change the output from many different Excel spreadsheets to a single DSS file.

Comparison of models

Initial use of DETAW showed it yielding significantly higher yearly peak and average consumptive use estimates compared to those calculated by DICU. However, since the two models assumed different historical land use and spatial precipitation patterns, these results were not particularly instructive. DWR then in 2009 - 2010 conducted a study to compare DICU and DETAW estimates of historical consumptive use for the period of March 2007 through September 2007. Both models used the 2007 Delta land use survey and the same precipitation. To help the analysis, Delta consumptive use was estimated over this period using the model Surface Energy Balance Algorithm for Land (SEBAL). SEBAL uses satellite-based measurements and energy balance models to estimate the spatiotemporal distribution of actual ET. When used in conjunction with spatial land use data, SEBAL can provide estimates of actual ET by crop type.

Modification of DETAW estimates of native vegetation and seepage

As shown in Table 1, DETAW's initial consumptive use estimates for native vegetation in the Delta were significantly lower than those calculated by SEBAL. This is consistent with the results of a preliminary study of Delta native vegetation ET reported by Frank Anderson of DWR, Land and Water Use and field observations. Anderson's ongoing study is showing that actual seepage rates in the Delta lowlands may be significantly higher than previously thought. Apparently, seepage substantially meets the water demand of native vegetation in Delta lowlands and thus does not constrain ET.

After consulting with Richard Snyder of UC Davis and Morrie Orang of DWR Land and Water Use, changes to crop coefficients for native vegetation and field crops were made to finalize DETAW's crop coefficients (Table 2). In addition, the seepage rate for Delta lowlands was increased from 0.025 to 0.15 to ensure native vegetation was not constrained by water source. These changes result in new DETAW consumptive use values for the 2007 study period as shown in Table 3.

Table 1. SEBAL and initial DETAW total estimate of Delta ET by land use, March through September 2007 (values in TAF).

Land use category	SEBAL	Original DETAW
Agriculture	912	1114
Native Vegetation	299	126
Riparian Vegetation	88	106
Urban	98	106
Water Surface	263	271
Total	1660	1723

Table 2. Crop coefficient adjustment in DETAW

Land use	Original DETAW		Adjusted DETAW
	critical	non-critical	
Field	1.04	1.02	0.9
Native Vegetation	0.3	0.3	0.5

Table 3. Delta consumptive use from March to September 2007 after coefficient adjustment (Unit: TAF)

Land use	SEBAL	Original DETAW	Adjusted DETAW
Native Vegetation	299	126	297
Riparian Vegetation	88	106	106
Urban	98	106	106
Water Surface	263	271	271
Agriculture	912	1114	1076
Total	1660	1723	1856

Adjustment to Agriculture ET calculation in DETAW

The comparison of SEBAL and DETAW estimates of Delta consumptive use over the study period (Tables 1 and 3) shows DETAW calculating a much higher agriculture ET than does SEBAL. This poses a challenge for DETAW use: the crop coefficients in DETAW are well-accepted, but the resulting estimated consumptive based on these crop coefficients are much higher than SEBAL's, which are at least partly observation-based. While DETAW enables planning studies which include land use, it is believed that SEBAL is the better estimator of actual ET. Possible reasons for the lower ET values by SEBAL include factors not accounted for in DETAW crop coefficients include: chloride levels in the soil, water table, age of plants and irrigation water. The approach taken with DETAW is to apply a stress factor to its crop coefficients, such that ET by crop type matches that implied by SEBAL. The resulting factors are shown in Table 4 with consumptive use totals over the study period shown in Table 5.

Table 4. Stress coefficients applied to crop coefficients in DETAW

Land use	Stress coefficients
Alfalfa	0.77
DryGrain	1.00
Field	1.00
Grain	1.00
NativeVeg	1.00
Orchard	0.71
Pasture	0.79
Rice	0.76
RipVeg	0.85
SugarBeet	0.70
Tomato	0.64
Truck	0.59
Urban	1.00
Vineyard	0.56
water	1.00

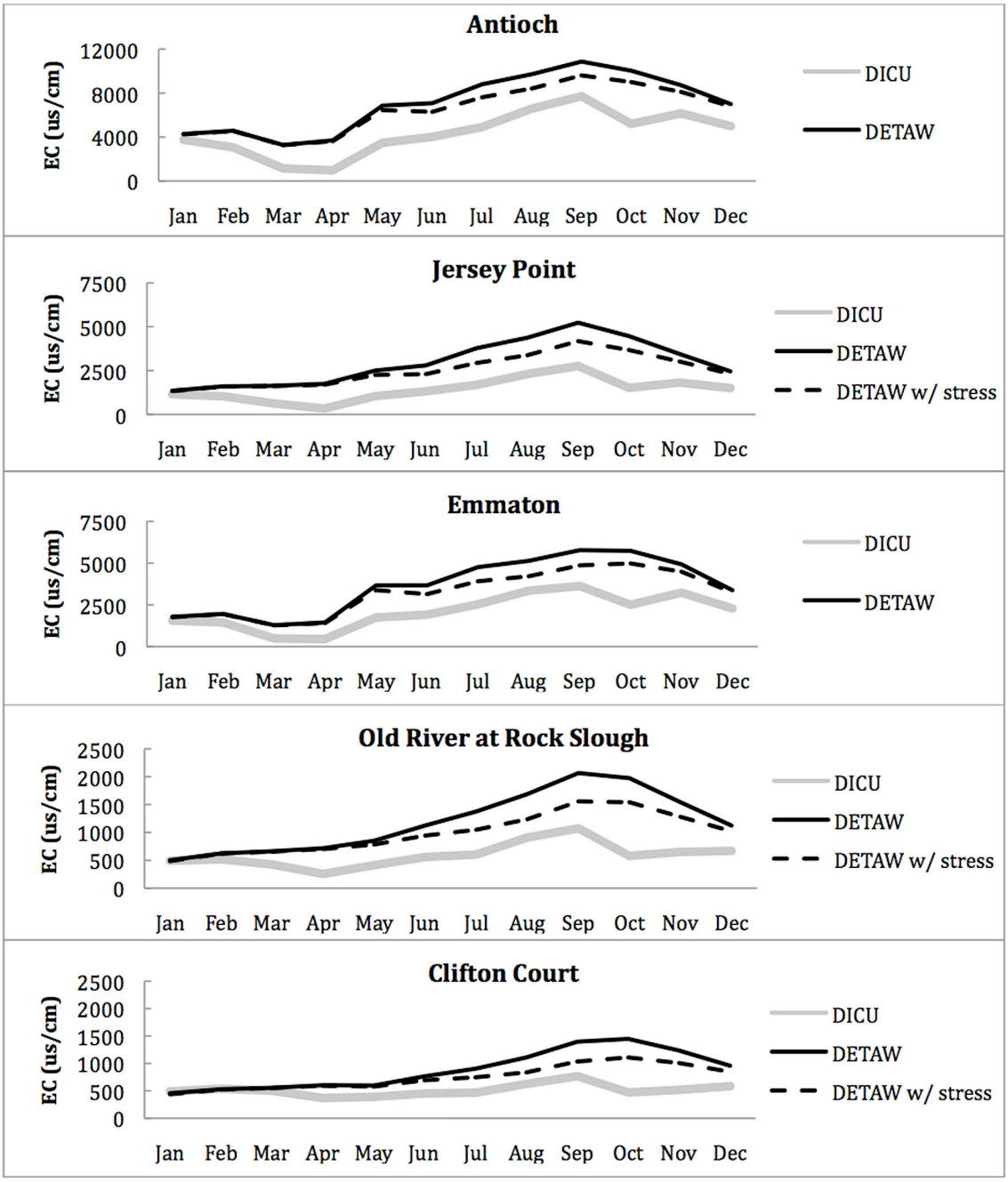
Table 5. Comparison of the Delta consumptive use from March - September 2007 generated by DETAW w/wo stress factors (Unit: TAF)

Land use	SEBAL	DETAW	DETAW w/Stress coef.
NV	299	297	297
RV	88	106	91
UR	98	106	106
WS	263	271	271
AG	912	1076	903
Total	1660	1856	1667

Implications of implementing DETAW into Delta water quality simulations

In general, different consumptive use schemes can cause differences to simulate water quality due to two reasons : 1) changes in Delta outflow due to higher/lower net Delta consumptive use can dramatically change the water quality in the western Delta and up Old River to Banks Pumping Plant, and 2) changes in agricultural drainage can change the water quality in areas with persistent low circulation, as in the south Delta. Historical Delta hydrodynamic and EC conditions were simulated over the 1990 – 2008 period under three conditions: using DICU, using DETAW without modifying for stress, and using DETAW modified for stress as indicated by SEBAL. As Figure 1 shows, adopting DETAW consumptive use without moderating via SEBAL results in significant increases in simulated EC over that based on DICU in both the Sacramento and San Joaquin Rivers and up Old River. Using modified DETAW consumptive use generates EC values which fall between those from DICU and DETAW. It is apparent that adopting a modified DETAW approach to estimating consumptive use will still require a recalibration of DSM2 QUAL.

Figure 1. The monthly averaged EC from 1990 to 2008 for different consumptive uses



Simulation of BDCP North Delta Diversion Operations in DSM2

Chandra Chilmakuri, CH2M Hill

An analysis has been done of the operation of the north Delta diversion system proposed in the BDCP. The system includes five (5) new intakes on Sacramento River upstream of Sutter Slough, in the north Delta. Each intake is assumed to have 3,000 cfs maximum pumping capacity. It is also proposed that the intakes will be screened using positive barrier fish screens to eliminate any potential for entrainment at the pumps. Water diverted at the five intakes is conveyed to a new forebay in the south Delta via tunnels capable of conveying up to a maximum flow of 15,000cfs.

BDCP is considering bypass (in-river) flow rules, which govern the amount of water required to remain in the river before any diversion can occur. Bypass rules are designed to avoid increased upstream tidal transport from downstream channels, to support salmonid and pelagic species transport to regions of suitable habitat, to preserve the shape of the natural hydrograph which may act as cue to important biological functions, to lower potential for increased tidal reversals that may occur because of the reduced net flow in the River and to provide flows to minimize predation effects downstream. Some of the features considered as part of the bypass rules are a constant low pumping level dependent upon the flow in the Sacramento River during Dec – Jun period, initial pulse protection in the Nov – Jan period and post-pulse operations that transition out the restrictions of the initial pulse protection. The bypass rules are simulated in CALSIM II using daily mapped Sacramento River flow, which provides the maximum potential diversion that can occur in the north Delta for each day. CALSIM II uses the monthly average of this daily potential diversion as one of the constraints in determining the final monthly north Delta diversion. For use in DSM2, the monthly diversion amount is mapped onto the daily pattern of the potential diversion estimated in CALSIM II.

Diversion at each intake is further subjected to sweeping velocity criteria so that the fish migrating past the fish screens do not impinge on them. A Delta Smelt criterion of 0.4 fps, is used in determining whether or not water can be diverted at an intake. The intake operations are also subjected to ramping rates that are required to shut off or start the pumps. These criteria cannot be simulated in CALSIM II. They are dynamically simulated using the operating rules feature in DSM2.

The north Delta diversion operating rule in the DSM2 allows diverting up to the amount specified by CALSIM II each day while subjecting each intake to the sweeping velocity and the ramping criteria. The intakes are operated as long as the daily diversion volume specified by CALSIM II is not met. Once the specified volume is diverted for the day, the pumps are shut off until next day.

The volume corresponding to first 500 cfs of the daily north Delta diversion specified by CALSIM II is diverted equally at all the five intakes. The remaining volume for the day is diverted such that operation of the upstream intakes is prioritized over the downstream intakes. Intake diversions are ramped over an hour to allow smooth transitions when they are turned on and off. The estimated amount of diversion at each intake is only diverted when the velocity measured just downstream of the DSM2 diversion node is greater than or equal to 0.4fps.

New channels, transfers and a reservoir are added to the DSM2 grid to simulate the five (5) north Delta diversion intakes as shown in the figure 1. Five channels, 601 – 605, divert water off the Sacramento

River and transfer to channel 607 and 608, from where the total diverted water is transferred to a new reservoir (IF_FOREBAY).

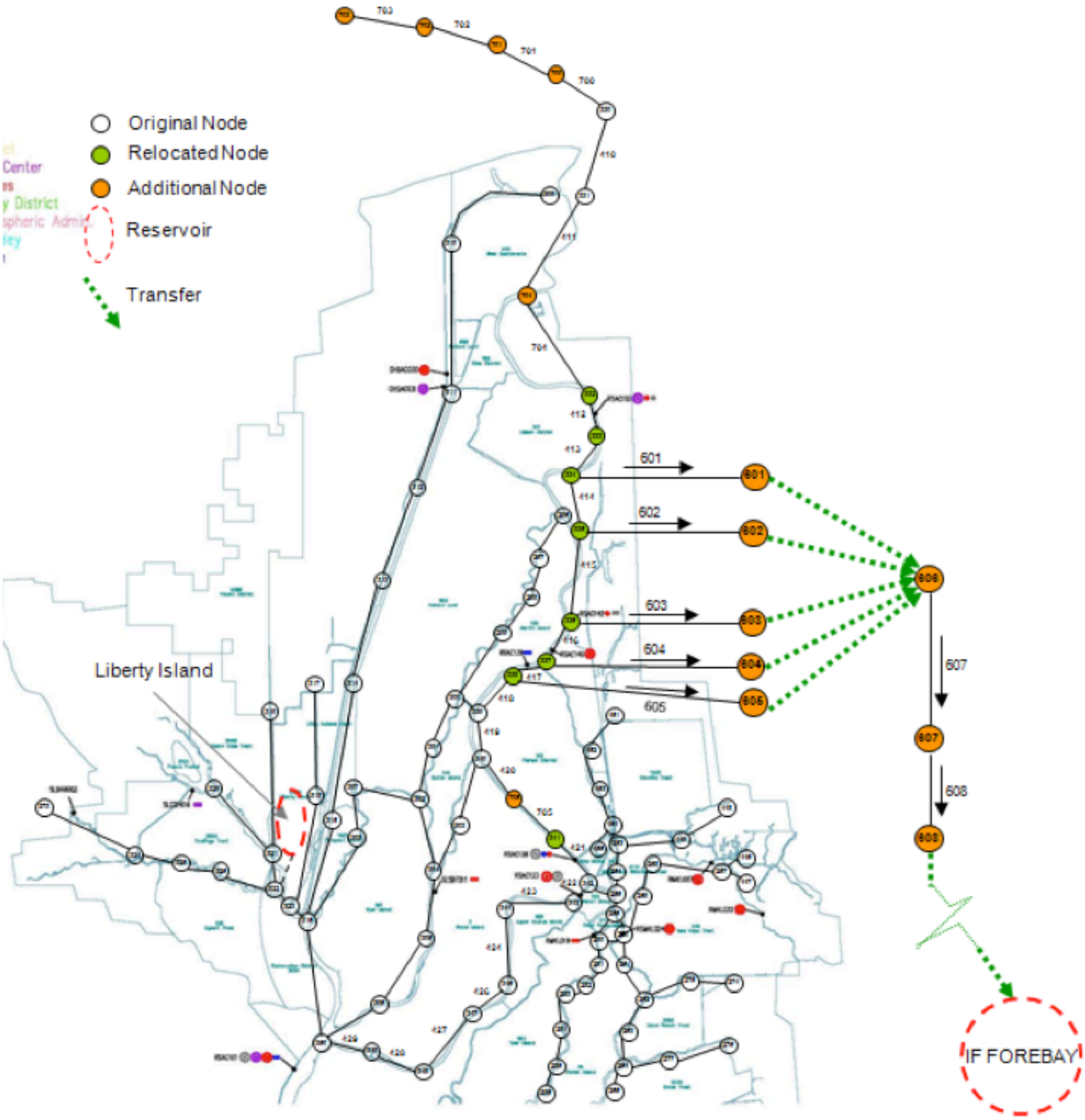


Figure 1: North Delta DSM2 Grid Modifications for Simulating North Delta Diversions

Figure 2 shows a short timeseries of sweeping velocities and the diversions at each intake. The plot shows how the intakes are ramped up and down when the velocity falls below 0.4 ft/s.

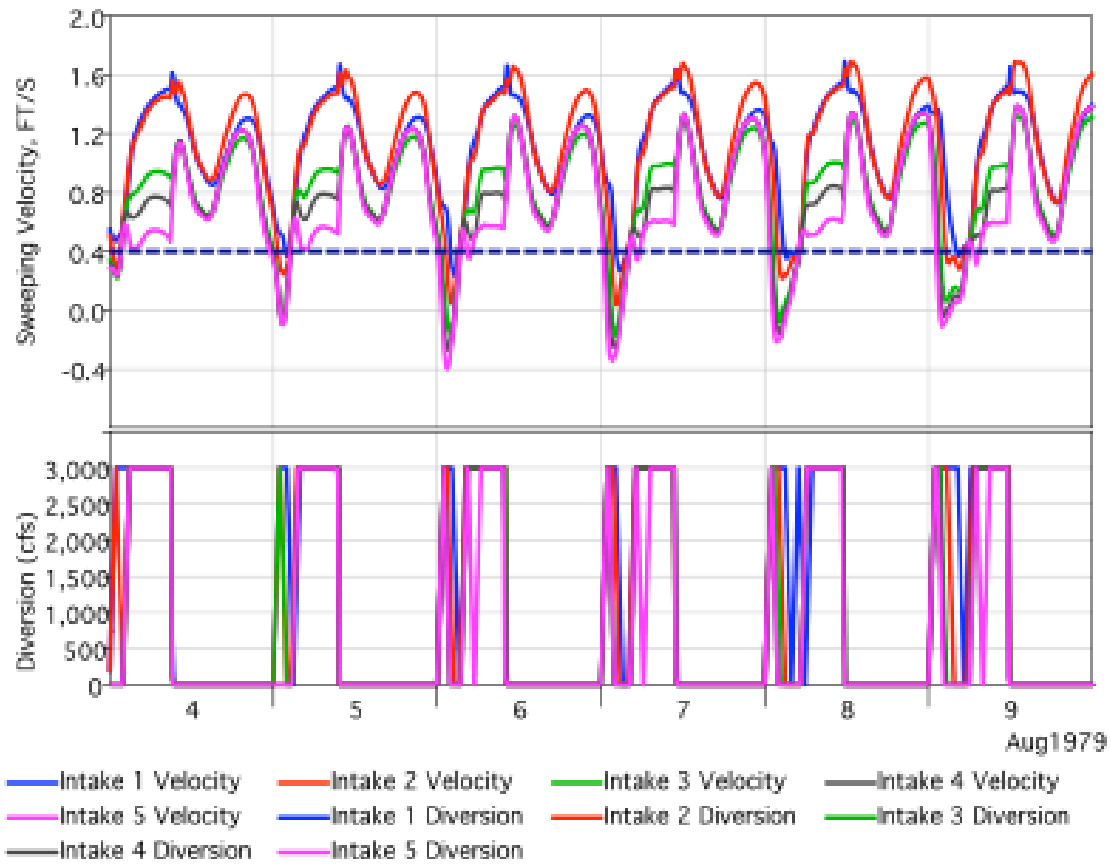


Figure 2: An Example of Sweeping Velocity and the Diversion at the Five Intakes Simulated in DSM2

Turbidity Simulation in the Delta using DSM2

Chandra Chilmakuri, CH2M Hill

Preliminary test simulations were performed to model turbidity as a non-conservative tracer using DSM2 v6. Since DSM2 does not allow simulation of turbidity or a non-conservative tracer, turbidity was simulated as the CBOD without the oxidation term (k1 = 0) and including the loss due to settling (k3).

The recalibrated DSM2 model from August 2009 was used in these test simulations. DSM2 was simulated for a 13 month period from 01AUG2007 to 31AUG2008. The initial turbidity in the Delta was set at a constant 10 NTU throughout the model grid based on the average observed turbidity for Sacramento River at Hood at the end of July 2007. The turbidity measurements at Hood, Mossdale and Martinez used for DSM2 boundary conditions are shown in the Figure 1. Sacramento River at Hood turbidity measurements were used as boundary condition for Sacramento River, Yolo Bypass, Mokelumne River and Cosumnes River. Sacramento River at Martinez observed data were used at the Martinez boundary and San Joaquin River at Mossdale measurements were used for the Vernalis boundary. For Calaveras inflow and agricultural drainage, the turbidity boundary was set at the constant value of 10 NTU.

A recent study by RMA found that simulating turbidity as a non-conservative constituent with 0.05 day-1 settling rate resulted in a reasonable agreement with observed data (RMA, 2008). Based on this three settling loss rates of 0.025 day-1, 0.05 day-1 and 0.075 day-1 were tested in DSM2 turbidity simulations. The observed and simulated turbidity time series were then compared at 13 Delta locations to assess the model performance, which was assessed based on visual inspection and computing goodness of fit measures such as mean and root mean squared error over the simulation period.

Figures 2 to 7 show the instantaneous observed and simulated turbidity time series for Rio Vista, Mallard Island, False River, Victoria Canal, Old River at Holland Cut, and Prisoners Point. Generally, simulated turbidity follows the observed trends and falls within the range of observed turbidity pulses in terms of the timing and magnitude of the peaks. Based on the results from the three simulations, it appeared that 0.05 day-1 resulted in the best fit with observed data at most of the locations in the Delta. However, 0.025 day-1 resulted in the best fit at Mallard Island indicating likelihood of missing sources of turbidity. Similarly, 0.075 day-1 resulted in best fit for Prisoners Point, likely due to high turbidity boundary condition applied for the eastside streams. DSM2 seemed to under predict the turbidity levels in the latter months (May and June), at most locations.

Overall, DSM2 shows promise in its capability of simulating turbidity in the Delta. However, while it seems to do well in transporting the boundary-driven turbidity pulses, it does not simulate processes or include any internal Delta sources that seemed to be important in the latter months. Better data at the boundaries and including internal sources resulting from additional processes such as resuspension could result in an improved DSM2 turbidity simulation.

RMA, 2008. Sacramento-San Joaquin Delta Turbidity Modeling. Prepared for: Metropolitan Water District of Southern California

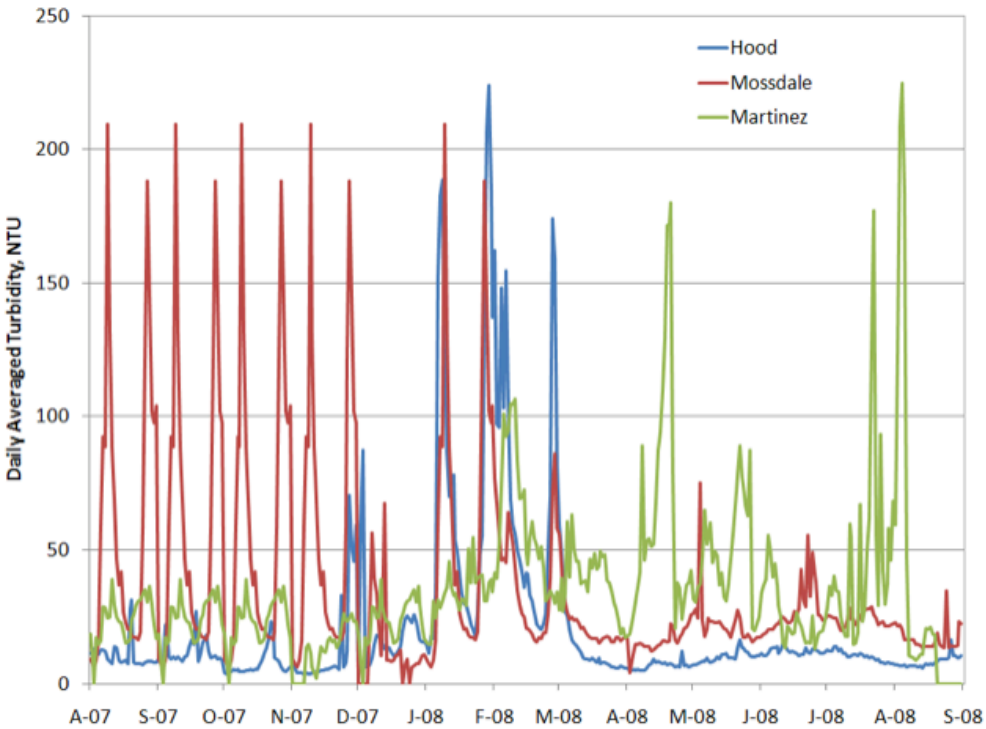


Figure 1: Observed Turbidity Timeseries at Hood, Mossdale and Martinez Locations

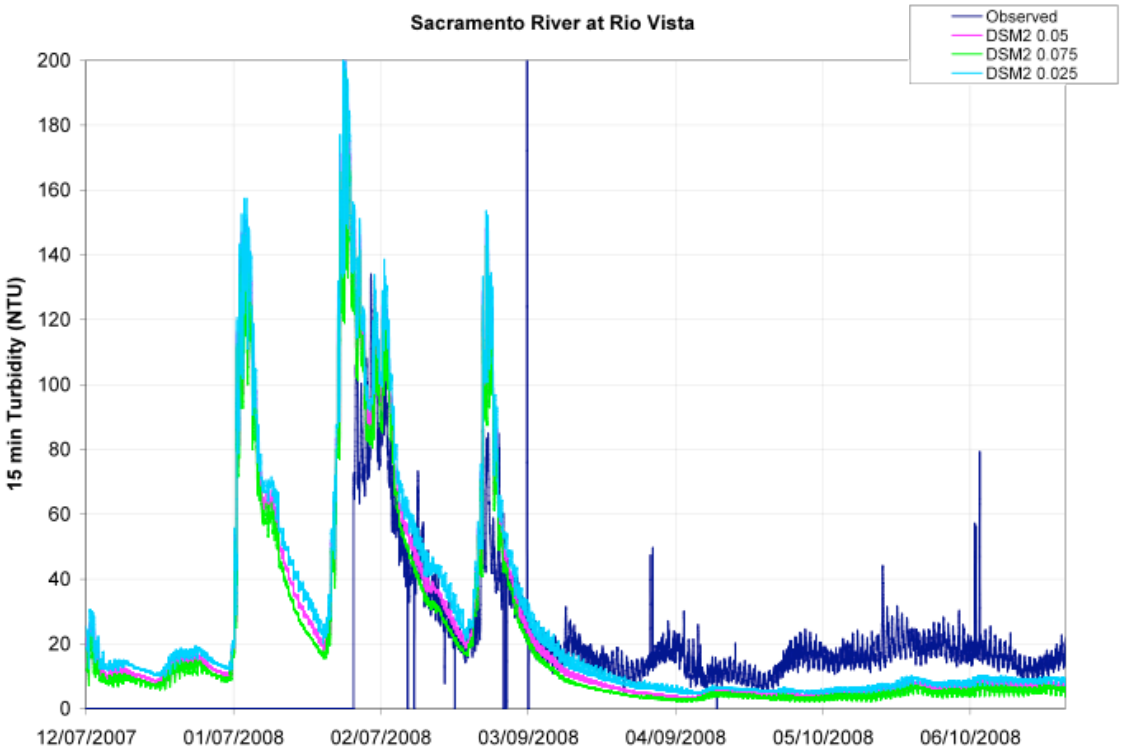


Figure 2: DSM2 Turbidity Simulation Results at Rio Vista Compared to Instantaneous Observations.

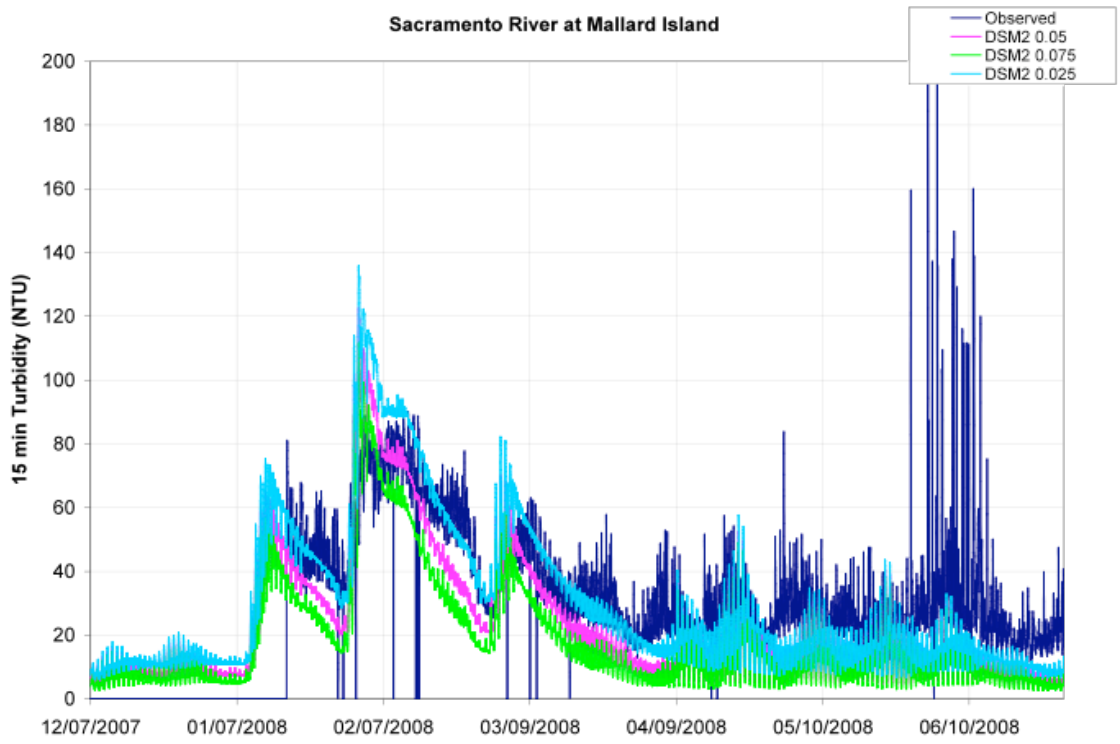


Figure 3: DSM2 Turbidity Simulation Results at Mallard Island Compared to Instantaneous Observations.

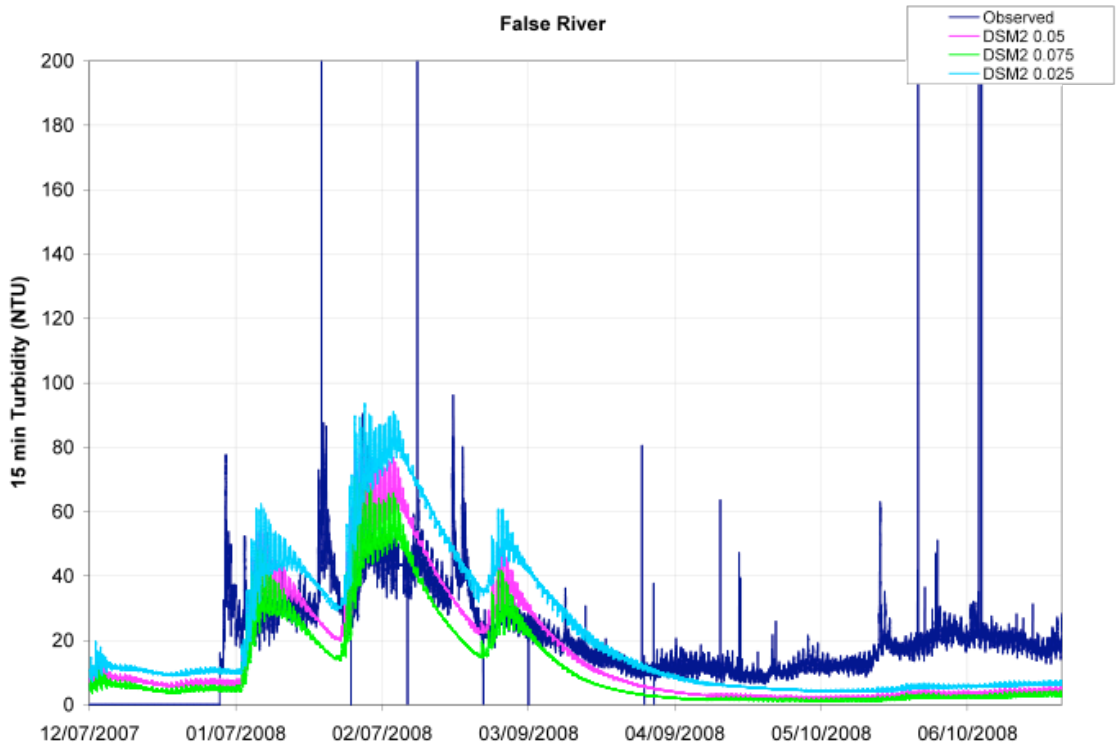


Figure 4: DSM2 Turbidity Simulation Results at False River Compared to Instantaneous Observations.

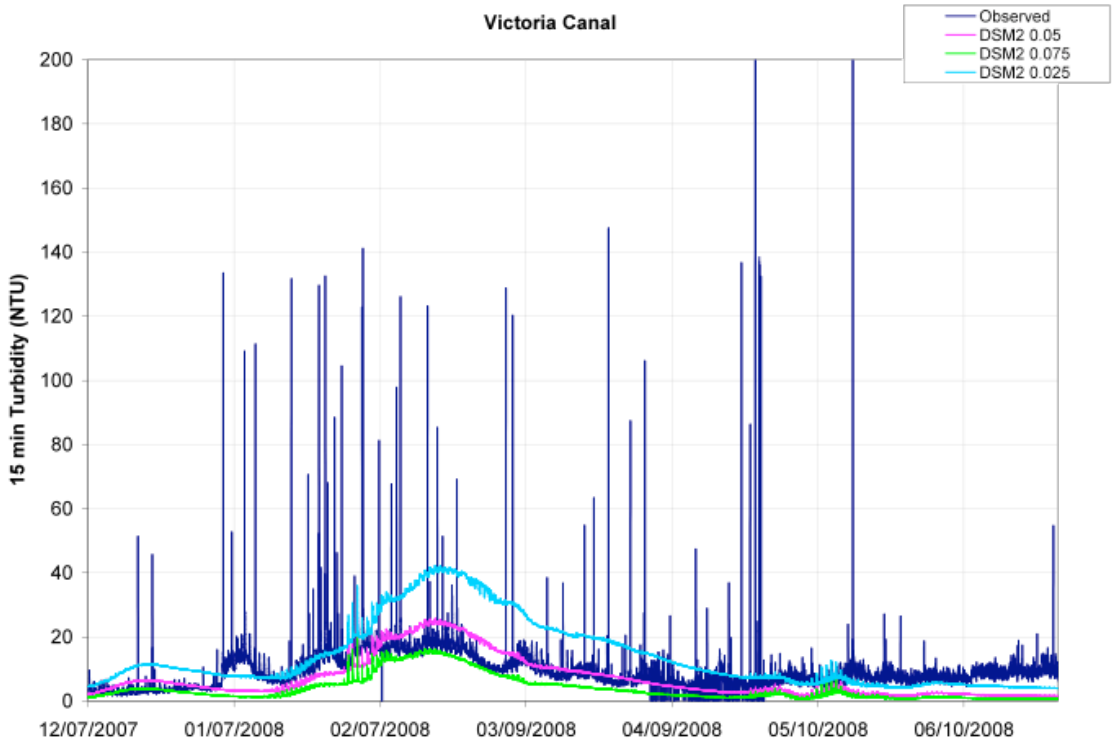


Figure 5: DSM2 Turbidity Simulation Results at Victoria Canal Compared to Instantaneous Observations.

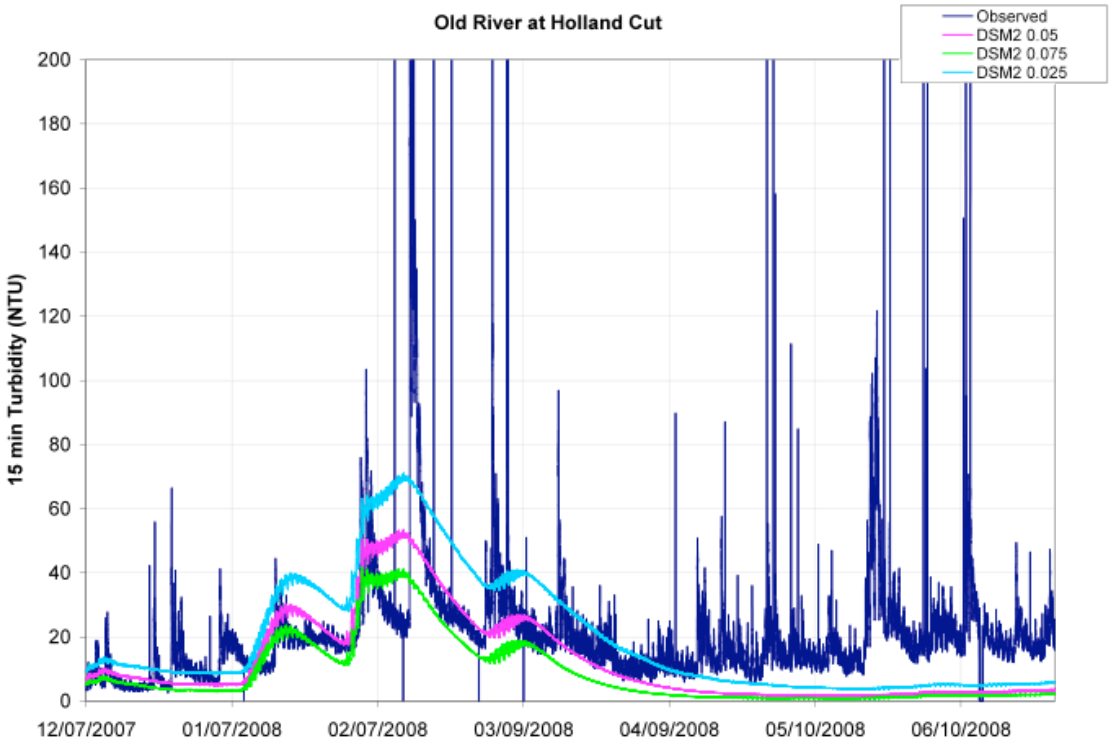


Figure 6: DSM2 Turbidity Simulation Results at Prisoners Point Compared to Instantaneous Observations.

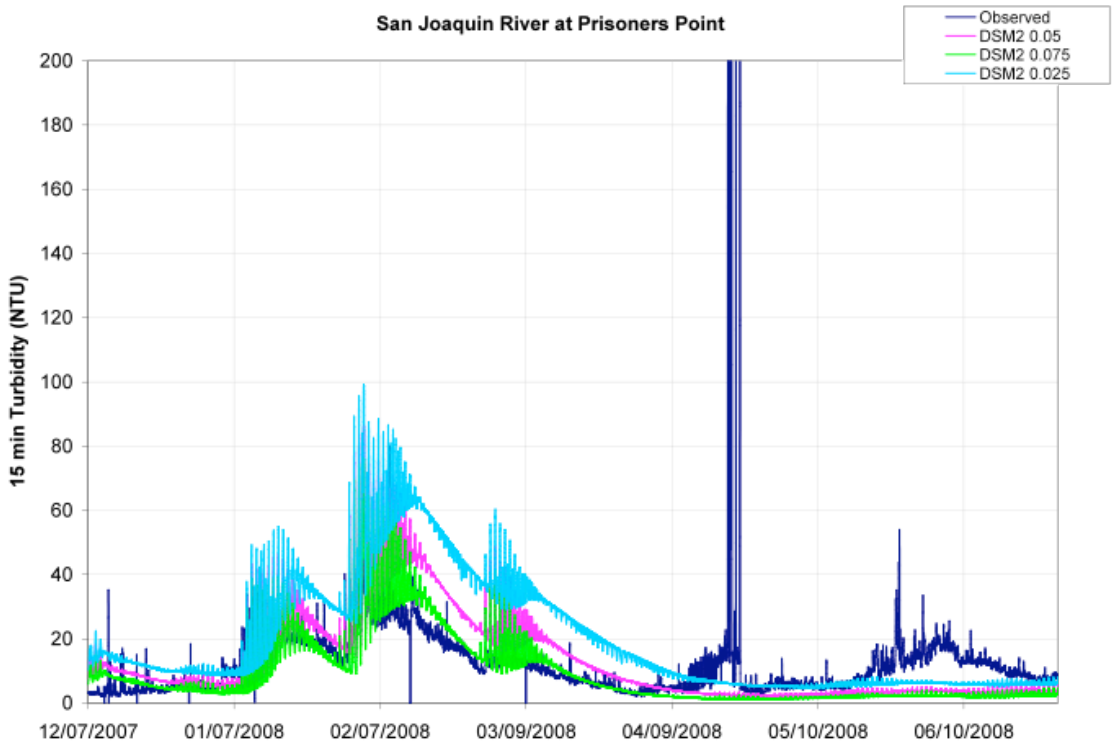
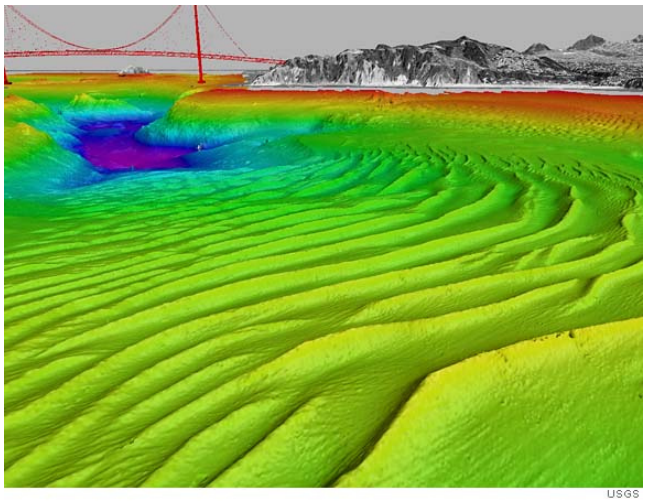


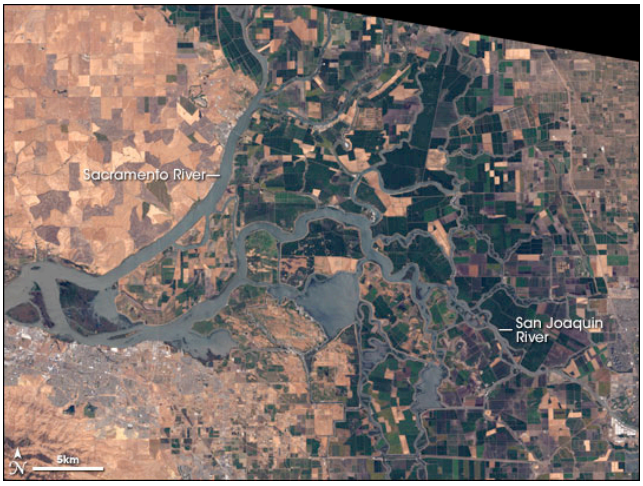
Figure 7: DSM2 Turbidity Simulation Results at Prisoners Point Compared to Instantaneous Observations.

Update on STM development

Jamie Anderson, DWR



USGS



A one-dimensional Sediment and Transport Module (STM) is being developed for the Delta Simulation Model 2. The project is a joint effort between DWR and UC Davis Civil and Environmental Engineering Department, including project Principal Investigator Professor Fabian Bombardelli and graduate student Kaveh Zamani. STM is a general transport model for conservative and non-conservative constituents with special attention to including sediment transport. The module will represent cohesive and non-cohesive sediment transport in tidal channel networks. Both suspended sediment and bed load will be included in the module. STM uses a static frame of reference (Eulerian) which will complement the existing moving frame of reference (Lagrangian) DSM2 water quality module, QUAL. STM uses a second order accurate, finite volume numerical solution approach. To verify that components of the model are coded properly, a companion testing code is being developed in conjunction with the STM code itself. At this time, work is wrapping up on a single channel advection, dispersion and reaction code including tests for each component both in isolation and in combination with each other. Additionally, a website is being developed that provides links to available sediment data sources for the Sacramento-San Joaquin Delta. A draft website is complete, and logistics will be worked out on hosting the website. We are planning to have a Technical Advisory Committee meeting in the early Fall. Both an oral and a poster presentation on this project are planned for September's Bay Delta Science Conference. Please contact Jamie Anderson (jamiea@water.ca.gov) if you would like any additional information.

STM website: *http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/stm/stm.cfm*

DSM2UG People

The Arrival of En-Ching

Min Yu, DWR

This past year the community of scientists and engineers who model the Sacramento-San Joaquin Delta expanded a bit with the arrival of En-Ching Hsu to the Delta Modeling Section. She comes to us well prepared. She received both of her Bachelor of Science and Master of Science Degrees in Agricultural Engineering from National Taiwan University, and her Ph.D in Civil Engineering from Purdue University. DMS enticed En-Ching away from a consulting firm where she had worked for three years modeling groundwater and developing desktop and web applications. One application was integrating a database management system with a map interface. She also was one of the primary developers for the statewide project IWRIS.

Since joining DMS, En-Ching has been kept very busy. Under Nicky Sandhu's supervision, En-Ching is evaluating existing presentation capabilities while exploring possible future techniques. She also is assisting the BDCP project by developing tools for automating pre-processing of DSM2 files.

If you've had the opportunity to meet En-Ching, you might interpret her quiet and measured manner as a sign of timidity. En-Ching actually is an avid traveler and mountain climber. She has climbed Mt. Whitney and trekked both coasts extensively. Her favorite places in the U.S. are its national and state parks. The 'Furlough Fridays' allowed En-Ching to frequently travel. On those Fridays, she would pick a destination and take off to make a short getaway for herself. On her last furlough weekend, En-Ching drove to San Simeon and toured Hearst Castle.

Caples Lake in Tahoe area

Even though En-Ching is quite adventurous when she makes up her travel plans, her palate for food is authentic Chinese cuisine, especially Taiwanese street food and spicy hotpot.

Her lifelong dream is to combine her two great loves and eat a spicy meal while reclining on top of Mt. Whitney.

A Semester in Tokyo

Jeremy Bricker, URS

Kiyotake, a frozen waterfall

From September 2009 through February 2010, I worked as a research fellow of the Japan Society for the Promotion of Science (JSPS) at the Tokyo University of Marine Science and Technology (TUMSAT) under Hidekatsu Yamazaki, a professor of Physical Oceanography. Prof. Yamazaki's research group focuses on the measurement of oceanic turbulence. My role in his laboratory was to build a new hydrodynamic model of Tokyo Bay that could better simulate steep internal waves. Internal waves and the mixing they can induce are important processes in Tokyo Bay, which experiences frequent water quality problems such as red tides and blue tides (upwelling of anoxic water due to offshore winds, which result in fish kills).

Especially difficult are simulations of the mixing resulting from the interaction of internal waves with steep topography. This situation, which is present near the mouth of Tokyo Bay, can result in strong vertical accelerations, which necessitate nonhydrostatic flow computation. In extreme cases, internal wave steepening can even lead to internal wave breaking, which cannot be simulated by standard Navier-Stokes solvers, but which is often parameterized as enhanced turbulence.

To address these issues, I used the Stanford Unstructured Nonhydrostatic Terrain-following Adaptive Navier-Stokes simulator, in close collaboration with Bay Modeling's Edward Gross and Stanford's Professor Oliver Fringer. This was my first application of an unstructured mesh model, and learning the complications of unstructured meshes and parallel computing was a long and difficult process, exacerbated by being at an institute without any computing support. In Japan, students and researchers are generally expected to know everything about their computer and instrument systems, and there is no technical support to assist with computer or systems problems. Having previously been only a user of Windows on my PC, the use of LINUX and parallel computing, without anyone to mentor me on these, entailed a very steep learning curve for me! Nonetheless, by the end of my sometimes-frustrating, sometimes-rewarding half year there, I got a model of Tokyo Bay working.

Life outside the laboratory, on the other hand, was great fun. I had lived in Kobe, Japan for 3 years just after finishing my schooling back in

2003, and was spoiling for the chance to use my Japanese language again (which is the reason I went to Japan for this fellowship to begin with, as I have little opportunity to speak the language here in the US). Tokyo is a big, sprawling city, about the geographical size of Los Angeles, but with the population density of San Francisco throughout. Despite the urban challenges this would present to our society here in the US, Tokyo is a clean, beautiful city with fast, comprehensive public transportation, almost no crime, and easy access to recreational and cultural opportunities like parks, museums, mountains, and the ocean.

My personal life there revolved around the outdoor club that I joined. With the outdoor club, I spent every weekend exploring one after another of Japan's beautiful mountains. With all the rain it gets, Japan's foliage is very lush, making for great hiking. In the wintertime, this rain becomes heaps of snow that fall on the north side of the mountains along the spine of the islands, making for world-class ski areas. One winter weekend, I took a bullet train an hour north of downtown Tokyo, which was rather mild and sunny the morning I left. After passing through a 15 mile long tunnel to the north side of the mountains, the train emerged suddenly into a blizzard with 10 feet of snow already piled on the wintry landscape. How much fewer accidents there's be on I-80 in the wintertime if we had an option like this for heading to Tahoe! As a civil engineer, I envy Japan's great infrastructure, which we lack here in the US.

One of the best qualities of hiking and skiing in Japan is the tradition of mountain pilgrimage that exists in that society. Throughout the year, monks and lay followers alike trek from temple to temple or shrine to shrine, scattered among the forests and alpine landscapes of Japan's mountains. Catering to them (and to ordinary hikers, snowshoers, and skiiers) are a plethora of lodgings and huts, where hikers can lodge and eat, making it possible to hike anywhere in the country without much gear. One of my favorite things to do there was to hike hours up one or another high, steep, wintry mountain, and then order a hot bowl of sweet mochi rice and red azuki bean (a soup called oshiruko) at the hut on top, to warm me up before beginning the long, cold descent.

If you have any questions or comments regarding this issue of the newsletter, please contact the facilitator of the DSM2 User Group:

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This newsletter can be accessed at the DSM2 User Group website: *http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/dsm2usersgroup.cfm*